Office of Energy Projects

June 2019

FERC/EIS-0294D

DRAFT ENVIRONMENTAL IMPACT STATEMENT

FOR HYDROPOWER LICENSE

Mineville Energy Storage Project FERC Project No. 12635-002

New York

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE, Washington, DC 20426

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Draft Environmental Impact Statement

Attached is the draft environmental impact statement (draft EIS) for the proposed Mineville Energy Storage Project (No. 12635-002), that would be located in the Town of Moriah, Essex County, New York.

This draft EIS documents the view of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicant's proposal and alternatives for licensing the project.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The draft EIS will be part of the record from which the Commission will make its decision. The draft EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about June 18, 2019.

Copies of the draft EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington D.C. 20426. The draft EIS also may be viewed on the Internet at www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Attachment: Draft Environmental Impact Statement

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COVER SHEET

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a. Title: Licensing the Mineville Energy Storage Project, FERC Project No. 12635-002

b. Subject: Draft Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract: Moriah Hydro Corporation proposes to construct the 240-megawatt Mineville Energy Storage Project in a decommissioned subterranean mine complex in the Town of Moriah, Essex County, New York. No federal lands would be occupied. The project would be a closed-loop pumped storage system, meaning it will rely on groundwater for the sole purpose of initial fill and periodic discharge needed for project operation, and would provide an estimated annual generation of 421,000 megawatt-hours. Dewatering of the proposed project mines would be required to achieve operational water levels, which would be maintained over the life of the project by continuous dewatering at a rate equivalent to groundwater infiltration.

Moriah Hydro Corporation (applicant) proposes to develop or finalize plans to protect and mitigate the environmental effects of project construction and operation on the following: local seismicity and subsidence, local groundwater levels, soil resources, groundwater and surface water quality, wildlife and wildlife habitat, threatened and endangered species, and cultural resources.

Staff's recommendation is to license the project as proposed, with some staff modifications and additional measures recommended by the agencies.

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f. Transmission: This draft environmental impact statement on an application to construct and operate the Mineville Energy Storage Project is being made available for public comment on or about June 18, 2019, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 CFR Part 380).

[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321–4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

> That the project adopted . . . shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e) . . .[4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. §791(a)-825r (2012), as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

[3] Pub. L. 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a) (2012).

[5] 16 U.S.C. § 803(g) (2012).

[6] 18 C.F.R. §385.206 (2018).

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ACRONYMS AND ABBREVIATIONS

3-D	three-dimensional
Advisory Council	Advisory Council on Historic Preservation
APA	Adirondack Park Agency
APE	area of potential effects
BMP	best management practices
BP	before present
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CEII	Critical Energy/Electric Infrastructure Information
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
˚F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
fps	feet per second
FWS	U.S. Fish and Wildlife Service
g	gravity
HPMP	Historic Properties Management Plan
IPaC	Information for Planning and Consultation
kHz	kilohertz
kV	kilovolt
LMD	local mine datum
mg/L	milligrams per Liter
m/s	meters per second
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
New York DEC	New York State Department of Environmental Conservation
New York DHESES	New York Division of Homeland Security and Emergency Services
New York NHP	New York Natural Heritage Program
New York SHPO	New York State Historic Preservation Officer
NHPA	National Historic Preservation Act of 1966

NWI	National Wetlands Inventory
NYISO	New York Independent System Operator
New York SCORP	New York Statewide Comprehensive Outdoor Recreation Plan
NYSEG	New York State Electric and Gas Corporation
PA	Programmatic Agreement
PCBs	Polychlorinated biphenyls
PGA	Peak Ground Acceleration
PGV	Peak Ground Velocity
ppm	parts per million
PPV	peak particle velocity
QA/QC	quality assurance/quality control
REA	Ready for Environmental Analysis
TDS	total dissolved solids
U.S.C	United States Code
USGS	United States Geological Survey
WNS	White-nose syndrome
WQC	water quality certification

EXECUTIVE SUMMARY

Proposed Action

On February 13, 2015, Moriah Hydro Corporation (Moriah Hydro or applicant) filed an application for an original major license to construct and operate its proposed 240-megawatt (MW) Mineville Energy Storage Project No. 12635 (Mineville Project or project). The closed-loop pumped storage project would be constructed in a decommissioned subterranean mine complex[7] in the Town of Moriah, Essex County, New York, and would generate an estimated 421,000 megawatt-hours (MWh) of energy annually. No federal lands would be occupied by the project.

Proposed Project Facilities

The proposed Mineville Project would consist of: (1) an upper reservoir located within the upper portion of the Harmony Mine between elevations +495 and +1,095 feet mean sea level (msl), or +400 and +1,000 feet local mine datum (LMD)[8] with an operating surface area of 4 acres and a storage capacity of 2,448 acre-feet;[9] (2) a lower reservoir in the lower portion of the Old Bed Mine between elevations −1,075 and −1,573 feet msl, (−1,170 and −1,668 LMD) with an operating surface area of 5.1 acres and a storage capacity of 2,448 acre-feet; (3) a 14-foot-diameter and 2,955-foot-long upper reservoir shaft connecting the upper reservoir to the high-pressure penstock located below the powerhouse chamber floor; (4) a 14-foot-diameter and 2,955-foot-long lower

[7] The existing mine complex comprises the interconnected Old Bed Mine, Harmony Mine, and 21 Mine and pit. A pit is a depression in the ground caused by mining activities. The 21 Pit is filled with water, as it is deeper than the groundwater table.

[8] All mine elevations are listed in msl and LMD, and denoted with a "+" or "–" to distinguish elevations above and below sea level. LMD was established before 1930 by Witherbee Sherman and Company and is extensively used in historical mine records. LMD is about 95 feet lower than msl.

[9] In its license application, Moriah Hydro reports the available volume for each of the proposed project's reservoirs as 2,448 acre-feet. Staff has independently calculated the available volumes as 1,114 acre-feet (upper reservoir) and 463 acre-feet (lower reservoir). Our estimates use the following assumptions: (1) the reservoirs extend across an area in plan of 65 acres (upper reservoir, using the +170-foot msl (+75-foot LMD) elevation as the base) and 27 acres (lower reservoir); (2) an average subsurface mine angle of 29 degrees; and (3) 100 percent mined-out space (i.e., no support pillars), with an average mined-out thickness of 15 feet.

reservoir shaft connecting the lower reservoir and the lower reservoir ventilation tunnel; (5) a 320-foot-long by 80-foot-wide powerhouse chamber, containing 100 reversible pump-turbine units, each with a nameplate generating capacity of 2.4 megawatts; (6) a 274-foot-long by 36-foot-wide underground electrical equipment chamber adjacent to the powerhouse chamber, containing switchgear, step-up transformers, and ancillary electrical equipment; (7) two 6-foot-diameter emergency evacuation shafts located between the powerhouse chamber and the electrical equipment chamber; (8) a 25-foot-diameter main shaft extending 2,955 feet from the surface down to the powerhouse chamber; (9) 15-foot-diameter high- and low-pressure steel penstocks embedded beneath the powerhouse chamber floor; (10) an aboveground structure functioning as a main shaft entry building and construction equipment service facility (entry and service building); (11) an approximately 3,600-foot-long, 10-foot-high and 15-foot-wide underground electrical tunnel containing 34.5-kilovolt (kV) transmission lines, connecting the underground electrical equipment chamber to a new 15-foot by 15-foot, aboveground concrete electrical vault, and interconnecting with an existing single circuit 115-kV transmission line at the New York State Electric and Gas Corporation (NYSEG) substation in the Hamlet of Mineville; and (12) appurtenant facilities.

The proposed project mines are currently filled with groundwater and continuously discharge from the overburden[10] contact at the Don B shaft (Don B outfall) to an adjacent unnamed stream (defined as tributary C-86-5 by the New York State Department of Environmental Conservation [New York DEC]) within the proposed project boundary. Moriah Hydro proposes to partially dewater the mines by pumping groundwater into the stream over a 1- to 2-year period and would use the remaining groundwater in the mines to operate the project.

Proposed Project Operation

The Mineville Project would operate as a fully automatic closed-loop pumped storage system, following supervisory control from the New York Independent System Operator to meet energy demands and grid control requirements. The project would pump water from the lower reservoir to the upper reservoir when energy is in excess or in low demand and would release water from the upper reservoir to the powerhouse to generate electricity during periods of high demand. The project would also be used to

[10] Overburden is defined as soil and rock overlying an extractable mineral deposit (e.g., ore, coal) or bedrock.

"time shift"[11] renewable generation, such as wind and solar generation, or to provide ancillary power services.[12]

Water used for generation would be cycled back and forth between the upper and lower sub-surface reservoirs and would not require supplementation from surface water sources. Groundwater flow into the project mines is expected to continue post-construction and would be continuously discharged at a rate equivalent to infiltration. During normal operation, the project head would range from 2,650 feet to 2,200 feet. The minimum head during pumping and generation would be 1,600 feet. The minimum and maximum hydraulic capacity of the project is 54 cubic feet per second (cfs) and 1,200 cfs, respectively. Based on a maximum generation schedule of 10 hours per day, the project would be capable of providing 737,600 MWh annually, with an estimated average annual output of 421,000 MWh.

Proposed Environmental Measures

Moriah Hydro proposes the following environmental measures to protect or enhance environmental resources at the project:

Geology and Soil Resources

- Conduct geotechnical investigations to gather data on seismic risk and reservoir stability for integration into the final project design, to include: (1) borehole sampling to determine the composition and permeability of the overburden, and the compressive strength, permeability, and quality of the underlying bedrock; and (2) creating a detailed three-dimensional (3-D) model of the project based on the borings and existing mine mapping.

- Monitor seismicity within the project boundary for 2 months prior to construction to 12 months after start of operation to minimize seismic risk to local residents.

[11] Energy time shift involves storing energy during low price times, and discharging during high price times.

[12] Ancillary services help balance the transmission system as electricity is moved from generating sources to ultimate consumers, and are necessary for proper grid operation. Ancillary services include: load following, reactive power-voltage regulation, system protective services, loss compensation services, system control, load dispatch services, and energy imbalance services.

- Reseal all mine shafts and openings in the project boundary (with the exception of the 21 Pit[13]) and Roe Shaft associated with the New Bed Mine,[14] and base final design of resealing activities on location-specific field measurements and conditions to minimize the effects of subsidence on geology and soil resources.

- Grout any leaking seals of major water-bearing seams and discontinuities, and seal all incidental inter-mine connections to minimize groundwater leakage into the project mines.

- Extend the municipal water distribution system along Witherbee Road, Chipmunk Street, and Lower Silver Hill Road within the project boundary to provide municipal water to residents currently using private groundwater wells.

- Implement the Erosion and Sediment Control Plan filed on February 24, 2015, which includes measures to retain existing vegetation, revegetate disturbed areas, avoid and protect stream channels; monitor subsidence at unspecified ground elevations and structures during the pumping of groundwater from the flooded project mines; and other measures.

Aquatic Resources

- Monitor water quality and flow of groundwater from the Don B outfall and at locations upstream and downstream of the Don B outfall on tributary C-86-5 during construction and throughout the life of the project. Water quality parameters would include temperature, pH, specific conductance, turbidity, dissolved oxygen (DO), total organic carbon, iron, and manganese. Results would be posted in real time to a public website. Any discharges exceeding state water quality standards, particularly iron and manganese, would be treated via simple aeration and detention prior to being discharged to tributary C-86-5.

- Construct a step tray aeration and detention facility near the Don B outfall to treat groundwater overflow during project construction and operation.

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[13] The 21 Pit would be sealed with material excavated from the proposed powerhouse chamber and reservoir shafts, as discussed in section 3.3.1, *Geology and Soils*.

[14] Some filings on the record refer to the New Bed Mine as the Barton Hill Mine. During the December 7, 2016, scoping meeting, New York DEC confirmed that these two names are synonymous. In this draft EIS, staff uses the term New Bed Mine in reference to this mine.

Terrestrial Resources and Threatened and Endangered Species

- Implement the March 9, 2018, Bat Protection Measures and Action Plan (Bat Plan), including the following measures to protect the federally listed endangered Indiana bat and threatened northern long-eared bat, a New York State species of special concern (eastern small-footed bat [*Myotis leibii*]), and other hibernating bat species (tri-colored bat [*Perimyotis subflavus*], little brown bat [*Myotis lucifugus*], and big brown bat [*Eptesicus fuscus*]):

    - Follow the U.S. Fish and Wildlife Service (FWS) and New York DEC guidance regarding the protection of the endangered Indiana bat and threatened northern long-eared bat,[15] such as: (1) avoid any tree clearing inside a 0.25-mile buffer around the New Bed Mine bat hibernaculum, or obtain permission from FWS if tree clearing is necessary within this area; (2) between April 1 to October 31, avoid cutting: (a) all cavity trees and snags within 5 miles of the New Bed Mine, known and documented northern long-eared bat roost trees, and any trees within 150 feet of a documented summer northern long-eared bat occurrence; (3) suspend tree cutting if northern long-eared bats are observed flying from a tree, or on a cut tree, and notify New York DEC of the observation; (4) maintain at least 35 percent of forest habitat within Indiana bat maternity colony home range; (5) avoid potential Indiana bat roost trees by retaining standing live trees with exfoliating bark and greater than 12 inches in diameter at breast height, and any black locust and hickory species regardless of size and condition; (6) from April 1 to September 30, avoid clearing any potential Indiana bat roost trees 4 inches or greater in diameter; and (7) minimize lighting impacts and use of chemicals in any stormwater detention basins.

    - Obtain existing New York DEC water elevation, temperature, and humidity data for the New Bed Mine to develop a monitoring database for baseline purposes prior to construction, and install new monitoring equipment at multiple locations within New Bed Mine during the first non-hibernation season after license issuance to monitor temperature,

[15] Moriah Hydro's Bat Plan cites to the following guidelines: FWS' Final 4(d) Rule for the northern long-eared bat (https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf), May 2016 Indiana Bat Project Review Fact Sheet (https://www.fws.gov/northeast/nyfo/es/Ibat%20fact%20 sheet), and New York DEC's guidance for projects that do not result in a net change of land use within northern long-eared bat occupied habitat (https://www.dec.ny.gov/animals/106090.html).

humidity, water elevation, air flow, seismic activity, and bat presence (via infrared video and acoustics) within New Bed Mine from 3 years prior to construction to a minimum of 5 years post-construction.

- Seal the horizontal crosscut connecting the Harmony and New Bed mines (West Drift) to prevent dewatering of the New Bed Mine bat hibernaculum, and exclude movement of bats between the New Bed and Harmony mines following dewatering.

- Within 12 months of sealing the West Drift to the New Bed Mine, establish a controlled mine discharge point at the rehabilitated and sealed Roe Shaft to permit control of water outflow from, and maintain the water level within, the New Bed Mine.

- During construction, exclude bats from colonizing all project-related mine openings with 0.25-inch mesh screen.

- After dewatering, provide access to the project mines for FWS and New York DEC for inspection and bat monitoring.

Recreation, Land Use, and Aesthetic Resources

- Provide $200,000 for recreational improvements, including a multiuse recreation complex, at Linney Field, located in the Town of Moriah.

- Design the entry and service building to replicate and continue the architectural theme established by the existing and adjacent Town of Moriah Highway Department Garage (town garage).

- As part of the Erosion and Sediment Control Plan, provide post-construction landscaping to add visual appeal to the aboveground facilities.

Cultural Resources

- Implement a Historic Properties Management Plan (HPMP), which includes development of historic industrial and interpretive displays about this ore mine and the pumped storage development.

Public Involvement

Before filing its license application, Moriah Hydro conducted pre-filing consultation under the traditional licensing process. The intent of the Commission's prefiling process is to initiate public involvement early in the project planning process and encourage citizens, governmental entities, tribes, and other interested parties to

identify and resolve issues prior to an application being formally filed with the Commission. After the application was filed, we conducted scoping to determine what issues and alternatives should be addressed.

As part of the National Environmental Policy Act scoping process, we distributed an initial scoping document to interested parties on November 4, 2016. Scoping meetings were held on December 7, 2016, in Warrensburg, New York, and on December 8, 2016, in Port Henry, New York, to obtain comments on the project. Based on comments made during the scoping meetings and written comments filed with the Commission, we issued a revised scoping document on June 23, 2017. On February 5, 2018, we issued a notice that Moriah Hydro's application for an original license for the Mineville Project was ready for environmental analysis, and requested comments, terms and conditions, recommendations, and prescriptions.

Alternatives Considered

This draft environmental impact statement (draft EIS) analyzes the effects of the proposed project's construction and operation and recommends conditions for any license that may be issued for the project. In addition to Moriah Hydro's proposal, we consider two alternatives: (1) no-action, whereby the project would not be licensed and constructed; and (2) Moriah Hydro's proposal with staff modifications (staff alternative).

Staff Alternative

Under the staff alternative, the project would include Moriah Hydro's proposed environmental measures, with the exception of the improvements to Linney Field, which is located 0.5-mile from the proposed project, is outside of the project boundary, and has no direct connection to hydropower.

The staff alternative includes the following recommended modifications of Moriah Hydro's proposal and some additional measures:

- Development of a geotechnical investigation plan to evaluate subsurface conditions above and within the project mines, to include:
    - Moriah Hydro's proposed boring and testing of overburden and underlying bedrock and development of a 3-D model of the project mines, following license issuance;
    - An analysis of the number and placement of borings to inform the project's final design;
    - An analysis of the need to lower the upper reservoir's maximum elevation, to avoid regular wetting of the glacial overburden overlying

the project mines during project operation, resulting in the potential for surface subsidence and flooding.

- Additional testing within the project reservoirs after dewatering to determine:
  - the compressive strength of support pillars within the project mines;
  - the seismic site class of the overburden and underlying bedrock;
  - the presence of marble within the project mines that may dissolve during project operation; and
  - the appropriate design of a rock support system to stabilize the project mines.

- Development of a seismic monitoring plan to include installation of a seismic monitoring network within the project area with additional seismographs to determine locations of induced seismic activity from construction and project operation to provide additional protection to local residents, for a period of 10 years after construction.

- Development of a mine shaft and pit resealing plan after issuance of a license, prior to final design, integrating available historical information and site-specific investigations for all mines potentially affected by the project (i.e., Harmony, Old Bed, 21, and Welch mines) to address the range of approaches required for the various shafts and pits prior to implementation.

- Development of a project mine sealing plan to minimize groundwater intrusion into the project mines, to include: (1) grouting leaking seals of major water-bearing seams, discontinuities, and any incidental inter-mine connections (including the previously sealed West Drift) after dewatering; and (2) during project operation, intermittent inspections and grouting of the upper reservoir to maintain isolation of the project mines from groundwater intrusion.

- Development of a groundwater monitoring plan to gain a spatial understanding of groundwater hydrology and investigate connectivity among the project mines, the New Bed Mine, 21 Pit, and other locations (e.g. Welch Mine, tributary C-86-5). Moriah Hydro's proposed flow monitoring would be included and modified to limit post-construction monitoring to a 3-year period with options to extend, if necessary.

- Modification of the Erosion and Sediment Control Plan to include site-specific measures for all locations with ground-disturbing activities (including areas on the surface necessary for sealing the West Drift, resealing all subsiding mine connections, constructing the proposed electrical vault at the existing substation, and other facilities) and a plan for the disposal or reuse of excavated materials.

- Development of a water quality monitoring plan through consultation with FWS and New York DEC that would include polychlorinated biphenyl (PCB) monitoring and would modify the proposed monitoring to 1 year prior to construction, during project construction, and for 3 years during project operation with options to extend, if necessary.

- Modification of Moriah Hydro's March 9, 2018, Bat Plan, through consultation with FWS and New York DEC, to include: (1) identification of all project-related ground disturbance and tree clearing that would occur during each phase of construction, to clarify the specific areas and seasons in which tree clearing should be avoided (consistent with FWS and New York DEC guidance); (2) identification of the number and location of devices to monitor New Bed Mine conditions; (3) development of a protocol to seal the West Drift that identifies all aboveground and underground activities associated with sealing the drift; (4) prior to dewatering, establishment of a groundwater elevation monitoring station at the site of the purported seep near Roe Shaft to determine the need for a controlled mine discharge point, following analysis of groundwater data within the project area; (5) prior to dewatering, identification of the number and design of bat exclusion devices to be constructed and maintained at mine openings; and (6) prior to implementing staff's recommended mine shaft and pit resealing plan, identification of the need for bat surveys at all shafts and pits proposed for resealing.

- Revise the proposed HPMP to: (1) update the project description; (2) provide an overview of the historic background of the area, including the extensive mining history; (3) provide a description of the National Register-listed properties that are located in the project's area of potential effects and explain their significance and public value; (4) include a provision to provide cultural resources training to all staff, describe how often the training would occur, who would provide it, and what it would cover; (5) update the inadvertent discovery section to provide more detail, including that work in the area of the discovery would be stopped immediately until the artifact or area is evaluated, and that if the discovery is related to the area's tribal history, the appropriate tribe would be contacted and consulted, in addition to the New York State Historic Preservation Officer; (6) include more details about the interpretive historic signs, including a detailed development schedule, who would be consulted

during development, and the specific location of their placement; and (7) make all revisions in accordance with the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Projects*. Making these revisions would create a more comprehensive HPMP and ensure greater protection of historic properties.

No-action Alternative

Under the no-action alternative, the project would not be constructed.

Environmental Impacts and Measures of the Staff Alternative

The primary issues associated with constructing and operating the project are effects of project construction, operation, and maintenance on induced seismicity and subsidence; maintenance of soil resources; water quality; terrestrial habitat and wetlands; threatened and endangered species; aesthetics; and cultural resources. The environmental effects of the staff alternative are described in the following section.

Geology and Soils

The proposed Mineville Project is located in a seismically active area. Risks to the project from naturally occurring earthquakes could include structural effects on the existing project mines and the proposed underground power facilities. Staff's recommended development of a geotechnical investigation plan would include Moriah Hydro's proposed geotechnical investigations, along with other staff-recommended investigations of the mined-out spaces of each reservoir following dewatering. The plan and additional studies would provide a more comprehensive evaluation of the quality of the rock mass, strength, and the safety margin for earthquake loading. These additional data would help inform the project's final design.

Construction of the proposed project could affect stress[16] conditions due to excavation for shafts and power facilities as well as by the dewatering of the project mines. During project operation, the daily movement of water between the two reservoirs could affect stress conditions. Induced earthquakes[17] could derive from subsurface stress changes during power facility construction, dewatering, and project operation, as well as localized pillar and roof collapses that could develop during project operation. Developing and implementing the staff-recommended seismic monitoring

[16] Stress is the force applied to an object. Geological stress can be confining, compression, tension or shear, and may lead to rock deformation or fracture.

[17] Induced earthquakes result from a release of energy from a stress build-up caused by man-made activities.

plan, to include a seismic monitoring network around the project area, would identify the location of any induced seismic activity during construction and operation. Further, extending the post-construction seismic monitoring to 10 years would provide an understanding of the effect of project operation on rock mass instabilities such as collapses or rockbursts, which would thereby provide the information needed to respond to any induced seismic earthquakes.

Land within and surrounding the project boundary has experienced subsidence and cave-ins as result of settling and degradation of materials used for filling and sealing the mine access shafts and pits. During project construction, dewatering of the project mines would result in a loss of groundwater from the pore spaces of the fill of the access shafts. This loss of groundwater would increase the effective stress in the fill, resulting in further compaction and increased risk of subsidence and cave-ins. During project operation, the constant wetting and drying from water moving between the project reservoirs would mobilize particles in the fill within the three shafts connected to the Harmony Mine if the bedrock/overburden interface were not tightly sealed with a concrete cap. Mobilized sediment would then be transported down into the upper reservoir, and the fill in the shaft would settle further. Staff's modification to Moriah Hydro's mine shaft and pit resealing plan would include routine inspections and maintenance to ensure the effectiveness of the reconstructed seals, and would help prevent residual settling or further subsidence and cave-ins during project operation.

The proposed project mines are thought to be hydraulically connected to adjacent mines (New Bed, Welch, and 21), thus it is likely that the dewatering of the project mines and project operation would affect groundwater elevation in all mines. Staff's recommendation would develop a project mine sealing plan. The plan would include Moriah Hydro's proposal to grout leaking seals of major water-bearing seams and discontinuities and seal all incidental inter-mine connections, but would add intermittent inspections and maintenance to ensure isolation of the project mines from groundwater intrusion.

The current system of former mines within the project area appear to be hydraulically connected in a number of ways. For instance, historical mining maps suggest that the mined-out Welch orebody is connected to the adjacent 21 Pit, which is connected to the two proposed project mines. The sources of water that filled the project mines when mining operations ceased are a combination of surface water and groundwater, but the specific pathways that water entered the mines are not well understood. Staff's modification of Moriah Hydro's proposed groundwater monitoring would require the development of a formal groundwater monitoring plan and would increase the number of monitoring stations. The resulting data would provide a better understanding of groundwater hydrology in the project area and confirm hydraulic isolation of the project mines following implementation of measures in staff's

recommended project mine sealing plan (e.g., grouting major water-bearing seams and incidental inter-mine connections).

Construction of the Mineville Project would disturb soil and terrestrial resources as a result of developing access or staging areas and conducting excavations for project facilities. Similarly, dewatering of the project mines, during construction and project operation, could increase erosion and sedimentation in adjacent surface waters. Staff's modifications to Moriah Hydro's proposed Erosion and Sediment Control Plan would include the development of site-specific measures for all locations with construction activities and a plan for the disposal or reuse of excavated materials to protect soil resources and stream channels in the area.

