Relicensing Study 3.3.9

TWO-DIMENSIONAL MODELING OF THE NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT INTAKE/TAILRACE CHANNEL AND CONNECTICUT RIVER UPSTREAM AND DOWNSTREAM OF THE INTAKE/TAILRACE

Initial Study Report Summary

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

Prepared for:

FirstLight™
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1.1 Study Summary

This study models flow characteristics upstream and downstream of the Northfield Mountain Project tailrace under a variety of operating conditions to assess the potential for velocities and flow fields to interfere with migratory fish due to Northfield Mountain Project operations. The flow field conditions in the immediate vicinity of the Northfield Mountain Project intake/discharge structure (i.e. within the Northfield Mountain Project tailrace) will be assessed using field data collected under both pumping and generating conditions. Per the Federal Energy Regulatory Commission's (FERC) Study Plan Determination Letter (SPDL) dated September 13, 2013, the field data is to be collected at four transect locations. Flow field conditions in the vicinity of the tailrace are to be assessed with a two-dimensional model. The model extents include a 10 kilometer portion of the Turners Falls Impoundment (Impoundment) surrounding the Northfield Mountain Project tailrace (5 km upstream, 5 km downstream). A series of "production runs" with the two-dimensional model will be performed to evaluate velocity and water level fluctuations in the vicinity of the Northfield Mountain Project tailrace. The production runs will vary three model variables: a) Impoundment elevation; b) Northfield Mountain Project flow; c) main stem Connecticut River flow (base flow). The Impoundment elevation will be evaluated at 2 different levels (i.e. maximum and minimum Impoundment elevations permitted under the current FERC License, and four (4) different flow scenarios are to be evaluated for the Northfield Mountain Project flow (i.e. 4 pumps, 2 pumps, 4 generators, 2 generators). Per the FERC's SPDL, the base flow is to be evaluated at five different flows (i.e. the 5%, 25%, 50%, 75%, and 95% exceedance flow at Turners Falls Dam), for a total of 40 productions runs.

1.2 Study Progress Summary

Task 1: Review Existing Data and Identify Data Gaps

Review of the existing data is complete. Updated bathymetric data of the Impoundment was collected 5 km upstream and 5 km downstream of the Northfield Mountain Project tailrace. During this task it was also determined that two new water level loggers, in addition to the those approved in the RSP, should be installed as part of Task 2. The first new logger was located in the Impoundment along the bank across from the Northfield Mountain Project tailrace. This logger will be beneficial during model calibration for representation of the water level drawdown due to pumping and generating operations. The second new logger was installed on the concrete intake structure above the water level to correct all of the other loggers for atmospheric pressure.

Task 2: Bathymetric Survey Update & Post Processing

Bathymetric survey of the 10 km reach of the Impoundment was completed over the course of four days (May 27, 2014, and June 2, 2014 through June 4, 2014). The bathymetric survey was collected using an Acoustic Doppler Channel Profiler (ADCP) linked to a GPS unit, and included the collection of both bathymetry and velocity data. All information was collected in the North American Vertical Datum of 1988 (NAVD88). A thorough review of the data was performed during post-processing to remove outliers from the dataset due to loss of satellite communication (this is often caused by overhead obstructions such as the French King Gorge Bridge and trees along the bank). Post-processing has been completed, and the bathymetric data is available in both NAVD88 and the Northfield Mountain Project vertical datum (National Geodetic Vertical Datum of 1929, NGVD29). Figure 1 provides an overview of the bathymetric terrain developed from this dataset. Per the RSP, seven (7) water level loggers were installed, and data is periodically offloaded for analysis. Only six of these loggers record water pressure, while the seventh is used to correct for atmospheric pressure. Figure 2 indicates the location of the water level loggers, while Figure 3 shows the water level information collected to date.

Task 3: Develop and Graph Water Column Velocity Profiles

Bathymetric and water column velocity data has been collected at three transects within the Northfield Mountain Project tailrace under four different operating scenarios. Data for two units generating and pumping was collected on April 6, 2014 and April 7, 2014 respectively, while data for four units was collected on July 12, 2014. An Acoustic Doppler Channel Profiler (ADCP) linked to a GPS unit was utilized for the collection of this data. Similar to the bathymetric survey, this data was collected in NAVD88, and converted to NGVD29 during post-processing. Figures 4 – 7 show the average velocity with direction for each of the four operating scenarios.

