BLENHEIM-GILBOA PUMPED STORAGE POWER PROJECT FERC No. 2685
POWER PROJECT RELICENSING

INITIAL STUDY REPORT MEETING

March 3, 2016

NEW YORK STATE OF OPPORTUNITY. | NY Power Authority

Purpose for Meeting

- Per 18 C.F.R. § 5.15:
- To discuss study results, and
- the applicant's and/or other participant's proposals, if any, to modify the study plan in light of the progress of the study plan and data collected .

Relicensing Process

Apr 10, 2014	Power Authority filed NOI and PAD
Jul 7-9, 2014	FERC held scoping meetings
Aug 1, 2014	Public filed comments on PAD and Scoping Document
Sep 22, 2014	Power Authority filed Proposed Study Plan
Oct 16, 2014	Power Authority held Study Plan Meeting
Dec 1, 2014	Public filed comments on Proposed Study Plan
Jan 20, 2015	Power Authority filed Revised Study Plan
Feb 1, 2015	Public filed comments on Revised Study Plan
Feb 19, 2015	FERC issued Study Plan Determination
Aug 19, 2015	Power Authority filed Study Progress Report
Feb 19, 2016	Power Authority filed Initial Study Report
Mar 3, 2016	Power Authority holds Initial Study Report meeting

Next Steps

Mar 18, 2016	Power Authority will file meeting summary
Apr 17, 2016	Public may file comments
May 17, 2016	Power Authority will respond to comments, including revised study plans if warranted
Jun 16, 2016	FERC will amend approved study plan(s) as appropriate

Agenda

9:00	Introduction
9:30	Effect Of Project Operations On Downstream Flooding Study
	Break
10:30	Historic Structures Survey, Phase 1A Archaeological Survey
11:00	Fish Entrainment/Protection Assessment Study
	Lunch
12:30	Socioeconomics
1:15	Recreation Use/User Contact Study, Recreational Boating Desktop Feasibility Assessment
2:00	Wrap-up
2:15	Adjourn

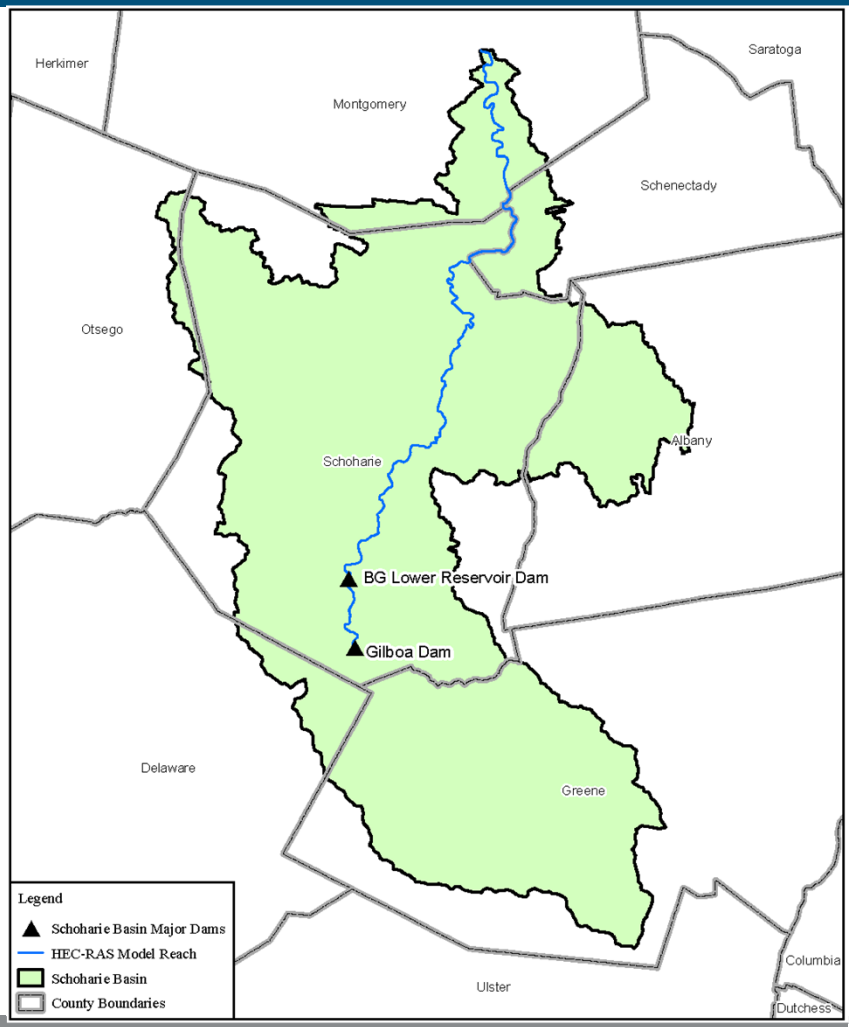
Effect Of Project Operations On Downstream Flooding Study

Study Goals and Objectives

- Goal
  - Provide an analysis of the potential effect of the B-G Project on downstream flooding and potential operational measures that could alleviate downstream flooding.
- Objectives
  - Estimate streamflows, water surface elevations, and extent of flooding along Schoharie Creek downstream of the Lower Reservoir Dam for the 10-year, 50-year, 100-year, and 500-year precipitation events for three scenarios.
  - Identify the impact of existing operations on downstream water surface elevations, depths, and extent of flooding.
  - Identify any reasonable, credible, and prudent operational measures that potentially could reduce downstream flooding during high-flow events.
  - For any operational measures determined to be feasible, conduct an analysis to determine their effect on flooding on the Schoharie Creek downstream of the Lower Reservoir Dam.

Geographic Scope

- Hydrologic Model – entire Schoharie Creek watershed
- Hydraulic Model – Schoharie Creek from Gilboa Dam to Mohawk River
- Operations Model – B-G Project



Study Progress

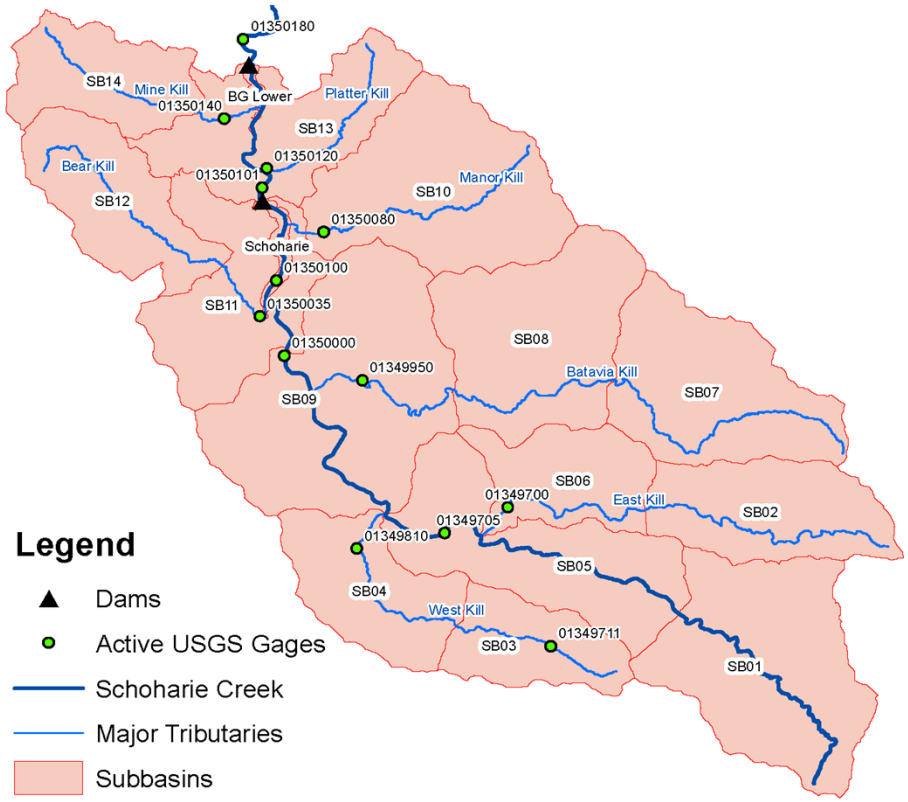
- Hydrologic Model (HEC-HMS/Regression Analysis)
  - Collected/processed precipitation, flow, and operations data for Tropical Storm Irene event
  - Verification and production runs substantially complete, QA/QC in progress
- Hydraulic Model (HEC-RAS)
  - Collected/processed topographic, flow, and high water mark data for Tropical Storm Irene and January 1996 events
  - Calibration/Verification substantially complete, QA/QC in progress
  - Production Runs awaiting completion of operations model development
- Operations Model (HEC-ResSim)
  - Under development
- Study Report
  - In progress

Hydrologic Model (HEC-HMS)

- Objective: Convert precipitation over time (hyetograph) to streamflow over time (hydrograph)
- Methodology: Various model elements determine this conversion including subbasins, reaches, and reservoirs.
  - Some of the parameters for these model elements are representative of physical characteristics of the watershed, while others are specific to the storm being modeled.

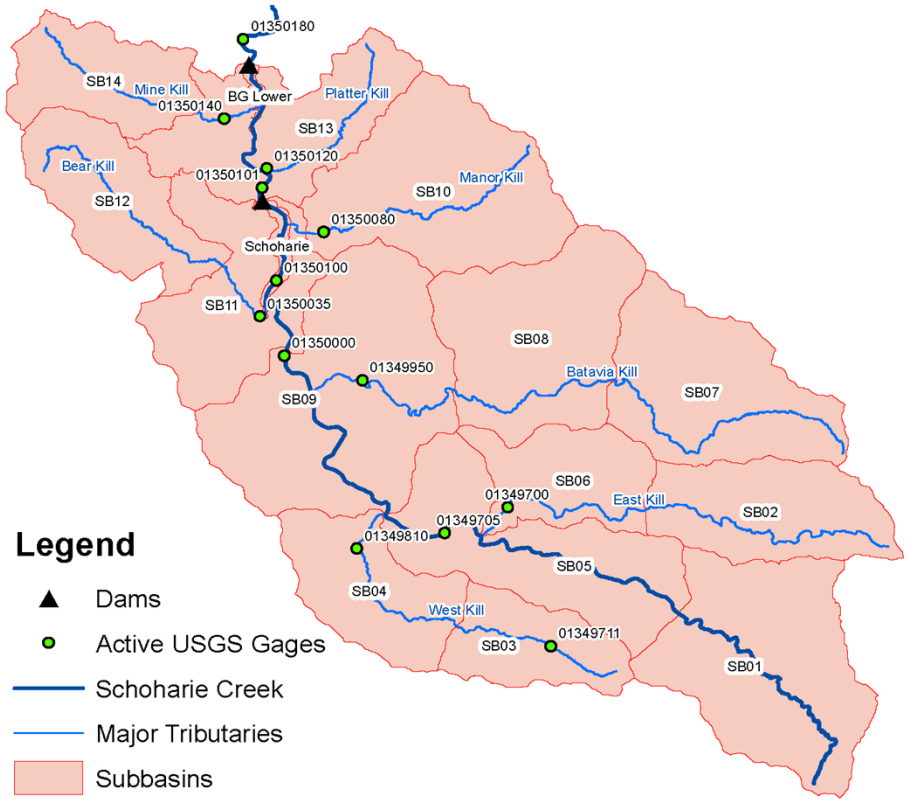
Hydrologic Model (Existing)

- Existing Hydrologic Model (HEC-HMS)
  - Reviewed and Approved by the Federal Energy Regulatory Commission (FERC) and an Independent Board of Consultants (November, 2009)
- Intended Use
  - Provide estimated inflow to the Lower Reservoir for the operations model
  - First verify adequacy of existing model to predict future storm events with information from August 2011, Tropical Storm Irene (Irene)



Hydrologic Model (Existing)

- Subbasin Parameters
  - Basin Related: Driven by size, shape, slope, land use
  - Storm Related: Driven by infiltration capacity of the soil when the storm begins
- Verification only alters Storm Related Parameters

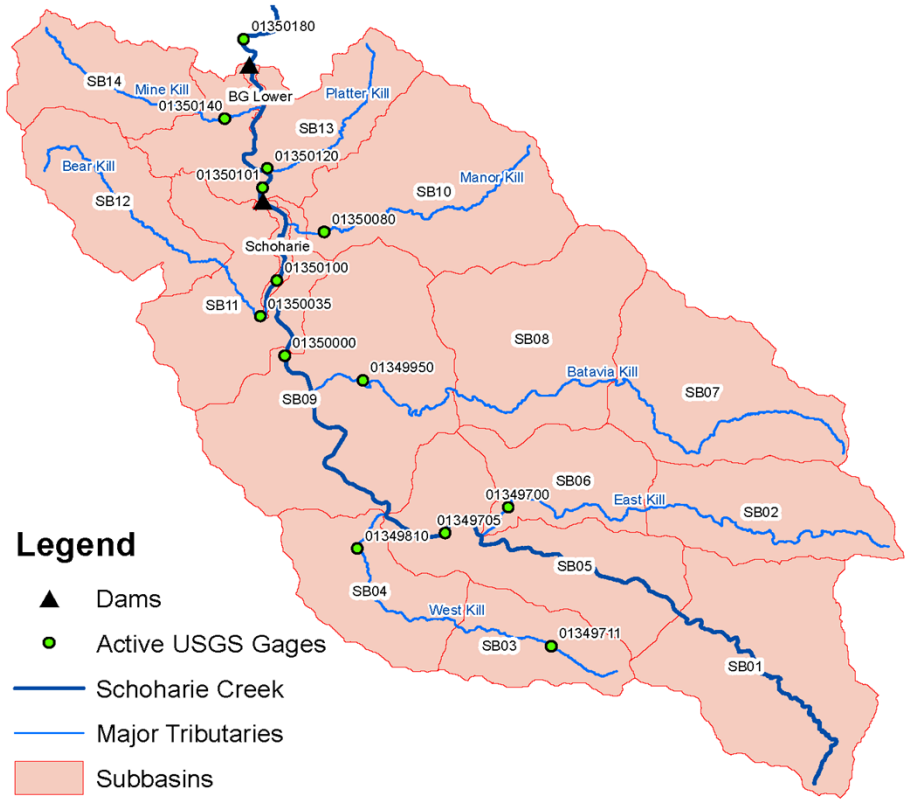


Irene Precipitation Data

- Precipitation Data Collected
  - Ground Measurements
    - National Weather Service (NWS)
    - New York City Department of Environmental Protection (NYCDEP)
    - Applied Weather Associates (AWA)
  - NWS Radar
- Used as input to model
- Data reported for this storm is imperfect

Irene Flow Data

- United States Geological Survey (USGS) Data Collected
  - Gage Records
  - USGS Report: Floods of 2011 in New York (SIR 2014-5058)
- Compared reported flows to modeled flows
- Data reported for this storm is imperfect
  - USGS acknowledges potential errors in their reported flow estimates

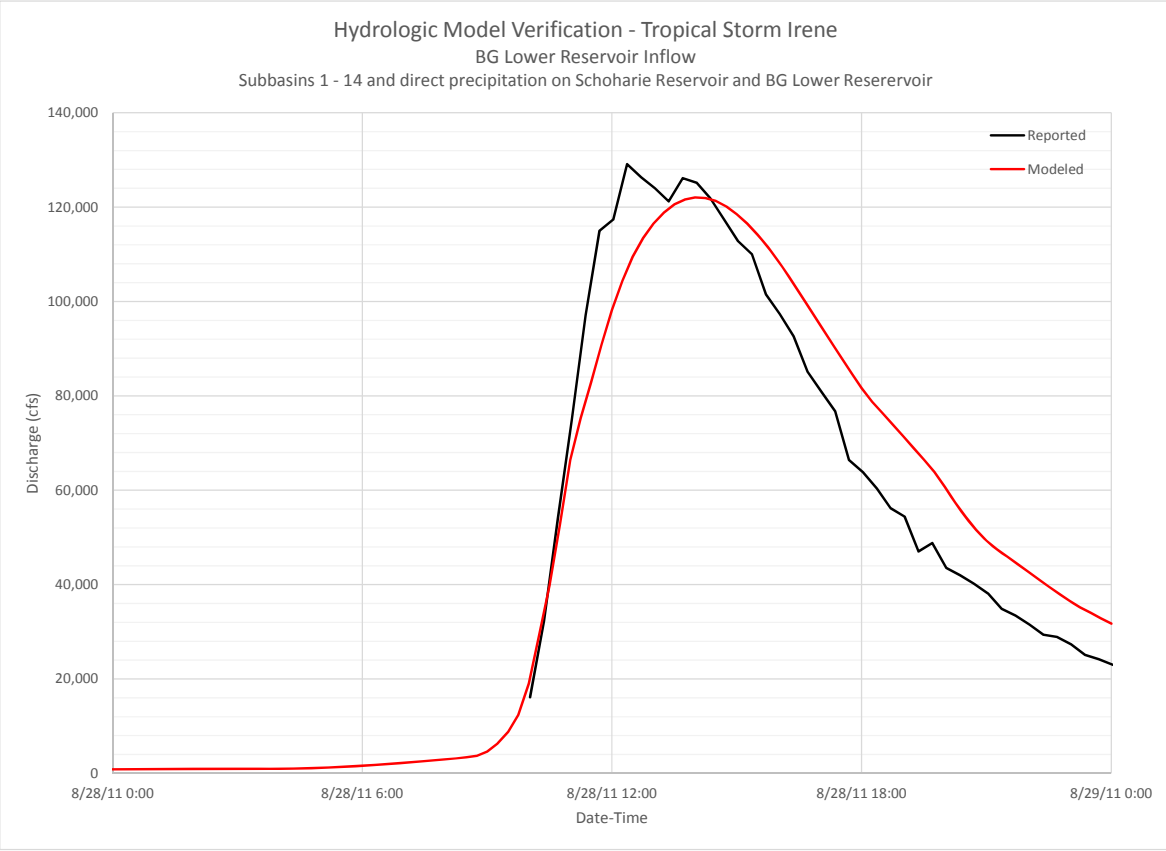


Irene Operations Data

- Reservoirs
  - Schoharie Reservoir/Gilboa Dam (NYCDEP)
  - Blenheim-Gilboa Pumped Storage Project (Power Authority)
- Irene Operations
  - Reservoir Storage Rating Curves
  - Spillway Discharge Rating Curves
  - Reservoir Elevation Measurements
  - Estimated Reservoir Discharge
  - Estimated Inflow (Power Authority Only)

Hydrologic Model Verification

- Preliminary Results
  - Compared USGS flow data with model results for Irene
  - Simulated inflow to the Lower Reservoir was within approximately 5% of the reported discharge



Hydrologic Model (Next Steps)

- Upstream Methodology (HEC-HMS)
  - Update reservoir parameters
  - Maintain existing storm related parameters
  - Precipitation Inputs (10-year, 50-year, 100-year, and 500-year)
  - Flow versus time results (hydrographs) used as input to HEC-ResSim and HEC-RAS models

Hydrologic Model (Next Steps)

- Downstream Methodology (Regression Analysis)
  - USGS Report: Magnitude and Frequency of Floods in New York (SIR 2006-5112)
  - Estimated peak discharge is based on data at the USGS gages along the Schoharie Creek as well as regional regression equations
  - These estimates will be used as downstream tributary inflows into the Hydraulic Model.