Aquatic Resources

Project construction would require partial dewatering of the proposed project mines into tributary C-86-5, followed by continuous pumping of groundwater at a rate equivalent to infiltration over the life of the project. Groundwater quality (e.g., temperature, DO, and dissolved metals) within the project mines is expected to degrade in response to increasing depth, stagnation, and prolonged exposure of the water to the minerology of the adjacent rock. Thus, as construction and project operation exposes these waters, dewatering could affect water quality in tributary C-86-5. Similarly, mobilization of contaminants, particularly polychlorinated biphenyls, which have been documented in the project mines, could also occur as a result of dewatering and through turbulent flows under project operation. Staff's recommended water quality monitoring plan would include Moriah Hydro's proposed monitoring and treatment, but would further protect aquatic resources during construction and operation by including provisions for PCB monitoring and defining water quality conditions under which treatment or a temporary stoppage or termination of dewatering would occur.

Terrestrial Resources

The proposed project facilities and staging areas would largely be constructed on unvegetated, disturbed upland habitat that previously supported active mining activities and is currently used for the town garage, a solid waste transfer station, and access to former mining properties. Nevertheless, construction of project facilities, as well as sealing the West Drift and subsiding shafts within the project area, would disturb some existing terrestrial habitat. Moriah Hydro's Erosion and Sediment Control Plan would minimize sedimentation on adjacent terrestrial resources through procedures and BMPs to reduce erosion, contain sediment, and stabilize soils after construction. Modifying the plan to include specific measures to address work associated with sealing the West Drift and resealing subsiding shafts and mine openings would further minimize effects on terrestrial habitat.

Construction, operation, and maintenance of the proposed project would likely affect four non-federally listed bat species (eastern small-footed bat, tri-colored bat, little brown bat, and big brown bat) that hibernate within New Bed Mine, and that likely roost and forage in forested habitat within the project boundary. However, since these four bat species have similar summer and winter habitat requirements as the federally endangered Indiana bat and the threatened northern long-eared bat, project effects and measures regarding the four non-federally listed bat species are addressed in *Threatened and Endangered Species* below.

Threatened and Endangered Species

Two federally listed species (the endangered Indiana bat and threatened northern long-eared bat) are known to occur within the New Bed Mine bat hibernaculum, adjacent to the proposed project and potentially connected by the West Drift to the project's lower reservoir (Old Bed Mine). Project construction, operation, and maintenance are likely to result in noise, vibration, and changes to air temperature, humidity, air flow, and water levels within New Bed Mine. Implementing Moriah Hydro's proposed Bat Plan, with modifications, may minimize the potential to impact physical conditions within the New Bed Mine and on bat species that use the mine.

However, the number of potential inter-mine hydraulic connections involving the project mines, New Bed Mine, and other former mines in the project area is not known. As the project mines are flooded, it is not possible to account for the specific potential effects that each stage of the project (dewatering, construction, and operation) may have on conditions within the New Bed Mine. Therefore, we conservatively conclude that licensing the construction of the proposed project under the staff alternative would be likely to adversely affect the endangered Indiana bat and threatened northern long-eared bat. Adverse effects would include: (1) removal of suitable Indiana and northern long-eared bat summer roost and maternity colony habitat due to tree clearing associated with project construction and maintenance; (2) temporary to permanent displacement from suitable hibernation sites within the New Bed Mine due to fluctuation of water levels caused by project construction (e.g., sealing the West Drift and other inter-mine connections) and operation; (3) proliferation of *Pseudogymnoascus destructans* and an

increase in white-nose syndrome (WNS)[18] infection rates and bat mortality caused by project construction- or operation-related alterations in water levels, temperature, humidity, or air flow and exchange; (4) reduced suitability of locations within the hibernaculum due to project construction- or operation-related vibration and noise; and (5) direct mortality of bats entering any unsealed entrances in the project mines during project construction and operation. Each of these adverse effects have the potential to effect most or all of the federally listed Indiana and northern long-eared bats presently using summer roost or maternity colony habitat near the project or hibernating within the New Bed Mine, which is the largest known overwintering population of Indiana bats in the northeastern U.S., and the largest known population of northern long-eared bats in New York.

Recreation, Land Use, and Aesthetics

While the proposed project would be located within a region of New York that offers a diverse range of year-round outdoor recreation opportunities, there are no recreation sites located within the proposed project boundary and the proposed project would be constructed within a decommissioned, subterranean mine complex, which makes public access difficult. Further, because little recreational activity currently occurs within the project boundary, construction of the project would not disrupt existing recreation, and because the majority of the proposed project would be underground, it would not greatly alter the existing viewshed, nor would it offer the same recreational opportunities as a conventional hydropower project. Therefore, staff does not recommend that Moriah Hydro develop any recreation facilities at the proposed project. However, as part of the HPMP, Moriah Hydro proposes to develop historic industrial and interpretive displays that highlight the extensive mining history of the area and adaptive reuse of these mines into a pumped storage project, which would educate the public and provide both an historic and recreational benefit to the area. In addition, constructing the

[18] *Pseudogymnoascus destructans* is a fungus that colonizes the bare skin of bats during hibernation and causes WNS. It is believed to be transmitted by bat-to-bat contact and through contact with surfaces in caves or mines where the fungus can persist in the absence of bats (Langwig et al. 2017). WNS-affected bats exhibit increased activity and unusual behavior (including daytime flight during the winter), which reduces fat deposits necessary for hibernation. WNS causes emaciation, damage to wing membranes, and dehydration, and a higher incidence in mortality in species affected by the disease (Blehert 2009; FWS 2013). WNS is a main threat to hibernating bats, and has caused a precipitous decline in bat numbers (in many cases, 90 to 100 percent) in New York State and throughout the U.S. and Canada. There is currently no treatment for the disease. See https://www.whitenosesyndrome.org/

new entry and service building in the style similar to existing structures and repairing, revegetating, and landscaping aboveground construction areas at the conclusion of construction activities, would enhance the aesthetics of the project area.

Cultural Resources

The project area is rich in mining history. Although most of the proposed project construction would be underground and Moriah Hydro only proposes to construct one aboveground structure, project construction and operation could still disturb archeologically sensitive areas and affect historic properties located within the proposed project's area of potential effects (e.g., the National Register-eligible Wasson & West Streets Historic District and the National Register-listed Witherbee Memorial Hall). Implementing Moriah Hydro's HPMP, with the staff-recommended modifications, would protect historic properties by providing measures to educate the public about the area's extensive mining history, cultural resources training for all staff, and a framework for consultation with the New York State Historic Preservation Officer to ensure required approvals are received and appropriate measures are implemented to protect cultural resources.

Socioeconomic Resources

Project construction and operation would provide a minor increase in short- and long-term employment opportunities. However, the increase in the local population and the demand for local housing or public services would be negligible. The largest benefit of the project to the local economy would come from an estimated $260,000,000 increase in the town's taxable assessment due to the valuation of the project.

Conclusions

Based on the analysis, we recommend licensing the project as proposed by Moriah Hydro with some staff modifications and additional measures.

In section 4.2 of this draft EIS, we estimate the likely cost of alternative power for each of the three alternatives identified above. The analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $12,065,860 or $28.66 per MWh more than the likely alternative cost of power. Under the staff alternative, project power would cost $12,036,390 or $28.59/MWh more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (421,000 MWh annually); (2) the public benefits of this alternative would exceed those of the no-action alternative; and (3) the recommended environmental measures proposed by Moriah Hydro, as modified by staff, would adequately protect and enhance environmental

resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Mineville Energy Storage Project
FERC Project No. 12635-002

1.0 INTRODUCTION

1.1 APPLICATION

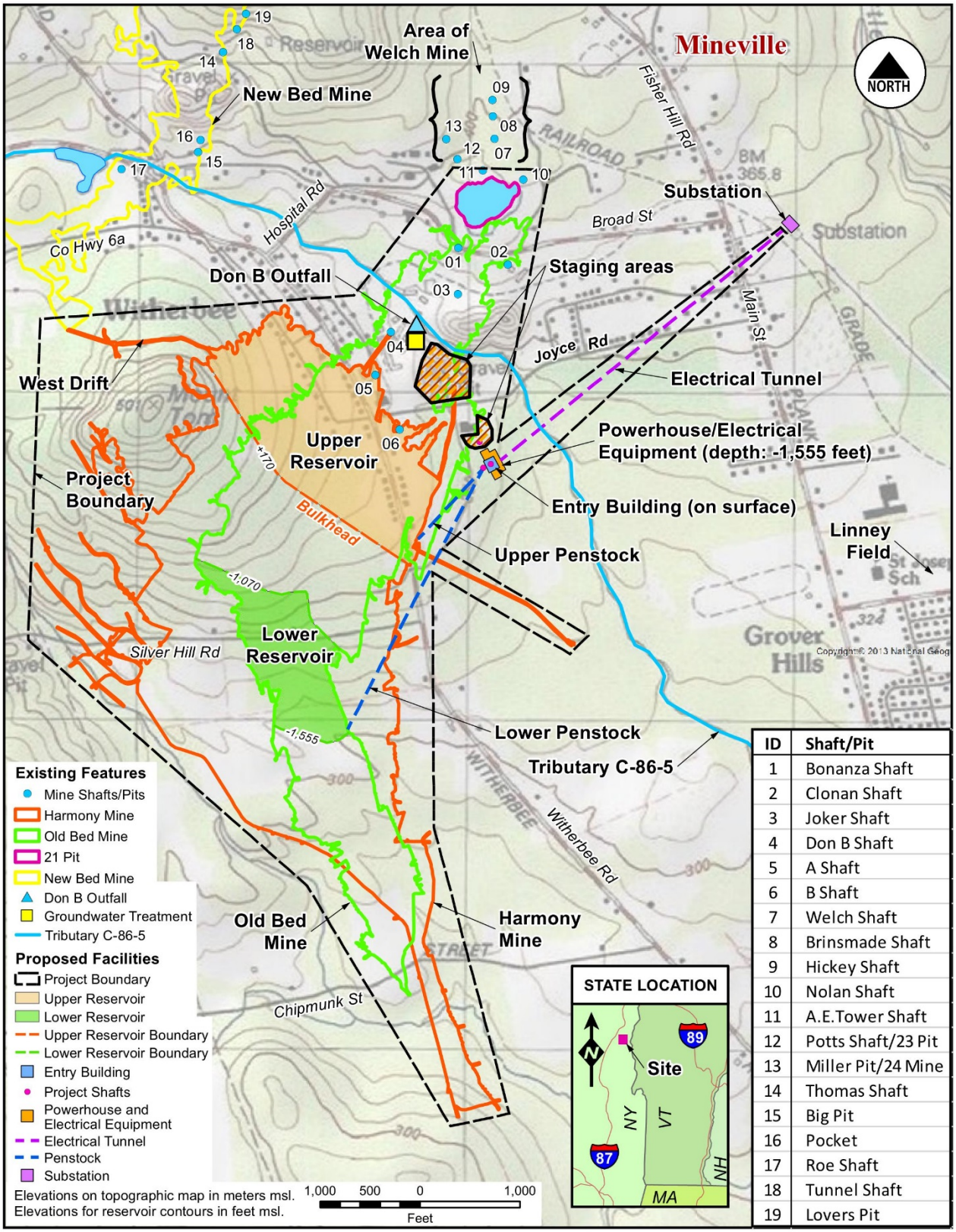
On February 13, 2015, Moriah Hydro Corporation (Moriah Hydro or applicant) filed an application for an original major license to construct and operate its proposed 240-megawatt (MW) Mineville Energy Storage Project No. 12635 (Mineville Project or project). The closed-loop pumped storage project would be constructed in a decommissioned subterranean mine complex[19] in the Town of Moriah, Essex County, New York, and would consist of constructing an upper and lower reservoir, a powerhouse, power tunnel, a transmission line, entry building, and appurtenant facilities (figures 1-1 and 1-2). No federal lands would be occupied. The proposed project would generate an estimated 421,000 megawatt-hours (MWh) of energy annually.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed Mineville Project is to provide a new source of hydroelectric power and provide ancillary services to the electrical grid. Therefore, under the provisions of the Federal Power Act (FPA), the Federal Energy Regulatory Commission (Commission or FERC) must decide whether to issue a license to Moriah Hydro for the project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which

[19] The existing mine complex is illustrated below in figures 1-1 and 1-2, and comprises the interconnected Old Bed Mine, Harmony Mine, and 21 Mine and pit. A pit is a depression in the ground caused by mining activities. The 21 Pit is filled with water, as it is deeper than the groundwater table.



ID	Shaft/Pit
1	Bonanza Shaft
2	Clonan Shaft
3	Joker Shaft
4	Don B Shaft
5	A Shaft
6	B Shaft
7	Welch Shaft
8	Brinsmade Shaft
9	Hickey Shaft
10	Nolan Shaft
11	A.E.Tower Shaft
12	Potts Shaft/23 Pit
13	Miller Pit/24 Mine
14	Thomas Shaft
15	Big Pit
16	Pocket
17	Roe Shaft
18	Tunnel Shaft
19	Lovers Pit

Figure 1-1. Location of the proposed project, including mines and facilities (Source: license application, as modified by staff).

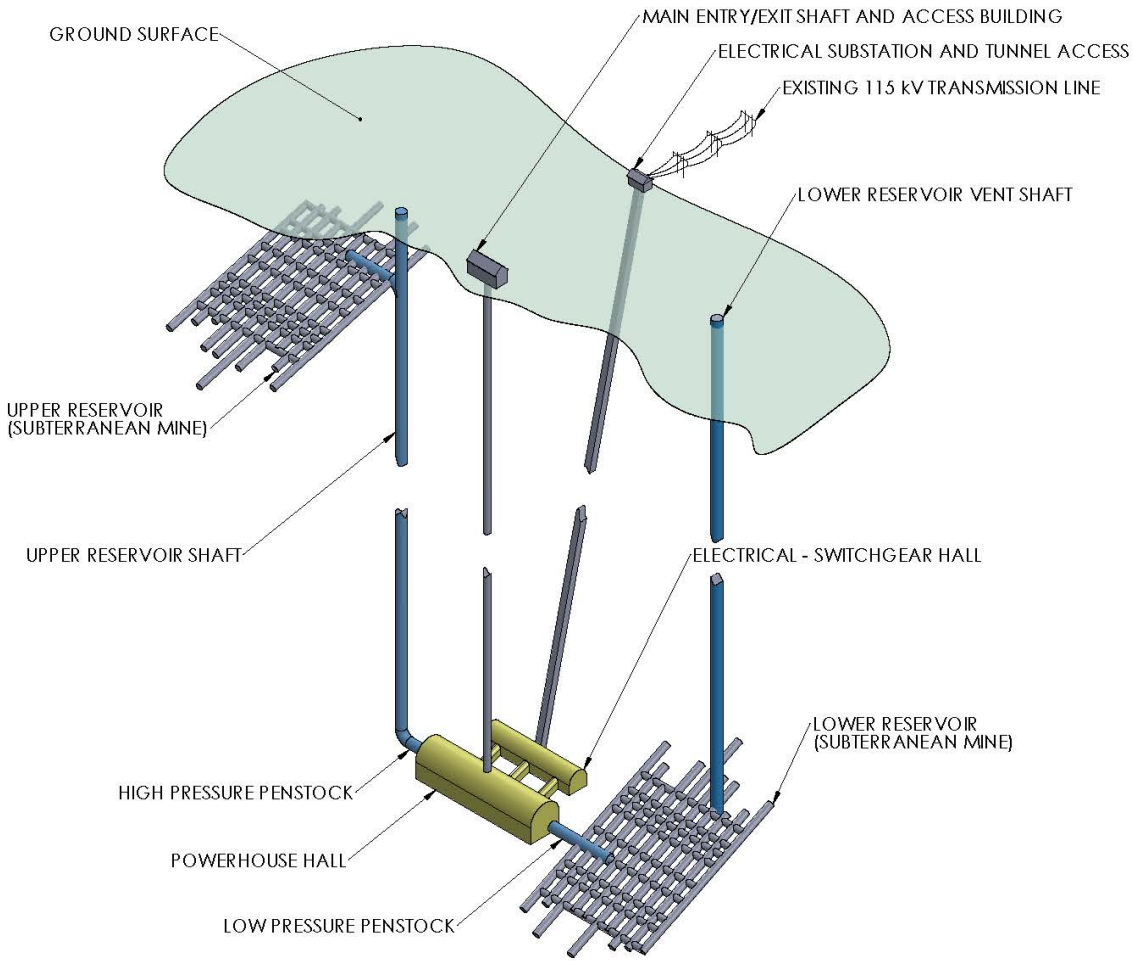


Figure 1-2. Conceptual drawing of the proposed facilities of the Mineville Project (Source: license application, as modified by staff).

licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

This draft environmental impact statement (draft EIS) has been prepared in compliance with the National Environmental Policy Act of 1969 to assess the environmental and economic effects associated with the construction and operation of the project, alternatives to the project, and makes recommendations to the Commission on whether to issue an original license, and if so, recommends terms and conditions to become a part of any license issued for the project.

In this draft EIS, we assess the environmental and economic effects of constructing, operating, and maintaining the project: (1) as proposed by Moriah Hydro (proposed action); and (2) as the proposed action with additional or modified measures (staff alternative). We also consider the effects of taking no action (no-action alternative), in which the project would not be licensed or constructed. Important issues that are addressed include the effects of construction, operation, and maintenance on geology and soils, aquatic and terrestrial resources, threatened and endangered species, and socioeconomics.

1.2.2 Need for Power

Pumped storage facilities are net energy consumers. The amount of energy produced as water passes from the upper reservoir to the lower reservoir through the turbines is less than the amount of energy required to operate the plant and to pump water back to the upper reservoir. However, the benefits of pumped storage facilities are realized in the difference between the value of the power generated versus the cost required to pump water to the upper reservoir. Typically, there are sources of power, such as base-load nuclear, coal, and fossil-fueled facilities, as well as certain renewable resource facilities, that can provide power at low rates during nighttime or low-demand hours, compared to rates available during daytime, high-demand hours. Baseload units are typically brought online and remain operational through the course of the day due to the lengthy startup time required, and because they operate at optimum efficiency at higher load. Therefore, pumped storage facilities can provide power during the day when energy demand is high and can use power from other facilities during the night when energy demand is low.

The Mineville Project, as a closed-loop pumped storage facility, would provide hydroelectric generation to meet part of New York's power requirements at times of high energy use and would be available in a reserve mode to respond to unanticipated losses of

generation within the electric system. The project would have an installed capacity of 240 MW and generate 421,000 MWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The project is located within the Northeast Power Coordinating Council - New York region of NERC. According to NERC's 2018 forecast (NERC, 2018), average annual total internal demand requirements for the region are projected to grow at a rate of 0.1 percent from 2019 through 2028. NERC projects anticipated reserve capacity margins (generating capacity in excess of demand) in the region will range between 24.12 percent and 21.57 percent of firm peak demand during the 10-year forecast period.

Should an original license for the Mineville Project not be granted, the proposed services that the project would provide to the grid, including peaking generation and black start capability, would need to be provided by other existing projects or in some other fashion by the system operator. As a net consumer of electricity, the power the project generates itself would not need to be replaced. We conclude that power from the Mineville Project would help meet the need for power in New York in both the short- and long-term.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any license for the Mineville Project would be subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described below.

1.3.1 Federal Power Act

1.3.1.1 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

On April 5, 2018, the Department of the Interior (Interior) timely filed recommendations under section 10(j), as summarized in section 5.3, *Recommendations of Fish and Wildlife Agencies*. In section 5.3, we also discuss how we address the agency's recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain either water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the CWA, or a waiver of certification by the appropriate state agency. The failure to act on a request for certification within a reasonable period of time, not to exceed one year, after receipt of such request constitutes a waiver.

On May 14, 2018, Moriah Hydro applied to the New York State Department of Environmental Conservation (New York DEC) for a section 401 certification for the project. New York DEC received the application on the same day.[20] In a May 13, 2019,[21] email correspondence, New York DEC denied Moriah Hydro's request for a section 401 certification without prejudice. In accordance with the Commission's policy, Moriah Hydro must, within a 90-day period from the denial, notify the Commission that it has filed a timely appeal of the denial with the certifying agency, and/or that it has refiled its certification.[22] The notification is due by August 12, 2019.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of such species. On March 6, 2018, Commission staff requested an official species list for the project through the U.S. Fish and Wildlife Service's (FWS) Information for Planning and Conservation (IPaC) system, which indicated that two federally listed species, the endangered Indiana bat (*Myotis sodalis*) and the threatened northern long-eared bat (*Myotis septentrionalis*), are known to occur, or are considered to potentially occur, in Essex County, New York.[23] There are no proposed or designated critical habitats for either species in the project area.

Our analysis of project effects on the Indiana bat and the northern long-eared bat is presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations are included in section 5.1, *Comprehensive Development and*

[20] The applicant filed copies of the certification request and receipt of delivery on May 15, 2018, and May 22, 2018, respectively.

[21] New York DEC filed the denial letter on May 14, 2019.

[22] See May 31, 2019, letter to Moriah Hydro.

[23] See March 7, 2018, official species list memorandum.

Recommended Alternative. Based on the available information, we conclude that licensing the project is likely to adversely affect the Indiana bat and the northern long-eared bat. We expect to request formal consultation with FWS regarding the project's effects on the Indiana bat and northern long-eared bat.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state's coastal zone management agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 6 months of its receipt of the applicant's certification.

In an e-mail dated January 10, 2019 (filed March 13, 2019), the New York State Department of State indicated that the Mineville Project is not located within New York State's coastal area, and that it does not anticipate that the project would have an effect on coastal uses or resources within New York State's coastal area.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA)[24] requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion on the National Register of Historic Places (National Register).

According to a search of the project's area of potential effects (APE)[25] in the New York State Historic Preservation Officer's (New York SHPO) Cultural Resources Information System,[26] there are two archeologically sensitive areas, one National Register-eligible historic district (Wasson & West Streets Historic District), and one National Register-listed building (Witherbee Memorial Hall). Although most of the project construction would be underground and Moriah Hydro only proposes to construct

[24] 54 U.S.C. § 306108 (2012).

[25] The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. For the proposed project, the APE includes the lands enclosed by the project's boundary.

[26] https://cris.parks.ny.gov/. Accessed November 27, 2018.

one aboveground structure, project construction and operation could still disturb the archeologically sensitive areas and the National Register-eligible and -listed facilities because project construction and operation could result in induced seismicity and exacerbate ground subsidence. While those effects are expected to be minimal, if they occur, historic properties could be shifted and potentially damaged. In order to protect cultural resources at the project and highlight the historic mining character of the proposed project area, Moriah Hydro developed an historic properties management plan (HPMP) that includes historic property management actions, reporting provisions, and a provision to install interpretive historic signs near the proposed project's entrance.

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the construction of the Mineville Project. The terms of the PA would ensure that Moriah Hydro addresses and treats any adverse effects to historic properties identified within the APE throughout implementation of the HPMP.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], § 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, ESA, NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this draft EIS, we conducted scoping to determine what issues and alternatives should be addressed. We issued an initial scoping document (SD1) on November 4, 2016.[27] Scoping meetings were held on December 7, 2016, in Warrensburg, New York, and on December 8, 2016, in Port Henry, New York, to obtain comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to the comments provided at the scoping meetings, the following entities have filed written comments:

Commenting Entities	Date Filed
New York DEC	January 13, 2017
Solvay USA Inc. (Solvay)	January 9, 2017

[27] SD1 was noticed in the Federal Register on November 14, 2016.

Kay Stafford	January 9, 2017
Interior	January 3, 2017
U.S. Environmental Protection Agency (EPA)	December 12, 2016

Based on comments received during the December 7 and 8, 2016, scoping meetings and written comments received during the scoping process, a revised scoping document (SD2) was issued on June 23, 2017.

1.4.2 Interventions

On October 4, 2016, the Commission issued a notice accepting Moriah Hydro's application for an original license for the Mineville Project. This notice set December 3, 2016, as the deadline for filing protests and motions to intervene. The following entities filed notices of intervention or motions to intervene (none in opposition to the proposed project):

Intervenor	Date Filed
New York State Council of Trout Unlimited	December 12, 2016
New York DEC	December 5, 2016
Kay Stafford	December 2, 2016
Solvay	December 1, 2016
Interior	November 28, 2016

1.4.3 Comments on the Application

On February 5, 2018, the Commission issued a Ready for Environmental Analysis (REA) notice for the Mineville Project, and solicited comments, recommendations, terms and conditions, and prescriptions. The following entities filed comments, recommendations, terms and conditions, and prescriptions:

Commenting Entity	Date Filed
EPA	April 16, 2018
Solvay	April 6, 2018
Interior	April 5, 2018

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the project would not be built, and environmental resources in the project area would not be affected. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

The proposed Mineville Project would consist of: (1) an upper reservoir located within the upper portion of the Harmony Mine between elevations +495 and +1,095 feet mean sea level (msl), or +400 and +1,000 feet local mine datum (LMD)[28] with an operating surface area of 4 acres and a storage capacity of 2,448 acre-feet;[29] (2) a lower reservoir in the lower portion of the Old Bed Mine between elevations −1,075 and −1,573 feet msl, (−1,170 and −1,668 LMD)[30] with an operating surface area of 5.1 acres and a storage capacity of 2,448 acre-feet; (3) a 14-foot-diameter and 2,955-foot-long

[28] All mine elevations in this draft EIS are listed in msl and LMD, and denoted with a "+" or "–" to distinguish elevations above and below sea level. LMD was established before 1930 by Witherbee Sherman and Company and is extensively used in historical mine records. LMD is about 95 feet lower than msl.