Task 4: Build and Calibrate 2D Model

This task has not been started at this time, but is scheduled to start at the beginning of the 4th quarter of 2014.

Task 5: Conduct and Analyze Production Runs

This task has not been started at this time. As part of the 2015 study year, the initial results will be presented to the stakeholders, and additional runs may be requested.

Task 6: Report

A final report will be completed in the 2nd quarter of 2015.

1.3 Variances from Study Plan and Schedule

The RSP indicated that field data within the Northfield Mountain Project tailrace would be collected at three transects. FERC's SPDL modified the RSP to include an additional transect located equidistant from the intake and the closest proposed transect. It should be noted that the face of the intake structure is not located at the concrete structure as seen in aerial imagery. The upper half of Figure 8 indicates the approximate face of the intake structure (red dashed line) in comparison to the proposed location of transects (green lines) while the face of the intake structure is faintly visible in the aerial imagery (dated 9/18/2011) provided in the lower half of Figure 8. The distance from the face of the intake structure to the closest transect is approximately 25 feet. As such a fourth transect was not collected as it would sit atop the intake structure, and only the three originally proposed transects were collected.

1.4 Remaining Activities

Minor fieldwork remains as the water level loggers will remain in place throughout the summer. The data will be offloaded from these loggers periodically, and processed in the office. Additional processing of the field data for the development of the water column velocity profile graphs need to be performed for final report figures. Additionally the two-dimensional model must be developed using River 2D software, and calibrated to existing water surface elevation data. The initial 40 "production runs" are expected to be completed by the 1st quarter of 2015.