Hydraulic Model (HEC-RAS)

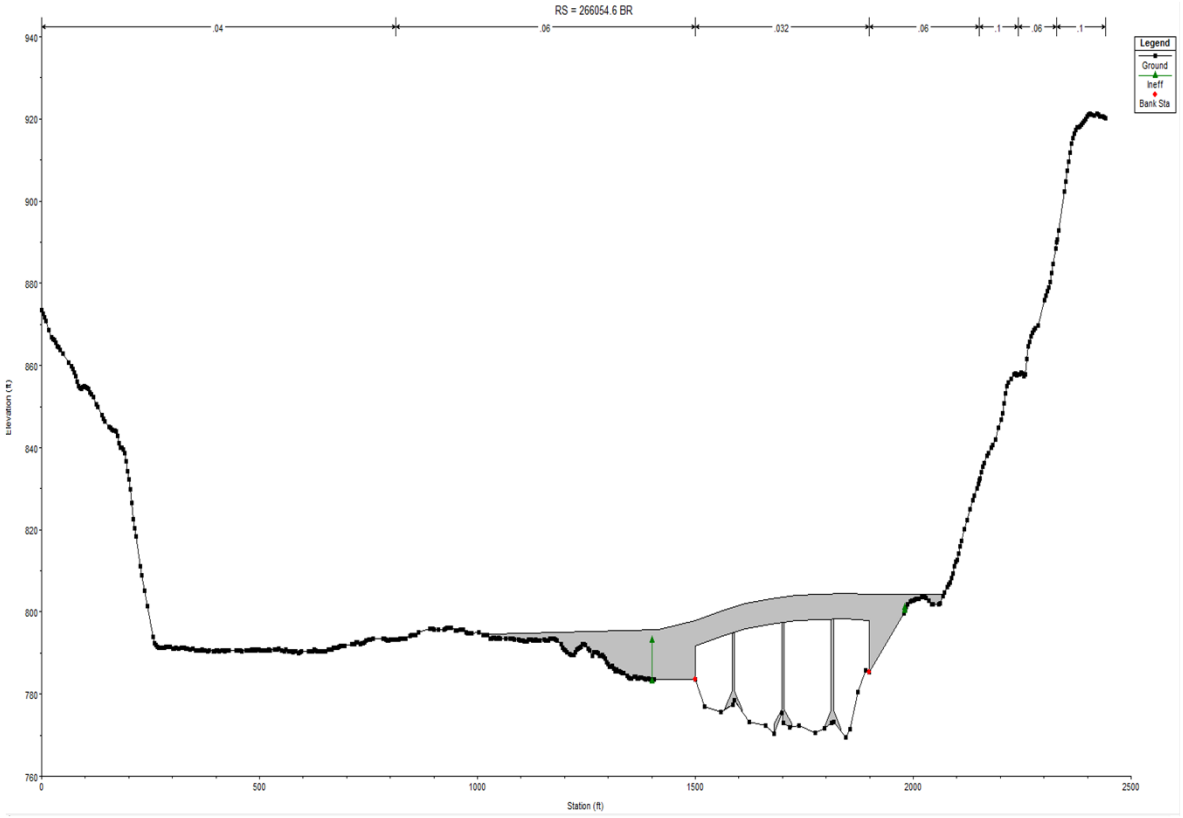
- Objective: Route flow versus time data (hydrograph) to estimate water surface elevations
- Methodology: Elevation, structure, and roughness data are used to evaluate the routing of the flow.

Hydraulic Model (Existing)

- Existing Hydraulic Model (HEC-RAS)
  - Reviewed and Approved by the Federal Energy Regulatory Commission (FERC) (June 2014)
- Intended Use
  - Provide estimated water surface elevations along the Schoharie Creek for different flows
  - First calibrate and verify existing model with information from August 2011, Tropical Storm Irene (Irene) and January 1996 flooding events

Hydraulic Model (Existing)

- 16 bridges updated
  - Surveys (New York State Canal Corporation 2014)
- 230 cross sections updated
  - Light Detection and Ranging (LiDAR) data (United States Geological Survey 2014)
  - Channel bottom (e.g. bathymetry, bridge surveys, Flood Insurance Study models, structure drawings, USGS quadrangle maps)



Hydraulic Model (Calibration/Verification)

- Differences between the storm events
  - Channel Geometry
  - Bridge Geometry
  - Roughness Elements
- Calibration and Verification will only alter the roughness values
  - Calibrate each event independently
  - Verify each event with a common set of roughness values

Flow Data for Calibration

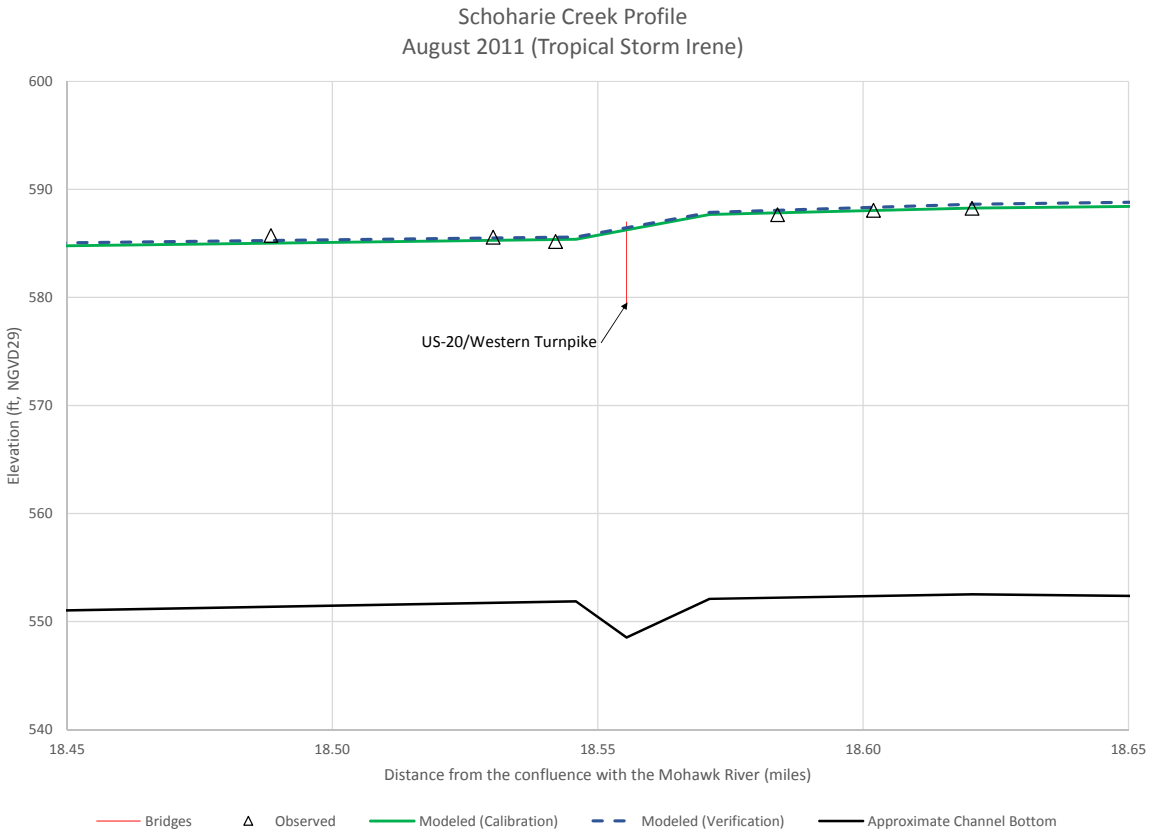
- Hydrograph Data Collected
  - USGS Gage Data
  - USGS Reports
    - Floods of 2011 in New York (SIR 2014-5058)
    - Flood of January 19-20, 1996 in New York State (WRIR 97-4252)
  - B-G Project Discharge

High Water Marks for Calibration

- High Water Mark (HWM) Data Collected
  - USGS Reports
    - Floods of 2011 in New York (SIR 2014-5058)
    - Flood of January 19-20, 1996 in New York State (WRIR 97-4252)
  - Power Authority Reports
- Data reviewed for outliers
  - Number of Marks used for Final Analysis
    - Jan-96: 74
    - Irene: 80
- Available HWMs generally concentrated near bridges

Hydraulic Model Calibration

- Preliminary Results
  - Compared flow and high water mark data with model results for Irene and January 1996 events
  - Model calibration yielded estimated WSELs that were within 0.5 feet for approximately 75% of the observed HWMs

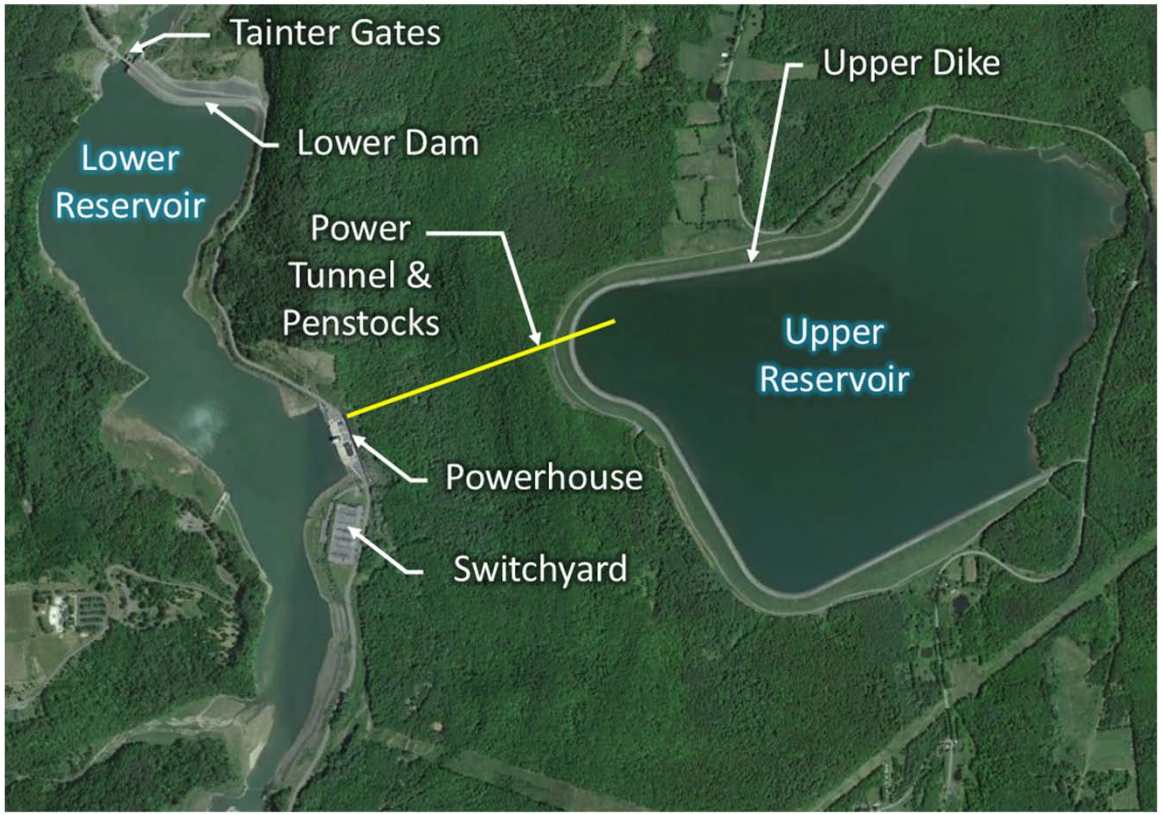


Operations Model (HEC-ResSim)

- Objective: Simulate various reservoir operations
- Methodology: Uses a rule based description of operational goals and constraints to make discharge decisions.
  - Discharge decisions are limited by the physical constraints of the system.

Operations Model (Development)

- B-G Project Features
  - Lower Reservoir
    - gated spillway
    - low level outlets
    - low discharge outlets
    - storage
  - Upper Reservoir
    - storage
  - Powerhouse
    - 4 pump-turbine units
- Intended Use
  - Simulate Existing Operations and High Flow Operation Alternatives



Operations Model (Development)

- Existing Operations
  - License Requirements
    - Releases from the Lower Reservoir should be no greater than flows which would have occurred in the absence of the B-G Project.
  - 1975 Settlement Agreement
    - Attempt to maintain a constant total reservoir volume during the rising flood inflows, so outflow will closely match inflow
    - Fluctuations in outflow will be controlled and minimized to the extent practicable

Operations Model (Development)

- Alternative Operations During High Flow Events
  - Physical Limitations
    - Lower and Upper Reservoir Storage
    - Tainter Gate Capacity
    - Pump-Turbine Capacity and Operability
  - Operational Limitations
    - Dam Safety
    - National Weather Service (NWS) Flood Forecasting Reliability
    - Reliability of Real-Time Observations (e.g. availability and accuracy of flow gages)
    - Regional Power Requirements

Hydraulic Model (Next Steps)

- Without B-G Project for 10-, 50-, 100-, and 500-year events
  - Flows from HEC-HMS and gage regression
- Current Operations for 10-, 50-, 100-, and 500-year events
  - Flows from HEC-ResSim and gage regression
- Alternative Operations during High Flow Events for 10-, 50-, 100-, and 500-year events
  - Flows from HEC-ResSim and gage regression

Break

Historic Structures Survey
and
Phase 1A Archaeological Survey

Study Goals and Objectives

- Meet requirements of Section 106 of National Historic Preservation Act of 1966 as amended (Section 106)
- Identify historic properties (historic structures and archaeological resources) that may be eligible for listing or listed in the National Register of Historic Places within the Project's Area of Potential Effect (APE)
- Review archaeological data that are pertinent to the formulation of a sensitivity model to determine where archaeological resources may be located in the APE
- Offer a field strategy for archaeological testing to determine whether archaeological resources are present in the Project's APE

Geographic Scope

- Area of Potential Effect (APE) are lands within the Project boundary
  - NY State Historic Preservation Office (SHPO) concurred with APE 1/2/2015

Study Progress

Historic Structures Survey

- Consulted with NY SHPO, Schoharie County Historical Society, local historians
- Conducted background research to identify known historic structures
- Conducted fieldwork including searching file archives and a survey of all resources 50 years and older.
- Prepared a historic context to aid in determining NRHP eligibility
- Evaluated structures for NRHP eligibility
- Submitted draft report to the NY SHPO
- On February 22, 2016, NY SHPO concurred with findings in the draft report.
- Have begun update of the 1992 Lansing Manor Historic Structure Report

Study Progress

Phase 1A Archaeology Study

- Reviewed existing information from NY SHPO and maps
- Developed sensitivity model to identify locations that may contain resources
- Conducted field reconnaissance survey
- Submitted draft report to the NY SHPO on February 1, 2016

Summary of Findings

Historic Structures Survey

- Seven resources evaluated for eligibility to NRHP

Resource	Eligibility Recommendation
Lansing Manor	Listed
Mattice Cemetery	Not eligible
The Baldwin House (aka Park Manager's House)	Not eligible
Lansing Turnpike	Not eligible
Coyne Cottage	Not eligible
The B-G Project and Mine Kill State Park	Eligible when 50 years old

Summary of Findings

Phase IA Archaeological Study

- Sensitivity model identified four variables needed for potential presence of archaeological resources
  - Location of known archaeological site
  - Steepness of terrain
  - Proximity to a waterbody
  - Presence of arable soils
- Field Reconnaissance with NYSHPO (October 15, 2015)
  - Mouth of Mine Kill Creek
  - Portions of old floodplain
  - Fluctuation zone of Lower Reservoir on date of reconnaissance

- Conclusions
  - Only those bottomlands with little topographic relief in proximity to the former creek channel likely to be sensitive for presence of archaeological resources.
  - Substrates in the fluctuation zone were jumbled throughout meaning any archaeological materials, observed or buried, would not be in their primary context.
  - Phase IB testing (shovel test pits) therefore is not recommended in connection with the relicensing.