[29] In its license application, Moriah Hydro reports the available volume for each of the proposed project's reservoirs as 2,448 acre-feet. Staff has independently calculated the available volumes as 1,114 acre-feet (upper reservoir) and 463 acre-feet (lower reservoir). Our estimates use the following assumptions: (1) the reservoirs extend across an area in plan of 65 acres (upper reservoir, using the +170-foot msl (+75-foot LMD) elevation as the base) and 27 acres (lower reservoir); (2) an average subsurface mine angle of 29 degrees; and (3) 100 percent mined-out space (i.e., no support pillars), with an average mined-out thickness of 15 feet. For verification, staff separately estimated the volumes for all associated mines in the area (i.e., 21 Mine, Old Bed Mine [without area of 21 Mine], Harmony Mine, part of Welch Mine, part of New Bed Mine) and compared the results to those of Farrell (1992). Our estimate for these mines is consistent with the groundwater volume estimate by Farrell (1992) of 12,936 acre-feet. Thus, the analyses in section 3 of this draft EIS use staff's estimated available reservoir volumes.

[30] In a December 20, 2017, letter, Moriah Hydro states that the correct bottom elevation of the lower reservoir is −1,573 feet msl (−1,668 feet LMD).

upper reservoir shaft connecting the upper reservoir to the high-pressure penstock located below the powerhouse chamber floor; (4) a 14-foot-diameter and 2,955-foot-long lower reservoir shaft connecting the lower reservoir and the lower reservoir ventilation tunnel; (5) a 320-foot-long by 80-foot-wide powerhouse chamber, containing 100 reversible pump-turbine units, each with a nameplate generating capacity of 2.4 megawatts; (6) a 274-foot-long by 36-foot-wide underground electrical equipment chamber adjacent to the powerhouse chamber, containing switchgear, step-up transformers, and ancillary electrical equipment; (7) two 6-foot-diameter emergency evacuation shafts located between the powerhouse chamber and the electrical equipment chamber; (8) a 25-foot-diameter main shaft extending 2,955 feet from the surface down to the powerhouse chamber; (9) 15-foot-diameter high- and low-pressure steel penstocks embedded beneath the powerhouse chamber floor; (10) an aboveground structure functioning as a main shaft entry building and construction equipment service facility (entry and service building);[31] (11) an approximately 3,600-foot-long, 10-foot-high and 15-foot-wide underground electrical tunnel containing 34.5-kilovolt (kV) transmission lines, connecting the underground electrical equipment chamber to a new 15-foot by 15-foot, aboveground concrete electrical vault, and interconnecting with an existing single circuit 115-kV transmission line at the New York State Electric and Gas Corporation (NYSEG) substation in the Hamlet of Mineville;[32] and (12) appurtenant facilities.

The proposed project mines are currently filled with groundwater and continuously discharge from the overburden[33] contact at the Don B shaft (Don B outfall) to an adjacent unnamed stream (defined as tributary C-86-5 by New York DEC) within

[31] In the final license application, Moriah Hydro describes this facility variously as: (1) a 9,000-square-foot entry and service building to be built adjacent to the existing town garage, directly over the main shaft, in a previously developed area; (2) a construction equipment maintenance building erected on land leased from the Town of Moriah and utilized during construction; (3) an entry building; and (4) consisting of two buildings – an entry building to be built directly over the main shaft and a metal storage building that would replace the existing town garage. Moriah Hydro states that the building would be donated to the Town of Moriah upon completion of project construction, although it is unclear whether Moriah Hydro intends to donate the building, or portion of the building, that provides entry to the project's main shaft. For the purposes of this draft EIS, staff assumes that Moriah Hydro is proposing to construct a single, 9,000-square-foot, aboveground service and entry building on the previously disturbed area adjacent to the existing town garage.

[32] See Moriah Hydro's September 1, 2015, additional information response.

[33] Overburden is defined as soil and rock overlying an extractable mineral deposit (e.g., ore, coal) or bedrock.

the project boundary. Moriah Hydro proposes to partially dewater the mines by pumping groundwater into the stream over a 1- to 2-year period and would use the remaining groundwater in the mines to operate the project as a closed-loop system.

The project would help meet energy demands and grid control requirements by providing an estimated average annual generation of 421,000 MWh. The average pumping power used by the project would be 554,000 MWh.

2.2.2 Proposed Project Boundary

The project boundary would encompass 625 acres of surface land. As described in section 2.2.1., *Proposed Project Facilities*, with exception to the proposed entry and service building, all project facilities would be located underground.

2.2.3 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after construction. Inspection during construction would concentrate on adherence to Commission-accepted plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.4 Proposed Project Operation

The Mineville Project would operate as a fully automatic closed-loop pumped storage system, following supervisory control from the New York Independent System Operator (NYISO) to meet energy demands and grid control requirements. The project would pump water from the lower reservoir to the upper reservoir when energy is in excess or in low demand and would release water from the upper reservoir to the powerhouse to generate electricity during periods of high demand. The project would

also be used to "time shift"[34] renewable generation, such as wind and solar generation, or to provide ancillary power services.[35]

Water used for generation would be cycled back and forth between the upper and lower sub-surface reservoirs and would not require supplementation from surface water sources. Groundwater infiltration into the project mines is expected to continue post-construction and would be discharged from the Don B outfall to tributary C-86-5. During normal operation, the project head would range from 2,650 feet to 2,200 feet. The minimum head during pumping and generation would be 1,600 feet. The minimum and maximum hydraulic capacity of the project is 54 cubic feet per second (cfs) and 1,200 cfs, respectively. Based on a maximum generation schedule of 10 hours per day, the project would be capable of providing 737,600 MWh annually, with an estimated average annual output of 421,000 MWh.

2.2.5 Proposed Environmental Measures

Moriah Hydro proposes the following environmental measures:

Geology and Soil Resources

- Conduct geotechnical investigations to gather data on seismic risk and reservoir stability for integration into the final project design, to include: (1) borehole sampling to determine the composition and permeability of the overburden, and the compressive strength, permeability, and quality of the underlying bedrock; and (2) creating a detailed three-dimensional (3-D) model of the project based on the borings and existing mine mapping.

- Monitor seismicity within the project boundary for 2 months prior to construction to 12 months after start of operation to minimize seismic risk to local residents.

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[34] Energy time shift involves storing energy during low price times, and discharging during high price times.

[35] Ancillary services help balance the transmission system as electricity is moved from generating sources to ultimate consumers, and are necessary for proper grid operation. Ancillary services include: load following, reactive power-voltage regulation, system protective services, loss compensation services, system control, load dispatch services, and energy imbalance services.

- Reseal all mine shafts and openings in the project boundary (with the exception of the 21 Pit[36]) and Roe Shaft associated with the New Bed Mine,[37] and base final design of resealing activities on location-specific field measurements and conditions to minimize the effects of subsidence on geology and soil resources.

- Grout any leaking seals of major water-bearing seams and discontinuities, and seal all incidental inter-mine connections to minimize groundwater leakage into the project mines.

- Extend the municipal water distribution system along Witherbee Road, Chipmunk Street, and Lower Silver Hill Road within the project boundary to provide municipal water to residents currently using private groundwater wells.

- Implement the Erosion and Sediment Control Plan[38] filed on February 24, 2015, which includes measures to retain existing vegetation, revegetate disturbed areas, avoid and protect stream channels; monitor subsidence at unspecified ground elevations and structures during the pumping of groundwater from the flooded project mines; and other measures.

Aquatic Resources

- Monitor water quality and flow of groundwater from the Don B outfall and at locations upstream and downstream of the Don B outfall on tributary C-86-5 during construction and throughout the life of the project. Water quality parameters would include temperature, pH, specific conductance (conductivity), turbidity, dissolved oxygen (DO), total organic carbon (TOC), iron, and manganese. Results would be posted in real time to a public website.

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[36] The 21 Pit would be sealed with material excavated from the proposed powerhouse chamber and reservoir shafts, as discussed in section 3.3.1, *Geology and Soils*.

[37] Some filings on the record refer to the New Bed Mine as the Barton Hill Mine. During the December 7, 2016, scoping meeting, New York DEC confirmed that these two names are synonymous. In this draft EIS, staff uses the term New Bed Mine in reference to this mine.

[38] Moriah Hydro filed a proposed Erosion and Sediment Monitoring and Control Plan as Appendix 7 of the February 24, 2015, license application. Moriah Hydro refers to it variously as the "Erosion and Sediment Monitoring Plan" and the "Erosion and Sediment Control Plan" within the license application. The draft EIS uses "Erosion and Sediment Control Plan" throughout.

Any discharges exceeding state water quality standards, particularly iron and manganese, would be treated via simple aeration and detention prior to being discharged to tributary C-86-5.

- Construct a step tray aeration and detention facility near the Don B outfall to treat groundwater overflow during project construction and operation.

Terrestrial Resources and Threatened and Endangered Species

- Implement the March 9, 2018,[39] Bat Protection Measures and Action Plan (Bat Plan), including the following measures to protect the federally listed endangered Indiana bat and threatened northern long-eared bat, a New York State species of special concern (eastern small-footed bat [*Myotis leibii*]), and other hibernating bat species (tri-colored bat [*Perimyotis subflavus*], little brown bat [*Myotis lucifugus*], and big brown bat [*Eptesicus fuscus*]):

    - Follow FWS and New York DEC guidance regarding the protection of the endangered Indiana bat and threatened northern long-eared bat,[40] such as: (1) avoid any tree clearing inside a 0.25-mile buffer around the New Bed Mine bat hibernaculum, or obtain permission from FWS if tree clearing is necessary within this area; (2) between April 1 to October 31, avoid cutting: (a) all cavity trees and snags within 5 miles of the New Bed Mine, known and documented northern long-eared bat roost trees, and any trees within 150 feet of a documented summer northern long-eared bat occurrence; (3) suspend tree cutting if northern long-eared bats are observed flying from a tree, or on a cut tree, and notify New York DEC of the observation; (4) maintain at least 35 percent of forest habitat within Indiana bat maternity colony home range; (5) avoid potential Indiana bat roost trees by retaining standing live trees with exfoliating bark and greater than 12 inches in diameter at breast height, and any black locust and hickory species regardless of

[39] Moriah Hydro filed the public version of its Bat Plan on March 9, 2018, which redacted privileged bat species information following consultation with New York DEC and FWS.

[40] Moriah Hydro's Bat Plan cites to the following guidelines: FWS' Final 4(d) Rule for the northern long-eared bat (https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf), May 2016 Indiana Bat Project Review Fact Sheet (https://www.fws.gov/northeast/nyfo/es/Ibat%20fact%20 sheet), and New York DEC's guidance for projects that do not result in a net change of land use within northern long-eared bat occupied habitat (https://www.dec.ny.gov/animals/106090.html).

size and condition; (6) from April 1 to September 30, avoid clearing any potential Indiana bat roost trees 4 inches or greater in diameter; and (7) minimize lighting impacts and use of chemicals in any stormwater detention basins.

- Obtain existing New York DEC water elevation, temperature, and humidity data for the New Bed Mine to develop a monitoring database for baseline purposes prior to construction, and install new monitoring equipment at multiple locations within New Bed Mine during the first non-hibernation season after license issuance to monitor temperature, humidity, water elevation, air flow, seismic activity, and bat presence (via infrared video and acoustics) within New Bed Mine from 3 years prior to construction to a minimum of 5 years post-construction.

- Seal the horizontal crosscut connecting the Harmony and New Bed mines (West Drift) (see figure 1-1) to prevent dewatering of the New Bed Mine bat hibernaculum, and exclude movement of bats between the New Bed and Harmony mines following dewatering.[41]

- Within 12 months of sealing the West Drift to the New Bed Mine, establish a controlled mine discharge point at the rehabilitated and sealed Roe Shaft[42] to permit control of water outflow from, and maintain the water level within, the New Bed Mine.

- During construction, exclude bats from colonizing all project-related mine openings with 0.25-inch mesh screen.

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[41] The Harmony Mine operated from 1829 to 1975, and the New Bed Mine operated from 1870 to 1930. It is possible that the previous mine owners have already sealed the West Drift, based on a comment by a former mine employee and member of the mine survey crew, who worked there until the project mines closed in the 1970s. He stated that he was familiar with the mine layout and that "there was no interconnection between the New Bed and Old Bed Mines" (according to the Moriah Hydro filing of March 3, 2017; we assume that the term "Old Bed Mines" includes the Harmony Mine). However, aside from this anecdotal comment, Moriah Hydro did not provide any evidence that the drift is blocked and proposes to seal the drift.

[42] In a letter filed March 3, 2017, Moriah Hydro stated that "…there is some evidence of a New Bed water outlet near the surface of Roe Pond through the previously sealed Roe Pond Shaft…" Elsewhere in the record, the location of the purported seep is noted as Roe Shaft. As there is no evidence in the record of a separate Roe Pond Shaft, staff use the term Roe Shaft throughout the draft EIS.

- After dewatering, provide access to the project mines for FWS and New York DEC for inspection and bat monitoring.

Recreation, Land Use, and Aesthetic Resources

- Provide $200,000 for recreational improvements, including a multiuse recreation complex, at Linney Field, located in the Town of Moriah.

- Design the entry and service building to replicate and continue the architectural theme established by the existing and adjacent Town of Moriah Highway Department Garage (town garage).

- As part of the Erosion and Sediment Control Plan, provide post-construction landscaping to add visual appeal to the aboveground facilities.

Cultural Resources

- Implement the HPMP, which includes development of historic industrial and interpretive displays about this ore mine and the pumped storage development.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include Moriah Hydro's proposed environmental measures, with the exception of the improvements to Linney Field, and the following modifications and additional measures:

- Development of a geotechnical investigation plan to evaluate subsurface conditions above and within the project mines, to include:

    - Moriah Hydro's proposed boring and testing of overburden and underlying bedrock and development of a 3-D model of the project mines, following license issuance;

    - Gathering and analyzing all available historical information on the geology of the mines and adjacent area;

    - An analysis of the number and placement of borings to inform the project's final design;

    - An analysis of the need to lower the upper reservoir's maximum elevation, to avoid regular wetting of the glacial overburden overlying the project mines during project operation, resulting in the potential for surface subsidence and flooding.

- Additional surveying and testing within the project reservoirs after dewatering to determine:
    - rock types and structural geology in the subsurface, including orientations and characteristics of the joint system, faults, dikes, and foliation planes, to inform the project's final design;
    - the compressive strength of support pillars within the project mines;
    - the seismic site class of the overburden and underlying bedrock and the potential for hydrodynamic loading on the support pillars from possible sloshing of water in the reservoirs during an earthquake;
    - the induced seismic risk from the dewatering during construction and the cycling of water between the upper and lower reservoirs during operation;
    - the presence of marble within the project mines that may dissolve during project operation; and
    - the appropriate design of a rock support system to stabilize the project mines.

- Development of a seismic monitoring plan to include installation of a seismic monitoring network within the project area with additional seismographs to determine locations of induced seismic activity from construction and project operation to provide additional protection to local residents, for a period of 10 years after construction.

- Development of a groundwater monitoring plan that would include Moriah Hydro's proposed flow monitoring at the Don B outfall and tributary C-86-5, with a modification to limit post-construction monitoring to a 3-year period with options to extend, if necessary.

- Development of a mine shaft and pit resealing plan after issuance of a license, prior to final design, integrating available historical information and site-specific investigations for all mines potentially affected by the project (i.e., Harmony, Old Bed, 21, and Welch mines) to address the range of approaches required for the various shafts and pits prior to implementation.

- Development of a project mine sealing plan to minimize groundwater intrusion into the project mines, to include: (1) grouting leaking seals of major water-

bearing seams, discontinuities, and any incidental inter-mine connections (including the previously sealed West Drift) after dewatering; and (2) during project operation, intermittent inspections and grouting of the upper reservoir to maintain isolation of the project mines from groundwater intrusion.

- Modification of the Erosion and Sediment Control Plan to include site-specific measures for all locations with ground-disturbing activities (including areas on the surface necessary for sealing the West Drift, resealing all subsiding mine connections, constructing the proposed electrical vault at the existing substation, and other facilities) and a plan for the disposal or reuse of excavated materials.

- Development of a water quality monitoring plan that would include Moriah Hydro's proposed water quality monitoring at the Don B outfall and tributary C-86-5, with a modification to limit post-construction monitoring to a 3-year period with options to extend, if necessary.

- Modification of Moriah Hydro's March 9, 2018, Bat Plan, through consultation with FWS and New York DEC, to include: (1) identification of all project-related ground disturbance and tree clearing that would occur during each phase of construction, to clarify the specific areas and seasons in which tree clearing should be avoided (consistent with FWS and New York DEC guidance); (2) identification of the number and location of devices to monitor New Bed Mine conditions; (3) development of a protocol to seal the West Drift that identifies all aboveground and underground activities associated with sealing the drift; (4) prior to dewatering, establishment of a groundwater elevation monitoring station at the site of the purported seep near Roe Shaft to determine the need for a controlled mine discharge point, following analysis of groundwater data within the project area; (5) prior to dewatering, identification of the number and design of bat exclusion devices to be constructed and maintained at mine openings; and (6) prior to implementing staff's recommended mine shaft and pit resealing plan, identification of the need for bat surveys at all shafts and pits proposed for resealing.

- Modification of Moriah Hydro's February 13, 2015 HPMP to: (1) update the project description; (2) provide an overview of the historic background of the area, including the extensive mining history; (3) provide a description of the National Register-listed properties that are located in the APE and explain their significance and public value; (4) include a provision to provide cultural resources training to all staff, describe how often the training would occur, who would provide it, and what it would cover; (5) update the inadvertent discovery section to provide more detail, including that work in the area of the discovery would be stopped immediately until the artifact or area is evaluated, and that if

the discovery is related to the area's tribal history, the appropriate tribe would be contacted and consulted, in addition to the New York SHPO; (6) include more details about the interpretive historic signs, including a detailed development schedule, who would be consulted during development, and the specific location of their placement; and (7) make all revisions in accordance with the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Projects*. Making these revisions would create a more comprehensive HPMP and ensure greater protection of historic properties.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We did not identify any other alternatives to Moriah Hydro's proposal.

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3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project's vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area, with historical and current conditions described first. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[43]

3.1 GENERAL SETTING

The proposed project would be located in the Town of Moriah, Essex County, New York, about 1.5 miles northwest of Moriah Center, in the foothills of the Adirondack Mountains. Climate is characterized as humid continental, exhibiting high seasonal variability. Average annual temperature ranges from 30.9 degrees Fahrenheit (°F) to 54.9°F. Average high and low temperatures are 76.4°F and 8.8°F, respectively. Precipitation is moderate, averaging 36.9 inches of rain and 65.0 inches of snow annually.

Lake Champlain is immediately east of the project area at an elevation of about 100 feet msl. To the west, the High Peaks Region of the Adirondacks gives rise to summits in excess of 5,000 feet msl. In the vicinity of the project, elevations range between 1,100 and 1,250 feet msl. Valleys are typically long and straight, with gently curved ridges and radial drainage patterns. Land use in the project area is dominated by varying degrees of development. In the Town of Moriah, developed areas (e.g., hamlet, moderate intensity, low intensity, rural use, resource management, and industrial use classifications) compose nearly 80 percent (36,364 acres) of the land use (table 1-1). Similarly, within the proposed project boundary, land is largely disturbed due to residential and commercial development. Ore tailings from previous mining operations are common and support little to no organic growth.

[43] Unless noted otherwise, the sources of our information are the final license application filed February 13, 2015, and additional information filed by Moriah Hydro on September 1, 2015, September 2, 2015, May 25, 2016, July 29, 2016 (privileged), March 3, 2017 (privileged), December 20, 2017, and March 9, 2018).

Table 3-1. Land classification acreage statistics for the Town of Moriah, New York. (Source: APA, 2016).

Land Classification	Acreage
Hamlet	1,334
Moderate Intensity	3,574
Low Intensity	5,016
Rural Use	5,862
Resource Management	20,153
Industrial Use	435
Wild Forest	4,724
State Administrative	57
Pending Classification	689
Open Water	3,784
Total	**45,628**

The project boundary is bisected by a single unnamed tributary to Mill Brook, known as tributary C-86-5. It originates 1.2 miles northwest of the project location, falling an average of 190 feet per mile (3 percent) as it passes east through Roe Pond and the Hamlet of Witherbee before continuing south about 3 miles to its confluence with Mill Brook, 0.25 mile west of Moriah Center. Mill Brook flows into Lake Champlain in the Hamlet of Port Henry. Along its course, tributary C-86-5 has a natural gravel and rock channel that traverses through rural, vegetated terrain without obstructions.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 C.F.R., § 1508.7), a cumulative effect is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we have identified six bat species that hibernate within New Bed Mine as resources that may be cumulatively affected by the proposed construction and operation of the project in combination with other past, present, and foreseeable future activities. These include two federally listed species (the endangered Indiana bat and the threatened northern long-eared bat), the New York State species of special concern eastern small-footed bat, and three unlisted species: the tri-colored bat, little brown bat, and big brown bat. There are

several factors that have reduced populations of these bat species within their range, including high mortality of hibernating bats due to white-nose syndrome (WNS)[44] and loss of forested habitat necessary for reproduction, roosting, and foraging.

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources defines the physical limits or boundaries of the effects of the proposed action on the resources. Because the proposed action can affect resources differently, the geographic scope for each resource may vary.

The geographic scope for analysis for the two federally listed and four New York State bat species is New York State. According to New York DEC, the majority of the hundreds of thousands of bats known to hibernate in New York State do so in just five caves and mines.[45] Further, New York DEC's December 21, 2013, comments indicate that the New Bed Mine bat hibernaculum, adjacent to the proposed Mineville Project, supports the largest known population of endangered Indiana bats in the northeastern U.S., the largest known population of northern long-eared and little brown bats in New York State, and the largest population of eastern small-footed bats in the species' range. New Bed Mine is characterized in the license application as the largest and most significant hibernation site known in the region.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and reasonably foreseeable future actions and their effects on the federally listed and New York State bat species. Based on the term of the proposed license, we will look 30 to 50 years into the future, concentrating on the effects on these bat species from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the

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[44] White-nose syndrome (WNS) is a disease caused by a fungus (*Pseudogymnoascus destructans*) that colonizes the bare skin of bats during hibernation. It is believed to be transmitted by bat-to-bat contact and through contact with surfaces in caves or mines where the fungus can persist in the absence of bats (Langwig et al. 2017). WNS-affected bats exhibit increased activity and unusual behavior (including daytime flight during the winter), which reduces fat deposits necessary for hibernation. WNS causes emaciation, damage to wing membranes, and dehydration, and a higher incidence in mortality in species affected by the disease (Blehert 2009; FWS 2013). WNS is a main threat to hibernating bats, and has caused a precipitous decline in bat numbers (in many cases, 90 to 100 percent) in New York State and throughout the U.S. and Canada. There is currently no treatment for the disease. See https://www.whitenosesyndrome.org/.

[45] http://www.dec.ny.gov/animals/45088.html

amount of available information for each resource. We identified the present resource conditions based on the license application, agency comments, and comprehensive plans.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the site-specific environmental issues.

Only the resources that have the potential to be affected are addressed in this draft EIS. Based on this, we have determined that geology and soils, aquatic resources, terrestrial resources, threatened and endangered species, recreation, land use and aesthetics, and cultural resources may be affected by the proposed action and action alternatives. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

The proposed Mineville Project is located in the Central Highlands section of the Adirondack Mountains. The Adirondack Mountains are a structural dome that started to uplift in the Tertiary period (Isachsen et al., 1991). Uplift of the dome eroded the original sediment cover, which still exists in the regions surrounding the Adirondacks, and exposed igneous and metamorphic rock of Precambrian age. Uplifting continues today at an estimated rate of 1 to 3 millimeters per year. During the Quaternary period, glaciers covered the region. As a result, surficial glacial deposits partially cover lands within the region (figure 3-1).

Bedrock Geology

The Precambrian bedrock found within the project boundary formed about one billion years ago. The bedrock consists of metamorphic rocks (mainly gneiss) surrounding a central core of intrusive rocks (mainly anorthosite, granite, and metagabbro). The Precambrian rocks of the Adirondacks have been severely folded and sheared by both ductile (breaking) and brittle (bending or flowing) deformation, resulting in intensely deformed rocks throughout the region, including within the project boundary.

Surficial Geology

The Quaternary overburden deposits within the project boundary consist of kame and till deposits. A kame deposit is a stratified drift (i.e., material organized into distinct horizontal layers or bands) composed of sand, gravel, and silt. These deposits

accumulate depressions of retreating glaciers and are often deposited on the land surface with further melting of the glacier. Till is unstratified glacial drift (i.e., material not organized into distinct layers); therefore, its texture varies considerably (boulders, gravel, sand, sit, and clay). Till deposits are usually poorly sorted. The thickness of the glacial overburden above the Precambrian bedrock varies from about 50 to 350 feet in the region, including the project boundary.

Faulting and Seismicity

Between 650 and 600 million years ago, stretching of the continental crust resulted in the development of major faults (Isachsen et al., 1991). These faults extend from north-northeast to south-southwest throughout the eastern Adirondacks (Chiarenzelli et al., 2016). Often diabase dikes formed along faults from intruded molten rock. The displacement along faults in the project area averages 15 to 150 feet and can be as much as 500 feet. Faults in the project boundary are not known to be active.