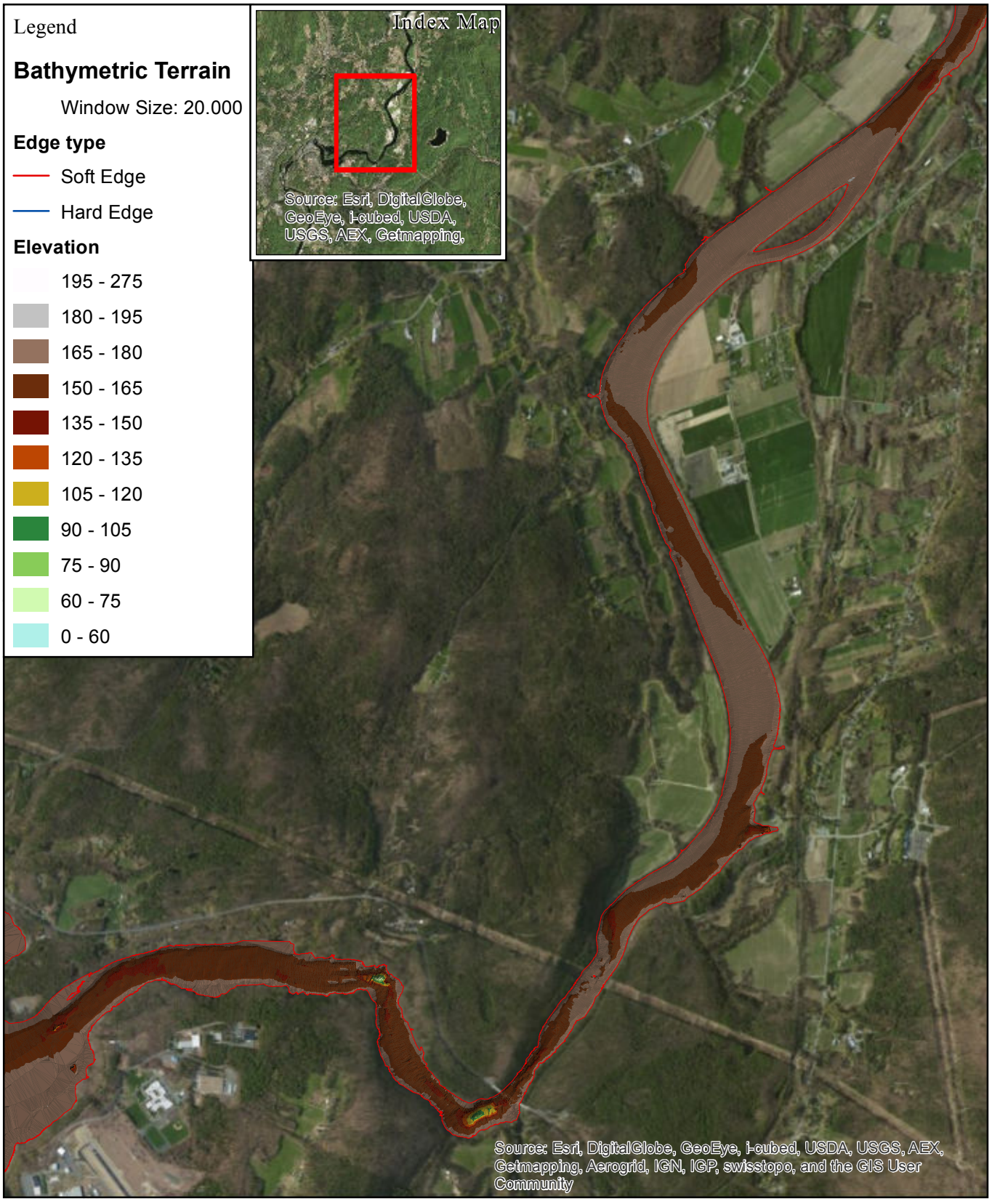

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Figure #1
Bathymetric Terrain

N

0 0.25 0.5 1
Miles

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Figure #2
Pressure Logger Locations