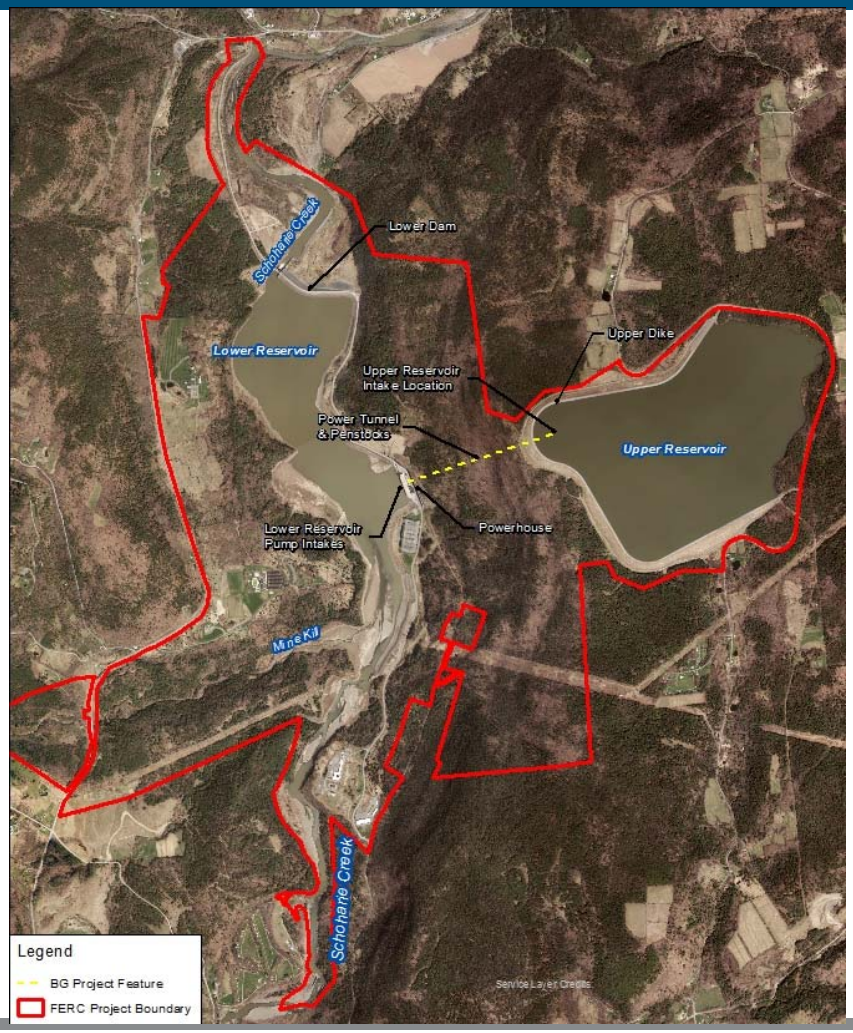
Fish Entrainment/Protection Assessment Study

Study Goals and Objectives

- **Goal:**
  - Conduct qualitative analysis of potential fish entrainment at the Project
- **Objectives:**
  - Describe Project characteristics
  - Summarize fish species present in the Upper and Lower Reservoir
  - Evaluate water quality and velocity conditions at intake locations
  - Evaluate which fish species and life stages have potential for entrainment
  - Review related studies conducted at similar projects
  - Estimate turbine passage survival based on available information

Geographic Scope

- Lower and Upper Reservoir



What is Entrainment and Survival?

- Entrainment:
  - The passage of organisms (e.g. fish) through the intake structure

- Survival:
  - The successful passage through the turbines so that the fish lives

Methodology

Tasks:

1. Describe Project Reservoir, Intake and Turbine Configurations
2. Field Collection of Intake Velocities
3. Water Level and Water Quality Data Analysis
4. Entrainment Analysis
   - Fish species
     - Evaluate biological and ecological factors
     - Habitat preference
     - Size, swim speed
   - Literature review of fish entrainment and survival studies at similar projects

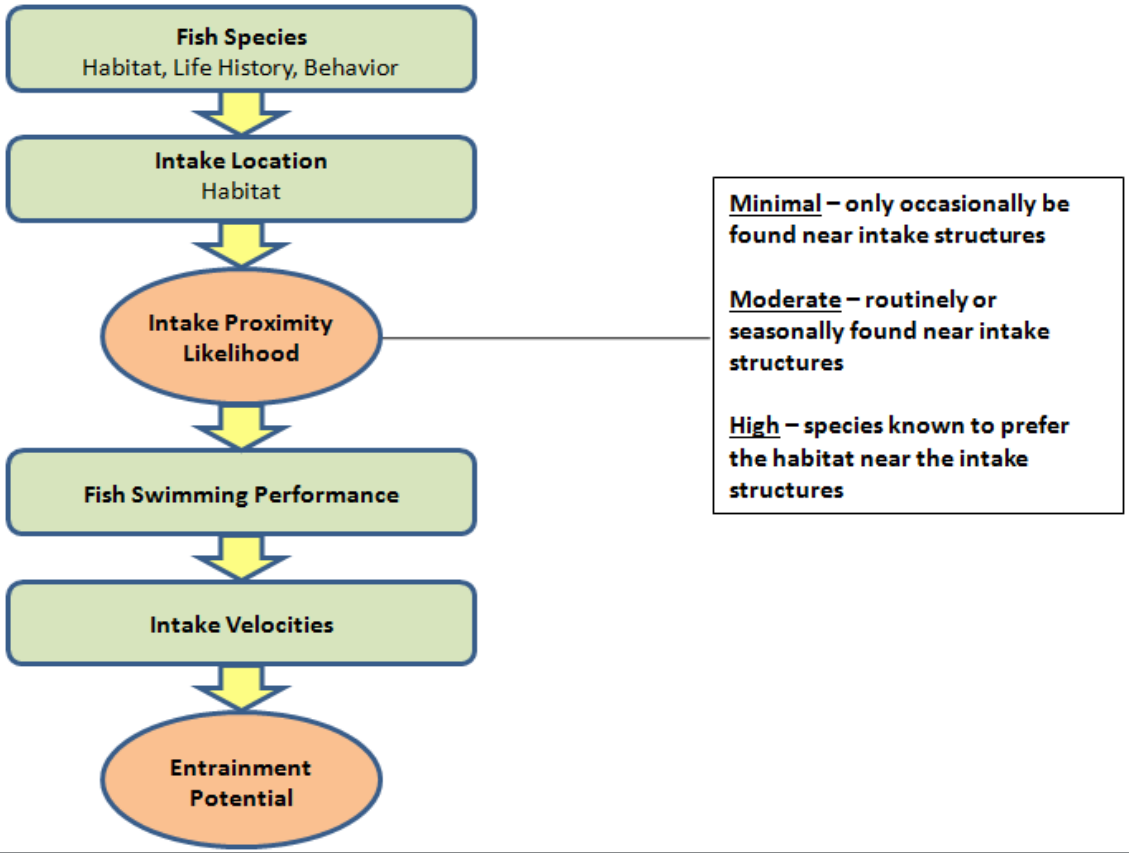
Methodology (cont.)

5. Assessment of Turbine Passage Survival
   - Estimated from similar hydroelectric projects
   - Blade strike model
   - Pressure calculations
6. Study Report

Factors that Affect Entrainment and Survival

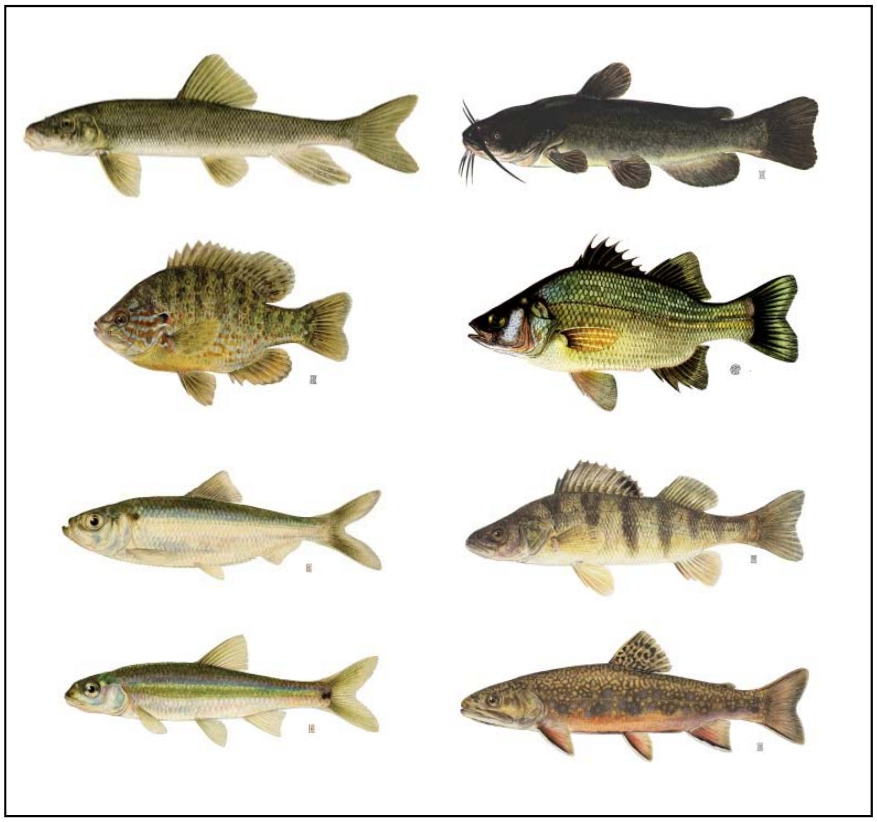
- Ecological
  - Environmental preferences (habitat)
  - Behavior (foraging, avoidance)
- Biological
  - Morphology (size/swimming performance)
  - Physiology (swim bladder)
  - Life History (migratory habits)
- Engineering
  - Size, location of intake, trashrack spacing
  - Intake velocity
  - Turbine type, number of blades, rotational speed, hydraulic capacity
  - Change in water pressure
  - Operations (water levels)

Entrainment Assessment Framework



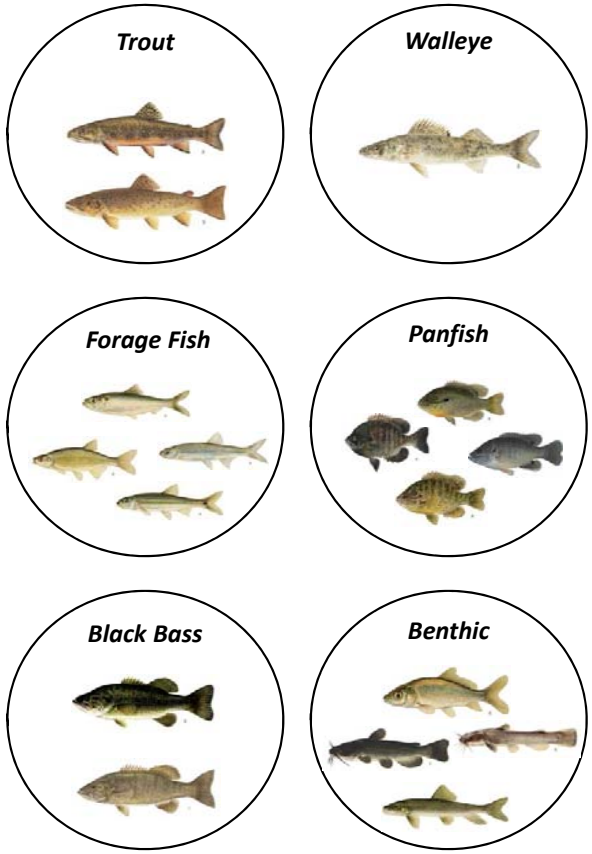
The Fishery

- Warmwater/Coolwater fishery
- Stocking of Trout and Walleye
- Bass, Perch, Sunfish, Forage, Bullhead
- No sea-run (diadromous) species
- No Threatened or Endangered species



Fish Species – Grouping

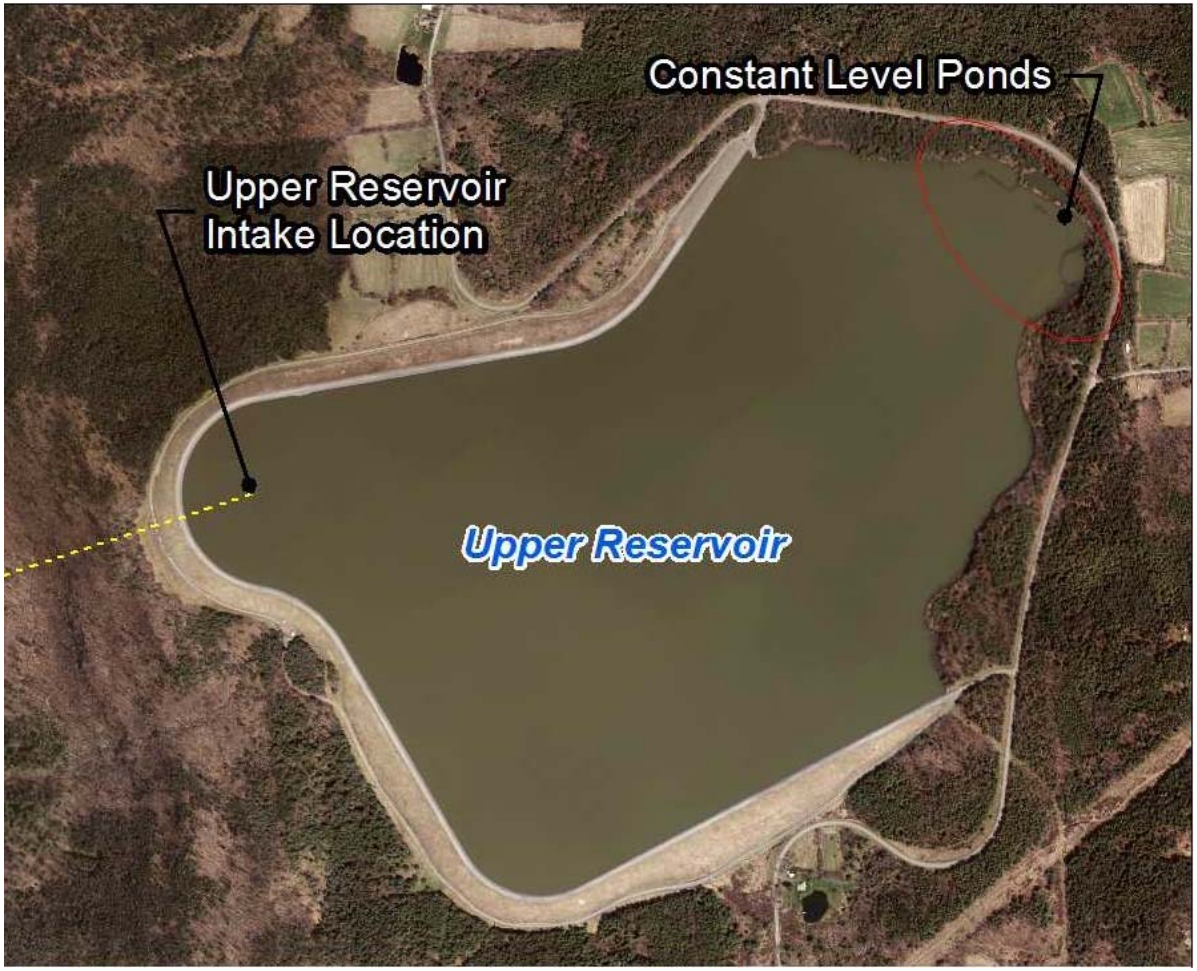
- Grouping:
  - Species with similar traits
    - Life histories
    - Habitat requirements
    - Behavior
- Life-stages:
  - juvenile, adults, spawning



Upper Reservoir Habitat

- Steep slopes, bowl shape
- Open water pelagic
- Limited littoral zone
- Constant Level Ponds
  - Littoral area, vegetation

Upper Reservoir



Upper Reservoir Intake

Depth and Habitat:

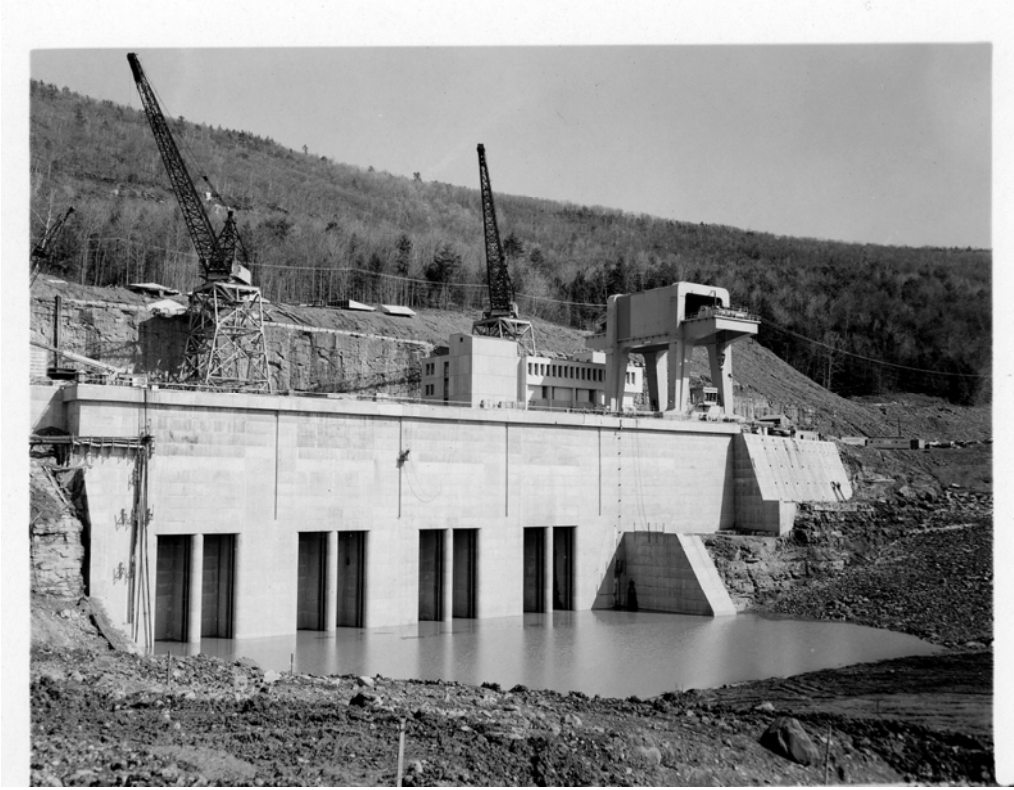
- 36.5 ft (min), 84.5 ft (max)
- No natural shoreline near intake
- Counter sunk with steep sides
- Sand, silt, bedrock substrate