Earthquakes[46] occur occasionally in the Adirondack region. Three earthquakes with magnitudes greater than 5.0 on the Richter scale have occurred within 100 miles of the project area since 1737 (New York DHSES, 2014). In 1944, an earthquake of magnitude 5.8 occurred near the City of Cornwall in Ontario, Canada and the Town of Massena, New York (about 90 miles northwest of the project area). In 1983, an earthquake of magnitude 4.9 caused slight damage in a sparsely settled part of the southern Adirondack Mountains (35 miles west of the project area). On April 20, 2002, an earthquake of magnitude 5.3 (United States Geological Survey [USGS], 2018a) caused damage in the vicinity of the City of Plattsburgh, New York (30 miles north of the project area). Moderately damaging earthquakes occur in the region every few decades. Smaller earthquakes are felt every 3 to 4 years. Between 1975 and the present, a few earthquakes with magnitudes ranging between 0.8 and 3.1 have occurred within 30 miles of the project boundary. The Adirondack Mountain region is far from any active plate margin and few Adirondack earthquakes can be linked to named faults.

[46] The terms earthquake (for an event) and seismicity (for the general phenomenon) refer to the shaking of the Earth's surface due to a sudden release of energy from natural stress conditions in the ground. Stress in the ground may also build up from man-made activities, such as mining and tunneling. A release of energy from a stress build-up caused by man-made activities is referred to as an "induced earthquake" (for an event) and "induced seismicity" (for the general phenomenon).

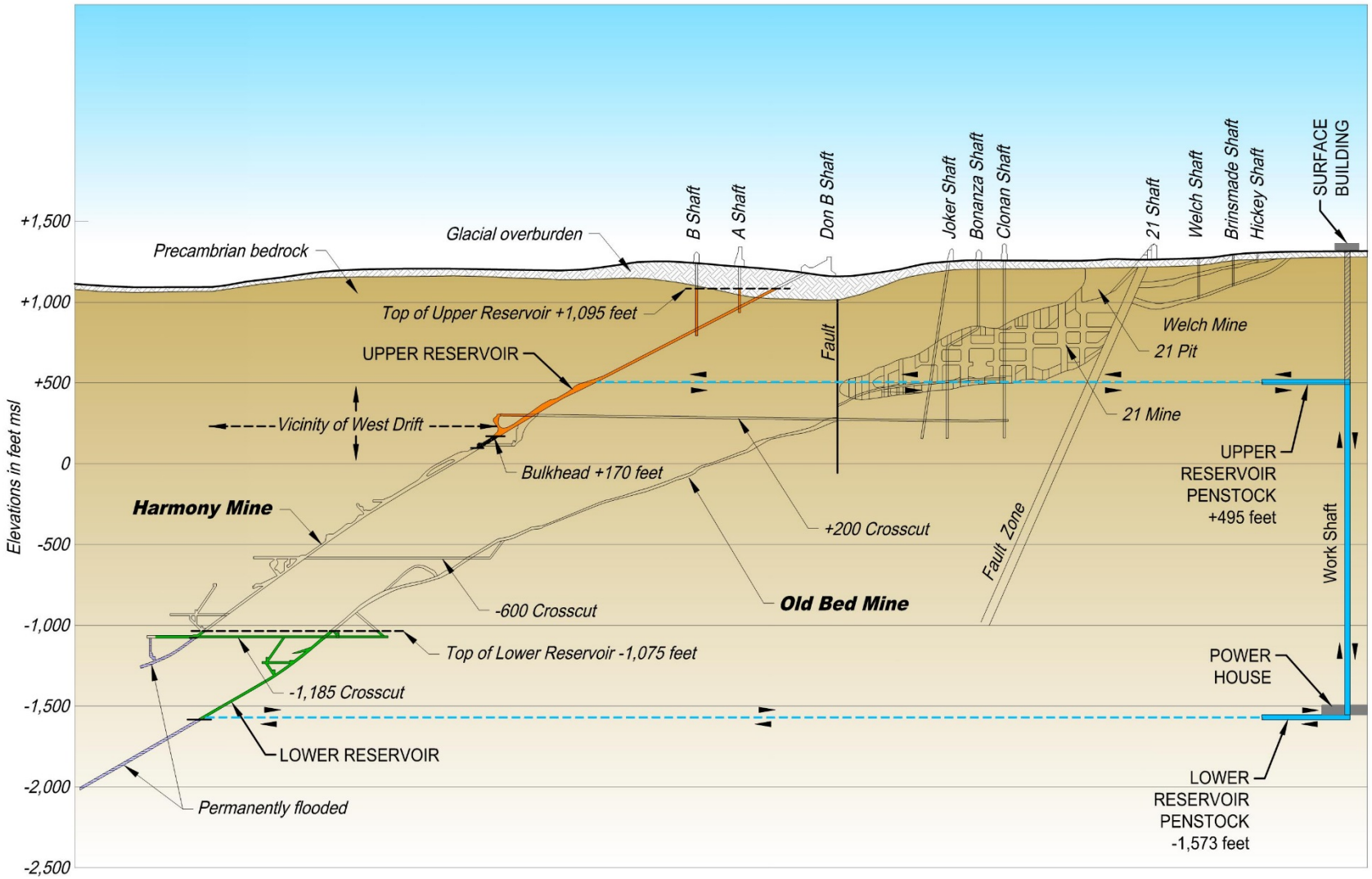

Figure 3-1. Section through Don B Shaft, Harmony Mine, and Old Bed Mine (Source: license application, as modified by staff).

Mining History and Geology

The interconnected mines in and around the project boundary were developed in ore-bearing deposits (referred to as orebodies) that formed as tabular to lenticular[47] veins within the Precambrian metamorphic and igneous rocks. The ore consists primarily of magnetite. The first record of mining in the Town of Moriah was that of Skene's Ironworks in 1775. Until the end of operations in 1971, Republic Steel Corporation and its predecessors developed five mines in the area (figure 1-1):

- **Old Bed Mine and Harmony Mine (project mines):** These two mines were constructed in ore veins that run southeast and northwest and dip downward to the southwest at angles of 20 to 30 degrees from the horizontal (figure 3-1). The ore veins continued to a depth of several thousand feet. The thickness of these two veins in the mines varied from 6 to 100 feet, averaging 10 feet of minable ore (Farrell, 1996). The magnetite was commonly mixed with quartz, feldspar, and hornblende minerals. The ore-bearing vein of the Old Bed Mine had a sharp boundary to the surrounding rock and contained about 60 to 70 percent magnetite. The ore-bearing vein of the Harmony Mine had a less sharp boundary than the Old Bed Mine, with some ore being dispersed in the ceiling rock (referred to as hanging wall). Ore in the Harmony Mine contained about 25 percent magnetite. The ore veins are folded and, during mining activity, were found to contain common diabase dikes and intrusions.

  Numerous vertical and inclined access shafts connected the mines to the surface. The Harmony Mine was accessed by the A Shaft, B Shaft, and Don B Shaft; the Old Bed Mine was accessed by the Clonan, Bonanza, and Joker shafts. From the surface, the shafts extended through the glacial overburden into the bedrock to access the ore veins. The project mines followed their respective inclined ore veins or "slopes" to depths of about 3,400 feet (Old Bed Mine) and 2,700 feet (Harmony Mine) from the surface. These slopes were the central features in a spider-web-like pattern with interconnected passageways or "drifts," which were small tunnels excavated within the ore veins. The drifts typically varied from 5 to 9 feet in height. The Old Bed and Harmony mines were connected by horizontal crosscuts at depths of +295, −585, and −1,090 feet msl (+200, −680, and −1,185 feet LMD) (i.e., referred to as the

[47] A tabular ore body is an ore layer that is similar in shape to a sedimentary layer, and located within another rock formation. This shape applies to the two project mines. A lenticular ore body is an ore layer that tapers out in many directions. This shape applies to the 21 Mine.

+200 crosscut, −680 crosscut, and −1,185 crosscut; figure 3-1).

- **21 Mine:** The 21 Mine was located to the northeast of the project mines. The 21 Mine orebody[48] was a magnetite mass that averaged more than 200 feet in thickness, and was located upgradient of the ore-bearing vein of the Old Bed Mine. It extended to the surface and was mined-out except for support pillars. The remaining open pit in the ground, called the 21 Pit,[49] is about 700 feet deep and is largely filled with water. The 21 Mine was accessed by the same three shafts as the Old Bed Mine, as well as by the 21 Shaft.[50]

- **Welch Mine:** The Welch Mine was located immediately to the north of the 21 Mine, just outside the project boundary. A fault zone extended between the Welch orebody and the 21 Mine orebody. The Welch orebody consisted of two inclined horizons located between about +1,295 feet and +945 feet msl (+1,200 feet and +850 feet LMD). The Welch Mine was accessed from the surface by A.E. Tower Shaft,[51] Potts Shaft/23 Pit, Miller Pit/24 Mine, Welch Shaft, Brinsmade Shaft, and Hickey Shaft.

- **New Bed Mine:** This mine was located to the northwest of the project mines, also outside the project boundary. The New Bed Mine had eight access shafts, including Roe Shaft. The New Bed Mine is connected to the Harmony Mine by the purported West Drift. New Bed Mine supports six species of hibernating bats, as discussed in sections 3.3.3, *Terrestrial Resources* and 3.3.4, *Threatened and Endangered Species*.

The estimated total tons of crude ore mined in the Town of Moriah from discovery of the New Bed Mine in 1844 to the end of Republic Steel operations in 1971 was 71 million tons; about half of it was mined after 1938 (Farrell, 1996).

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[48] In other filings, the 21 Mine orebody is referred to as the 21 Bonanza-Joker orebody. For consistency, we use the term 21 Mine orebody in this draft EIS.

[49] Throughout this draft EIS, we use the term 21 Mine to refer to the below ground portion of this mine, and 21 Pit to refer to the open pit portion of the mine visible at the surface.

[50] The 21 Shaft is likely equivalent to Nolan shaft that is shown on a map in filings by Moriah Hydro from December 20, 2018, and as shown in figure 1-1. The 21 Shaft extended into the 21 Mine from the slope of the 21 Pit (figure 3-1).

[51] Alternatively, the A.E. Tower shaft may have provided access to the 21 Mine.

Apatite in Ore Deposits

The ore-bearing deposits in the Old Bed Mine contain rare-earth-bearing apatite. Apatite is a calcium fluoro-phosphate mineral that occurs as colorless, white, green, and red-brown rice-shaped grains, primarily in the Old Bed Mine. The reddish-brown apatite is predominant and contains the bulk of the associated rare-earth elements at concentrations ranging from 5.8 to 21 percent (Staatz et al., 1980; Dunn Geoscience Corporation, 1977). The apatite also contains thorium and uranium at concentrations of 0.15 and 0.032 percent, respectively, based on 14 samples from the Old Bed, 21 Mine, and Smith[52] orebodies (McKeown and Klemic, 1956). The metamorphic and igneous Precambrian bedrock, within which excavation for the power facilities would occur, is not known to contain apatite.

Mine Closure

Republic Steel Corporation vacated the project mines in the 1970s. It stopped pumping groundwater from the mines in February 1979, contracted for the filling and sealing of certain pits and mine shaft openings in June 1979, and sealed mine access shafts by April 1980. Approaches used to seal individual shafts and pits included filling shafts and pits with stone and mine tailings, capping them with concrete slabs, and installing fencing around their perimeters. Over the last 40 years, some of these sealed shafts have subsided or caved in,[53] such as the Joker, Welch, Brinsmade, and Don B shafts. Most of the shafts are located on private property, owned by Solvay. (Essex County, 2018) and are not publicly accessible, although not all shafts and pits are fenced.

After closure of the mines in 1979, groundwater gradually filled the void spaces in the project mines. The mines are estimated to have completely filled with about 12,900 acre-feet of groundwater in 2003.[54] Since then, the water seeps and exits to the surface between the top of the bedrock and the glacial overburden layer at a rate of about 320 gallons per minute (0.7 cfs)[55] at an elevation of about +1,145 feet msl (+1,050 feet

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[52] The Smith Mine and orebody were located about 1.5 miles to the north of the project mines.

[53] Subsidence is generally a gradual process of settling; a cave-in refers to a more rapid or sudden process of settling (i.e., collapse).

[54] Calculation by Farrell (1996) as presented by Moriah Hydro.

[55] Moriah Hydro uses varying flow rates in its license application, ranging from 317 to 330 gallons per minute (0.71 to 0.74 cfs). For consistency, this draft EIS uniformly applies a rate of 320 gallons per minute (0.7 cfs).

LMD). The discharge point is at the Don B outfall, as discussed above in section 2.2.1, *Proposed Project Facilities*, which empties to tributary C-86-5.

Soils

Soils in the project boundary have origins in bedrock and glacial deposits. Natural soil types include Adams loamy sand on slopes of 15 to 25 percent, Becket fine sandy loam on 15 to 35 percent slopes, Croghan fine sand on 3 to 8 percent slopes, Fernlake loamy fine sand on 35 to 60 percent slopes, Lyman-Knob Lock complex on 35 to 60 percent slopes, Kalurah silt loam on 3 to 8 percent slopes, Medomak mucky silt loam on 0 to 3 percent slopes, Malone silt loam on 3 to 8 percent slopes, and Pyrities fine sandy loam on 8 to 25 percent slopes. Soil types also include an area with mine spoil, located about 600 feet to the south of the 21 Pit.

3.3.1.2 Environmental Effects

Effects of Naturally Occurring Earthquakes and Subsidence on Proposed Project Facilities

The proposed Mineville Project is located in a seismically active area.[56] Risks to the project from naturally occurring earthquakes could include structural effects on the existing project mines and the underground power facilities (penstocks, power chamber, and access and ventilation shafts), which would be constructed mostly within the Precambrian bedrock. The effect of earthquakes on surface subsidence of previously filled and sealed historical mine shafts is discussed below in the *Effects of Project Construction and Operation on Subsidence of Prior Mine Shafts* section.

Moriah Hydro proposes to dewater the project mines in two stages. The first stage would dewater the project mines to elevation +95 feet msl (0 feet LMD) to allow for construction of the bulkhead for the upper reservoir at elevation +170 feet msl (+75 feet LMD).[57] The second stage would dewater the project mines to the base of the lower reservoir at elevation −1,573 feet msl (−1,668 feet LMD). Part of the removed

[56] See 2014 New York State Seismic Hazard Map (https://earthquake.usgs.gov/earthquakes/byregion/newyork-haz.php.

[57] The project record contains discrepancies regarding the proposed elevation for the bulkhead. In its filing of December 20, 2017, Moriah Hydro lists elevations of +265 feet msl (+170 feet LMD) and +170 feet msl (+75 feet LMD). Based on the context in the filing, we assume that the latter is the intended elevation for the bulkhead and use this elevation in our analysis.

water during the second stage would fill the upper reservoir with project water; the remaining water would be discharged into tributary C-86-5.

Moriah Hydro proposes to conduct geotechnical investigations following the issuance of any license for the project, and prior to final design, to develop information on seismic risk and other structural and environmental issues. The proposed geotechnical investigations would include: (1) sampling a minimum of five borings through the glacial overburden, each with a minimum depth of 50 feet into the underlying rock; (2) determining the composition and permeability of overburden material from the boring samples; (3) determining the permeability, compressive strength, rock quality designation of the underlying rock; and (4) preparing a detailed 3-D geographic and geotechnical model of the project based on the borings and available mine mapping.

In its comments filed on January 3, 2017, following its review of SD1, FWS recommends that Moriah Hydro investigate the geological conditions after the mines have been dewatered to assess their structural integrity. FWS states that the investigation should include a comparison of the observed conditions with information contained within geologic and mining reports.

Our Analysis

Seismic activity in the project area requires appropriate design of structures for the facilities. The strongest recorded earthquake in the region, the 1944 earthquake in the Town of Massena, New York, resulted in some damage along a 500-foot section of an underground shaft in the Lyon Mountain Mine, located about 40 miles east southeast from the Town of Massena, New York (Farrell, 1996). Mineville is located about 90 miles from Massena.

Technical literature pertaining to the effect of earthquakes on underground mining operations is limited. However, extensive literature about the effect of seismic loading on tunnels exists and is applicable for underground mined spaces. For example, Lenhardt (2009) used methods and case histories related to seismic loading on tunnels to analyze the effect of earthquakes on mining operations in Austria, concluding that natural earthquakes have a limited effect on underground mining operations. This conclusion is consistent with findings in the tunnel industry, where tunnels in rock are considered naturally resistant to earthquake responses, including faulting, shaking, deflection, and ground failure (Jaramillo, 2017). Therefore, any initial assessment of the potential seismic behavior of the mined-out space in the project mines should be based on available case histories and methodologies for tunnels. In an earthquake, damage to structures such as buildings is associated to ground motion characteristics, which can be represented by peak ground acceleration (PGA) and peak ground velocity (PGV). These parameters are another measure for earthquakes, aside from magnitude. PGA and PGV are typically used as indicators of potential damage from earthquake loading, as

documented in analytical studies and databases of damage to structures caused by earthquakes. Case histories of tunnels in rock subject to earthquake action have shown that minor to moderate damage can occur at PGAs up to 0.5 g[58] and PGVs up to 0.9 meter per second (m/s) (Jaramillo, 2017). Very few cases of minor damage resulting from shaking have been observed at surface PGA values up to 0.25 g (Dowding and Rozen, 1978).

The applicable PGA at the surface of the project is 0.22 g, based on the characteristics of seismic site class B[59] (i.e., rock, unmeasured shear wave velocity) (ASCE 2018; USGS, 2018b). Based on case histories presented by Dowding and Rozen (1978) and Jaramillo (2017), and referenced also by Lenhardt (2009), only minor to moderate damage would be expected for a PGA of 0.22 g.

The PGV at the surface of the project area can also be approximated based on Hashash et al. (2001), who suggest that the ratio of PGV (measured in centimeters per second) to PGA (measured in g) is about 76 to 86 for a rock site subject to an earthquake magnitude of 6.5 with a source distance ranging from 12 to 63 miles. These earthquake parameters are within the approximate range of historical earthquakes observed in the region surrounding the project area. Therefore, an estimated PGV at the surface of the project area would be about 0.2 m/s, which is consistent with the range of minor to moderate damage in rock tunnels listed by Jaramillo (2017).

Moriah Hydro's proposed geotechnical investigations would provide some of the seismic design parameters needed for the power facilities, such as the power chamber, penstocks, and shafts. However, the stability of structural components within the project mines cannot be fully assessed until the mines are dewatered and can be entered. Developing a geotechnical investigation plan to include Moriah Hydro's proposed geotechnical investigations, along with additional investigations conducted in the mined-out spaces for each reservoir within the two project mines after each is dewatered, would allow for a more comprehensive evaluation of the quality of the rock mass, strength, and the safety margin for earthquake loading. Specifically, surveying the structural geologic features (i.e., orientations and characteristics of the joint system, faults, dikes, and foliation planes) would assist in the assessment of seismic risk and the project's final

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[58] Peak ground acceleration is equal to the maximum ground acceleration that occurs during earthquake shaking at a location. PGA is measured in "g," the acceleration due to Earth's gravity, equivalent to g-force (1 g = 9.81 m/s^2).

[59] A seismic site class is determined by the soil types present and their engineering properties, as defined by the National Earthquake Hazard Reduction Program and the United States Design Standards (e.g., ASCE7 [ASCE, 2018]). The USGS (2018b) has an online application for determining a seismic site class within the United States.

design. The compressive strength tests of the rock in the pillars and surrounding surfaces would determine the stability under static loads and their margin to accommodate seismic loads. Also, determination of the seismic site class of the bedrock and overburden with geophysical surveys would improve the seismic risk analysis. While existing evidence for underground structures suggests that the expected levels of ground acceleration during an earthquake would cause minor to moderate damage to underground project structures, data from all geotechnical investigations (i.e., investigations proposed by Moriah Hydro prior to final design and additional investigations after each dewatering stage) would allow for a more detailed seismic risk analysis.

Effects of Project Construction and Operation on Induced Seismicity and Subsidence

Moriah Hydro proposes to construct the power chamber underground, adjacent to the project mines, at an elevation of −1,555 feet msl (−1,650 feet LMD). Excavation would also be required for the access and ventilation shafts and the two penstocks to connect the power chamber to the upper reservoir in the Harmony Mine and the lower reservoir in the Old Bed Mine. All excavation would be done with conventional drill and blast methods. Moriah Hydro states that induced seismic activity related to construction of the project would be highly unlikely because the rock surrounding the mine voids is competent granite and gneiss.

During project operation, water would be exchanged regularly between the upper and lower reservoirs. Discharge from the upper reservoir to the lower reservoir would occur at high velocity; refilling the upper reservoir would occur at a slower velocity. Moriah Hydro states that it does not expect induced seismic activity related to the operation of the project.

The nature of the proposed facility, and its depth of about 3,000 feet, gives rise to potential issues of rock burst phenomenon.[60] Moriah Hydro states that it would address this phenomenon in final design and field construction by using rock mass support analysis software to identify the effect of potential rock bursts. Moriah Hydro also proposes to install two seismographs, at the nearest structure (town garage) and at the nearest habitable structure, at least 2 months before construction activities begin. With these seismographs, Moriah Hydro would monitor ground motion during blasting events measured against its proposed limit of 0.1 inch per second peak particle velocity (PPV). Moriah Hydro proposes to modify its blasting protocol to ensure that blasting activities

[60] A rock burst is a spontaneous, violent fracture of rock that can occur in deep mines. The opening of a mine shaft or related excavations relieves surrounding rocks of tremendous pressure, which can literally cause the rock to explode as it attempts to re-establish equilibrium.

do not exceed this ground motion limit, should conditions require it. Lastly, Moriah Hydro proposes to continue seismic monitoring for 12 months after completion of project construction.

In its comments filed on December 12, 2016, in response to SD1, the pre-application document, and several other pre-filing documents, EPA states that the ongoing uplift of the Adirondacks Mountains indicates that the area is under geologic stress and that project operation would result in changing stress regimes on the rock surrounding the reservoirs. EPA suggests that the changing stresses associated with the rapid movement of water between the reservoirs could conceivably result in fault movement or induced seismicity, depending on magnitudes and directions of principal stresses across any adjacent faults. EPA requests that Moriah Hydro conduct an analysis to determine whether the movement of water and the vibrations from the pumps could erode the pillars and thereby affect the stability of the bedrock. EPA further recommends an evaluation of the stratigraphy to determine the presence of any carbonate rock that might be affected by dissolution that could lead to roof collapses within the reservoirs.

Our Analysis

During project construction, stress conditions could be affected by excavation for shafts and power facilities as well as by the dewatering. During project operation, the daily movement of water between the two reservoirs could affect stress conditions. Induced earthquakes could derive from subsurface stress changes during power facility construction, dewatering, and project operation, as well as localized pillar and roof collapses that could develop during project operation.

Vibrations

The controlled blasting approach, as proposed by Moriah Hydro, would limit vibrations during construction. Human reactions to vibration depend on duration and level of the vibrations, and are the controlling factor for blasting-induced ground vibrations. This is because vibration levels that can be felt are considerably lower than those required to produce structural damage. For short exposure times of one second and less, the proposed PPV limit of 0.1 inch per second is considered barely detectable by humans (USBM, 1980). Moriah Hydro's seismic monitoring of the ground motion with seismographs would allow for controlling the oscillations below Moriah Hydro's proposed limit and for adjusting the blasting energy, if needed. Therefore, blasting-induced ground vibrations during construction would likely be small and would unlikely be felt by residents or cause damage to buildings or groundwater wells.

Induced Seismicity from Construction of Power Facilities

Rock excavation during construction would induce changes in the rock mass stress state. An altered stress state can fracture rock or cause rockbursts. Rockbursts induce

ground motions of different magnitudes that depend in part on the spatial and temporal extent of the excavation, existing stress state, rock strength, excavation rate, and excavated rock volume (Hudyma, 2004; Mendecki and Lötter, 2011). The potential of induced seismicity during construction is higher in subsurface excavation sections that cross fault zones and in deeper parts of the mines where the stress field is higher. Typically, the magnitude of most induced seismic earthquakes associated with mining is small (lower than 3), but may exceed 5 in some mining regions (Bennett et al., 1994).

Two centuries of mining of the project mines would have generated stress in the rock. This stress would likely have been adjusted by induced earthquakes over time, which may explain tremors during past mining operations, as communicated during the December 8, 2016, scoping meeting by Katrinka Trombley, a resident of the Hamlet of Witherbee. The adjustment of the stress regime over time may have also led to the two localized areas of roof collapses between the two project mines.[61] These collapses occurred when the mines were active but the exact dates are unknown. At present, the stress state in the mines is expected to be adjusted. This is consistent with another comment by Katrinka Trombley stating that the tremors have stopped since the project mines closed.

The potential for induced seismic earthquakes during construction of the power facilities is expected to be small considering the competent bedrock (gneiss and granite) and the substantially smaller disturbance compared to past mining operations. Furthermore, we expect that the results of the geotechnical investigations would be used to design adequate rock support and adapt the excavation sequence and techniques to control the stress relief in the rock mass.