N

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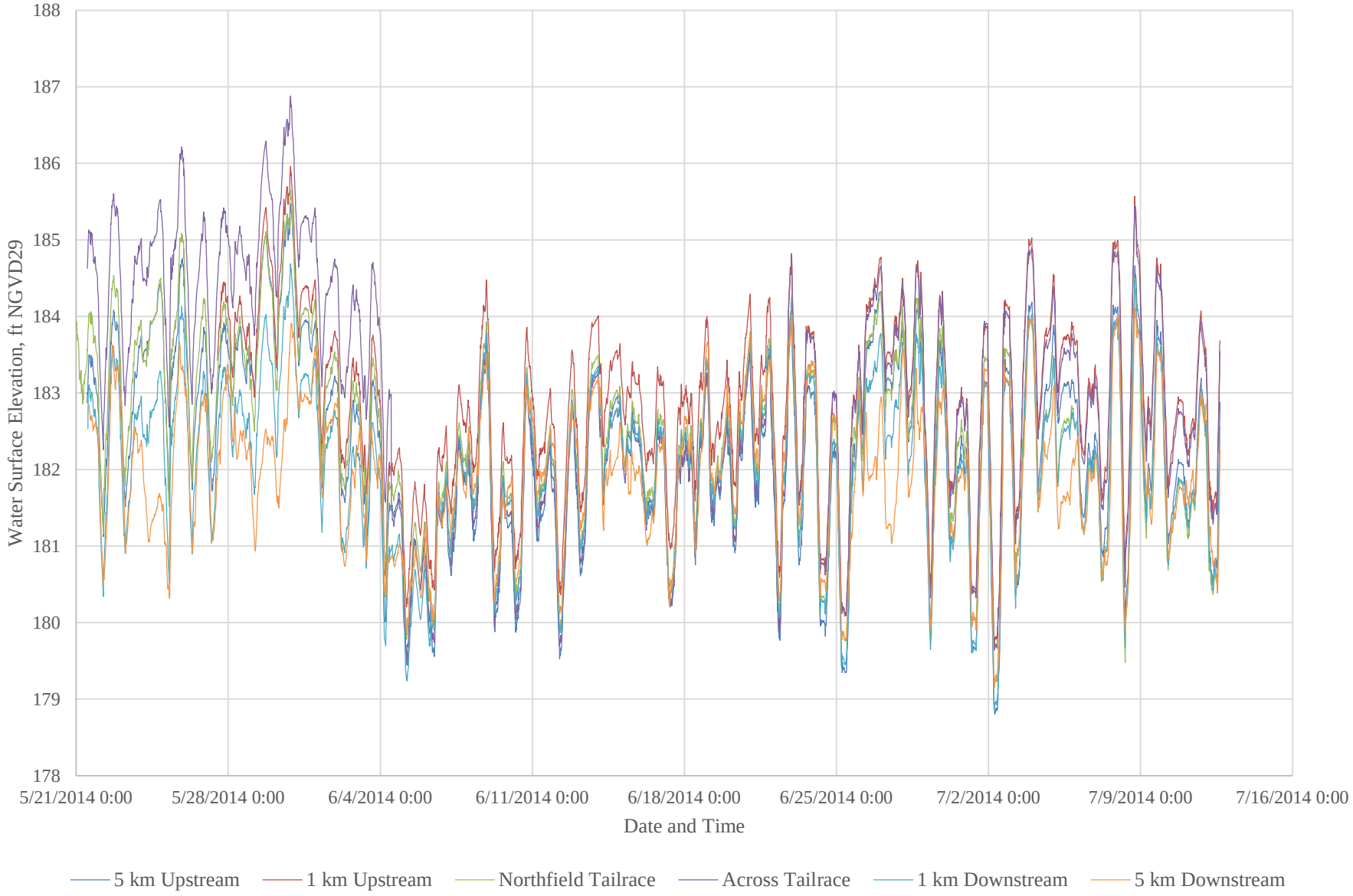
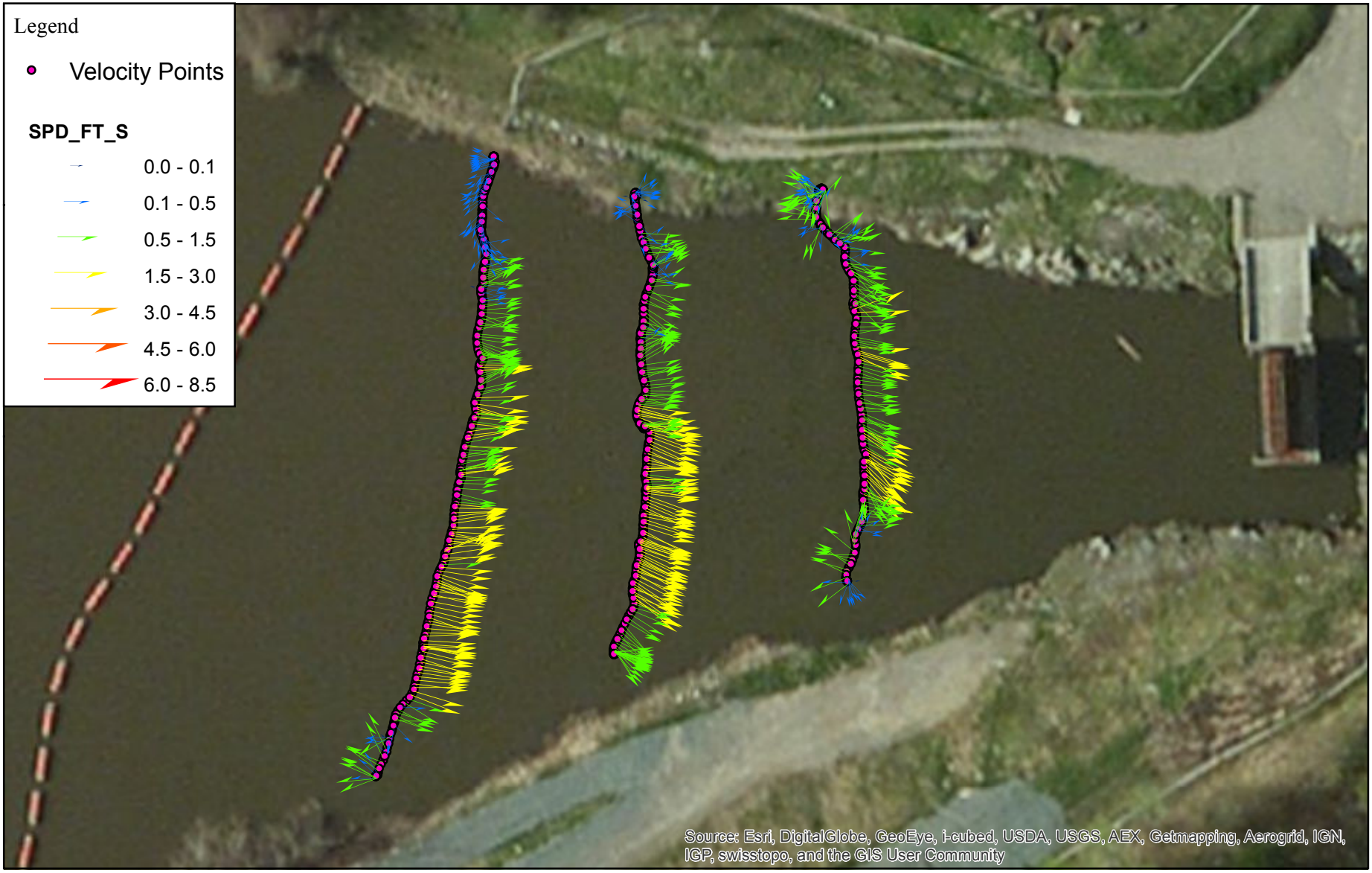
Figure #3: Water Level Logger Data