Lower Reservoir

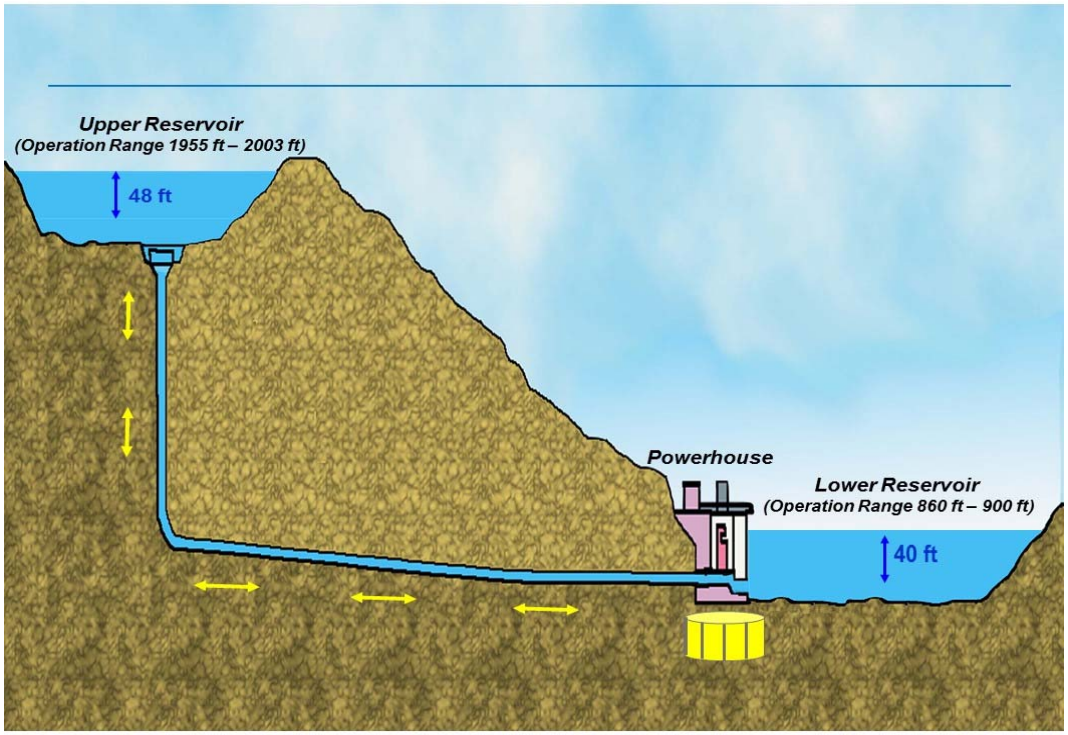
Lower Reservoir Intake

Depth and Habitat:

- Intake openings are 66 ft high
- Excavated channel with steep sides
- Sand, silt substrate
- Lack of littoral zone near intake



Schematic of Project Operations



Turbines

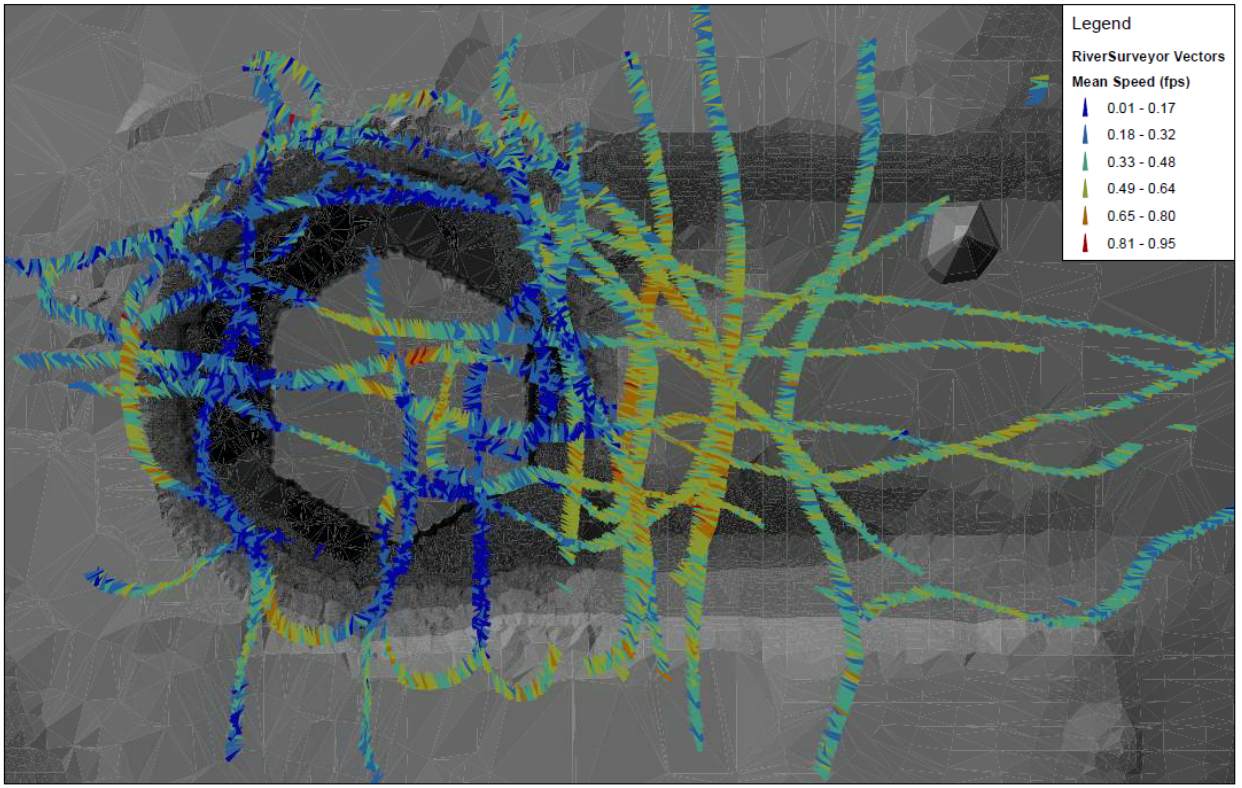
- 4 Reversible modified vertical Francis-type
  - 20 ft runner
  - 7 blades
  - 257 rpm
  - Hydraulic capacity
    - 3,200 cfs (generating)
    - 2,550 cfs (pumping)
  - Calculated Intake Velocities
    - Upper Reservoir 3.28 ft/s (1 ft in front)
    - Lower Reservoir 1.38 ft/s (1 ft in front)

Field Velocity Measurements: Upper Reservoir

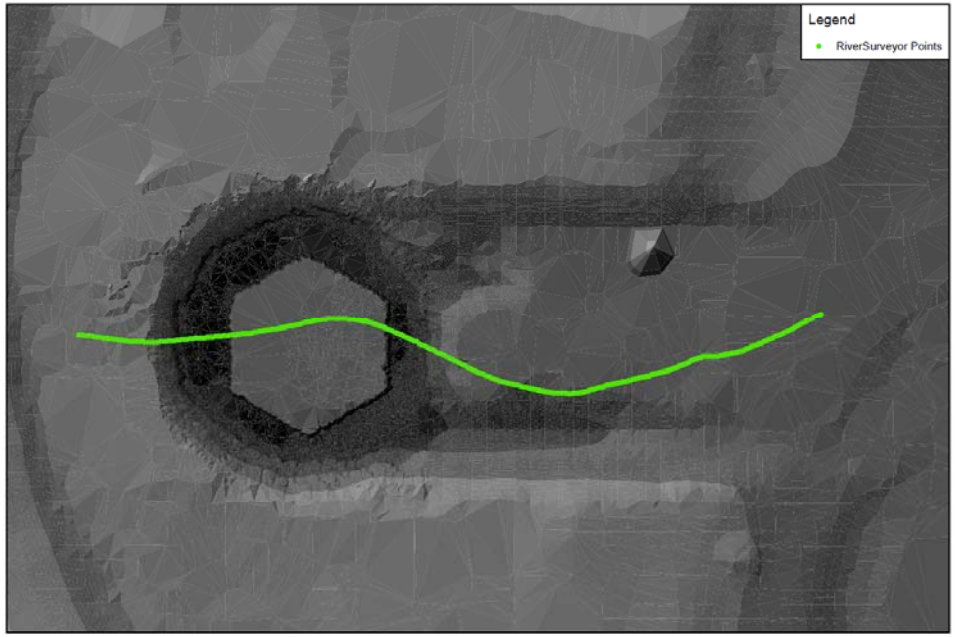
Water velocity in the vicinity of the intake in the Upper Reservoir measured 7/29/15

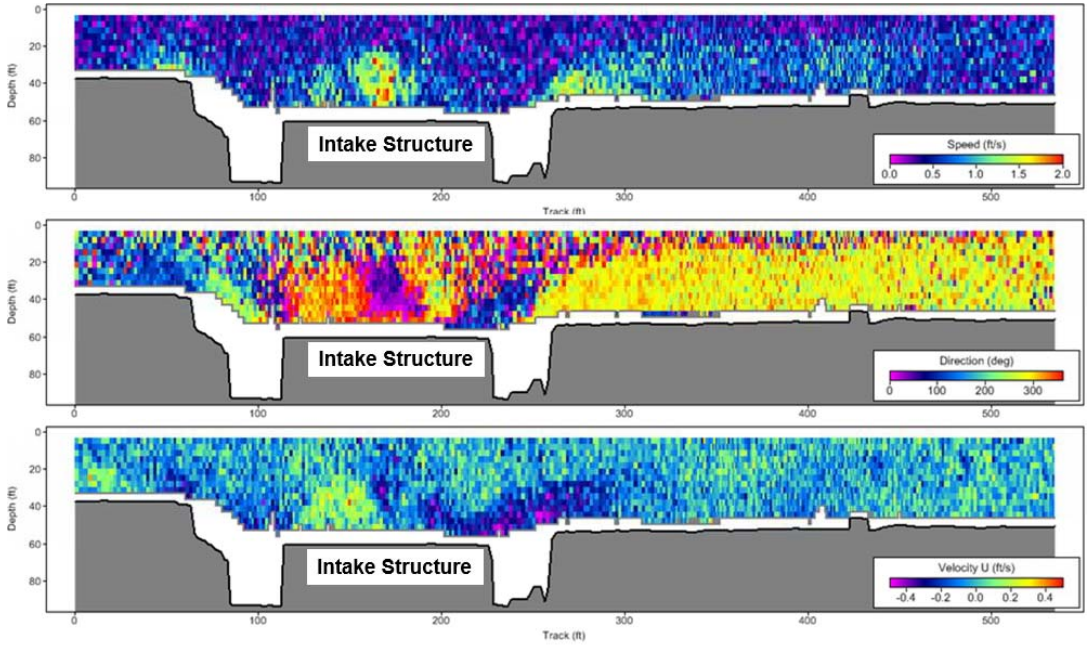
- Four units were generating at approximately full load
- Most (~90%) velocities measured were below 1.5 fps
- Max value: 2.95 fps

Sampling tracks during four units generating



Field Velocity: Upper Reservoir





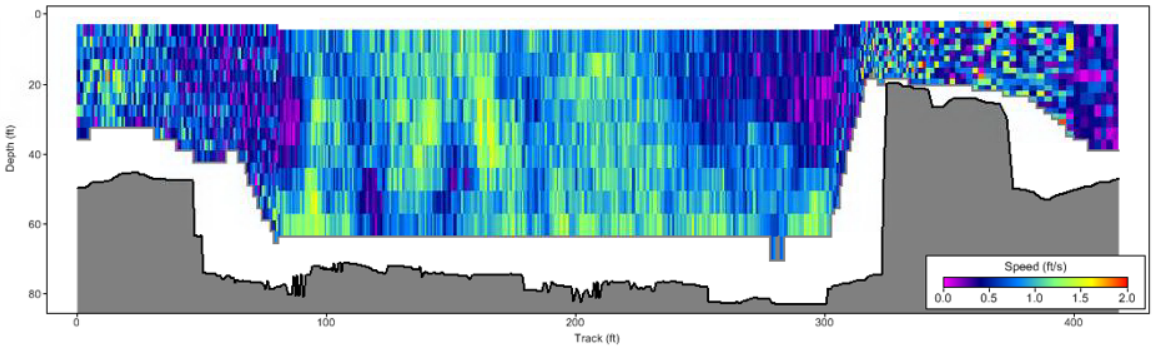
Field Velocity Measurements: Lower Reservoir

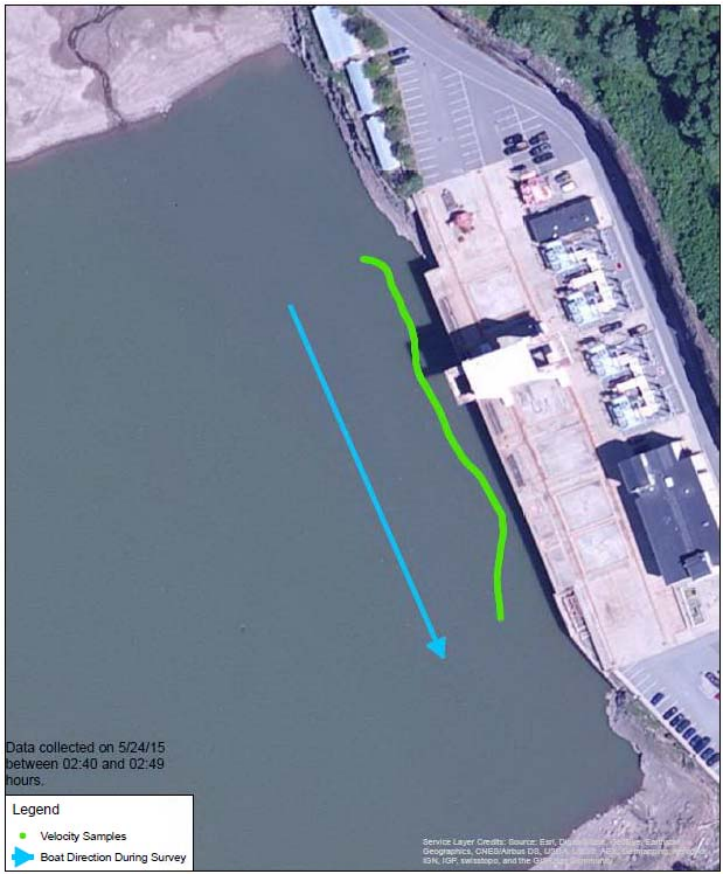
Water velocity in the vicinity of the intake in the Upper Reservoir measured 5/24/15

- During this time, four units were pumping at approximately -1,185 MW
- Maximum velocities were slightly higher than the 1.38 fps calculated velocity
  - Max velocity = 1.95 fps
  - Variable across intake

Field Velocity Measurements: Lower Reservoir

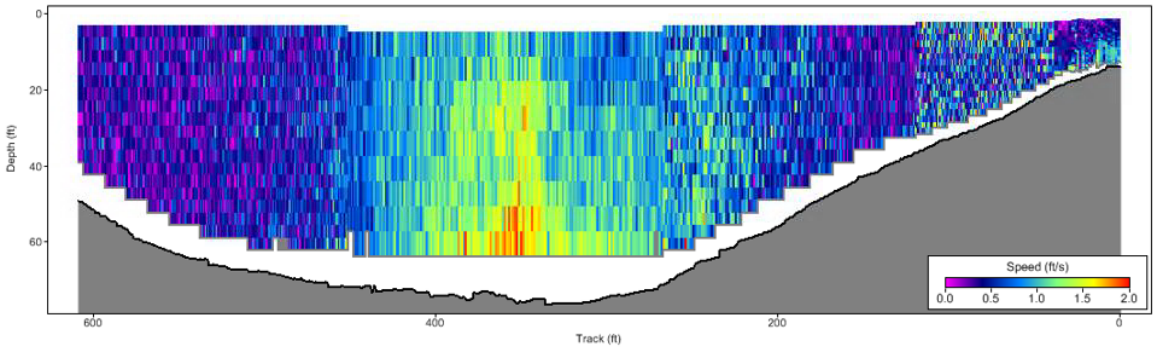
Parallel, nearest to the intake, 25-35 feet from the wall

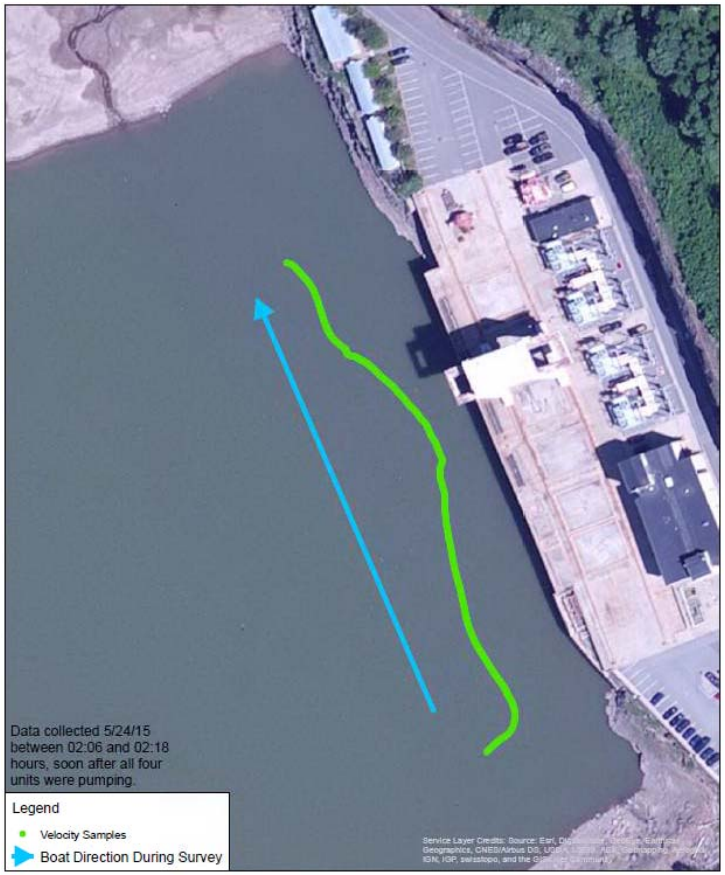




Field Velocity Measurements: Lower Reservoir

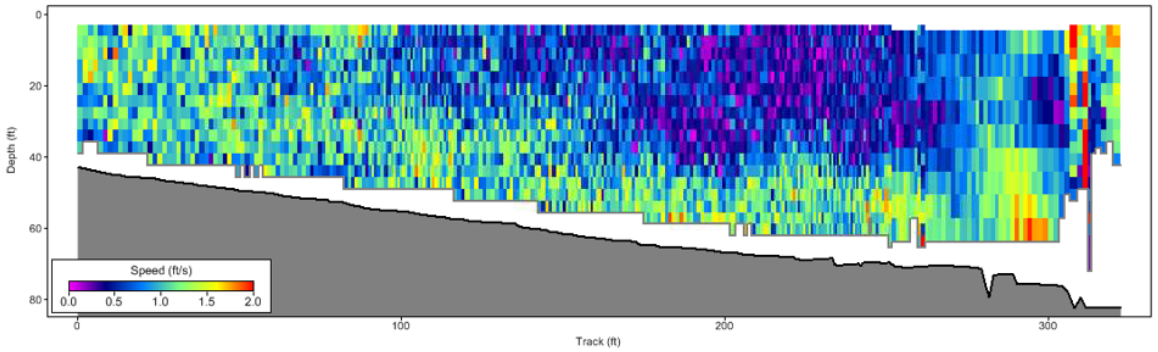
Parallel, approximately 60-100 feet away from the intake, soon after all four units were online and pumping