Induced Seismicity from Dewatering of the Project Mines during Construction

Dewatering of the project mines during construction would remove much of the accumulated groundwater from the mines. The Old Bed Mine would become permanently dry between elevation −1,075 feet msl (−1,170 feet LMD) and the ground surface; it would remain permanently flooded below elevation −1,573 feet msl (−1,668

[61] An area with a diameter of about 200 feet caved in between −1,555 and −455 feet msl (−1,650 and −550 feet LMD), resulting in a settled plug of 1,100 feet of bedrock between the two mines. This collapse was located in an area crossed by two faults and adjacent to a third fault. An area with a diameter of about 75 feet collapsed between −1,555 and −1,090 feet msl (−1,650 and −1,185 feet LMD), resulting in a settled plug of 465 feet between the two mines. Moriah Hydro's December 20, 2017, additional information response only describes the first, larger roof cave-in collapse, but not the second, smaller cave-in collapse that occurred. Both cave-in collapses are shown on the historical mine maps, filed by Moriah Hydro on April 28, 2017.

feet LMD) down to its bottom at −2,150 feet msl (−2,245 feet LMD) (figure 3-1). The zone between elevations −1,075 feet msl (−1,170 feet LMD) and −1,573 feet msl (−1,668 feet LMD) would be occupied by the lower reservoir. The Harmony Mine would become almost entirely dry, except for the zone occupied by the upper reservoir.

Similar to the construction of the power facilities, dewatering of the project mines would alter the stress regime within the surrounding rock and may induce earthquakes. Occurrence of earthquakes under these conditions depends on the magnitude of stress changes, existence of faults, presence of fluid pathways to faults, and extent of fluid pressure changes (Rubinstein and Mahani, 2015). In general, a change in volume in the subsurface produces shear stresses, which can then be released by earthquakes (McGarr, 1976).

Filling of the project mines with groundwater after closure of the mines could have increased the pore pressure to levels beyond their historical values in some areas, thus potentially bringing fault systems into critical state and leading to induced seismicity (McGarr et al., 2002). The mines were filled with groundwater by 2003; therefore, induced earthquakes due to filling the project mines with water may have already taken place over time. Dewatering of the project mines during construction would return the stress state to closer to pre-filling conditions (groundwater would only remain permanently at the base of the Old Bed Mine). However, localized instabilities in weak zones of the rock mass (e.g., along faults or fractured areas) could occur during dewatering. Water might potentially be pumped out at a rate faster than it can drain from such water-saturated weak zones. Localized instabilities in the weak zones could be caused by the removal of confinement stress provided by the water surrounding the rock mass of the weak zones, while the weight of saturated rock only decreases slowly. Such conditions could trigger localized collapses. However, due to the strength of the type of rock in the project mines (magnetite, granite, and gneiss), such instabilities are expected to be of limited size, and induced earthquakes, if any, resulting from potential rock collapses during dewatering are expected to be very small.

Induced Seismicity and Physical Erosion of Pillars during Project Operation

During project operation, stress would be introduced from three sources: (1) the constructed underground power facilities (power chamber, penstocks, and shafts) creating pore pressure changes in the newly excavated rock; (2) fluctuating water between the upper and lower reservoirs shifting weight on a regular (possibly daily) basis; and (3) penstock discharge directly onto the support pillars. The potential of induced seismicity from each of these sources of stress is discussed below.

1. **New power facilities**: The volume of excavated rock for the underground power facilities would be very small compared to the volume of rock that was excavated during mining. The power facilities would be built in competent rock (gneiss and

granite). The vertical shafts would be lined with reinforced concrete in order to hydraulically isolate them from the surrounding rock. The penstocks (each 15 feet in diameter) to the upper and lower reservoirs would be constructed from steel and thus would also hydraulically isolate the penstocks from the surrounding rock. Therefore, the risk of induced seismicity from residual adjustments of stress in the new power facilities during project operation is expected to be small, assuming that findings of the geotechnical investigations were appropriately integrated in the design of these facilities.

2. **Water moving between reservoirs:** Project operation would regularly shift water used for power generation between the upper and lower reservoirs, introducing stress by the regular shift in mass. Natural adjustment of stress conditions has caused large-scale failure of rock pillars in some mines, triggering larger induced earthquakes. For example, about 3,200 pillars in the depth range of 2,790 to 2,950 feet failed in the Ernst Thaelmann Potash Mine in Germany (McGarr et al., 2002), leading to a magnitude 5.4 earthquake. Similarly, an earthquake in the Solvay Trona Mine, Wyoming, occurred in 1995; the event had a magnitude of 5.1, and was induced by the collapse of pillars at a depth of 1,610 feet over an area of about 0.6 mile by 1.3 miles. Both examples were mines developed with the room and pillar method, showing that if one pillar fails, others can fail in a cascade triggering a one-time larger earthquake, or pillars may collapse more gradually triggering several smaller earthquakes over time. However, the rock types (i.e., salt deposits) in both mine examples were substantially weaker than the rock type of the proposed project mines (i.e., magnetite, surrounded by gneiss and granite). Therefore, we anticipate that the risk of large-scale sudden failure of multiple pillars in the project mines as a result of added stress from project operation would likely be small, assuming that findings of the geotechnical investigations of the conditions of pillars in the reservoir cavities were appropriately evaluated and integrated in the detailed project design.

3. **Penstock discharge**: Erosion of the pillars could be caused by water discharged into the Old Bed Mine by the lower penstock after power generation. The flow through the project would be 1,200 cfs at full capacity. The lined penstock would have a diameter of 15 feet. Therefore, the average velocity of the water discharged by the lower penstock into the Old Bed Mine would be about 6.8 feet per second. When water at this velocity encounters a mine pillar, it would impinge a substantial amount of force on the pillar. Using the Giles' (1962) equation for water impinging on a flat plate, the force exerted on the pillar at that velocity would be about 16,000 pounds. Transient, higher-than-average flow velocities could result in even higher forces. Over time, joints in the rock could open and the mine pillars could deteriorate, causing loss of cross-sectional area, increasing the stress in affected pillars in the Old Bed Mine and thereby increasing the risk of failure. After power generation, the velocity of water that is pumped

via the upper penstock back into the upper reservoir in the Harmony Mine would be considerably lower, thus the force impinging on the pillars in the Harmony Mine would be considerably lower as well. The additional geotechnical investigations would allow for a determination of potential mitigation measures for pillars at risk from erosion caused by flow discharged by the penstocks, particularly in the lower reservoir. Rock pillars would need to have an adequate margin of safety under all expected loads from project operation. Encapsulating pillars with concrete or equivalent materials would limit or avoid the risk for erosion from discharged flows. In addition, a bifurcation of the end of the steel penstock or another type of energy dissipater could reduce the velocity of the water impinging on the pillars.

In summary, considering the strength of the rock type of the pillars and surrounding bedrock (magnetite, gneiss, and granite), the risk for induced seismicity during project operation is expected to be small. However, additional geotechnical investigations of the mined-out spaces for the upper and lower reservoirs would allow for a more comprehensive analysis of induced seismicity risk during project construction and operation and the determination of potential mitigation measures for the project design. In addition, intermittent inspection of the reservoirs and rock pillars during project operation would allow for identification of any weakening of pillars and rock walls from abrasion and regular wetting and drying.

Chemical Erosion of Marble from Water Discharges during Project Operation

The geologic map by Chiarenzelli et al. (2016) shows calcareous and dolomitic marble within the Precambrian bedrock in the southern half of the project boundary, just to the south of the footprint of the lower reservoir. However, the map reflects only surface outcrops; it is not known if marble also occurs at the depths of the proposed upper and lower reservoirs. It is expected that pillars in the project mines largely consist of magnetite or similar ore-bearing rock types because miners would have followed the ore-bearing veins; marble areas would not have been mined. However, there might be some marble pillars due to folding and faulting of the rock strata. In addition, marble could exist in the hanging walls and foot walls (i.e., rock at the ceiling and below the floor of the mine, respectively) of the mined-out areas.

Naturally occurring acidic rainwater could make its way into the mine and begin dissolving any marble during project operation. The rate of dissolution would increase with flowing water, particularly from the high-pressure releases in the lower reservoir. Dissolution of any marble pillars, or marble hanging and foot walls above and below any pillars, could adversely affect the structural integrity of the reservoirs and thereby cause induced earthquakes. Additional geotechnical investigations, after dewatering of the project mines, would identify the presence of marble in the proposed space for the upper

and lower reservoirs, and would allow for developing feasible mitigation measures, such as encapsulating the marble with a coating of concrete or equivalent materials.

Seismic Monitoring

Moriah Hydro's proposed seismic monitoring with two seismographs for 2 months prior to construction and 12 months after construction would provide information on ground motion but would not allow for pinpointing the source of induced seismic activity. However, developing a seismic monitoring plan, to include a seismic monitoring network around the project area with additional seismographs, could identify the location of any induced seismic activity during construction and operation, including blasting for power facilities, rock collapses in the mine, or rockbursts (e.g., Wang et al., 2012). The identification of developing rock mass instabilities would further be improved by the installation of surface and underground seismographs. Seismic monitoring during project operation would identify the location of any induced earthquakes and may allow for adjustments for potential risk reduction. Further, instead of monitoring for only 12 months after project operation commences, as proposed by Moriah Hydro, seismic monitoring for 10 years would provide an understanding of the effect of project operation on rock mass instabilities such as collapses or rockbursts, which would thereby provide baseline information needed to respond to any induced seismic earthquakes.

Effects of Project Construction and Operation on Subsidence of Prior Mine Shafts

When the project mines were actively mined, magnetite deposits were accessed through open pits and mine shafts. In addition to the 21 Pit, Moriah Hydro identified 13 sealed shafts and pits in the project area (figure 1-1). This number includes shafts for the Welch Mine just to the north of the 21 Pit. Republic Steel Corporation sealed the open access shafts in 1979 and 1980, after closing the mines. Older access shafts, such as the Joker Shaft and A Shaft, had been filled in earlier years. Upon review of publicly available records from Republic Steel Corporation about mine closure specifications, Moriah Hydro concluded that mine shaft closures were not designed for infinite life, as some shaft closures included timber, uncoated steel, unclassified fill as structural support, or concrete caps.

Land within and surrounding the project boundary has experienced subsidence and cave-ins as result of settling and degradation of materials used for filling and sealing mine access shafts and pits. Following the acquisition of property rights, Moriah Hydro proposes to stabilize and recap any subsiding mine openings not addressed by the current mine owner, Solvay. Specifically, Moriah Hydro proposes to reseal all mine shafts and openings in the project boundary (with the exception of the 21 Pit) and certain shafts related to access of the New Bed Mine (including Roe Shaft), using the following

methodology: (1) excavate all shafts to their base; (2) construct a work platform at the shaft base using steel beams and plates; (3) construct shear keys into surrounding rock using grouted rebar; (4) construct a structural reinforced concrete floor slab with a depth of twice the maximum span; (5) use granular soil cement (made with the rock fines from the power chamber and shaft excavations) to fill the shaft to a depth of 24 inches below the ground surface; and (6) construct a 24-inch-thick, reinforced concrete surface cap that extends a distance of 10 feet beyond the edge of the shaft in all directions. Moriah Hydro states that the final design of resealing activities would be based on location-specific field measurements and conditions.

Moriah Hydro proposes to review the location, depth, and composition of the overburden in the vicinity of the upper reservoir prior to final design and to conduct additional geotechnical investigations during the post-licensing phase, as described above in the *Effects of Naturally Occurring Earthquakes and Subsidence on Proposed Project Facilities* section. These geotechnical investigations would include borings and sampling through the overburden to determine its composition and permeability. Moriah Hydro would not sample the sealed shafts because it plans to reseal them entirely. If these investigations determined that the proposed maximum upper reservoir elevation was located within the glacial overburden, causing mobilization of material in the overburden, Moriah Hydro would lower the operational elevations of both the upper and lower reservoirs to mitigate this effect.

In its letter filed April 16, 2018, EPA comments that the Precambrian bedrock is likely hydraulically connected to the glacial overburden via permeable fractures. EPA expects that vertical stress relaxation through geologic time has resulted in increased horizontal fractures and porosity (produced by weathering) toward the top of the Precambrian bedrock.[62] Specifically, EPA expects an increase in pressure permeability within the upper few hundred feet of the bedrock. Therefore, EPA suggests that the fluctuations of hydraulic pressure within the unconsolidated glacial overburden during project operation may result in compaction of the unconsolidated sediments and surface subsidence. Therefore, to impede hydraulic connection between the unconsolidated overburden and the fractured Precambrian bedrock, EPA recommends that Moriah Hydro consider lowering the depth of the upper reservoir by 300 feet.

In its comments in response to SD1, the pre-application document, and several other pre-filing documents, EPA further recommends that Moriah Hydro provide an

[62] Vertical adjustments of the Earth's crust from very gradual changes in load, such as the melting of a large ice sheet covering the region, or erosion of a mountain range.

adaptive management strategy of any future issues with subsidence, including criteria for land stability, if project operation affects the ground above the facility.

In its letter filed April 6, 2018, Solvay expresses concern that construction and operation of the project would exacerbate land subsidence or erosion in the project area, including mine shaft openings located both inside and outside the project boundary. Solvay states that sinkholes have formed, or have started to form, at all of the sealed mine shafts. Solvay further states that if the elevation of the top of the upper reservoir was higher than the ground elevation near the Don B Shaft, groundwater could seep out from the Don B Shaft and the glacial overburden in low-lying areas, potentially affecting Solvay's property by eroding the land surface and forming a new drainage channel. Solvay requests that Moriah Hydro: (1) conduct geotechnical investigations and other studies (such as water level monitoring in non-project mines) to identify at-risk areas where land subsidence and erosion may occur or be exacerbated during project construction and operation, including the effects of the high hydrostatic pressures involved in the operation of the project; (2) develop a project plan to address such areas, which should include the identification and resealing of all at-risk mine shafts and the maintenance of water levels in the upper reservoir at below the ground surface elevation in the vicinity of the Don B Shaft; and (3) ensure that all areas at-risk of land subsidence or erosion are included in the project boundary and marked for acquisition by Moriah Hydro so that Moriah Hydro assumes full responsibility and liability of such areas, post-licensing.

Our Analysis

The groundwater elevation in the 21 Pit is at about +1,170 feet msl (+1,075 feet LMD).[63] Considering that the various mines in the project area appear to be hydraulically connected by underground shafts, groundwater likely also fills the sealed mine shafts to the same elevation. As part of the dewatering during construction, the groundwater would be removed from these shafts. During project operation, the three shafts extending into the upper reservoir (A Shaft, B Shaft, and Don B Shaft) could experience daily wetting and drying of the lower section of the shafts. The other shafts in the project area would not extend into the upper reservoir and therefore are expected to remain dry (aside from stormwater infiltration).

[63] The approximate elevation of +1,170 feet msl (+1,075 feet LMD) was obtained from Google Earth (data from September 8, 2014). This elevation is consistent with other data—the 1999 U.S. Geological Survey topographic map of the area shows an elevation of +1,260 feet msl (+1,165 feet LMD) of the land surface surrounding the pit, and the website minddat.org (2018) lists a depth of 100 feet of the pit.

Sealing of Shafts

The available record of Republic Steel Corporation's sealing of the shafts and pits is incomplete. Design plans are available for only some of the shafts and pits, and there are no construction drawings. Available plans show Republic Steel Corporation's shaft closures in the project area used degradable materials such as timber and uncoated steel, and the type of fill used varied and included rock and mine tailings. Republic Steel Corporation's approach for sealing shafts also varied. The license application includes the following information for the Harmony, Old Bed, 21, and Welch mines:

- **Harmony Mine**
    - B Shaft was a vertical shaft that extended 372 feet into the ground, from +1,210 to +838 feet msl (+1,115 to +743 feet LMD). The upper 266 feet of B Shaft penetrated glacial overburden and the lower 106 feet penetrated Precambrian bedrock. B Shaft was framed with 12-foot by 12-foot timbers through the overburden (Farrell, 1996). It entered the Harmony Mine at about +875 feet msl (+780 feet LMD). The 1979 sealing plan for B Shaft called for filling the lower 110 feet with rubble or coarse rock and the remaining upper section of the shaft with finer-grained rubble and mine tailings. The plans did not specify a concrete cap.
    - A Shaft was a vertical shaft that entered the Harmony Mine at about +895 feet msl (+800 feet LMD). A Shaft was framed with 12-foot by 12-foot timbers through the overburden (Farrell, 1996). According to different historical mine maps, A Shaft was either filled in 1950 or 1955; details of the filling approach used are not available.
    - Don B Shaft was originally constructed in 1941 and extended 350 feet through overburden. It entered the Harmony Mine at about +935 feet msl (+840 feet LMD). The shaft was lined with concrete during construction (Farrell, 1996). The shaft was sealed with a steel bulkhead that was anchored in the concrete-lined section 30 feet below the surface; the shaft was then backfilled with sand and rubble to the surface (Farrell, 1996).
- **Old Bed Mine and 21 Mine**
    - Clonan Shaft was a vertical shaft that extended from +1,227 feet msl (+1,132 feet LMD) at the ground surface into the 21 Mine and from there via the +200 crosscut to the deeper Old Bed Mine. The upper 50 feet of the Clonan Shaft penetrated glacial overburden, and the remaining portion of the shaft penetrated Precambrian bedrock. The shaft was concrete-lined at the collar and framed with timber sets down to bedrock. Republic Steel Corporation's 1979 sealing plan called for installing a steel bulkhead at

bedrock level 50 feet below the surface, covering the bulkhead with concrete, placing mine tailings and rubble above the concrete, and cover the fill with a 1-foot clay layer.

- Bonanza Shaft was a vertical shaft that penetrated the 21 Mine at about +850 feet msl (+755 feet LMD) and extended from there to the +200 crosscut. In 1955, it was filled to the surface with crushed rock. The shaft opening collar had an area of 26 feet by 26 feet. Republic Steel Corporation's 1979 sealing plan called for grading the surface with crushed rock and placing a 12-foot-thick reinforced concrete slab on top of the collar.

- Joker Shaft was an oblique shaft that penetrated the 21 Mine at about +850 feet msl (+755 feet LMD) and also extended to the +200 crosscut. The shaft was filled in 1979; details of the filling approach used are not available.

- **Welch Mine**

  - Access to the Welch Mine was provided by Welch Shaft, Brinsmade Shaft, Hickey Shaft, A.E. Tower Shaft, Potts Shaft/23 Pit, and Miller Pit/24 Mine. According to a historical mine map, the Welch and Brinsmade shafts accessed both ore veins in the Welch Mine (figure 3-1). The Hickey Shaft only accessed the upper ore vein just below the glacial overburden. Access information for the other shafts and pits of the Welch Mine is not available. Republic Steel Corporation's 1979 sealing plans for Welch Shaft, Brinsmade Shaft, Hickey Shaft, and Miller Pit/24 Mine called for grading of the area to fill the opening; steep inclines were to be blocked at underground entrances with steel beams and plates to stabilize the fill.

In recent years, multiple occurrences of subsidence and cave-ins at shaft openings indicate that the seals of the access shafts are inadequate (figure 3-2). Causes for subsidence and cave-ins likely include compaction as well as mobilization of fill material into mined-out space below. For example, in the filled B Shaft, the deeper rock rubble particles are assumed to interlock, thereby forming a strong matrix that would not experience settlement. The finer-grained upper rubble and mine tailings mixture would be expected to settle over time. Water seeping into the shaft would lubricate the particles, allowing them to pack in more tightly creating a higher density. We estimate that the fill would likely have settled to about 70 percent of its maximum density, or a vertical distance of 50 feet. This estimate is consistent with the settlement of 40 feet that

Figure 3-2. Subsiding mine shaft seal at Joker Shaft, December 8, 2016 (Source: staff).

occurred in a Harmony Mine shaft on April 23, 2004.[64] Subsidence and cave-ins from settling, as well as decaying timbers and steel, would likely continue with or without this project, unless mitigated.

Subsidence in the mine access shafts is not expected to be triggered by earthquakes in most cases. For example, two additional cave-ins occurred in the project area (Joker Shaft and Don B Shaft) in the spring of 2004, but no seismic activities occurred within 50 miles of the project area in 2004 (USGS, 2018a). However, larger earthquakes could accelerate soil densification,[65] subsidence, and cave-ins.

During project construction, dewatering of the project mines would result in a loss of groundwater from the pore spaces of the fill of the access shafts. This loss of groundwater would increase the effective stress in the fill, resulting in further compaction and increased risk of subsidence and cave-ins.

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[64] Newspaper article titled *Mine Cave-in Owner Sought* in the April 27, 2004, Press-Republican, filed in Moriah Hydro's December 20, 2017, additional information response.

[65] Soil densification is the process of increasing the density of soil or sediment, either by compaction or vibration.

During project operation, constant wetting and drying would further mobilize particles in the fill within the three shafts connected to the Harmony Mine (B Shaft, A Shaft, and Don B Shaft) if the bedrock/overburden interface were not tightly sealed with a concrete cap. For example, the top of the proposed upper reservoir at elevation +1,095 feet msl (+1,000 feet LMD) would extend 151 feet into the glacial overburden alongside B Shaft, since B Shaft does not currently appear to have a concrete cap. Mobilized sediment would be transported down into the upper reservoir, and the fill in the shaft would settle further.

Complete resealing of the shafts, as proposed by Moriah Hydro, would address potential future subsidence. Moriah Hydro proposes to reseal shafts by totally removing the fill in the shaft and replacing it with a cement–fill mixture, which would presumably harden and prevent settlement or material loss. This method would be a conservative and effective way to remediate the settlement issue. As an alternative, Moriah Hydro could also inject grout through multiple boreholes and thereby consolidate existing fill in the shafts. This approach may apply to narrow shafts with vertical walls, and would further assume that the upper reservoir elevation is lowered to +895 feet msl (+800 feet LMD), as discussed below in *Effects of Dewatering of Project Mines on Erosion and Stream Flo*w, to avoid the regular wetting and drying of the fill in the lower portion of shafts during project operation.

The process of sealing may be different for each shaft, depending on conditions, and Moriah Hydro's proposed location-specific field measurements and condition assessments would help to develop effective resealing designs. For example, sealing Don B Shaft could be more complex because the shaft penetrated the glacial overburden at an oblique angle and therefore may have a large opening at the surface. The shaft was originally constructed with structural steel shaft sets and reinforced concrete lining, but the state of the lining of the approximately 80-year-old shaft is not known. However, Moriah Hydro proposes to use the Don B Shaft as an access point for constructing the bulkhead for the upper reservoir and for maintaining the upper reservoir during project operation. Using the shaft in this manner would require appropriate engineering measures to protect the shaft from erosion of surrounding glacial overburden material and collapse of existing shaft walls. As another example, the overburden/bedrock interface in B Shaft is at a depth of 266 feet below the ground surface, which would require considerable excavation.

Considering the diversity of shafts and pits and the limited available information from Republic Steel Corporation's resealing operations in 1979 and 1980, a mine shaft and pit resealing plan would allow for appropriate planning and implementation to ensure the effectiveness of the reconstructed seals for preventing future subsidence and cave-ins. The plan would also address residual settling of resealed shafts and pits, or potential subsidence and cave-ins of undocumented mining structures, during project operation.

Top Elevation of the Upper Reservoir

At a top elevation of +1,095 feet msl (+1,000 feet LMD), the proposed reservoir would likely extend into the glacial overburden. We estimate that the shortest distance between the top of the upper reservoir and the ground would still be about 50 feet at locations just to the west of the town garage and to the east of the B Shaft. Therefore, seepage of water out of the reservoir in low-lying areas and erosion of the land surface would not be expected to occur.

However, within the ground, particle mobilization could occur along any inadequately sealed shafts, and also along fractures in the bedrock connecting the upper reservoir to the unconsolidated overburden. Information about the density of the fractures is not available, but would be obtained during the proposed post-licensing geotechnical investigations. In places where glacial material is mobilized, it would be transported down into lower portions of the upper reservoir. Over time, voids created in the glacial overburden by the constant filling and emptying of the upper reservoir could result in subsidence of the land surface.

Moriah Hydro could avoid or minimize this impact by assessing the need to lower the top elevation of the upper reservoir using information from historic mine mapping and data collected during borings for geotechnical investigations. Mine maps from 1978 with detailed elevation data indicate that the roof of the mined-out space in the Harmony Mine rarely extends to elevations shallower than about +900 feet msl (+805 feet LMD). B Shaft, located at the northeastern corner of the mine, intercepted the roof of the Harmony Mine at about +870 feet msl (+775 feet LMD). Don B Shaft intercepted the mined-out space at about +935 feet LMD (+840 feet LMD). Only a few small pockets around A Shaft extend to elevations of about +1,000 feet msl (+905 feet LMD). This implies that the benefit of pumping water to shallower depths (such as to +1,095 feet msl [+1,000 feet LMD] as proposed by Moriah Hydro) would be limited during project operation because very little storage space for water appears to be available above +900 feet msl (+805 feet LMD). Conversely, pumping water to elevation +1,095 feet msl (+1,000 feet LMD) would add stress in the mined-out space and could open up fractures in the bedrock to the glacial overburden layer, potentially increasing the mobilization of fines from the overburden. Lowering the top elevation of the upper reservoir would be consistent with the same recommendation made by EPA. It would also increase the shortest distance between the top of reservoir and the ground surface.

Effects of Project Construction, Operation, and Maintenance on Soil Resources in the Project Area

Moriah Hydro states that project construction would not require in-stream work or alterations, road construction, or any features that would require major cut or fill and grading operations. Moriah Hydro also indicates that permanent surface development

would include a small structure at the proposed entrance to the facility, ventilation shaft openings at the surface, and emergence of an underground electrical tunnel containing the project transmission lines into a proposed concrete electrical vault to be constructed at the existing NYSEG substation. Construction of the facility entrance structure would occur on previously disturbed land adjacent to the town garage. Two temporary construction staging areas would be located in an area of unvegetated mine tailings adjacent to the town's waste transfer station, just to the north of the town garage (figure 1-1); a third temporary construction area would likely be necessary to store equipment and excavated materials associated with sealing the West Drift[66] (discussed below in section 3.3.4, *Threatened and Endangered Species*). The larger of the two temporary staging areas would be adjacent to the entrance of the Don B Shaft, which Moriah Hydro plans to use as a potential access point for constructing the upper reservoir bulkhead. Moriah Hydro proposes to retain and protect the minimal existing vegetation on the town garage construction site and the two staging areas to minimize soil erosion.