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0 0.005 0.01 0.02
Miles

Figure #4
Average Water Column Velocities
2 Units Pumping

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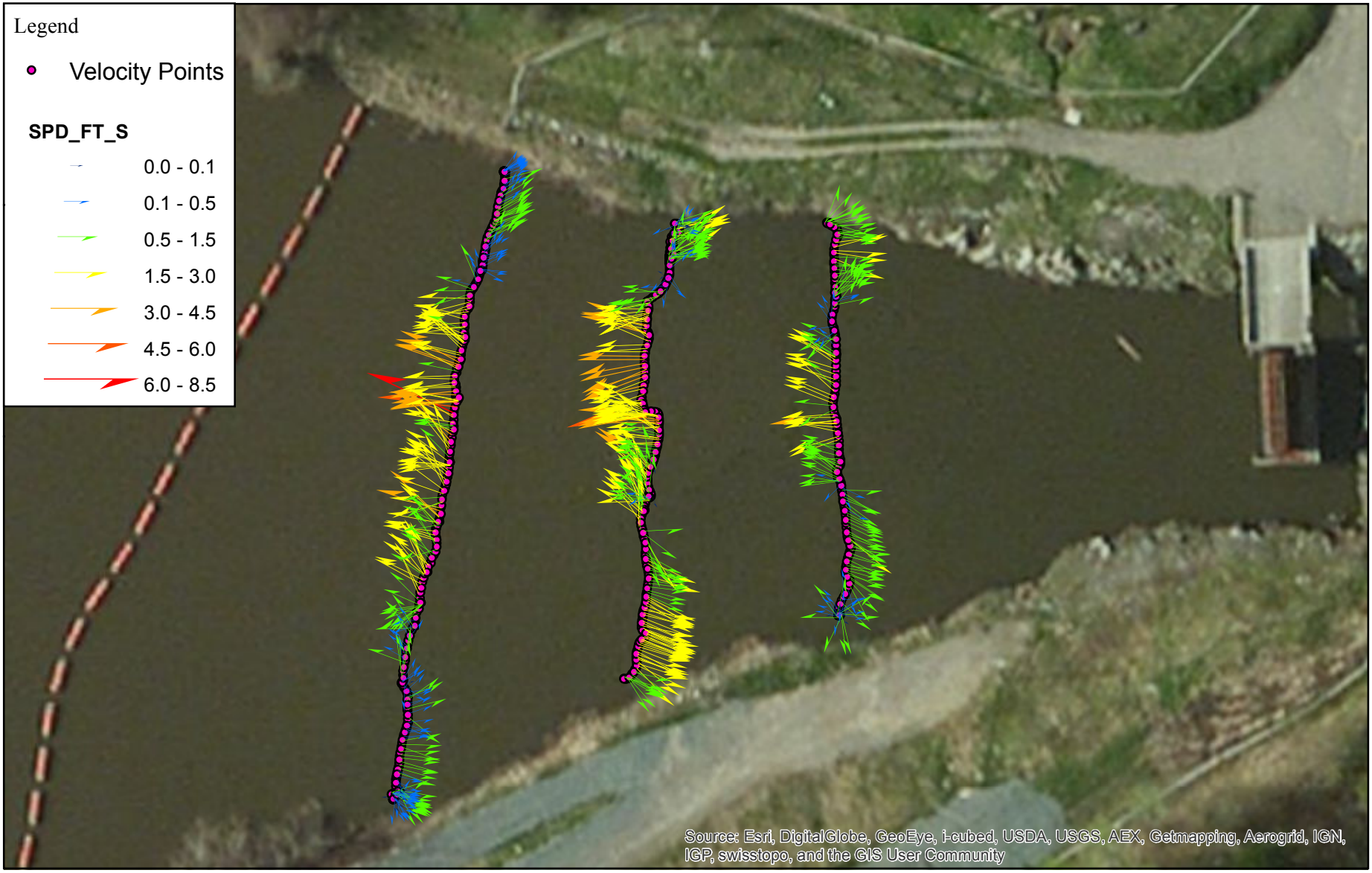