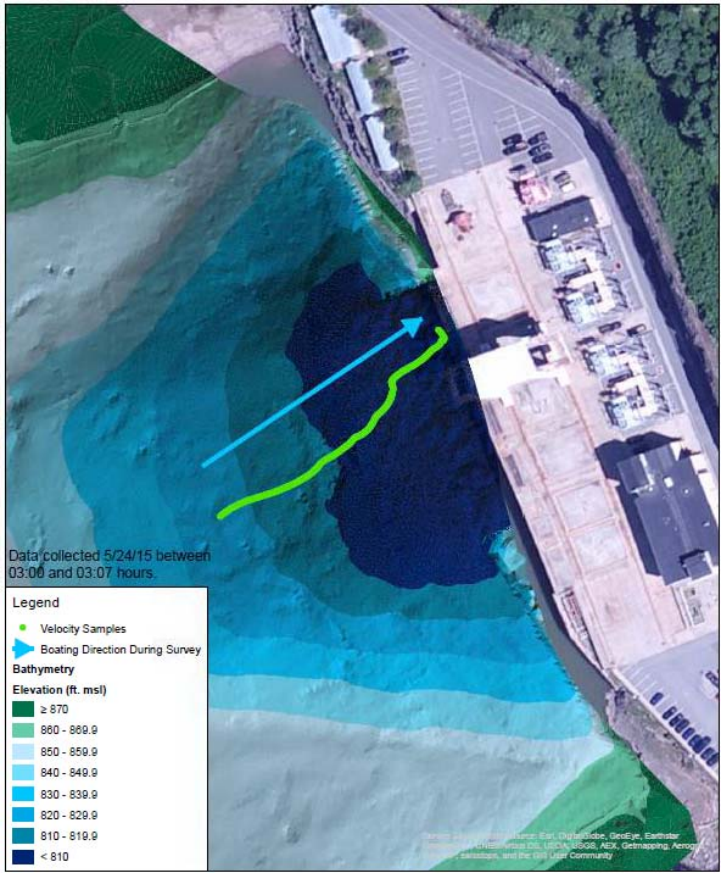




Field Velocity Measurements: Lower Reservoir

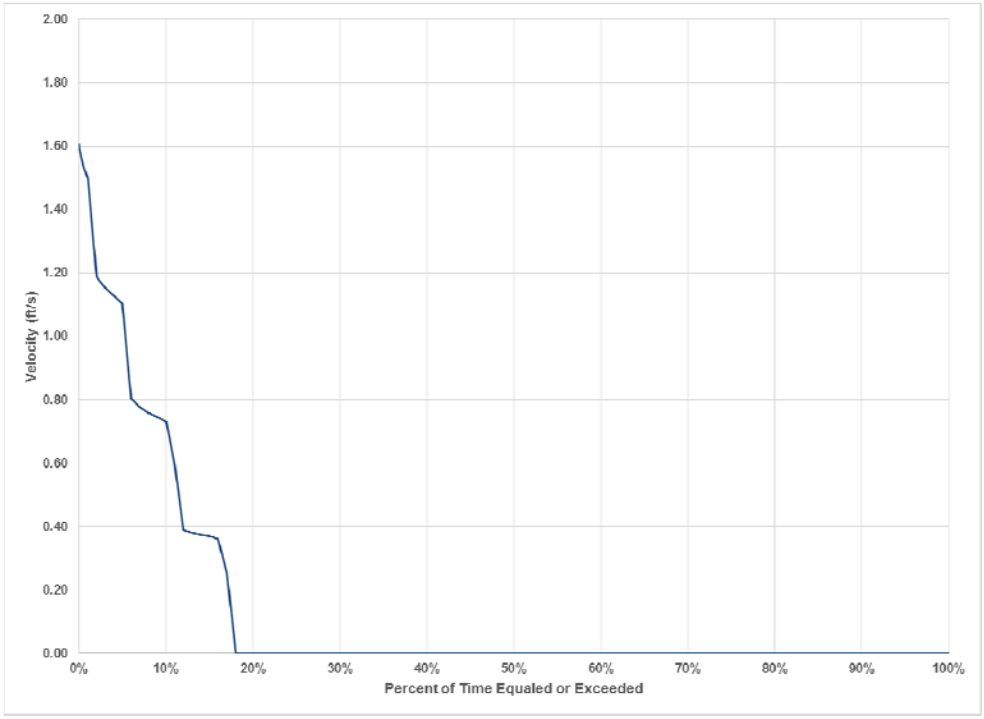
Perpendicular, collected in a direction towards the intake



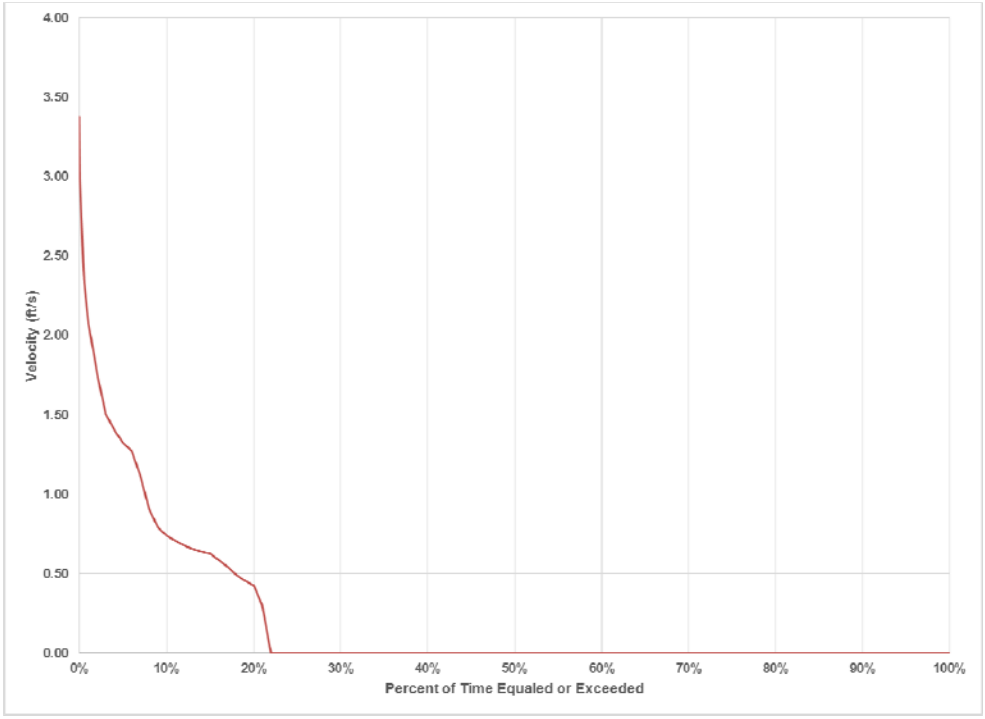


Annual Velocity Duration Curves (Calculated)

Lower Reservoir (Pumping) Years 2002-2014

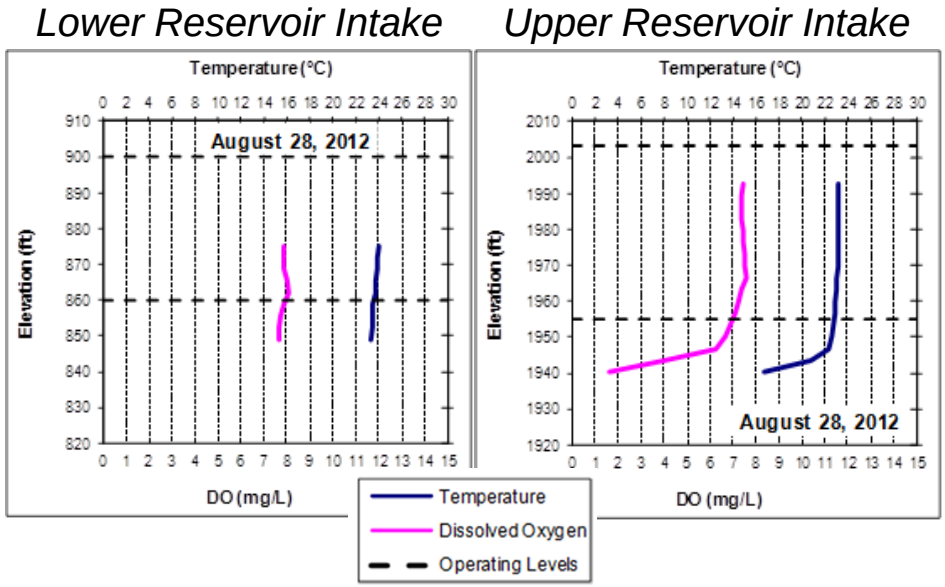


Upper Reservoir (Generating) Years 2002-2014

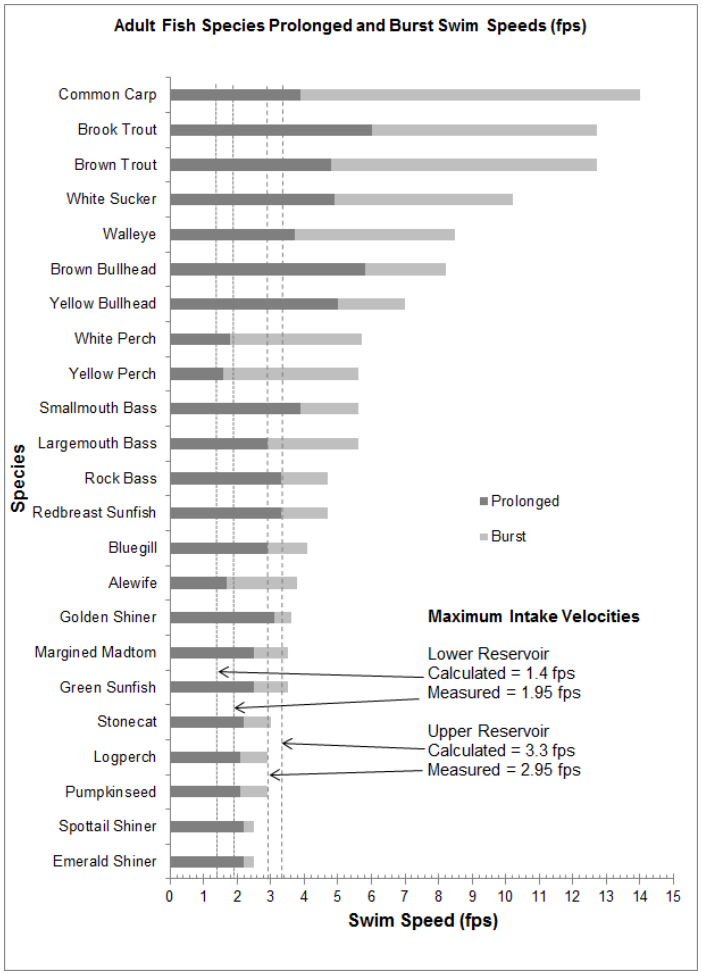


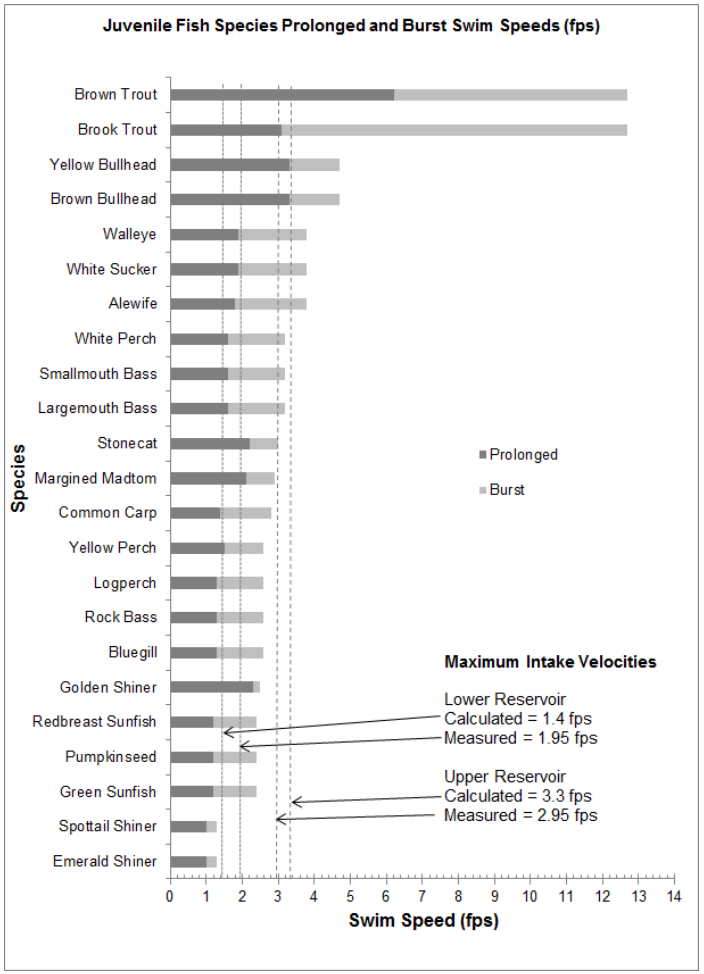
Water Level and Water Quality

- Depth to intake changes with operations
- No seasonal drawdown
- Water temperature and dissolved oxygen
  - Thermal and dissolved oxygen preference/tolerance



Swim Speeds


Adult Fish Species Prolonged and Burst Swim Speeds (fps)
Species
Common Carp
Brook Trout
Brown Trout
White Sucker
Walleye
Brown Bullhead
Yellow Bullhead
White Perch
Yellow Perch
Smallmouth Bass
Largemouth Bass
Rock Bass
Redbreast Sunfish
Bluegill
Alewife
Golden Shiner
Margined Madtom
Green Sunfish
Stonecat
Logperch
Pumpkinseed
Spottail Shiner
Emerald Shiner
Prolonged
Burst
Maximum Intake Velocities
Lower Reservoir
Calculated = 1.4 fps
Measured = 1.95 fps
Upper Reservoir
Calculated = 3.3 fps
Measured = 2.95 fps
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Swim Speed (fps)


Juvenile Fish Species Prolonged and Burst Swim Speeds (fps)
Species
Brown Trout
Brook Trout
Yellow Bullhead
Brown Bullhead
Walleye
White Sucker
Alewife
White Perch
Smallmouth Bass
Largemouth Bass
Stonecat
Margined Madtom
Common Carp
Yellow Perch
Logperch
Rock Bass
Bluegill
Golden Shiner
Redbreast Sunfish
Pumpkinseed
Green Sunfish
Spottail Shiner
Emerald Shiner
Prolonged
Burst
Maximum Intake Velocities
Lower Reservoir
Calculated = 1.4 fps
Measured = 1.95 fps
Upper Reservoir
Calculated = 3.3 fps
Measured = 2.95 fps
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Swim Speed (fps)

Entrainment Potential – Lower Reservoir (At Maximum Pumping Capacity)

- Species susceptible to entrainment
  - Forage Group –
    - Alewife (juvenile), Emerald Shiner (juvenile), Spottail Shiner (juvenile), Logperch (juvenile)
      - Vertical movements
      - Preference for open water
      - Burst swim speed < intake velocity of 1.95 fps
  - Benthic Group
    - Brown and Yellow Bullhead, Margined Madtom, Stonecat (juvenile)
      - Bottom-oriented
      - Burst swim speed likely less than intake velocity of 1.95 fps

Ways Fish May Enter Upper Reservoir

- Stocking
  - Bass, Trout, Walleye
- “Bait bucket” introductions
- Bird-mediated dispersal
- Entrainment of small/early life stages
  - High survival rate due to small size

Entrainment Potential – Upper Reservoir (At Maximum Generating Capacity)

- Species susceptible to entrainment
  - Walleye Group
    - Walleye (juvenile)
      - Prefer moderately deep, Burst swim speed < intake velocity of 3.3 fps
  - Panfish Group
    - Bluegill, Green Sunfish, Pumpkinseed, Redbreast Sunfish, and Yellow Perch (adult)
      - Deep water in winter, thermal refuge, Burst swim speed < intake velocity of 3.3 fps
  - Forage Group
    - Alewife (juvenile), Emerald Shiner, Golden Shiner, Spottail Shiner and Logperch (adult and juvenile)
      - Forage in mid-water, vertical migrations in limnetic zone, Burst swim speed < intake velocity of 3.3 fps
  - Benthic Group
    - White Sucker (juvenile), Brown and Yellow Bullhead (juvenile), Margined Madtom and Stonecat (adult and juvenile)
      - Benthic oriented, Burst swim speed < intake velocity of 3.3 fps

Literature Review of Field Studies

- Several Pumped-Storage Projects Reviewed
  - *Bad Creek (SC)*
  - *Balsam Meadow (CA)*
  - *Northfield Mountain (MA)*
  - *Muddy Run (PA)*
  - *Richard B. Russell (GA)*

Literature Review of Field Studies

- Common findings:
  - *Focus is on effects of pumping*
  - *Diadromous species more susceptible due to migrations*
  - *Juvenile fish are most commonly found to be entrained*
  - *The location of the intake in relation to habitat has been shown to affect entrainment*

Turbine Passage Survival

Factors potentially influencing fish survival or injury during turbine passage:

- Turbine type and size
- Turbine speed
  - Higher speeds increase the likelihood of fish contact with structural elements.
- Fish size
  - Smaller fish have less likelihood of contact with mortality-inducing factors.