Moriah Hydro proposes to monitor the streambed and banks, and if affected by land clearing, grading, and construction activities, Moriah Hydro would protect streams to prevent bank erosion, stream enlargement, and degradation or loss of fisheries habitat.

Excavations for the access shaft, penstocks, and power chamber would generate rock and aggregate that would require storage and disposal. Moriah Hydro would use some of those materials when constructing the bulkhead for the upper reservoir along the +170-foot msl (+75-foot LMD) depth contour in the Harmony Mine. Moriah Hydro would also use some of the materials to fill the 21 Pit.

Moriah Hydro proposes to implement the Erosion and Sediment Control Plan filed on February 24, 2015, to avoid or minimize soil erosion and effects on surface waters.

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[66] The West Drift is a crosscut connecting the New Bed Mine with the Harmony mine (figure 1). Dewatering the Harmony Mine would also partially dewater the New Bed Mine to the same elevation and would thereby adversely affect environmental conditions in its bat hibernaculum.

The Harmony Mine operated from 1829 to 1975, and the New Bed Mine operated from 1870 to 1930. It is possible that the previous mine owners have already sealed the West Drift, based on a comment by a former mine employee and member of the mine survey crew, who worked there until the project mines closed in the 1970s. He stated that he was familiar with the mine layout and that "there was no interconnection between the New Bed and Old Bed Mines" (according to the Moriah Hydro filing of March 3, 2017; we assume that the term "Old Bed Mines" includes the Harmony Mine). However, aside from this anecdotal comment, Moriah Hydro did not provide any evidence that the drift is blocked and proposes to seal the drift.

Moriah Hydro prepared the plan with guidance from the New York DEC's *2005 Technical and Operational Guidance Series*. The plan includes the following components: (1) using structural and vegetative measures to control erosion and sedimentation throughout the project; (2) monitoring all areas on the ground surface above the mines for any sign of erosion or subsidence; (3) informing agencies about locations and dimensions of any needed erosion and sediment control facilities; and (4) providing periodic reports to agencies about the operation, maintenance, and performance of any temporary or permanent erosion and sediment control facilities.

Our Analysis

The town garage site would allow for the construction of access shafts, the power chamber, penstocks, and bulkhead. The powerhouse would be located 2,955 feet below the surface. Excavations for the construction of the access shafts, penstocks, ventilation tunnels, and power chamber would generate stockpiles of material consisting mostly of metamorphic and igneous rock and a small amount of till as the access shaft penetrates the 50- to 350-foot-thick glacial overburden. The construction area (i.e., land adjacent to the town garage) is previously disturbed, and could accommodate the expected stockpile of rock and aggregate generated by project construction before the rock and aggregate is reused for the upper reservoir bulkhead and to fill the 21 Pit.

Three additional activities could potentially affect soil resources:

1. **Constructing the electrical tunnel—**Moriah Hydro would construct an about 3,600-foot-long underground electrical tunnel containing 34.5-kV transmission lines to connect the underground electrical equipment chamber to a 15-foot by 15-foot, aboveground concrete electrical vault, and interconnecting with an existing single circuit 115-kV transmission line at a NYSEG substation in the Hamlet of Mineville. It is likely that a temporary stockpile of excavated material from the drilling would be located adjacent to the substation, and that the construction footprint would be comparatively small.

2. **Drilling a vertical hole to seal the West Drift—**The West Drift is a horizontal shaft that extends largely underneath the forested Mount Tom.[67] Moriah Hydro would access the drift by borehole from the slope of Mount Tom from a surface elevation of about +1,500 feet msl (+1,405 feet LMD). Borehole drilling could involve: 1) construction of a temporary access road through undeveloped land, or use of an existing access road (e.g., from County Highway 6a/Silver Hill Road north of West Drift); 2) clearing an area, or use

[67] Mount Tom is located in Witherbee above the northwestern corner of the Harmony Mine (figure 1-1). The mountain reaches an elevation of 1,644 feet msl.

of an existing cleared area, for directional drilling equipment and stockpiling an estimated 45 to 60 cubic yards of excavated material[68] from drilling activity.

3. **Sealing mine shafts and pits—**Moriah Hydro would reseal all mine shafts and openings associated with the project mines (with the exception of the 21 Pit) as stated in the *Effects of Project Construction and Operation on Subsidence of Prior Mine Shafts* section above. Some locations of former shafts, such as shafts of the Welch Mine, are vegetated and would require some vegetation clearing above the shafts to accommodate construction equipment and stockpile excavated fill.

Including site-specific measures to control erosion and sedimentation resulting from these three proposed activities into Moriah Hydro's Erosion and Sediment Control Plan, as well as a plan for disposal or reuse of excavated materials, would provide additional protection for soil resources and surface waters within the project boundary.

Effects of Dewatering of Project Mines on Groundwater

During active mining operations in the past, water bearing seams and discontinuities in the bedrock, when encountered and intersected by mining operations, were grouted to minimize the amount of water entering the mine. Moriah Hydro proposes to regrout these seals within the project mines, as needed and as they become exposed and accessible during dewatering, to isolate the project mines from groundwater intrusion.

As discussed in the *Effects of Naturally Occurring Earthquakes and Subsidence on Proposed Project Facilities* section above, Moriah Hydro would conduct geotechnical investigations prior to final design, after any license is issued for the project. The investigations would include a minimum of five borings through the glacial overburden, each with a minimum depth of 50 feet into the underlying rock, determination of composition and permeability of overburden material from the boring samples, and determination of permeability of the underlying rock.

In its January 13, 2017, letter, New York DEC states that the bedrock between the Harmony and New Bed mines is highly fractured and that hydraulic connections between the two mines seems likely. It requests that Moriah Hydro conduct comprehensive studies to investigate connectivity between the mines for a reasonable range of depths from top to bottom. New York DEC suggests consideration of geophysical exploration and mapping techniques such as microgravity, seismic, or electric resistivity surveying.

[68] Estimated by staff, assuming that directional drilling would involve an 8- to 12-inch borehole drilled over 1,000 feet from the surface to West Drift.

New York DEC also discusses dye testing and water chemistry testing to assess connectivity between the two mines.

In its filing of January 3, 2017, FWS recommends surveying the groundwater elevations in the Old Bed Mine and comparing them to the New Bed Mine groundwater elevations.

Our Analysis

Continuous dewatering of mines was part of Republic Steel's regular mining operations. Following mine closure, it was estimated that groundwater completely filled the mines by 2003. The elevation in the 21 Pit is about +1,170 feet msl (+1,075 LMD), as stated above. Moriah Hydro provides a similar groundwater elevation (+1,165 feet msl [+1,070 feet LMD])[69] for the New Bed Mine, suggesting a hydraulic connection. Farrell's (1992) calculation of the flooding rate after mine closures also assumed that the two project mines and adjacent mines (New Bed, Welch, and 21 mines) are hydraulically connected. Therefore, dewatering and project operation would likely affect the groundwater elevation in all mines, including the New Bed Mine. For instance, three potential pathways exist for groundwater exchange with the project mines:

1. **West Drift—**Available records indicate that the West Drift is the only man-made connection between the Harmony and New Bed mines. The drift appears to be open; no definitive evidence exists in the available record indicating that the drift was sealed during closures of the New Bed Mine (in 1930) or the Harmony Mine (in the 1970s), or that the drift is otherwise blocked as a result of natural collapse of surrounding rock. With a cross-sectional area of 50 square feet, the drift likely represents a major pathway for groundwater exchange between the two mines.

2. **Bedrock—**Considering that the area is severely deformed and is undergoing uplift, the otherwise dense bedrock is expected to contain fractures (including joints, faults, and other zones of weakness) that may transmit groundwater. The permeability of the bedrock is a function of the density and size of these fractures; their density and size typically decrease with depth. Data on the extent of fractures in the bedrock are not available. During active mining operations in the past, water-bearing seams and discontinuities in the bedrock, when encountered and intersected by mining operations, were grouted to minimize the amount of water entering the

[69] Moriah Hydro does not identify the source or date of this elevation. Farrell (1992) predicted that the groundwater in all interconnected mines (including New Bed Mine) would not flood above elevation +1,145 feet msl (+1,050 feet LMD).

mine. Historical mine maps do not show any faults connecting the Harmony and New Bed mines.

3. **Glacial overburden—**The upper part of the groundwater body in the New Bed and Harmony mines could potentially be connected through the glacial overburden. The elevation of the ground surface of the southern end of the New Bed Mine in the vicinity of Roe Shaft is +1,312 feet msl (+1,217 feet LMD); the elevation of the ground surface of the northern end of the Harmony Mine in the vicinity of B Shaft is +1,210 feet msl (+1,115 feet). Considering further that the glacial overburden is up to 350 feet thick, it may extend down to an elevation of about +960 feet msl (+865 feet LMD) near the New Bed Mine. Considering that the groundwater table is currently at about +1,165 feet msl (+1,070 feet LMD) and considering that the glacial overburden contains horizons with high permeability,[70] up to 200 feet of water-bearing glacial overburden could connect the two mines.

During dewatering of the project mines, monitoring the groundwater elevations in the project area would help determine whether: (1) sealing the West Drift would raise the groundwater elevation in the New Bed Mine because a major pathway for groundwater movement was now blocked; or (2) dewatering the project mines would lower the groundwater table in the New Bed Mine through an inadequate seal of the West Drift, fractures in the bedrock, or transport via the glacial overburden.

Moriah Hydro's proposed geotechnical investigations would evaluate the permeability in the bedrock and the glacial overburden, assuming that Moriah Hydro drilled an adequate number of borings at locations between the New Bed and Harmony mines and incorporates appropriate tests in the geotechnical investigations. The borings in the area between the two mines would assist in determining whether the glacial overburden presents a potential pathway for groundwater. In addition to borings, a seismic refraction survey[71] could identify the depth of the interface between the glacial overburden and bedrock in the area between the two mines over a broader area. If the borings and seismic refraction survey showed that the base of the glacial overburden

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[70] For example, Don B shaft was constructed from 1940 to 1941 through 350 feet of glacial overburden, which included a 50-foot-thick layer of "water-bearing free flowing ground" referred to as "quicksand" (Farrell, 1996, page 257).

[71] Seismic refraction is a geophysical technique used to study the subsurface of the earth by generating compressional waves via hammering or explosive methods. The variations in velocity of the waves traveling through rocks or geological layers are measured, and used to identify subsurface composition of the earth. See https://mrdata.usgs.gov/catalog/science.php?thcode=2&term=1047.

between the New Bed and Harmony mines was continuously deeper than +1,165 feet msl (+1,070 feet LMD), and the glacial overburden contains at least one continuous water-bearing layer, then the glacial overburden would be a potential conduit for the movement of groundwater between the two mines.

Moriah Hydro's proposed sealing of historical water-bearing seams and bedrock discontinuities in the project mines would assist in reducing groundwater intrusion into the project mines after dewatering. However, as additional water-bearing seams and discontinuities may be revealed during project operation, Moriah Hydro could also inspect and grout any leaks in the bedrock of the project mines to further minimize groundwater intrusion into the project mines. Additionally, establishing monitoring stations within the project area would help develop a spatial understanding of groundwater hydrology. This would include selected boreholes (to be drilled during the proposed geotechnical investigations) within the project area, and in the 21 Pit, and Moriah Hydro's proposed stream flow monitoring at the Don B outfall and tributary C-86-5. Monitoring of the groundwater in the Welch Mine through an installed well in the vicinity of the deeper Welch and Brinsmade shafts would help identify the presence of hydraulic connections among the project mines, the Welch Mine, and other mines in the area, and determine the methods needed to isolate the project mines for operational purposes.

Effects of Project Construction and Operation on Water Supply Wells

Drinking water is provided to the greater Moriah area through a public water distribution system by a water plant at Bartlett Pond (CGR, 2009). Sections of the project area that are not served by the distribution system are located along Witherbee Road, Silver Hill Road, and Chipmunk Street (see figure 1-1). It is possible that draining the project mines during construction, and regular filling and draining of the upper reservoir during project operation, could adversely affect the water level and yield in private wells used by residents in the project area.

To protect individual residential water supplies for homes currently serviced by wells, Moriah Hydro proposes to extend the municipal water distribution system along Witherbee Road, Chipmunk Street, and Lower Silver Hill Road within the project boundary. Moriah Hydro would install the new water mains within 12 months of the commencement of project construction.

Our Analysis

A municipal water supply system serves most of the residents near the proposed project. It also serves the areas within the footprint of the Welch Mine and the footprint of the New Bed Mine in the section at risk of being dewatered (i.e., to the south of Roe Shaft). Providing water to residents along roads not currently connected to the distribution system would avoid effects on water supply from a potentially lower

groundwater table as a result of project construction and operation. We anticipate that any ground disturbance related to extending the water supply system would be within the existing roadway corridors, thus any adverse effects would be minimal.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity and Use

As described above in section 3.3.1.1, *Geology and Soils, Affected Environment, Mine Closure*, the proposed project mines have been filled with groundwater since 2003 and continuously overflow about 0.7 cfs to tributary C-86-5. Estimated monthly flows in the tributary range from 0.26 cfs to 24.94 cfs (table 3-2),[72] with low flows occurring during August and September (mean: 1.65 and 0.88 cfs, respectively) and high flows occurring in March through May during spring runoff (mean: 12.29 cfs). The estimated 1- and 10-year recurrence flows,[73] derived from regression analyses described in Lumia (1991), are 87 cfs and 225 cfs, respectively (table 3-3). In Mill Brook, the receiving stream for tributary C-86-5, recurrence flows are estimated at 557 cfs and 1,318 cfs.

There are no permitted water withdrawals or discharges in tributary C-86-5.

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[72] Flows in tributary C-86-5 were estimated using drainage area weighting and the following equation: $Q_{ungaged} = (A_{ungaged}/A_{gaged}) \times Q_{gaged}$ where,

$Q_{ungaged}$ = flow at tributary C-86-5,
Q_{gaged} = flow at Mill Brook (USGS gage no. 04276770),
$A_{ungaged}$ = drainage area of tributary C-86-5 (3.0 square miles), and
A_{gaged} = drainage area at the Mill Brook gage station (27.8 square miles).

[73] A recurrence flow is a statistical value. For example, a 1-year recurrence flow of 87 cfs means that there is a 1 in 1 chance (100 percent) that this flow rate would be equaled or exceeded in any given year. A 10-year recurrence flow of 225 cfs means that there is a 1 in 10 chance (10 percent) that this flow rate would be equaled or exceeded in any given year.

Table 3-2. Estimated monthly mean discharge at tributary C-86-5, Essex County, New York (Source: staff).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	--	--	10.98	12.66	10.63	3.09	1.82	4.03	1.14	6.16	6.99	7.43
1991	3.41	3.14	7.92	7.94	3.94	1.21	0.72	0.63	0.99	2.05	1.80	2.67
1992	3.81	1.02	7.47	11.25	5.58	5.44	1.50	1.03	1.03	1.31	4.51	2.61
1993	3.20	1.42	2.08	24.94	3.38	2.55	0.64	0.97	0.78	1.01	1.53	1.76
1994	1.15	1.34	2.68	17.93	7.02	2.57	1.22	1.53	0.81	0.80	1.70	3.04
1995	4.25	1.90	6.48	3.57	1.99	0.62	0.62	1.38	0.52	4.60	8.67	2.52
1996	8.67	4.30	3.37	11.30	8.96	4.80	5.42	1.79	0.88	1.64	3.69	8.10
1997	2.91	3.00	4.66	13.23	5.76	1.64	1.06	0.87	0.64	1.13	2.56	1.42
1998	9.27	2.86	11.24	9.03	3.51	6.67	4.82	4.03	2.01	1.91	2.14	1.77
1999	2.61	4.05	7.68	11.07	2.27	0.84	0.56	0.26	--	--	--	--
Mean	3.93	2.30	6.46	12.29	5.30	2.94	1.84	1.65	0.88	2.06	3.36	3.13

Table 3-3. Recurrence flows at tributary C-86-5 and Mill Brook, Essex County, New York (Source: license application, as modified by staff).

	Recurrence flow (cfs)					
Location	**1-year**	**2-year**	**5-year**	**10-year**	**50-year**	**100-year**
Tributary C-86-5	87	127	184	225	319	361
Mill Brook	557	775	1,096	1,318	1,829	2,054

Water Quality

Surface Waterbody Classification

Water quality standards are implemented by New York DEC, with oversight from EPA, to establish maximum allowable levels of chemical pollutants and serve as regulatory targets for permitting, compliance, enforcement, and monitoring and assessing the quality of the state's waters. All fresh surface waters are assigned a letter classification (e.g., A, B, C, and D) that denotes their best uses.

Upstream of Roe Pond, tributary C-86-5 is a Class AA waterway with an accompanying standard of (T) denoting a designated trout water[74] (New York DEC,

[74] Trout waters are waters that provide habitat in which trout can survive and grow within a normal range on a year-round basis, or on a year-round basis excepting periods of time during which almost all of the trout inhabiting such waters could and would temporarily retreat into and survive in adjoining or tributary waters due to natural circumstances.

2018a, 2009). The best usages of Class AA waters are water supply for drinking, culinary or food processing purposes, primary and secondary contact recreation, and fishing. Downstream of Roe Pond, the tributary flows through the project boundary toward Mill Brook and is a Class D waterway. Class D waters are best used for fishing, but do not support fish propagation due to intermittency of flow, water quality, or stream bed conditions that prohibit such uses (table 3-4). From its confluence with tributary C-86-5 to Port Henry, Mill Brook is designated a Class C waterway with a (T) standard. Class C waters are suitable for fish, shellfish, wildlife propagation (including trout), and survival, as well as primary and secondary contact recreation. Downstream of Port Henry to Lake Champlain, Mill Brook is designated a Class D waterway.

Water Quality Surveys

Water quality surveys conducted by New York DEC (1994) and Moriah Hydro (2007, 2009 and 2014) indicate conditions typical of small streams in the region (table 3-5). Results from two sampling locations from 1994 to 2009 found DO concentrations exceeding the 4.0 mg/L standard for Class D surface waters, with slightly basic pH (mean: 7.6) and summer water temperature ranging from 53 to 67°F. Prior to

Table 3-4. Surface waterbody classification and associated water quality parameters of tributary C-86-5, Essex County, New York (Source: license application, as modified by staff).

Classification and Best Use	**Water Quality Parameters** Class - D
The best usage of Class D waters is fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish, shellfish, and wildlife survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.	DO concentration for non-trout waters: Minimum daily average DO = 5.0 milligrams per liter (mg/L). Minimum DO = 4.0 mg/L.
	pH: 6.0 to 9.0
	Conductivity: No standard, but recommended guidance for a healthy stream is 150 to 500 microsiemens per centimeter at 25° Celsius (µS/cm).
	Dissolved solids: Low as practicable and never exceeding 500 mg/L.
	Turbidity: No increase that will cause a substantial visible contrast to natural conditions.
	Fecal coliforms: The monthly geometric mean, from a minimum of five examinations, shall not exceed 200 colonies per 100 milliliters (mL).

Table 3-5. Water quality data from select surveys of tributary C-86-5 (Source: license application, as modified by staff).

Location	Date	Water Temperature (°F)	Conductivity (µS/cm)	DO (mg/L)	pH	TDS (ppm)	Flow (cfs)
Station 1[a]	6/30/94	64	179	n/a	n/a	n/a	n/a
Station 2[b]	6/30/94	67	137	n/a	n/a	n/a	n/a
Station 1	5/24/07	61	168	n/a	n/a	n/a	3.0
Station 2	5/24/07	64	126	n/a	n/a	n/a	n/a
Station 1	9/25/09	53	470	10.5	8.1	320	5.8
Station 2	9/25/09	54	210	10.5	8.0	140	3.1
Station 1	7/30/14	59	380	9.8	7.5	260	1.2
Station 3 [c]	7/30/14	57	530	9.8	7.9	360	0.9
Mine Overflow	7/30/14	51	650	4.2	7.6	440	0.3

[a] Station 1 was located upstream of Joyce Road (see figure 1-1).
[b] Station 2 was located downstream of Hospital Road (see figure 1-1).
[c] Station 3 was located immediately downstream of the Don B outfall (see figure 1-1).
n/a Not available. Parameter was either not sampled or not recorded.

2007, conductivity was less than 180 µS/cm for all samples; however, values from 2009 and 2014 averaged 353 µS/cm. Groundwater from the project mines was only assessed in 2014, but was characterized by much lower DO (4.2 mg/L) and much higher conductivity (650 µS/cm) and total dissolved solids (TDS) (440 parts per million [ppm]) than that of tributary C-86-5.

Aquatic Biota

Fish Community

Tributary C-86-5 supports a depauperate fish community. Electrofishing surveys conducted by New York DEC upstream of Joyce Road yielded only 52 brook trout between 42 and 187 millimeters (1.7 to 7.4 inches) in total length[75] (New York DEC, 1994). No other fishes were collected. In 2014, Moriah Hydro noted the capture of a single "minnow," but the specimen was not identified to species.

[75] Total length is the length of a fish measured from the tip of the snout to the tip of the longer lobe of the caudal fin (tail), usually measured with the lobes compressed along the midline.

In Mill Brook, fourteen fish species have been documented (New York DEC, 1994) (table 3-6). Cyprinidae (minnows) comprise nearly 83 percent of individuals and one-half of the species collected. The three species of Salmonidae (trout) include both naturally reproduced and stocked brown trout and rainbow trout, and native brook trout. Of those species, only brown trout and rainbow trout included specimens of harvestable size (12 inches).

Stocking is prevalent in the watershed, with annual allotments of about 170 8- to 9-inch brown trout in Roe Pond and 1,650 brown trout in the mainstem of Mill Brook (New York DEC, 2018b). The stocking supports recreational angling and, in the case of Roe Pond, is intended as a "put and take" fishery.[76] Despite its proximity and connectivity to Roe Pond, no brown trout have been documented in tributary C-86-5.

Table 3-6. Fish species documented in Mill Brook, Essex County, New York (Source: New York DEC, 1994).

Family		**Abundance**		**Total Length**	
Common Name	**Scientific Name**	**No.**	**Percent**	**Min.**	**Max.**
Cyprinidae (Minnows)					
Northern redbelly dace	*Chrosomus eos*	177	16.0	1.5	2.4
Cutlips minnow	*Exoglossum maxilingua*	29	2.6	2.4	5.4
Common shiner	*Luxilus cornutus*	49	4.4	1.9	2.1
Golden shiner	*Notemigonus crysoleucas*	3	0.3	3.2	3.5
Bluntnose minnow	*Pimephales notatus*	1	0.1	3	3.0
Blacknose dace	*Rhinichthys atratulus*	473	42.7	0.9	3.7
Creek chub	*Semotilus atromaculatus*	188	17.0	1.1	5.9
Catostomidae (Suckers)					
White sucker	*Catostomus commersoni*	41	3.7	1.2	8.4
Ictaluridae (Catfish)					
Brown bullhead	*Ameiurus nebulosus*	1	0.1	4	4
Salmonidae					
Rainbow trout	*Oncorhynchus mykiss*	12	1.1	12.4	15.1
Brown trout	*Salmo trutta*	85	7.7	2.3	12.7
Brook trout	*Salvelinus fontinalis*	35	3.2	2.1	8.0
Centrarchidae (Sunfish)					
Pumpkinseed	*Lepomis gibbosus*	15	1.4	2.0	3.7
Largemouth bass	*Micropterus salmoides*	6	0.5	1.7	2.4

[76] A "put and take" fishery enhancement strategy is one in which fish are stocked and not expected to reproduce or even grow before they are harvested.

Aquatic Invertebrates

Benthic macroinvertebrates were noted as being present during the New York DEC and Moriah Hydro surveys of tributary C-86-5, but were not formally collected or identified. Freshwater mussels have not been assessed or documented in the tributary.

3.3.2.2 Environmental Effects

Effects of Project Construction and Operation on Aquatic Habitat and Water Quality

Over a period of up to 2 years during construction, Moriah Hydro would pump accumulated groundwater from the proposed project mines into tributary C-86-5 via an existing overflow pipe connected to the Don B Shaft. Groundwater currently drains from the mines at a rate of about 0.7 cfs, corresponding to the estimated rate of groundwater infiltration, and would increase to about 5 cfs during dewatering. During project operation, Moriah Hydro anticipates pumping groundwater at 0.7 cfs to maintain the volume of operational water and otherwise keep the project mines dry.

Moriah Hydro proposes to implement its Erosion and Sediment Control Plan during construction, which would include streambed and streambank monitoring of all on- and off-site streams, and use best management practices (BMPs) (e.g., gabion baskets, rip-rap, log cribbing and vegetative stabilization) to prevent stream bank erosion, stream enlargement, and degradation or loss of fisheries habitat. Moriah Hydro also proposes to monitor flow at the Don B outfall and at locations upstream and downstream of the outfall during construction and project operation (see section 3.3.1.2, *Geology and Soils*, *Environmental Effects*, *Effects of Dewatering of Project Mines on Groundwater*). Water quality parameters (temperature, pH, conductivity, turbidity, DO, TOC, iron, and manganese) would be monitored at the same locations and over the same time period. Any exceedances of state water quality standards or other limits stipulated by New York DEC in the groundwater during construction and operation would be treated prior to being released to tributary C-86-5 through Moriah Hydro's proposed water treatment facility.