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N

0 0.005 0.01 0.02
Miles

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Figure #5
Average Water Column Velocities
2 Units Generating

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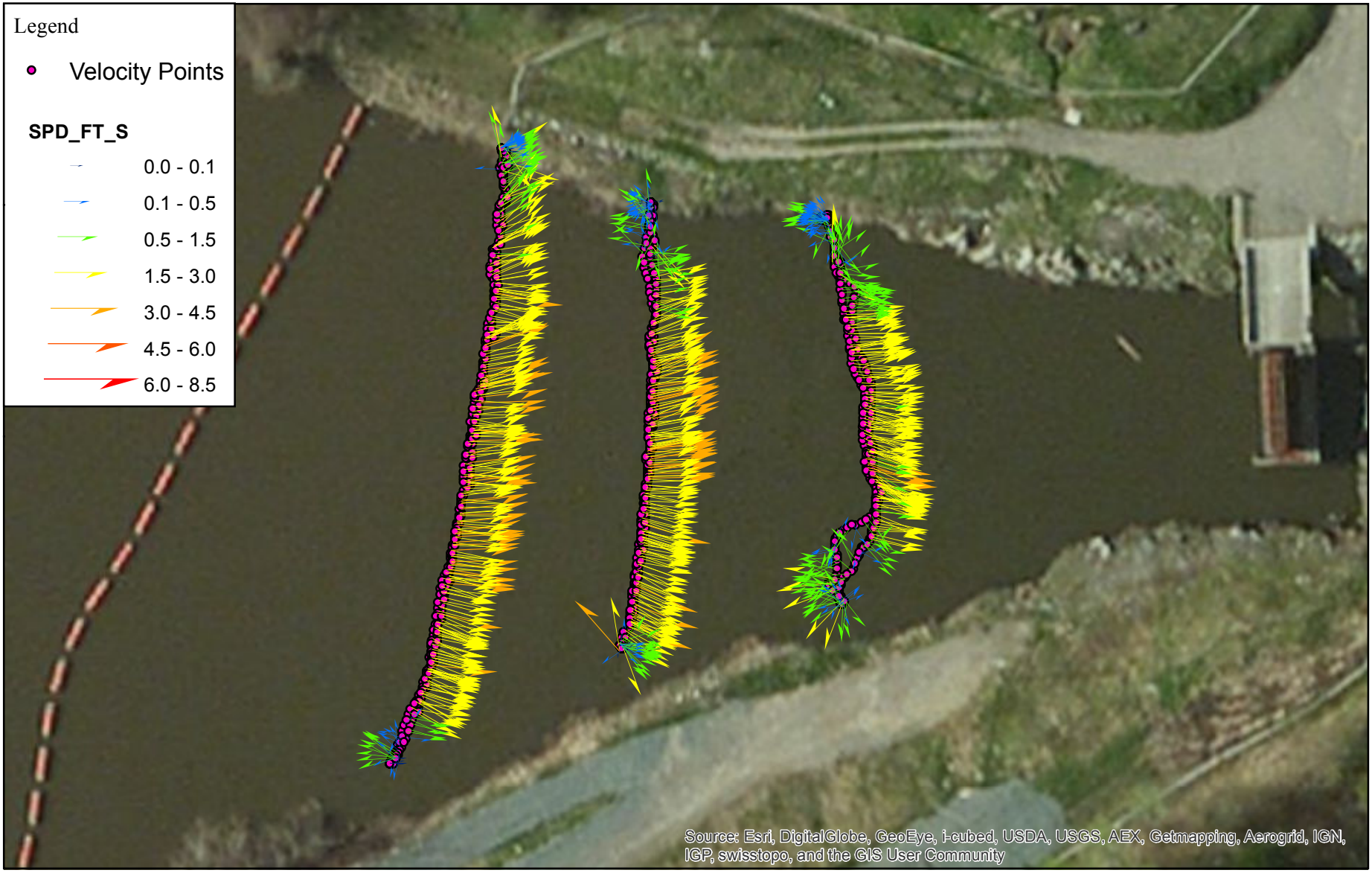