Turbine Passage Survival Database

Fish Survival Rates (Immediate) by Fish Size Class for Francis Turbine with Rated Flow >2400 cfs from EPRI Database

Site Characteristics Relevant to Turbine Passage Survival

Site Name	Unit # Tested	Turbine Type	Rated Head (ft)	Rated Power (MW)	Rated Flow (cfs)	Speed (rpm)	Runner Diameter (in)	No. of Runner Blades
E.J. West	3	Francis (vertical)	63	12.8	2450	112.5	131	15
Finch Pruyn	4	Francis (horizontal, quad)	49	14	4600	-	-	-
	5	Francis (horizontal, double)	49	14	4600	-	-	-
B-G	-	Francis (vertical)	1123	290	3200	257	240	7

Turbine Passage Fish Survival Rates

Site Name	Turbine Type	Fish Size (inches)	*N*	Average Immediate Survival *(all species combined)*		
				Minimum (%)	*Maximum (%)*	*Mean (%)*
E.J. West	Francis (vertical)	3.9	-	-	-	-
		3.9-7.8	12	59.2%	97.1%	84.8%
		7.9-11.8	6	72.2%	105.3%	88.0%
		11.8+	-	-	-	-
Finch Pruyn	Francis (horizontal)	3.9	-	-	-	-
		3.9-7.8	2	94.12%	94.92%	94.52%
		7.9-11.8	4	70.73%	92.59%	83.93%
		11.8+	-	-	-	-

Predicted Survival Calculations

Analysis of turbine survival was performed using the formula developed by Franke *et al.* (1997)

- Five representative fish lengths and two blade strike correlation factors were selected for both generating and pumping modes of operation
- Results similar for generation and pumping, and indicate higher predicted survival of smaller fish
- 82-99% survival depending on fish size

Pressure Differential

- Rapid changes in pressure can be a source of mortality
  - Vented swim bladder
    - Physostomous: Trout, minnows, catfish
  - Non-vented swim bladder (more susceptible)
    - Physoclistous: Basses, sunfish, perch
- Potentially detrimental during pumping
  - LR is at maximum
  - UR is at minimum

Summary of Survival Trends

- Empirical data from hydroelectric projects with similar turbine types and hydraulic capacities as the Project indicates that turbine passage survival ranges from 85-95% depending on fish size.
- The empirical data also indicates that turbine passage survival trends by fish size (smaller fish are more likely to survive turbine passage).
- Blade strike probability equations specific to the Project turbines indicate that fish survival is similar during pumping and generation phases of operations. The calculations support the empirical data results relative to higher survival of smaller fish.
- Pressure gradients may be detrimental to entrained fish during the pumping phase of operation when the Lower Reservoir is full and the Upper Reservoir is at its minimum elevation.

Conclusions

Entrainment and turbine passage mortality risk to fish resources at the B-G Project is low

- Intake configuration in relation to habitat
- Low intake velocities
- Infrequent operations

Conclusions

- There are no diadromous or threatened/endangered species present
- Fishery is enhanced with stocking
- Of those fish likely to be entrained, most are either forage species or juveniles that are small in size and are expected to have high turbine passage survival
- Larger fish are not likely to be involuntarily entrained due to swimming performance

Lunch

Socioeconomics

Study Goals and Objectives

- To develop a demographic and economic profile of the Local and Neighboring Communities.
- To evaluate potential impacts on the Local Communities from the Power Authority's tax-exempt status.
- To evaluate potential impacts associated with the Local and Neighboring Communities providing first responder services.
- To evaluate potential socioeconomic impacts resulting from the production of power by the Project.

Geographic Scope

- **New York State**
- **The B-G Region** – *Schoharie County and its adjacent counties:*
  - Albany County
  - Delaware County
  - Greene County
  - Montgomery County
  - Otsego County
  - Schenectady County
- **Local Communities** - *those government entities in which the Power Authority owns Project Lands:*
  - Schoharie County
  - Town of Gilboa
  - Town of Blenheim
  - Gilboa-Conesville School District
- **Neighboring Communities** - *those government entities outside of the Project FERC-boundary that support the Project by providing first responder services:*
  - Town of Conesville
  - Town of Jefferson
  - Town of Middleburgh
  - Town of Roxbury (taxing jurisdiction containing the Hamlet of Grand Gorge)

Study Progress

- Task 1. Describe the Economics of the Project
- Project-specific data have been collected from Power Authority records:
  - Expenditures by type, including total payroll;
  - Past contributions to first responders organizations; and
  - Employee data by ZIP code
    - B-G Project has 150 employees
    - 57% of employees live in Schoharie County; 29% of employees live in a Local or Neighboring Community
    - Payroll associated with employees who live in Schoharie County totals $6,858,788 (55% of total payroll)
- The consulting firm ICF has been hired to:
  - Evaluate the Project's effect on energy markets and
  - Conduct REMI modeling of the Project's effects on Local and Neighboring Communities

Integrated Planning Model (IPM®)

- ICF is using its Integrated Planning Model (IPM) to evaluate the B-G Project's effects on the New York State energy markets.
- The model works through a multi-phased process:
    1. Identifies demand for generation and capacity;
    2. Determines existing resources available to meet demands and ranks by generation cost;
    3. Models the operation of facilities to meet load requirements;
    4. Utilizes transmission resources, up to available capacity;
    5. Calculates emissions and compares to limits; revises the operation of facilities (step 3) if necessary to reach compliance;
    6. Evaluates new capacity options when needed; and
    7. Calculates required returns for investment and re-evaluates the model with new capacity.

IPM, continued

- Outputs from IPM include projections of:
  - Electricity prices
  - Need for and timing of additional capacity builds
- Prices and build decisions are used in the next step of the study: the modeling of the economies of New York State, the B-G Region, Local Communities, and Neighboring Communities.

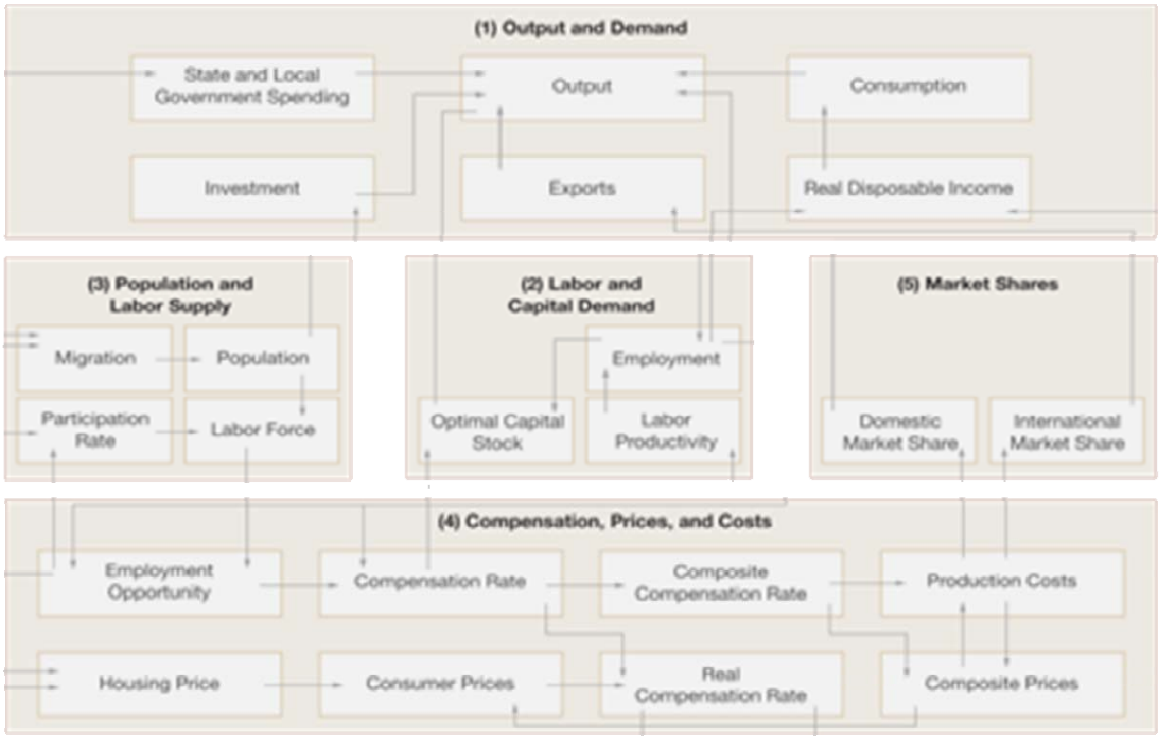
Regional Economic Models, Inc. (REMI®)

- ICF uses Regional Economic Models, Inc. (REMI) Policy Insight Plus to evaluate the socioeconomic effects of various energy projects and policies.
- REMI can be customized with a variety of industrial sectors and different modeling regions.
  - Regions can be individual states, counties (districts) or the entire country.
- REMI provides the ability to forecast economic effects over time. For the US, current version has the ability to forecast effects to 2060.
  - For this study, results will be provided in 10-year increments through 2060.

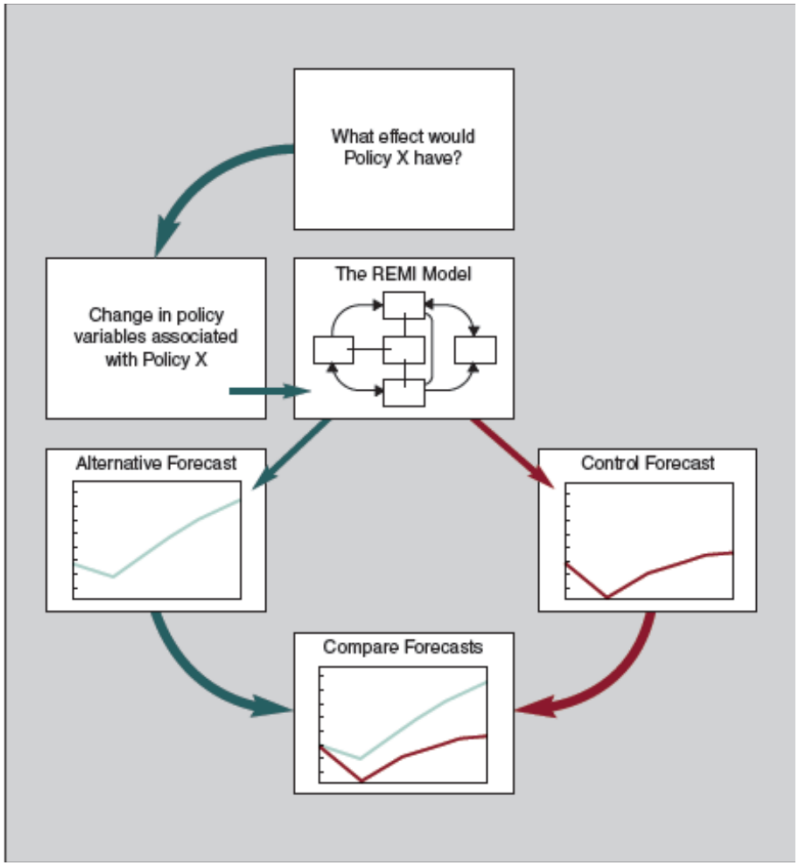
REMI, continued

- REMI takes into account the inter-relationships between various components of the economy and between industries.
- REMI includes multiplier effects (effects as spending cycles through the economy).

REMI Model Linkages (Excluding Economic Geography Linkages)



Conceptual Approach to Modeling with REMI



- Effects of the Project will be identified by comparing the alternative forecast to a control forecast.
  - With the Project's operation vs. without the Project's operation
  - With tax-exempt status vs. without the tax-exempt status
- Results will include effects on population, employment, income, and Gross Regional Product (GRP).
- Current status of REMI modeling:
  - Model has been leased and customized by ICF.
  - Different modeling runs are being undertaken.

Study Progress

- Task 2. Establish the Demographic Baseline Conditions
- Population, Income/Poverty, Industry, and Housing:
  - Data are being collected from the 2014 American Community Survey—this information was released in December 2015.
  - Data are an average of the 2010 through 2014 period.
  - Data are at the town and school district level.
- Real Estate Transactions and Median Residential Sales Prices
  - 2014 data have been obtained from the New York Department of Taxation and Finance.
  - Data are available at the county-level.

Study Progress

- Task 2. Establish the Demographic Baseline Conditions, continued
- Bureau of Labor Statistics Labor Force data:
  - Data are being collected from the Bureau of Labor Statistics (Nov 2015).
  - Data are available at the county-level.
  - Available data include total labor force, employment level, and unemployment rate.
- American Community Survey Labor Force data:
  - Data are available at the town and school level.
  - Data are an average of the 2010 through 2014 period. Data provides a general picture of the economic health of the communities over the past five years.

Study Progress

- Task 3. Analyze the Impact of Tax-Exempt Status on Local Communities
- The analysis is being conducted on the Project as it exists today.
- Data have been gathered from the Schoharie County Real Property Tax Office.
  - Total tax base of Blenheim, Gilboa, Gilboa-Conesville Consolidated School District, and Schoharie County
  - Equalization rates and tax rates
  - Project assessed value

Data from Schoharie County Real Property Tax Office

- Project full market value
  - Town of Blenheim: 3 parcels with a total full market value of $100,641,875
  - Town of Gilboa: 2 parcels with a total full market value of $1,077,679
  - Gilboa-Conesville Consolidated School District: includes above 5 parcels with a total full market value of $101,719,554
  - Schoharie County: includes above 5 parcels with a total full market value of $101,719,554

Study Progress

- Task 3. Analyze the Impact of the Tax-Exempt Status on Local Communities, continued
- Direct effects are being calculated.
  - Effect on tax rates
  - Hypothetical Project-related tax levies
- ICF is conducting REMI modeling based on direct effects of the Project's tax-exempt status.
  - Results will include effects on population, employment, income, and GRP.

Study Progress

- Task 4. Analyze the Impacts Relating to First Responders
- The Power Authority has completed its initial analysis of first responders. This effort included:
  - On-site interviews with first responders
  - On-site interviews with Power Authority staff
  - Existing documentation of Power Authority contributions
- Results of the study include:
  - Cost and benefits of providing recurring payments for the services of first responder units.

Study Progress

- Task 5. Prepare the Study Report
- Initial drafting is underway.
- On schedule to file report with the Updated Study Report in February 2017.
- But targeting a final report to be available for stakeholder review and comment in summer 2016.

Recreation Use/User Contact Study

Study Goals and Objectives

Goals:

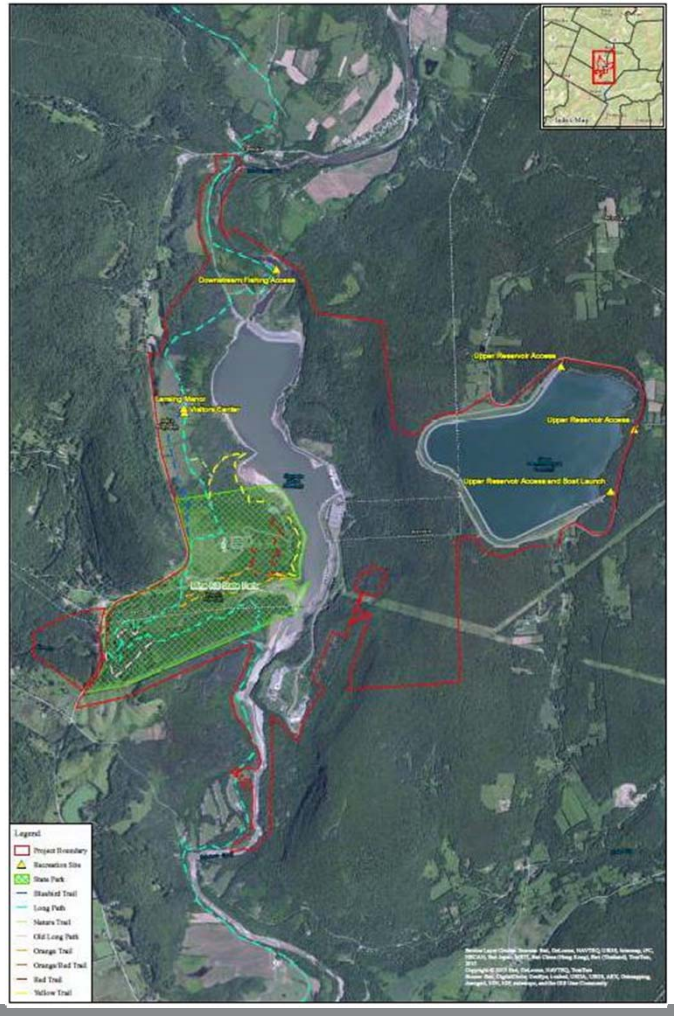
- Evaluate recreational use at the Project.
- Determine the adequacy of existing Project recreation sites/facilities in meeting recreation needs and demand at the Project.

Objectives:

- Determine the amount and types of recreation use at the Project;
- Interview the recreating public to determine users' perceptions with regard to their use of Project recreation sites and facilities;
- Evaluate recreational demand at the Project and determine if existing recreation sites and facilities are meeting the current demand; and
- Evaluate the effects of Project operation and maintenance on the recreation use at the Project and the usability of Project recreation sites and facilities.

Geographic Scope

- Lansing Manor Complex (including Visitors Center)
- Mine Kill State Park (including Mine Kill State Park Overlook)
- Downstream fishing access
- Three access areas on the Upper Reservoir



Study Progress

Task 1. Background Research

- Included review of:
  - B-G Project's 1995 Revised Exhibit R
  - 2015 FERC Form 80
  - Recreation Facilities Summary
- Collected Actual Use Records
  - Collected actual use numbers recorded for the Visitors Center, Lansing Manor, and boating use in the Upper Reservoir for 2014 and 2015. Collecting January and February 2016 actual use numbers for these.
  - Also collecting Mine Kill State Park use information collected by NYSOPRHP for 2015.