Interior recommends that Moriah Hydro develop a Streamflow Monitoring Plan in consultation with FWS and New York DEC to ensure that mine dewatering during construction and continuous maintenance discharges during project operation do not impair the water quality of Mill Brook.

Our Analysis

Aquatic Habitat

Moriah Hydro's proposed 5-cfs dewatering discharge would be roughly equivalent

to the 20-percent exceedance flow of tributary C-86-5 (figure 3-3) and would be 2- to 5-times greater than its mean monthly discharge from June through February (see table 3-2). Despite the increased flow, the total estimated streamflow would generally remain well below the 1- to 2-year recurrence flows (87 and 126 cfs),[77] thus we do not anticipate a change in channel morphology. Similarly, the effect on Mill Brook would be negligible as its estimated 1-year recurrence flow is higher (557 cfs) and would easily accommodate the additional volume. However, as flow in tributary C-86-5 would be sustained above the 20-percent exceedance level year-round, increased water velocity and the loss of seasonal variation in the hydrograph could result in localized streambank instability in tributary C-86-5, including at its confluence with Mill Brook. Lateral (streambank) scouring and erosion could develop in these areas and increase sediment deposition.

While dewatering flows are not expected to alter channel morphology, aquatic habitat could be adversely affected by localized bank erosion and the resulting sediment deposition. However, Moriah Hydro's proposed Erosion and Sediment Control Plan, would identify and minimize any erosional effects though implementation of its BMPs. Erosional effects could be further minimized by: (1) initiating dewatering outside of the

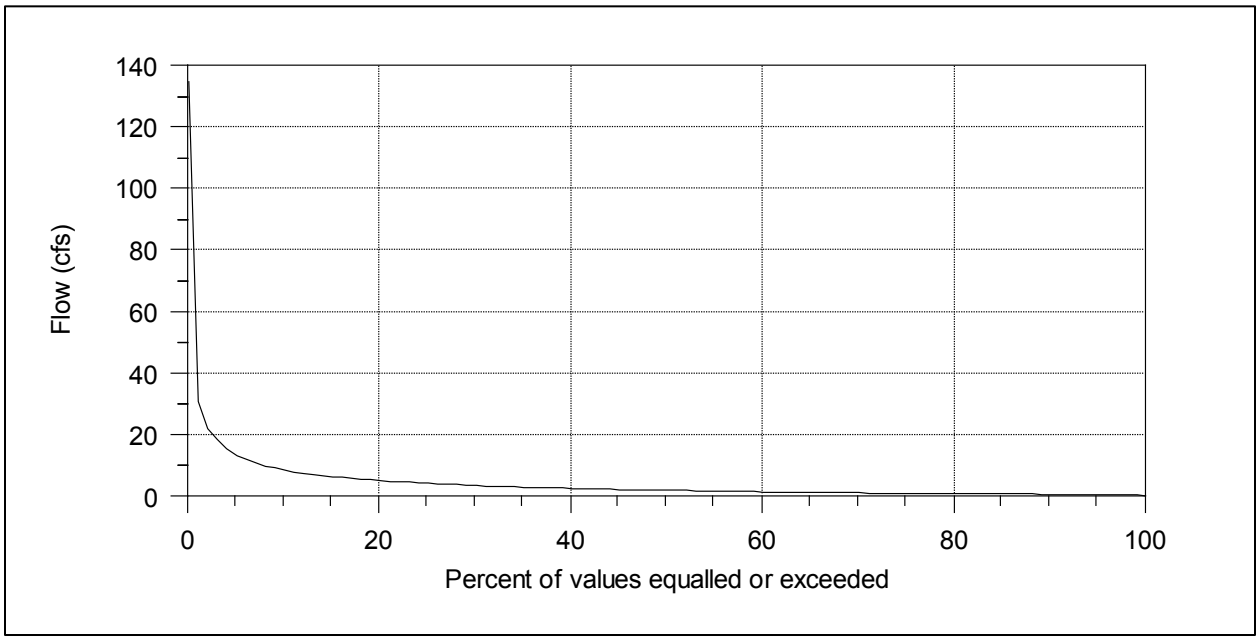

Figure 3-3. Flow duration curve for tributary C-86-5, Essex County, New York (Source: staff).

[77] One- to two-year recurrence flows represent bankfull discharge, which is the discharge at which channel maintenance (e.g., moving sediment, forming or changing bars, and forming or changing bends and meanders) is most effective (Dunne and Leopold, 1978).

seasonal low-flow period; (2) gradually increasing dewatering flows to the target rate over several days; and (3) varying dewatering rates in accordance with seasonal flows.

During project operation, the volume of groundwater discharge is expected to return to 0.7 cfs, thus there would be no change to its current condition.

Water Quality

Groundwater currently exiting the project mines at the Don B outfall is consistent with state standards for Class D streams and requires no treatment prior to entering tributary C-86-5. However, as the overflow is thought to represent recent groundwater infiltration, groundwater quality could degrade during construction dewatering in response to increasing depth, stagnation, and prolonged exposure of the water to the minerology of the adjacent rock. A study of groundwater wells in the Lake Champlain Basin supports this assertion, reporting lower water temperature and DO values (median values of 49.5°F and 2.7 mg/L, respectively) than those of the groundwater overflow (USGS, 2011). Contaminants could also be mobilized during dewatering and project operation. Polychlorinated biphenyl (PCB)-containing electrical equipment (e.g., transformers, capacitors, fluorescent light ballasts, and electrical cables) was commonly used in the underground mining industry (Marcus, 1997) and has been documented in the project mines.[78] The extent to which any PCB-containing equipment was removed or contained in the project mines is unclear and, if any equipment remains, its stability could be compromised through turbulent water flow and mixing during project operation. To prevent any accidental release of PCBs and protect downstream aquatic resources, including in Lake Champlain, monitoring should be conducted.

Under project operation, water would move between the project reservoirs. The repeated mechanical agitation of the operational water could change its chemistry through the introduction of oxygen, increased dissolution of the adjacent geology, or the suspension of remnant materials used during mining operations. As a result, the water quality of the 0.7-cfs operational discharge could be substantially different than the current overflow and the dewatering discharge.

Implementing Moriah Hydro's proposed water quality monitoring would allow for the immediate identification of inconsistencies with state water quality standards, or with levels stipulated by New York DEC, during project construction and operation. The results of the monitoring would inform any responses, including initiating the proposed treatment of groundwater via aeration and detention, and would ensure that any changes in water quality in tributary C-86-5 would be minimal. However, the proposed monitoring would benefit from a formalized plan that would include: (1) the exact

[78] See page 60 of the transcripts from the December 7, 2017, daytime scoping meeting.

locations of the proposed monitoring sites at the Don B outfall and upstream and downstream of the outfall on tributary C-86-5; (2) the type of monitoring instruments used and defined quality assurance/quality control (QA/QC) procedures; (3) continuous, real-time monitoring of temperature, pH, conductivity, turbidity, and DO at all monitoring locations; (4) a schedule for monitoring parameters that would not yield immediate results, including TOC, iron, manganese and PCBs; (5) conditions under which Moriah Hydro's proposed water treatment facility would be operated; (6) identification of water quality conditions, if any, that would result in a temporary stoppage or termination of dewatering during construction and operation; (7) the filing of annual summary reports for each year that monitoring is conducted; and (8) the conditions under which monitoring would be extended beyond a 3-year period.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

The Mineville Project is located within the Eastern Adirondack Foothills and Champlain Lowlands ecoregions, which are characterized by a transition from eastern Adirondack hills and mountains averaging 1,400 feet in elevation, to till-covered lowlands leading to the western shore of Lake Champlain (Bryce et al., 2010).

Upland habitat within the project boundary is largely forested, with some scrub and meadow habitat (figure 3-4). Areas within the project boundary where staging and construction of project facilities would occur have been substantially modified by historical mining and other industrial activity. Acreages by land cover classification, based on USGS Gap Analysis Program (GAP) land cover data,[79] are as follows: northern mesic hardwood and conifer forest (~468 acres); developed and urban (~96 acres); northern and central floodplain forest and scrub (~25 acres); eastern North American ruderal forest and plantation (~7 acres); recently disturbed or modified (~8 acres), and Appalachian and Laurentian rocky scrub and meadow (~14 acres).

Wetlands

Based on National Wetland Inventory (NWI)/Adirondack Park Agency (APA) wetland data, and a supplemental field survey during an August 11, 2015, site visit with New York DEC, Moriah Hydro identified about 42 acres of freshwater wetlands near the Mineville Project, including three wetlands within the project boundary (figure 3-5).

As numbered on figure 3-5, wetland 1, at the southern end of the project boundary, is about 24 acres in size (including 0.64 acre of open water, 4.54 acres of palustrine

[79] https://maps.usgs.gov/terrestrial-ecosystems-2011/.

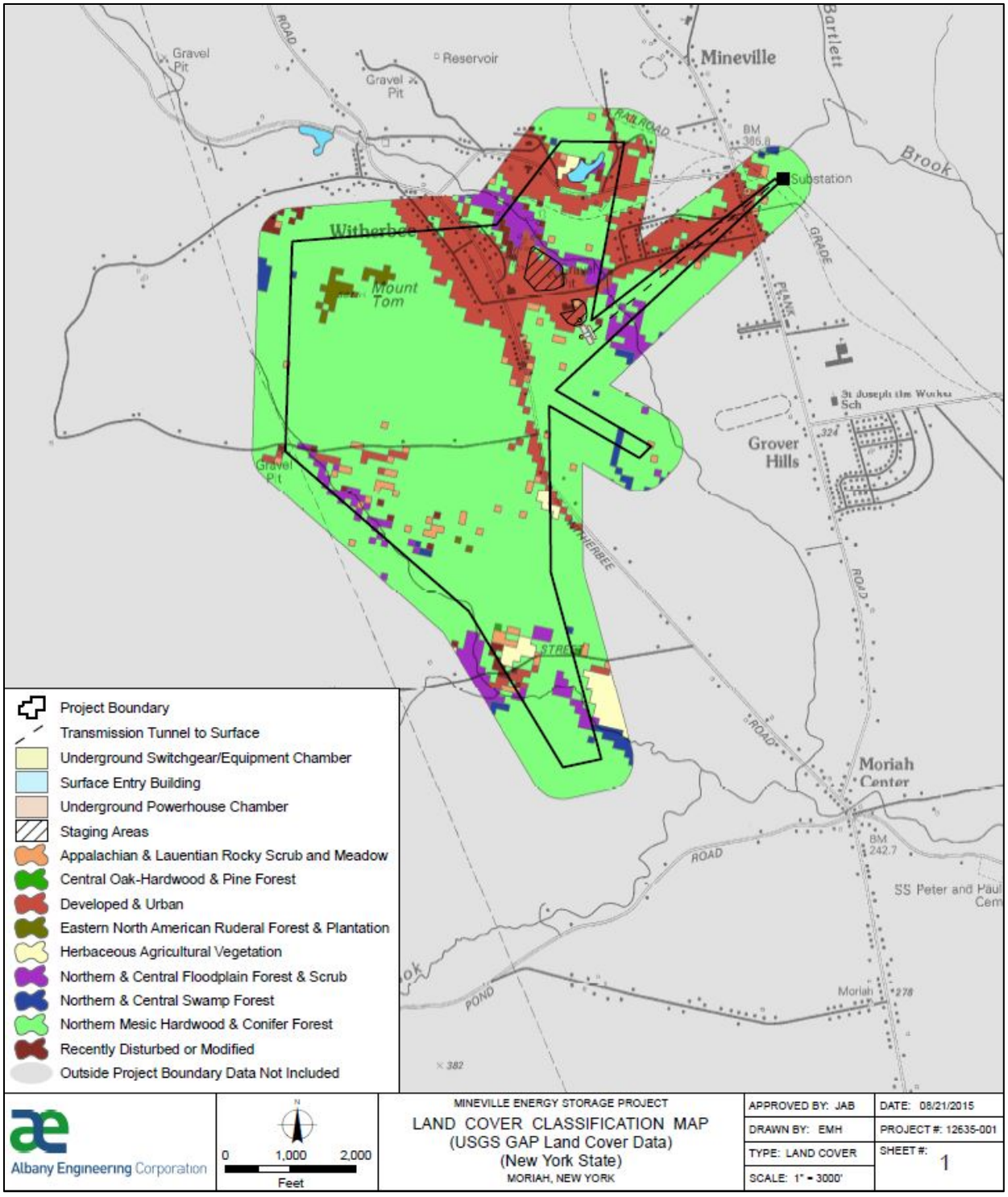

Figure 3-4. Land cover classification map (Source: license application, as modified by staff).

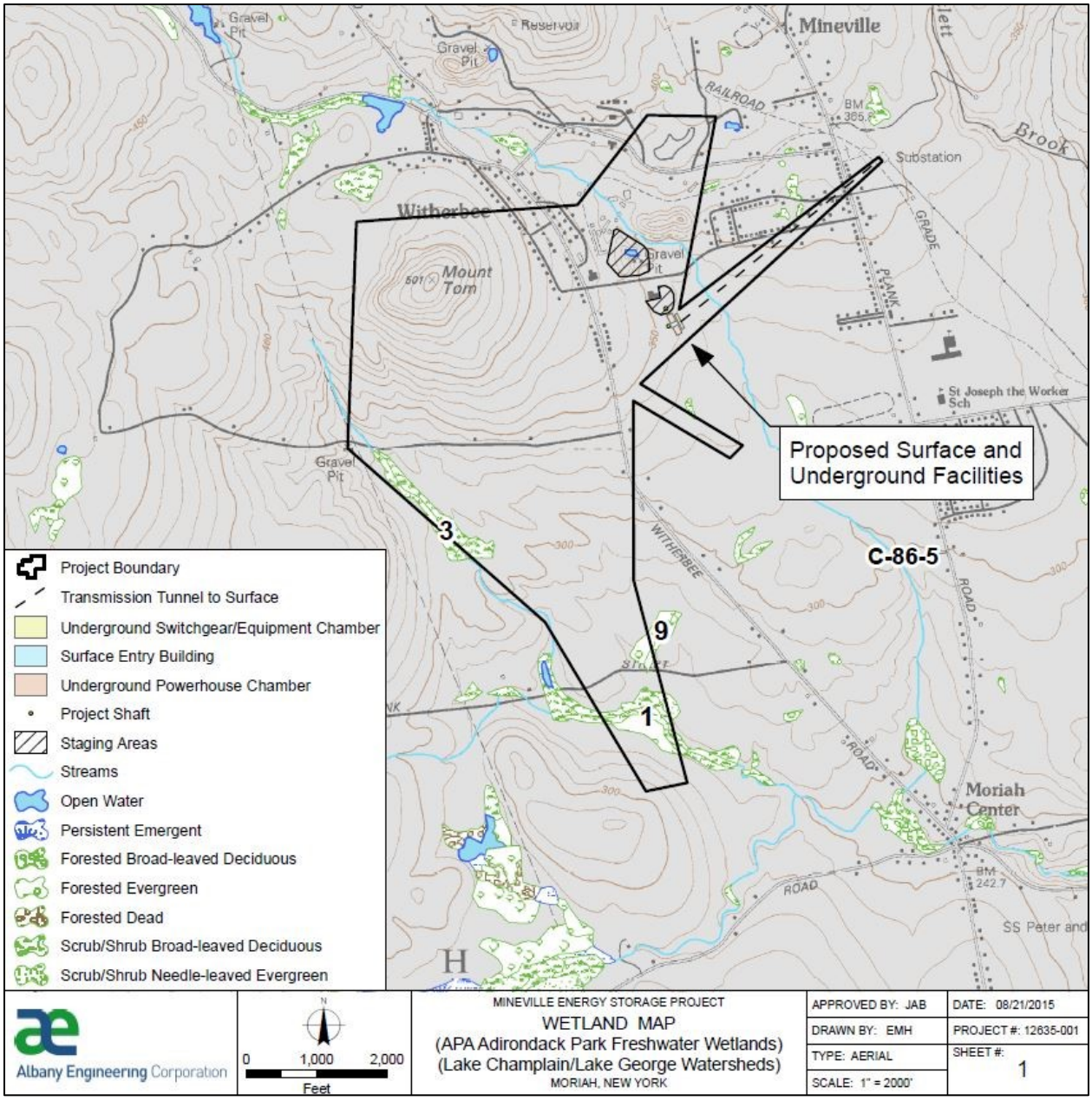

Figure 3-5. Wetlands within the project boundary (Source: license application, as modified by staff).

forested wetland, 1.64 acres of palustrine scrub-shrub wetland with associated needle-leaved evergreen vegetation, and 17.84 acres of palustrine scrub-shrub wetland with associated broad-leaved deciduous vegetation) located along New York DEC-designated tributary C-86-6, which flows to Mill Brook. Wetland 3, at the western edge of the project boundary, is an 11.87-acre palustrine scrub-shrub/emergent wetland with associated broad-leaved deciduous vegetation located on a tributary to C-86-6. Wetland 9 is a 5.75-acre palustrine forested/scrub-shrub wetland located on the southwestern edge of the project boundary. An additional 0.51-acre palustrine scrub-shrub/emergent

wetland is located along an eastern projection of the project boundary that is above an eastern shaft extension of the Harmony Mine. Other open-water habitat within the project boundary includes a 0.29-acre excavated open water area north of Joyce Road and within one of the two proposed staging areas. The approximately 4-acre 21 Pit in the northern portion of the project boundary presently holds open water, but does not appear in NWI mapping.

There are no wetlands located near the proposed aboveground project facilities or above the proposed transmission line underground tunnel that would extend northeast from the proposed underground powerhouse to an existing aboveground substation east of Plank Road. However, three wetlands are present along tributary C-86-5, which would receive additional flow during the dewatering phase of project construction (as discussed in section 3.3.2, *Aquatic Resources*): a 3.8-acre forested/scrub-shrub wetland located about 0.6 mile downstream of the existing overflow pipe connected to the Don B outfall, and two parcels (a 6-acre forested/scrub-shrub wetland and a 1.8-acre scrub-shrub/emergent wetland north and east of Moriah Center) about 1.5 miles downstream of the Don B outfall and near the confluence of tributary C-86-5 and Mill Brook.

Wildlife

The upland, wetland, and open-water habitat that exists within the project boundary, and Essex County in general, supports a variety of wildlife. Reptiles and amphibians, likely to be present within forest and wetland habitat, include common species (eastern American toad, green frog, eastern garter snake) and species associated with intermittent and permanent tributaries (northern dusky and Allegheny mountain dusky salamander). Mammals likely to be present within the project boundary include common mammals (white-footed mouse, gray squirrel, eastern cottontail, Virginia opossum, raccoon), wetland-dependent species (mink, fisher), and larger species with more extensive home ranges (white-tailed deer, black bear, coyote).

Bird species, including waterfowl (wood duck, mallard, Canada goose), waterbirds (great blue heron), raptors (red-tailed hawk, American kestrel), grassland-dependent species (eastern meadowlark, bobolink), interior forest species (ruffed grouse, wood thrush, ovenbird), and edge-adapted passerine species are likely to occur during breeding, migratory, and overwintering periods. In a letter dated October 25, 2012,[80] the New York Natural Heritage Program (New York NHP) stated that the Tennessee warbler, imperiled in New York State, is known to breed in the vicinity of the project. Tennessee warblers typically breed in boreal forest habitat, in open areas containing grasses, shrubs, and young deciduous trees (Rimmer and McFarland, 2012).

[80] See Appendix 12 of the final license application.

Bat species

Nine species of bats are found in New York State, including three species of "tree bats" that primarily live in trees throughout the year and migrate south in the winter (red, hoary, and silver-haired bats), and six species of "cave bats" that hibernate in caves and mines in New York, and use a variety of forested, wetland, and open habitats for reproduction, roosting, and foraging (Indiana, northern long-eared, eastern small-footed, tri-colored, little brown, and big brown bats.)[81] All six species of cave bats hibernate in the New Bed Mine, which is likely connected to the project mines by the West Drift (as discussed in section 3.3.1, *Geology and Soils*).

The eastern small-footed bat is listed as a species of special concern in New York State (New York NHP, 2017a). This species is observed in relatively low numbers within hibernating caves and mines, potentially due to its use of crevices and rubble and tendency to roost singly (rather than in clusters) during hibernation. Eastern small-footed bats are cold-tolerant, and often hibernate in areas near a cave or mine entrance with lower temperature and humidity (Butchkoski, 2014). In summer, eastern small- footed bats use fractures in rock ledges and talus areas for roosting and establishing maternity colonies, and forested habitat adjacent to caves and mines. In 2013, New York DEC conducted a winter bat count within the New Bed Mine, and recorded 3,023 eastern small-footed bats.[82] This species has been observed in about 25 percent of hibernacula surveyed in the state, most often recorded in northern New York State sites, with most of the large sites located in the Adirondacks (New York NHP, 2017a). This species' New York State populations are believed to be stable or slightly declining since the introduction of WNS, although there is uncertainty as to whether observed declines of 31 percent over the 2007 to 2015 period are due to sampling error.

The tri-colored bat, formerly known as the eastern pipistrelle, occurs within eastern North America from Canada to Georgia, and is a relatively uncommon species in New York State (New York NHP, 2017b). Prior New York DEC surveyors typically observed hibernating tri-colored bats away from other bat species, in warmer and more humid areas deep within caves or mines. In summer, this species forages in forested riparian areas, forest edges, and in early successional and open habitats. Tri-colored bats

[81] Federally listed Indiana and northern long-eared bats are discussed in section 3.3.4, *Threatened and Endangered Species*.

[82] See January 23, 2014, e-mail correspondence between Carl Herzog (New York DEC) and Veronica Weigand (Albany Engineering Corporation), provided in Appendix 12 of the final license application. The 2013 survey was the first comprehensive count of bats within the entire mine since 1993. This e-mail provides the New Bed Mine bat numbers cited in the remainder of the draft EIS.

summer roosts and maternity colonies are often observed below the canopy in live trees or dead trees that retain leaves, and in human structures. A 2013 winter bat count conducted by New York DEC recorded 12 tri-colored bats in the New Bed Mine. Prior to WNS, this species was recorded in most hibernacula surveyed in New York State, though most common in southern and western New York State. New York DEC estimates that tri-colored bat populations declined by 96 percent over the 2007 to 2015 period.

The little brown bat, a very common bat species in New York State prior to the appearance of WNS, forms large clusters in caves and mines for hibernation, typically selecting areas with higher humidity and temperatures that are typically above freezing (New York NHP, 2017c). In summer, this species uses a variety of forest types and human structures for foraging and reproduction. A 2013 winter bat count conducted by New York DEC recorded 33,492 little brown bats in the New Bed Mine. New York DEC estimates that little brown bat populations have declined by about 84 percent over the 2007 to 2015 period, the largest decline due to WNS for a New York State bat species.

The big brown bat is the largest species of bat to hibernate in caves and mines in New York State, and also may winter in human structures (New York DEC, Undated). During hibernation, big brown bats tend to select cooler, less humid areas of mines or caves, and are more abundant near entrances (Saunders, 1988). In summer, big brown bats may form maternity colonies in trees or human structures, and forage in forested habitat, often in forest canopies. A 2013 winter bat count conducted by New York DEC recorded 1,034 big brown bats in the New Bed Mine.

3.3.3.2 Environmental Effects

In SD2, Commission staff identified the following as resource issues: (1) effects of project construction, operation, and maintenance on botanical resources and wildlife, including game species; (2) effects of project construction, operation, and maintenance on wetland habitat and associated wildlife; and (3) effects of project construction, operation, and maintenance (including noise, vibration, air temperature, humidity, air flow, and water level) on New York State wildlife species and associated habitat, including the eastern small-footed bat, tri-colored bat, little brown bat, and big brown bat.

The Commission received comments on the effects of project construction, operation, or maintenance on four non-federally listed bat species (eastern small-footed bat, tri-colored bat, little brown bat, and big brown bat) that hibernate within New Bed Mine, and that likely roost and forage in forested habitat within the project boundary. However, since these four bat species are similar in summer and winter habitat requirements as the federally listed species (the endangered Indiana bat and threatened northern long-eared bat) discussed in section 3.3.4, *Threatened and Endangered Species*, and would be subject to proposed measures within Moriah Hydro's Bat Plan, project

effects on the four non-federally listed bat species and proposed measures to address these effects are analyzed in section 3.3.4.2, *Threatened and Endangered Species*, *Environmental Effects*.

In SD2, Commission staff also identified the four non-federally listed bat species as having the potential to be cumulatively affected by the proposed project. However, as potential cumulative effects would be similar for all bat species near the project, cumulative effects for the four non-federally listed bat species are addressed in section 3.3.4.3, *Threatened and Endangered Species*, *Cumulative Effects*.

Construction effects on terrestrial habitat and wetlands

In terms of land disturbance, Moriah Hydro proposes to construct an entry and service building in the vicinity of the town garage, which would be located above the main shaft to the underground powerhouse chamber. Moriah Hydro proposes to establish two staging areas to store project equipment, construction material, and excavated soil and rock generated by underground construction: a 2.25-acre area behind the town garage (also the site of the proposed entry and service building), and a 6.5-acre area north of the town garage on the north side of Joyce Road. In addition, proposed underground facilities that would have an interface at the surface include the upper and lower reservoir ventilation shafts, which would emerge in the vicinity of the town garage, and an electrical tunnel that would reach the surface at the site of an existing substation east of Plank Road, terminating in a proposed 15-by-15-foot concrete, aboveground electrical vault (see figure 1-1).