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0 0.005 0.01 0.02
Miles

Figure #6
Average Water Column Velocities
4 Units Pumping

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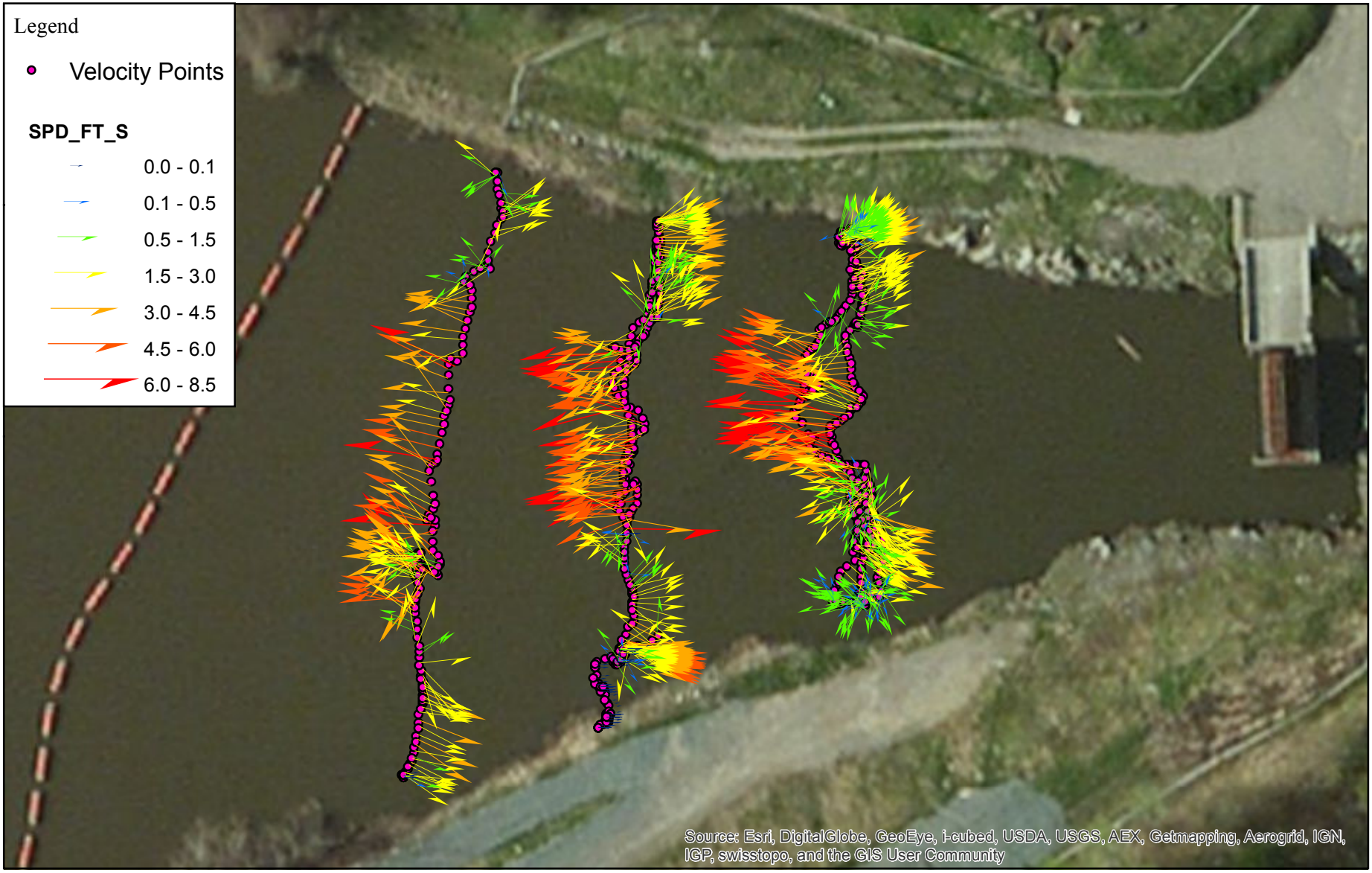

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N

0 0.005 0.01 0.02
Miles

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Figure #7
Average Water Column Velocities
4 Units Generating

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N

0 0.0075 0.015 0.03
Miles

Figure #8
Location of Proposed Transects with Respect to Face of Intake Structure

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