Study Progress

Task 2. Field Work (March 2015 - February 27, 2016)

- *Spot Counts*
  - One weekday and one weekend day a month, randomly selected
  - Twice a day counts, at various times during operating hours
  - **24 days of spot counts** conducted at each site
- *Calibration Counts*
  - One weekday and weekend day a month, randomly selected
  - Additional calibration counts on holidays and in peak summer season
  - Varied start times
  - **35 days of calibration counts** conducted at each site
- *Traffic Counters*
  - May 22, 2015 – Oct 30, 2015
  - Counters visited two times a week, typically Monday and Friday
- *Collection of water depth data at Mine Kill boat launch and Upper Reservoir boat launch*
  - Study Modification: Proposed to use bathymetric data for Upper and Lower Reservoir in conjunction with the minimum operating limits, in place of snapshot field measurements, to provide more complete information for assessing usability of these two boat launches than can be obtained from collection of water depth measurements on a given day and time.

Study Progress

Task 3. User Contact Survey

- Administered survey to determine users' perceptions of recreation use and existing sites and facilities for the period March 1, 2015 – February 27, 2016
- Conducted during calibration counts at Project recreation sites
- **174 user contact surveys** were completed over the course of the study

Task 4. Study Report

- Data entry, QA/QC, and statistical analysis underway
- Preparation of a technical report will commence shortly
- Report is on track to be filed with USR in February 2017
- But targeting a final report to be available for stakeholder review and comment in summer 2016

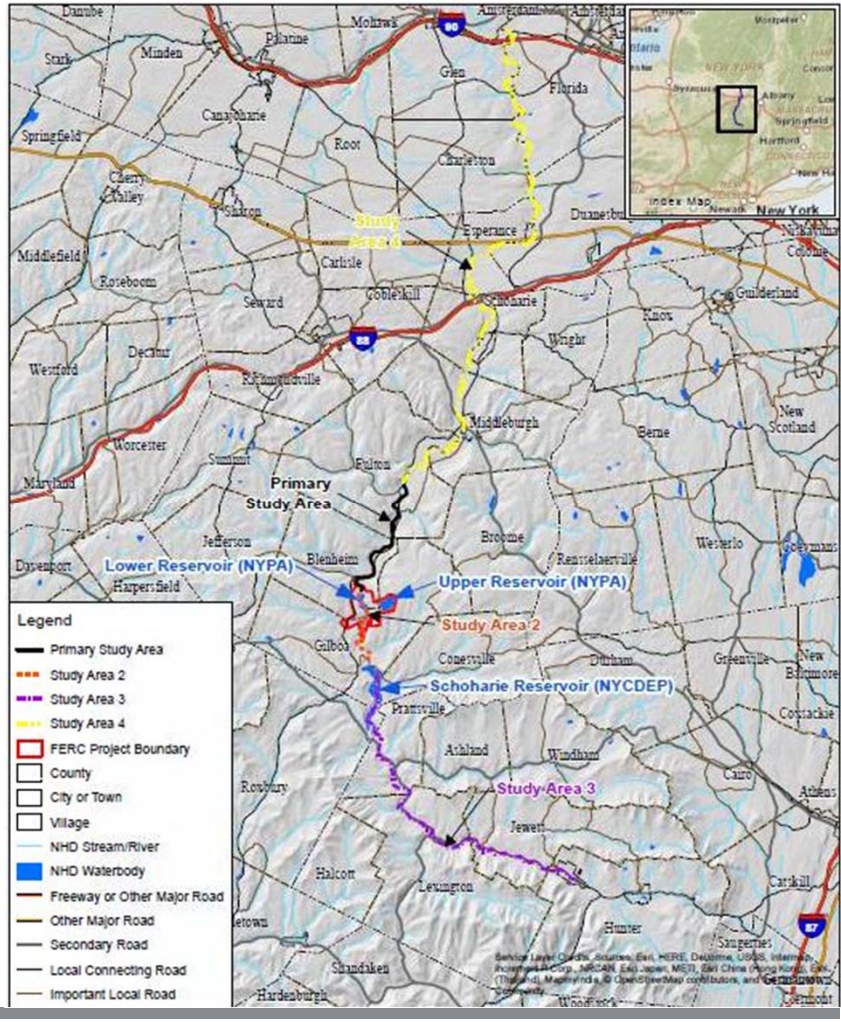
Recreational Boating Desktop Feasibility Assessment

Introduction

- In accordance with FERC's February 2015 Study Plan Determination letter, the Power Authority conducted a Level 1 boating flow analysis as outlined in *Flows and Recreation – A Guide to Studies for River Professionals* (Whittaker et al. 2005),
- Level 1 approach focuses on "desk top" methods using existing information, or limited interviews with people familiar with flows and recreation on the study reach
- The analysis consisted of:
    - Literature Review
    - Hydrology Assessment
    - Hydraulic Assessment
    - Structured Interviews

Geographic Scope

- **Primary Study Area:**
  - Schoharie Creek downstream of the Lower Dam to Max V. Shaul State Park, 9.2 miles
- **Additional Schoharie Creek:**
  - **Area 2** – Gilboa Dam downstream to the Lower Dam, including the Lower Reservoir, approximately 5.5 river miles;
  - **Area 3** – upstream from the Gilboa Dam, including Schoharie Reservoir, approximately 24 river miles;
  - **Area 4** – downstream from Max V. Shaul State Park to the confluence with the Mohawk River, approximately 43.1 river miles.
- **Regional**
  - 50 mile radius from Project



Methodology

Task 1. Literature Review

- Literature searches were conducted via the Internet, libraries, tourist/visitor bureaus, agencies, municipalities, and recreation-user-group documents (boating guides, etc.)

Task 2. Hydrology/Hydraulic Assessment

- Statistical analysis and hydrographs using USGS gages
- Stream bottom profile & depths at various flows from hydraulic model

Task 3. Structured Interviews

- Outreach and contact with knowledgeable boaters (phone or e-mail)
- Standardized questionnaire

Summary of Findings

Literature Review

Primary Study Area

- Adirondack Mountain Club (ADK) guide describes a segment of the primary study area in a write-up of Schoharie Creek (North Blenheim to Middleburgh).
  - Class I to I+, normally runnable in April and early May or after a storm that causes Schoharie Reservoir to spill water.
  - Usually paddled at water levels in the range of 1.5 to 3 feet
  - Below 1.5 feet too shallow; above 4 feet current swift, with high waves and possible floating debris
- Now out-of-print ADK guide last published in 2005; pre-Tropical Storm Irene.

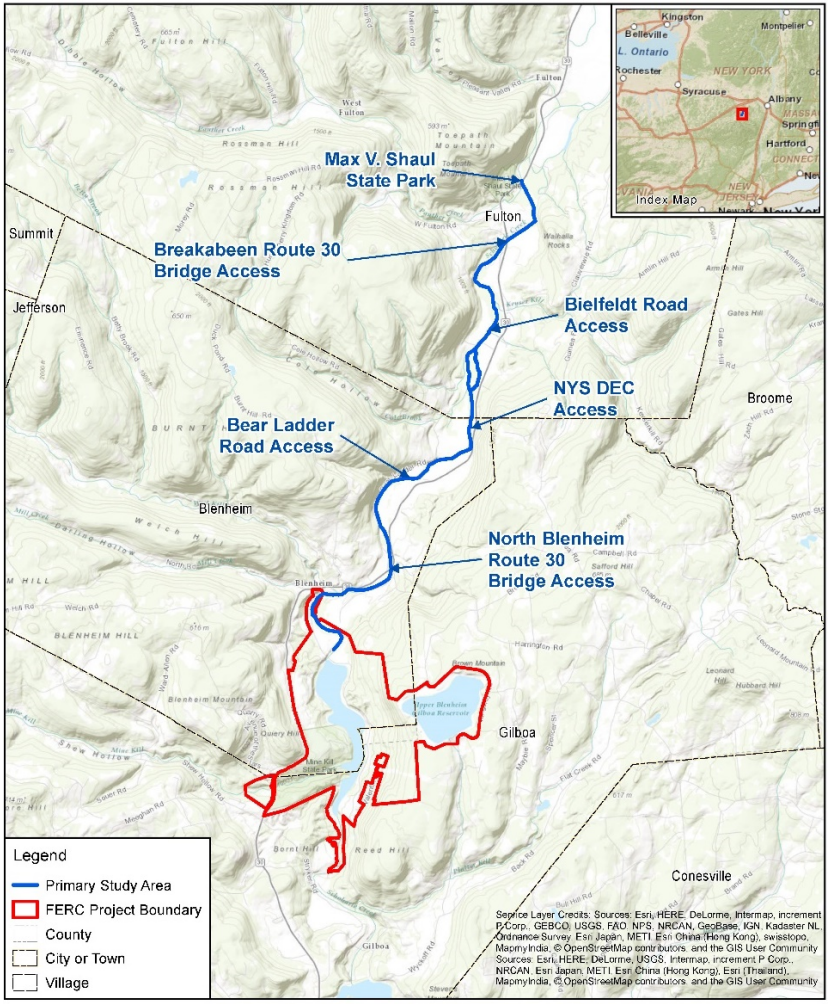
Summary of Findings

Literature Review

Primary Study Area

Six (6) public recreational boating access points were identified in the primary study area

- North Blenheim Route 30 bridge
- NYSDEC access
- Breakabeen Route 30
- Max V. Shaul State Park
- Bear Ladder Road
- Bielfeldt Road



Summary of Findings

Literature Review

Schoharie Creek Areas 2-4

American Whitewater Inventory, ADK guide, informal user's reviews

- Variable flows due to seasonal precipitation
- Provided relationship between runnability and stage/cfs at nearest USGS gage

- Access points
  - Area 2 - OPRHP launch at Mine Kill State Park (Lower Reservoir)
  - Area 3 - NYCDEP access (Schoharie Reservoir)
  - Area 4 - 11 recreational boating access points

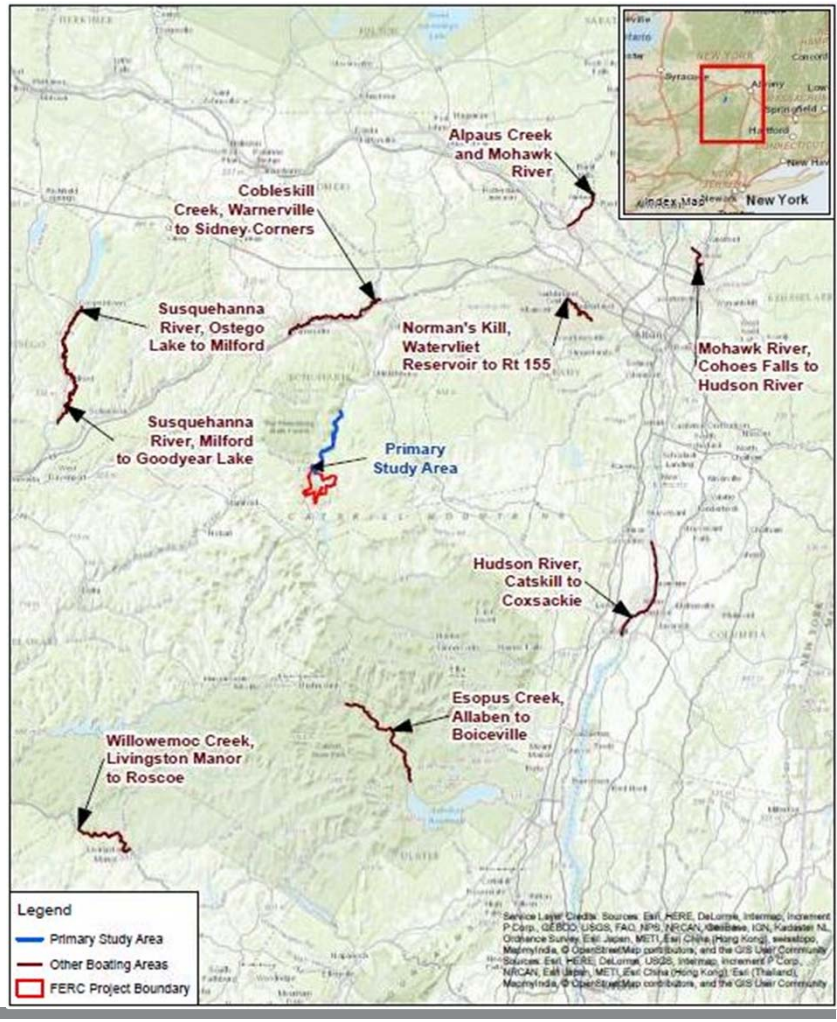
Summary of Findings

Literature Review

Similar sources as for Schoharie Creek Areas 2-4

Regional Boating Opportunities within a 50 mile radius of the Project

- Alplaus Creek
- Cobleskill Creek
- Esopus Creek
- Hudson River
- Mohawk River
- Normans Kill
- Susquehanna River
- Susquehanna River
- Willowemoc Creek



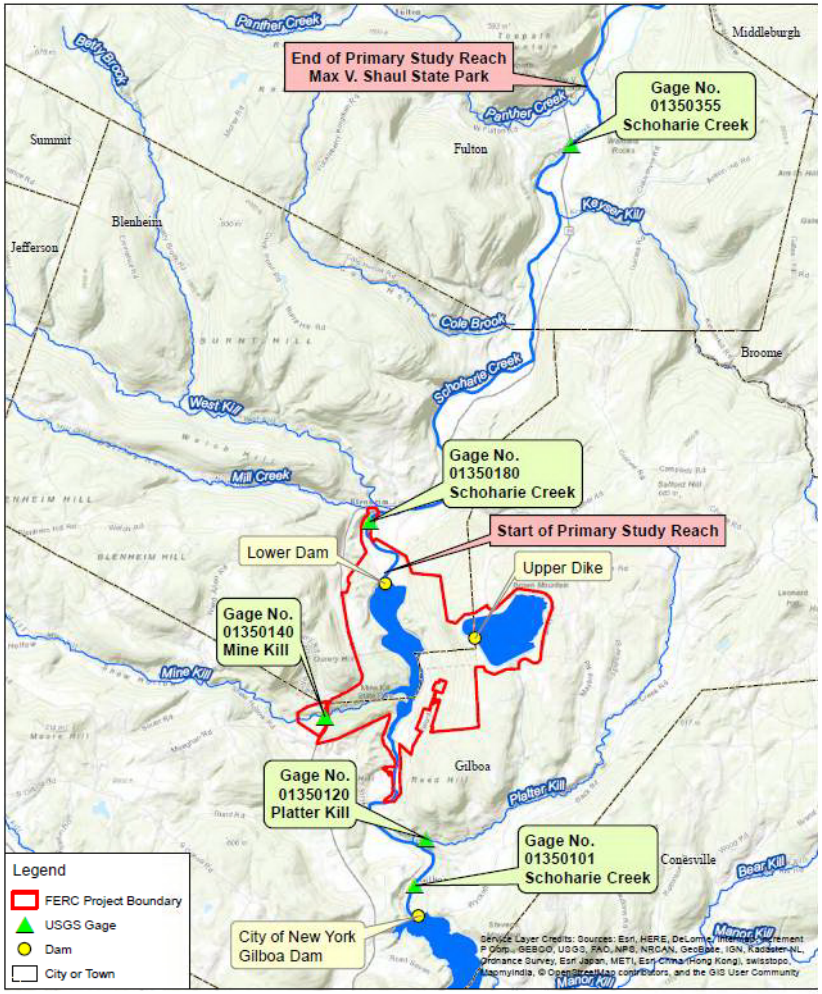
Summary of Findings

Hydrology Assessment

Locations and Drainage Areas of USGS Gages Used for All Analyses

USGS Gage Number	Location	Drainage Area (sq. mi.)
01350101	Schoharie Creek at Gilboa, NY	316
01350120	Platter Kill at Gilboa, NY	10.9
01350140	Mine Kill Near North Blenheim, NY	16.2
01350180	Schoharie Creek at North Blenheim, NY	358
01350335	Schoharie Creek at Breakabeen, NY	444

Analyses based on 40 year period of record (1976-2015)



Summary of Findings

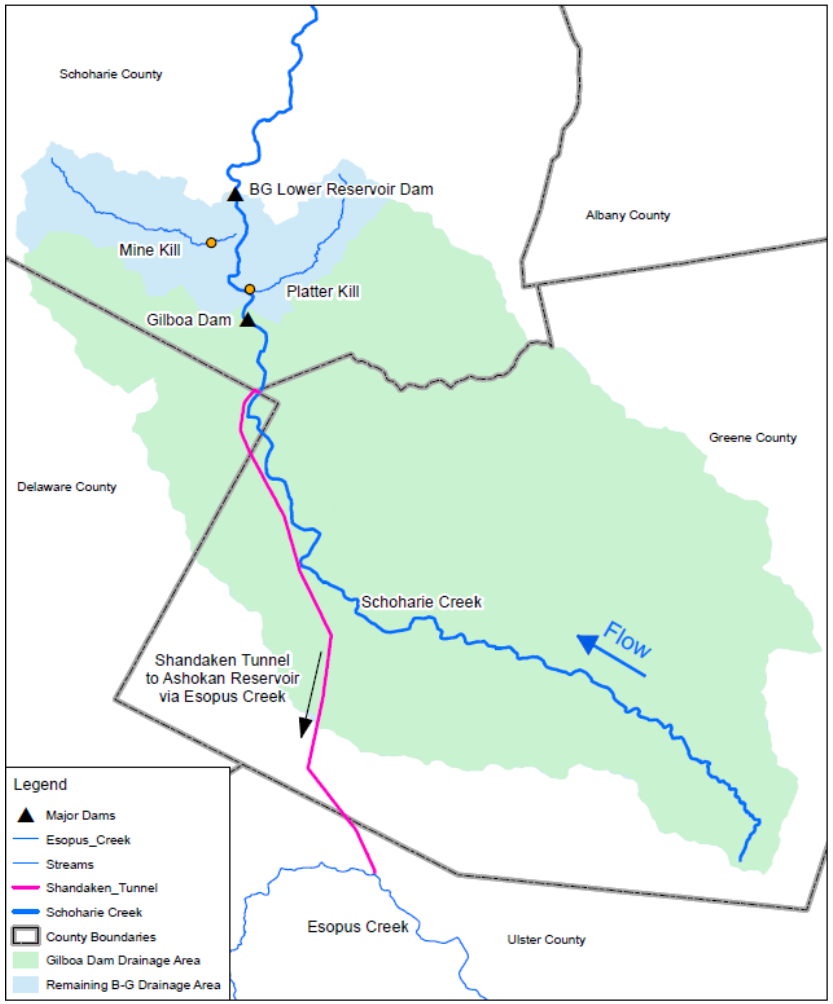
Hydrology Assessment

Project Drainage Area = 356 sq. mi.

Watershed diverted for Water Supply = 316 sq. mi.

Project inflows provided by intervening drainage between Gilboa Dam and Lower Reservoir Dam

Effective Drainage Area = 40 sq. mi.



Summary of Findings

Hydrology Assessment

Flows at Gilboa Dam (Water Years 1976-2015)

Flow (cfs)	Total days flow occurs over period of record	Average number of days per year flow occurs	Percent of time flow occurs	Average number of days per year that flow occurs in:						
				April	May	June	July	August	September	October
<10	8,778	220	60.10%	6.7	12.6	19.4	25.8	28.3	27.1	23.3
10-99	555	14	3.80%	0.4	1.5	1.7	0.9	0.8	0.2	0.4
100-199	518	13	3.50%	0.7	1.4	1.0	1.0	0.4	0.2	0.6
200-499	1,391	35	9.50%	2.6	5.1	2.9	1.9	0.8	0.5	2.4
500-999	1,652	41	11.30%	6.7	5.5	2.9	1.0	0.3	1.0	2.3
1000+	1,720	43	11.80%	12.9	5.0	2.3	0.4	0.5	1.1	2.2

Summary of Findings

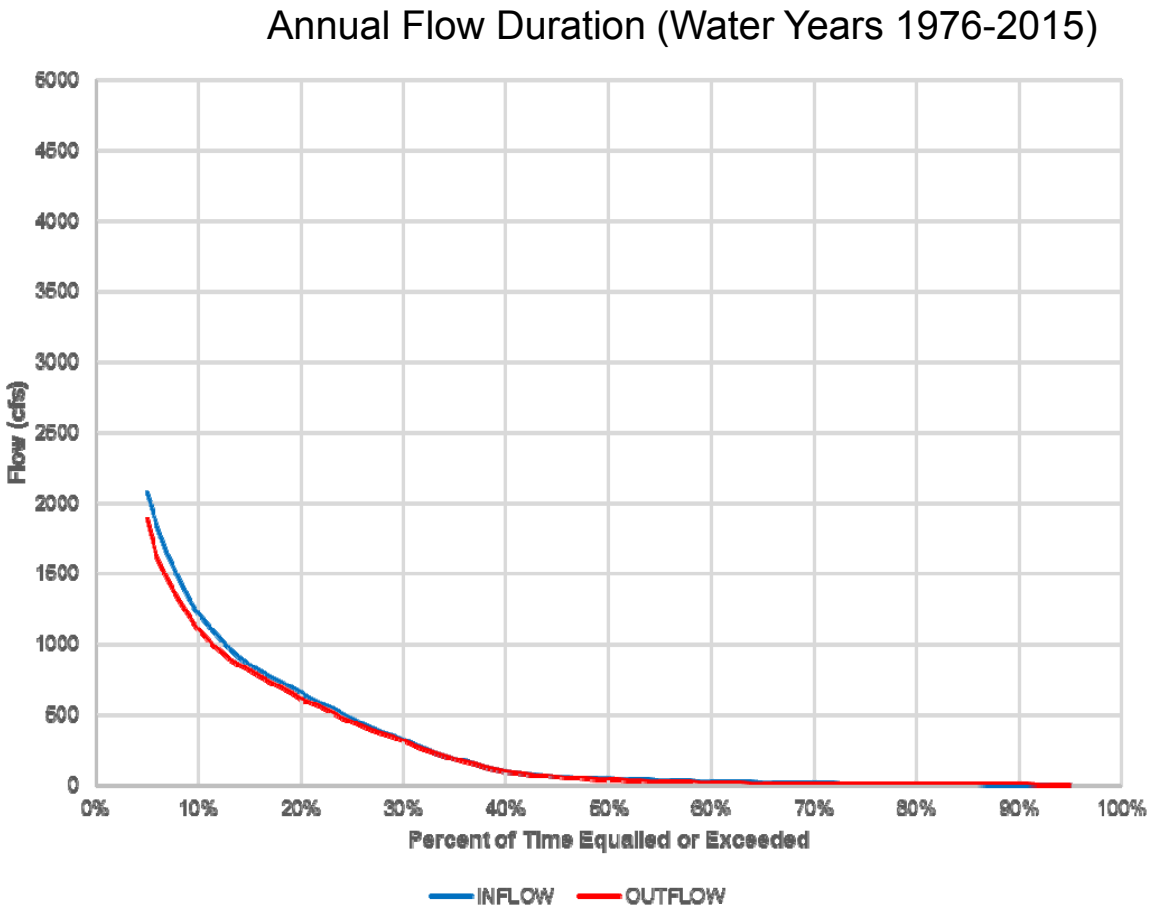
Hydrology Assessment

Project Operations

- Project outflow equals inflow
- 2,378 acre-ft of storage due to the difference in storage between two reservoirs.
- This water is used to replenish losses due to evaporation and minor seepage.
- This water is also used to supplement inflows < 10 cfs.

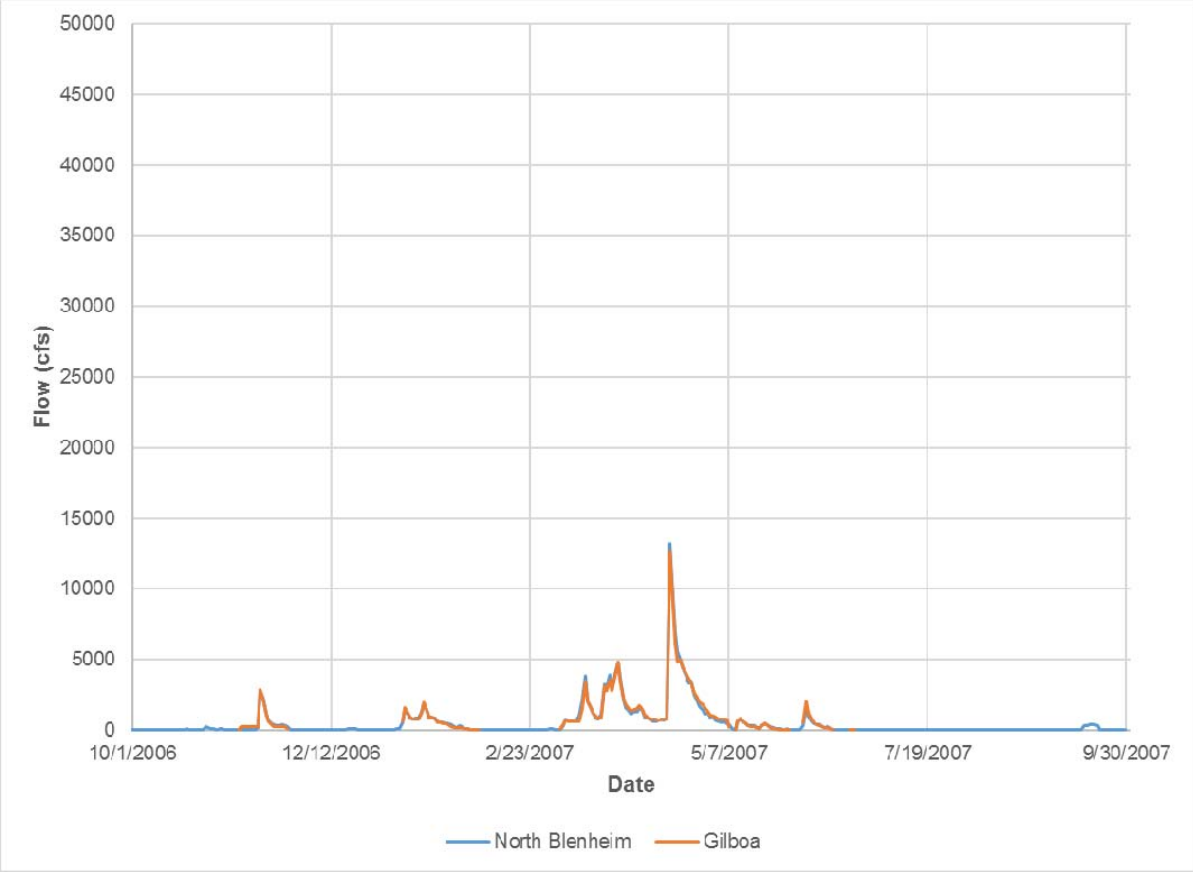
Project Median Flows

- Annual – 40 cfs
- June – 23 cfs
- July – 9 cfs
- August – 8 cfs
- September – 8 cfs
- October – 10 cfs



- Inflow and outflow hydrographs plotted for typical, wet, and dry years
- Pattern of high flows during spring freshet months followed by low flows. Sporadic high flow events the rest of the year.
- During dry years, no spillage at Gilboa Dam so smaller sporadic events. In 1985, two highest daily flows were 334 cfs and 150 cfs. In 2002, highest daily flow was 461 cfs.

Water Year 2007 Hydrograph (Typical Year)



Summary of Findings

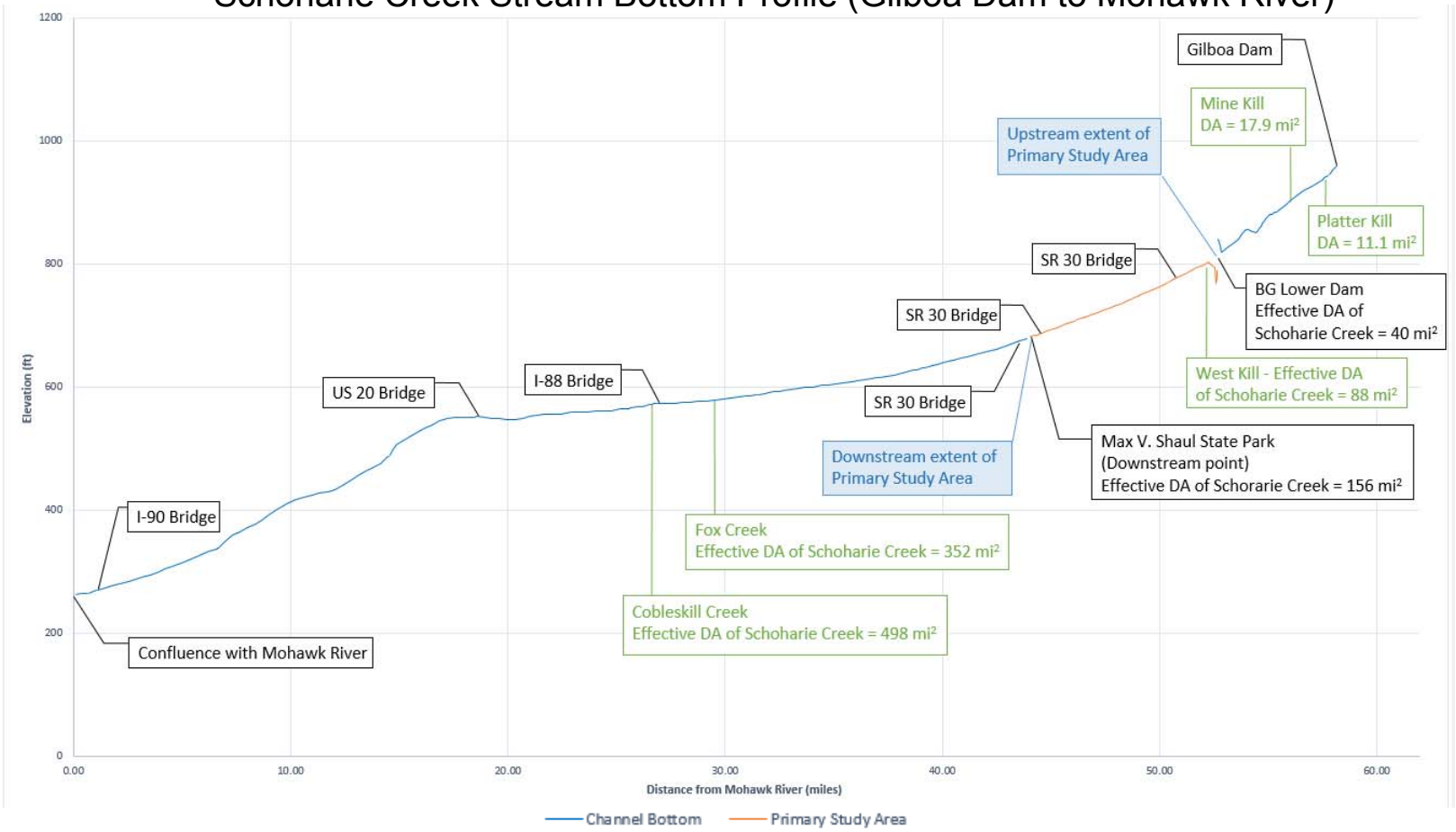
Hydrology Assessment

Streamflows in Schoharie Creek Downstream of Lower Dam (50% Exceedance)

Location	Total Drainage Area (sq. mi.)	Effective Drainage Area (sq. mi.)	Miles from Lower Dam	50% Annual Flow (cfs)	50% Apr Flow (cfs)	50% May Flow (cfs)	50% Jun Flow (cfs)	50% Jul Flow (cfs)	50% Aug Flow (cfs)	50% Sep Flow (cfs)	50% Oct Flow (cfs)
Schoharie Creek at Lower Dam	356	40	0	39	833.5	243	23	8.8	7.8	7.5	9.8
Schoharie Creek at North Blenheim	358	42	1.0	39	834	243	23	8.8	7.8	7.5	9.8
Schoharie Creek DS of West Kill	404	88	1.04	88	982	326	56	19	14	13	27
Schoharie Creek DS of Cole Brook	424	108	6.28	109	1046	362	71	24	17	16	34
Schoharie Creek DS of Keyser Kill	442	126	6.5	128	1104	394	83	28	20	18	41
Schoharie Creek at Breakabeen	444	128	6.6	130	1110	398	85	29	20	19	42
Schoharie Creek DS of Max V. Shaul State Park	472	156	9.2	160	1201	448	105	35	24	22	52
Schoharie Creek at Middleburgh*	534	218	15.04	226	1400	560	150	49	32	30	75

*Downstream of primary study area

Schoharie Creek Stream Bottom Profile (Gilboa Dam to Mohawk River)



Summary of Findings

Hydrology Assessment

Hydraulic Analysis

- Used hydraulic model to predict maximum depths at 54 locations over 9.2 mile primary study reach
- ADK Guide states that depths < 1.5 feet are “too shallow” for boating
  - 500 cfs, 52% locations < 1.5 feet
  - 750 cfs, 20% locations < 1.5 feet
  - 1000 cfs, 5% locations < 1.5 feet
- Using storage for boating releases would jeopardize Project’s ability to provide outflows comparable to those that would occur if B-G Project was not present.

Summary of Findings

Structured Interviews

Outreach and communication with:

- Local State Park Manager
- Town Officials
- Race Organizers
- American Whitewater
- Adirondack Mountain Club
- Individuals known to paddle primary study area

32 individuals contacted:

- 14 completed surveys
- 7 additional individuals via telephone

Summary of Findings

Structured Interviews

Survey Respondents (Questions 2-5)

- Median age: 46
- More than half had 20+ years of paddling experience
- Affiliations with boating organizations included Adirondack Mountain Club (3) and Schoharie County Kayaking (2)

Summary of Findings

Structured Interviews

Schoharie Creek General Boating Experience (Questions 6 and 7)

- Have boated at least some portion of the primary study area (9)
  - Six of the nine respondents (11+ trips), have done so since Tropical Storm Irene in 2011.
  - Three of the respondents have paddled portions of the primary study area 10 to 20 times, but have not done so in the past 10 years.
- Gilboa Dam to Mine Kill (2 respondents)
- Max V. Shaul State Park to Middleburgh or beyond (10)
- Esperance to Burtonsville (6)

Summary of Findings

Structured Interviews

Schoharie Creek Primary Study Area Experience (Questions 8 and 9)

- Kayak (8), Canoe (4), Raft (2)
- Of the 11+ post-Irene trips:
  - 9+ trips put-in at North Blenheim
  - 1 put-in at Fultonham
  - 1 put-in at the "B-G Power Plant"
  - Most common take-out was in Middleburgh (Area 4)
- Class I or II (6 of 9), Class II+ (1 of 9), Class III (1 of 9)
- *Qualitative comments:* Survey respondents and interviewees commented along the lines of the Creek being "rough to paddle" under low flow conditions.

Summary of Findings

Structured Interviews

Schoharie Creek Primary Study Area Experience (Questions 10 and 11)

Topics of interest

- Water releases – 6 comments
- Low water levels – 4 comments
- Post-Irene changes – 3 comments
- Water Quality issues – 3 comments
- Fisheries – 2 comments
- Whitewater Rafting – 2 comments
- Access availability – 2 comments

Conclusions

- Primary study area does not get a lot of boating use
- Most boating occurs in early spring
- Most of boating season water depth is too low for boating (≤ 1.5 feet)
- Adequate number of boating access points in primary study area
- Numerous nearby, and higher Class-rated boating opportunities exist
- Using storage for boating releases would jeopardize Project's ability to provide outflows comparable to those that would occur if B-G Project was not present

Closing

Recap of Next Steps

March 18, 2016	Power Authority will file meeting summary
April 17, 2016	Public may file comments on the meeting summary, including any requests for modifications to ongoing studies or a new study.
May 17, 2016	Power Authority may file responses to comments, including revised study plans if warranted
June 16, 2016	FERC will amend approved study plan(s) as appropriate

Project Website

http://www.bg.nypa.gov