As discussed above in section 3.3.1.2, *Geology and Soils*, *Environmental Effects*, Moriah Hydro also proposes to reseal all mine shafts and openings within the project boundary, and certain shafts associated with the New Bed Mine, due to subsidence resulting from the settling and degradation of materials used by Republic Steel Corporation to originally fill and seal mine access shafts and pits. The subsiding area around certain shafts, such as shafts of the Welch Mine, are vegetated with herbaceous woody vegetation, including small trees, and clearing may be necessary to reseal certain shafts, and to temporarily accommodate construction equipment and stockpile excavated fill.

Based on existing NWI wetland mapping and a site visit, Moriah Hydro identified four mixed forested, scrub-shrub, and emergent wetland parcels that are present within the project boundary. Additionally, a fifth scrub-shrub/emergent wetland parcel exists above the eastern shaft extension of the Harmony Mine, and three wetlands are located along tributary C-86-5, about 0.6 and 1.5 miles downstream from the Don B outfall. Additionally, open-water habitat exists within a staging area north of Joyce Road and within the 21 Pit.

To minimize the effects of land-disturbing activities, Moriah Hydro proposes to implement its February 24, 2015, Erosion and Sediment Control Plan, which includes measures to avoid or minimize soil erosion and erosion effects on tributaries during mine dewatering due to project construction, discussed above in section 3.3.1, *Geology and Soils*.

In its comments on the draft license application filed January 6, 2014, FWS states that project construction may disturb wetlands, and that an accurate delineation of wetlands within the project area is needed for planning and permitting purposes.

In its comments on the REA notice, Interior states that, although Moriah Hydro indicates that construction of the proposed project facilities and staging areas would require minimal surface disturbance, the proposed electrical tunnel would be constructed under a forested area by directional drilling, and that it's unclear whether tree removal would be necessary to construct the electrical tunnel.

Our Analysis

Proposed project facilities and staging areas would largely be established on unvegetated, disturbed upland habitat that previously supported active mining activities and is currently used for the town garage, a solid waste transfer station, and continued access to former mining properties. The proposed underground transmission tunnel is not expected to directly disturb forested habitat, as Moriah Hydro states in its September 2, 2015, additional information response that the electrical tunnel would terminate at a proposed 15-by-15 foot electrical vault to be constructed at the existing substation, in an area currently covered with crushed stone.

However, as noted in section 3.3.4, *Threatened and Endangered Species*, Moriah Hydro proposes to seal the West Drift via directional drilling. It is unclear whether Moriah Hydro would drill from the proposed staging area north of Joyce Road, which would be located about 2,000 feet east of the Harmony Mine end of West Drift, or if it would establish a closer drilling site outside of the project boundary. If the latter, the activity could involve: 1) construction of a temporary access road through undeveloped land, or use of an existing access road (e.g., from County Highway 6a/Silver Hill Road north of West Drift) to access the drilling site; and 2) clearing of an area, or use of an existing cleared area, for directional drilling and stockpiling an estimated 45 to 60 cubic yards of excavated material[83] from drilling activity. Additionally, Moriah Hydro proposes to reseal subsiding shafts that are presently surrounded by vegetation, including those associated with the Welch Mine.

[83] Estimated by staff, assuming that directional drilling would involve an 8 to 12 inch borehole drilled over 1,000 feet from the surface to West Drift.

Implementation of Moriah Hydro's Erosion and Sediment Control Plan, with procedures and BMPs to reduce erosion, contain sediment, and stabilize soils after construction would minimize sedimentation on adjacent terrestrial resources. Modifying Moriah Hydro's Erosion and Sediment Control Plan to include specific measures to address work associated with sealing the West Drift and resealing subsiding shafts and mine openings would further minimize effects on terrestrial habitat.

In terms of wetland impacts, construction of most project facilities would occur underground, in areas far below surface wetlands within the project boundary (e.g., project facilities in the vicinity of Wetland 3 would be located more than 3,000 feet below the surface wetland.) For those wetlands downstream of the Don B outfall along tributary C-86-5, it is estimated that mine dewatering discharges of about 5 cfs would exceed the existing continuous discharge of 0.7 cfs from the Don B outfall. However, as noted in section 3.3.2, *Aquatic Resources,* channel morphology of tributary C-86-5 and Mill Brook is unlikely to be affected by mine dewatering, as the 1- to 2-year recurrence flows far exceed the proposed 5-cfs discharge during mine dewatering. Similarly, it is unlikely that a 5-cfs flow would result in scouring or wetland loss to parcels downstream of the project. Therefore, it is unlikely that project construction or operation would affect wetlands within the project boundary, or those downstream of the Don B outfall along tributary C-86-5.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

According to FWS's IPaC system, two federally listed species are known to occur in Essex County: the endangered Indiana bat and the threatened northern long-eared bat.[84] As noted in Interior's April 5, 2018, letter, no critical habitat for any federally listed threatened and endangered species occurs within project-affected lands.

Indiana bat

FWS listed the Indiana bat as threatened on March 11, 1967.[85] Critical habitat for the Indiana bat was designated on September 24, 1976, and consisted of 11 caves and two mines in six states.[86] The original recovery plan for the species was published in 1983 and a revised draft version was released in 2007 (FWS, 2007).

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[84] See March 7, 2018, memorandum.

[85] 32 Fed. Reg. 4001 (March 11, 1967).

[86] 41 Fed. Reg. 41914 (September 24, 1976).

The Indiana bat occurs in the eastern United States, including New York State, hibernates colonially in caves and mines (hibernacula) through the winter. During hibernation, Indiana bats typically form tight clusters of more than 300 individuals per square foot, and require cool, humid caves with temperatures averaging 37 to 43°F (New York DEC, Undated [2]; FWS, 2018).

The non-hibernation season includes spring emergence and staging,[87] summer reproduction in maternity roosts, and fall swarming.[88]

Summer habitat requirements include: (1) dead or live trees and snags with peeling or exfoliating bark, split tree trunks or branches, or cavities that may be used as maternity roost areas; (2) live trees such as shagbark hickory and oaks that have exfoliating bark, or other hardwoods that are dead, or have dead branches with loose bark, which provide crawl spaces for the bats between the bark and the trunk or branches of the tree; and (3) stream corridors, riparian areas, and upland woodlots which provide forage sites (FWS, 2018).

Mating occurs in August or early September when Indiana bats swarm at the entrance of caves or mines (New York NHP, 2017d). Maternity colonies are formed by female bats that roost in groups of up to 100 or more individuals (FWS, 2018). Birth of a single young generally occurs in late June; pups then become able to fly 3 to 5 weeks after birth. Maternity roost trees can be considered as "primary" or "alternate" by the proportion of bats that consistently occupy the roost. Primary roosts serve as the bats main roosts for the summer; alternate roosts provide safe resting areas and protection from inclement weather, and in the event of damage to a primary roost. Indiana bats forage on a variety of flying insects, typically along forest edges and canopies.

Threats to Indiana bats include WNS-related mortality, human disturbance in hibernacula, environmental toxins such as herbicides and pesticides, and summer habitat loss and degradation (FWS, 2018).

As discussed above in section 3.3.1, *Geology and Soils*, the proposed project mines are presumed to be fully flooded and are not likely to support hibernating bats at

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[87] Spring staging is the time period between winter hibernation and migration to summer habitat. During this time, bats begin to gradually emerge from hibernation and exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume daily bouts of torpor (i.e., a state of mental or physical inactivity).

[88] Fall swarming occurs after summer and prior to winter hibernation. The purpose of swarming behavior may include: introduction of juveniles to potential hibernacula, copulation, and gathering at stop-over sites on migratory pathways between summer and winter regions.

the present time. A 2013 winter survey conducted by New York DEC identified 13,471 hibernating Indiana bats in the adjacent New Bed Mine, which is one of 10 known hibernacula in New York State, and one of two in Essex County (New York NHP, 2017d). New York DEC estimates that Indiana bat populations declined by 71 percent over the 2007 to 2015 period.

Northern long-eared bat

FWS listed the northern long-eared bat as threatened on May 4, 2015, (FWS, 2015) and determined on April 27, 2016, that designating critical habitat is not prudent (FWS, 2016a).

The northern long-eared bat is a medium-sized bat species (3 to 3.7 inches in length) with longer ears than other species in the *Myotis* genus (FWS, 2015). The species' range includes 37 states, including most of the central and eastern United States, as well as the southern and central provinces of Canada, coinciding with the greatest abundance of forested areas.

Northern long-eared bats hibernate in caves and mines through the winter, typically singly rather than in clusters. During hibernation, this species requires caves and mines with a constant air temperature, and prefers cooler areas with high humidity (New York NHP, 2017e; FWS, 2013).

Hibernacula and surrounding forest habitats play important roles in the bat's life cycle beyond the time when bats are overwintering, including for fall-swarming and spring-staging activities. Mating occurs during swarming in August and early September, and reproduction is limited to one pup per year in late spring. As such, bat populations can be slow to rebound from anthropogenic and naturally-occurring mortality events.

In summer, the northern long-eared bat is found in a variety of forested habitats for foraging and reproduction (New York NHP, 2017e). During this time, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. A variety of tree species are used for roosting, although trees that function as maternity colonies tend to be taller, larger diameter trees (New York NHP, 2017e).

On January 14, 2016, FWS issued a final 4(d) rule that prohibits the following activities in areas of the country impacted by WNS: incidental take within a hibernation site; tree removal within 0.25 mile of a known, occupied hibernaculum; and cutting or destroying known occupied maternity roost trees, or any other trees within 150 feet of that maternity roost tree, during the pup-rearing season (June 1 through July 31) (FWS, 2016b). On January 5, 2016, FWS developed an optional streamlined consultation framework that allows federal agencies to rely on a programmatic biological opinion on

FWS's final 4(d) rule to fulfill section 7(a)(2) consultation requirements for northern long-eared bat (FWS, 2016c).[89]

A 2013 winter survey conducted by New York DEC identified 12 hibernating northern long-eared bats in the New Bed Mine. New York DEC estimates that northern long-eared bat populations declined by about 99 percent over the 2006 to 2015 period (New York NHP, 2017e).

3.3.4.2 Environmental Effects

In SD2, Commission staff identified the effects of project construction, operation, and maintenance (including noise, vibration, air temperature, humidity, air flow, and water level) on two federally listed species (the endangered Indiana bat and the threatened northern long-eared bat) and their associated habitat within New Bed Mine.[90]

The Commission received comments on the effects of project construction, operation, or maintenance on bat species that hibernate within the New Bed Mine. Since the comments received were primarily regarding Moriah Hydro's proposed Bat Plan, staff analyzed the effects of project construction, operation, and maintenance that would be addressed by measures in the proposed Bat Plan.

Bat Plan

Several physical aspects of caves or mines determine their suitability for hibernating bats, including water level, air temperature, humidity, and suitable substrate (i.e., the surface upon which bats attach during hibernation). New Bed Mine is one of the

[89] FWS developed a key to help federal agencies determine if they can rely on the streamlined section 7 consultation in the 4(d) rule, or if their actions may cause prohibited incidental take that requires separate section 7 consultation (FWS, 2016d). FWS's key considers whether the federal action: (1) may affect the northern long-eared bat; (2) involves the purposeful take of northern long-eared bats; (3) is located inside the WNS zone; (4) will occur within a hibernaculum or alter the entrance/environment of a hibernaculum; (5) involves tree removal; (6) involves the removal of hazardous trees; and (7) includes (a) the removal of an occupied maternity roost tree or any trees within 150 feet of a known occupied roost tree from June 1 through July 31, or (b) the removal of any trees within 0.25 mile of a hibernaculum at any time of year.

[90] As noted in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, four non-federally listed bat species (eastern small-footed bat, tri-colored bat, little brown bat, and big brown bat) are also analyzed in this section, as it is likely that construction, operation, and maintenance effects would be similar for all six cave bat species.

largest bat hibernacula within the northeastern U.S. Bat species that hibernate in the New Bed Mine have a range of microclimate[91] preferences. Certain bat species prefer colder temperatures, lower humidity, and roost in seams or rock piles closer to mine entrances (i.e., eastern small-footed bat), while other species prefer higher temperatures, higher humidity, and tend to form dense clusters in areas with suitable conditions (i.e., the endangered Indiana bat).

Moriah Hydro proposes to dewater the project mines as part of the construction phase of the Mineville Project. Due to the likely connection between the Harmony and New Bed mines (West Drift), dewatering the project mines has the potential to decrease water levels within New Bed Mine, which could affect temperature, humidity, and other conditions within the New Bed Mine. This activity could affect hibernating bats directly, by modifying temperature and humidity within the mine, thus making areas of the mine less suitable for species that presently use it during hibernation, and indirectly, by creating conditions more favorable for the fungus that causes WNS (*Pseudogymnoascus destructans)*, which is a primary source of mortality for Indiana and northern long-eared bats, and other bats that hibernate within New Bed Mine.

Additionally, as project construction would involve blasting within the project mines, and project operation would involve the movement of large volumes of water between portions of Harmony and Old Bed mines (which would contain the upper and lower reservoirs), there is the potential for induced seismicity to occur within New Bed Mine.

Lastly, although the construction of project facilities would mostly occur underground, forested habitat used by non-hibernating bats may be affected by any tree clearing during aboveground activities, such as construction of temporary access roads to drill boreholes for sealing shafts, and clearing vegetation surrounding the subsiding mine openings that Moriah Hydro proposes to reseal. This has the potential to affect summer roosting habitat and maternity colonies.

Moriah Hydro proposes a Bat Plan to avoid or minimize the effects of project construction (including project mine dewatering), operation, and maintenance on the New Bed Mine bat hibernaculum and the six cave bat species that use the mine during the hibernation season and the surrounding forested habitat.

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[91] The term microclimate generally refers to localized climate conditions that differ from conditions in a larger area. These conditions may include temperature, humidity, and other parameters. For instance, individual hibernating bats may select an area within a mine or cave habitat with slightly warmer or colder microclimate conditions to lessen the physical effects of hibernation (Boyles et al., 2007).

By letter filed April 5, 2018, FWS states that Moriah Hydro needs to fully evaluate potential project impacts and provide a more complete project description, that FWS would work with Moriah Hydro to evaluate the project's effects on listed species, and that a revised biological assessment should be submitted to FWS for review. In addition, FWS states that details of the proposed Bat Plan are still being developed by Moriah Hydro, but that the plan should include measures to protect and monitor the bats during dewatering and other construction activities, and during project operations, including collecting baseline and post-construction data on environmental conditions within the hibernaculum. Further, FWS states that bat surveys may also be needed to determine any changes in the numbers of bats and use of the hibernaculum. Lastly, FWS encourages Moriah Hydro to continue to coordinate with FWS and New York DEC on the document.

The effects of each measure in Moriah Hydro's proposed Bat Plan are analyzed below, and presented in the sequence in which they would likely be implemented by Moriah Hydro.

Tree clearing in the vicinity of the New Bed Mine

Construction of project facilities, creation of temporary access to reseal the West Drift and all subsiding mine openings near the project, and the process of sealing mine openings with failing vegetated slopes is likely to involve some clearing of forested habitat within the project boundary. Forested areas in proximity to a bat hibernaculum may be used during the non-hibernation season by Indiana and northern long-eared bats and other hibernating bat species that use the New Bed Mine. Moriah Hydro proposes to limit tree clearing activity near the project, consistent with FWS and New York DEC guidance,[92] to minimize effects on Indiana and northern long-eared bat habitat, such as: (1) avoid any tree clearing inside a 0.25-mile buffer around the New Bed Mine bat hibernaculum, or obtain permission from FWS if tree clearing is necessary within this area; (2) between April 1 to October 31, avoid cutting: (a) all cavity trees and snags within 5 miles of the New Bed Mine, known and documented northern long-eared bat roost trees, and any trees within 150 feet of a documented summer northern long-eared bat occurrence; (3) suspend tree cutting if northern long-eared bats are observed flying from a tree or on a cut tree and notify New York DEC of the observation; (4) maintain at least 35 percent of forest habitat within Indiana bat maternity colony home range;

[92] Moriah Hydro's Bat Plan cites to the following guidelines: FWS' Final 4(d) Rule for the northern long-eared bat (https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf), May 2016 Indiana Bat Project Review Fact Sheet (https://www.fws.gov/northeast/nyfo/es/Ibat%20fact%20 sheet), and New York DEC's guidance for projects that do not result in a net change of land use within northern long-eared bat occupied habitat (https://www.dec.ny.gov/animals/106090.html).

(5) avoid potential Indiana bat roost trees by retaining standing live trees with exfoliating bark and greater than 12 inches in diameter at breast height, and any black locust and hickory species regardless of size and condition; (6) from April 1 to September 30, avoid clearing any potential Indiana bat roost trees 4 inches or greater in diameter; and (7) minimize lighting impacts and use of chemicals in any stormwater detention basins.

In its comments filed December 31, 2013, following its review of the draft license application, New York DEC states that impacts associated with the project could affect bats that are resident on the nearby summer landscape, outside of the hibernation season. It further states that adverse impacts could be avoided by implementing a time-of-year restriction on tree cutting, with seasonality incorporated into construction planning, and recommends that Moriah Hydro provide details on proposed tree clearing and a plan for seasonal protection of bat roosting sites.

In its comments filed January 6, 2014, following review of the draft license application, FWS recommends bat surveys to determine the proximity of roosting bats to the project. In its comments filed on January 3, 2017, following its review of SD1, FWS states that Moriah Hydro's proposed Bat Plan provides a list of generic measures associated with forest impacts from FWS' Indiana bat fact sheets, and that the plan needs to be tailored to the proposed action.

Our Analysis

Any tree clearing due to the construction of temporary access to borehole drilling sites, stockpiling excavated material, or clearing of vegetation around subsiding mine openings within the project area prior to resealing has the potential to effect summer roosting habitat and maternity colonies. Due to the project's location near an active hibernaculum, both the Indiana and northern long-eared bat are likely to use trees within the project boundary for roosting and establishing maternity colonies, as are the other cave bats present within the New Bed Mine.

Inclusion of measures to minimize impacts to forested habitat in the project boundary and the New Bed Mine, consistent with federal and state management guidelines and recovery plans for the Indiana bat and the northern long-eared bat, would help minimize effects to bat species with summer roosts and maternity colonies in the vicinity of the New Bed Mine. Modifying the Bat Plan to identify all project-related ground disturbance and tree clearing that would occur during each phase of construction would help clarify the specific areas and seasons in which tree clearing should be avoided, consistent with FWS and New York DEC guidance.

Monitoring in the New Bed Mine

Dewatering, construction, and operation of the project have the potential to affect hibernating bat species within the New Bed Mine. Moriah Hydro proposes to obtain

existing New York DEC water level, temperature, and humidity data for the New Bed Mine to develop a monitoring database for baseline purposes prior to construction, and install new monitoring equipment at multiple locations within the New Bed Mine during the first non-hibernation season after license issuance to monitor water level (two locations), temperature (four locations), humidity (two locations), seismic activity (one location), air flow and exchange (two locations), and bat presence (via acoustics and infrared video monitoring, two locations each) within the New Bed Mine prior to construction and for a minimum of 5 years after construction.

In its comments filed on January 3, 2017, following its review of SD1, New York DEC states that a significant concern is that the project may lead to an alteration of the microclimate within the New Bed Mine, which is the largest bat hibernaculum in the northeastern U.S. New York DEC states that changes in water level can lead to deviations in temperature and humidity, that even minor deviations in temperature and humidity can be detrimental, and that the presence of WNS can reduce the ability of some bat species to tolerate deviations in either parameter. New York DEC recommends a plan to establish fixed reference points within the New Bed Mine by surveying and benchmarking the existing water levels in the mine, placing permanent markers as reference points, and production of a map to reference the mine water levels to a surveyed, permanent benchmark outside of the mine. New York DEC recommends the following monitoring within the New Bed Mine, for at least 3 years prior to construction, as well as during and after construction for a period to be determined by New York DEC and FWS: (1) continuous monitoring of water levels by data loggers, monitored remotely whenever bats are present, for a minimum of 3 years prior to construction and both during and after construction and compared to benchmarks to determine seasonal or weather induced fluctuations; and 2) monitoring of temperature, humidity, and air flow and exchange, sufficiently detailed to characterize all areas in the mine used by bats. New York DEC states that monitoring data should be reported annually at least, and more often upon the request of itself or FWS.

In its comments following SD1 filed January 3, 2017, FWS states that a drop in water levels within New Bed Mine may cause external air to be pulled into the New Bed Mine, potentially altering temperature and humidity, and recommends a similar approach for monitoring as presented by New York DEC. FWS also recommends that Moriah Hydro investigate methods to measure noise and vibration within the New Bed Mine, and that measurements should provide baseline levels to determine if impacts occur within the New Bed Mine during construction and operation of the project.

Our Analysis

Since 1985, New York DEC has conducted annual bat surveys within the New Bed Mine to monitor numbers of hibernating Indiana bats, and two surveys (in 1993 and 2013) to assess numbers of all six hibernating bat species within the mine. During the

periods of 2001 to 2005 and 2008 to 2009, New York DEC collected data on temperature and humidity in certain areas of the New Bed Mine, although humidity measurements were found to be unreliable at elevated humidity levels.[93] In the fall of 2016, New York DEC installed a water level monitoring system to examine any fluctuations in water levels occurring within the mine during the year. In the Bat Plan, Moriah Hydro stated that, at a December 1, 2017, meeting, New York DEC discussed an upcoming effort to install over 75 data loggers to monitor temperature and humidity within the New Bed Mine.

Creation of a monitoring database that includes data collected by New York DEC prior to construction, including any new monitoring equipment installed since 2016, would provide valuable information on conditions within the New Bed Mine prior to construction, which can then be used to isolate the specific effects of the project on bats and any need for additional mitigation measures. Additionally, once Moriah Hydro has identified the number and location of devices for monitoring water level, temperature,[94] humidity, and air flow and exchange, through consultation with FWS and New York DEC, collecting data for a period prior to construction would provide further information on seasonal and weather-related fluctuations within the New Bed Mine in its current state.

In terms of the need for seismic monitoring in the New Bed Mine, Moriah Hydro's September 1, 2015, additional information response, included a literature review on the effects of noise and vibration on hibernating bats, drawn from analyses of blasting effects on the Indiana bat. This literature review: (1) was conducted for the Glen Park Hydroelectric Project No. 4796;[95] (2) referenced the findings of the Glen Park studies; and (3) included projects involving mining, quarrying, transportation projects, construction of a wind energy facility, and sound research on military installations with

[93] See April 24, 2017 e-mail and telephone correspondence memo summarizing correspondence between Andy Bernick (Commission staff) and Ms. Amanda Bailey (New York DEC) on March 15, 2017, and April 6 and 24, 2017.

[94] Moriah Hydro proposes four temperature monitoring locations in the license application and the Bat Plan. However, Moriah Hydro agreed to the installation of 40 temperature sensors during a January 10, 2018, meeting with New York DEC (filed with the Bat Plan).

[95] See Glen Park Hydroelectric Project Indiana Bat Monitoring Requirement Compliance Plan filed October 24, 1984 (https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14128951) and Glen Park Supplemental Report dated November 29, 1984, filed January 14, 1985 (https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14143331).

the potential to effect bats in cave or mine habitats. Moriah Hydro notes that: (1) standard mining practice using explosive blasting routinely limits the vibration at the closest monitoring point (for instance, a structure occupied by humans) to a PPV of 0.1 inch per second, which is three times below the threshold where a human can feel vibration; and (2) previous studies have concluded no impact on bats when vibration levels represent a PPV of below 0.2 inch per second. Moriah Hydro concludes that vibration within a bat hibernaculum located over 3,000 feet from the project construction zone, such as the Mineville Project, would be below measureable limits. In terms of noise effects, Moriah Hydro cites to a U.S. Army Corps of Engineers study that bat hearing is most sensitive in the peak frequency range of its echolocation calls (e.g., 50 kilohertz [kHz] with a range of 41–75 kHz for Indiana bat), although species such as big brown bat can detect sound far lower (3–12 kHz) than the typical echolocation range. However, Moriah Hydro did not specify the frequencies expected during blasting associated with construction of the Mineville Project.

Although vibration or induced seismicity resulting from project construction and operation is expected to be minimal, Moriah Hydro's proposed seismic monitoring device within the New Bed Mine would provide information on induced seismicity resulting from project construction and operation that may affect hibernating bats. Identifying the location and number of seismic monitoring devices and the need for monitoring sound pressure levels to determine noise impacts to bats, through consultation with FWS and New York DEC, would provide further information on potential effects to hibernating bat species.

Regarding Moriah Hydro's proposal for remote monitoring of bat activity, through infrared video and acoustic monitoring, New York DEC notes that bats are widely distributed in the New Bed Mine, and that, while installation of infrared video cameras would not cause harm, discrete video monitoring locations may not provide helpful information. However, given that project construction may alter temperature, humidity, and other conditions within the New Bed Mine that could allow for an expansion of WNS within the hibernaculum, the strategic placement of infrared video and acoustic monitoring equipment (particularly equipment that can be monitored in real time) is likely to provide useful information on bat behavior within the New Bed Mine hibernaculum during project construction and operation. Therefore, identifying the number and location of video and acoustic monitoring stations, through consultation with FWS and New York DEC, would provide additional data on bat activity within the New Bed Mine during project construction and operation.

Sealing West Drift

Moriah Hydro proposes to seal the West Drift that connects the Harmony and New Bed mines to avoid draining water within the New Bed Mine during dewatering of the project mines, which could result in impacts to hibernating bat species. Based on

information in original mine survey notebooks found in the Moriah Town Hall, Moriah Hydro estimates that the survey drift has a cross-sectional area of 50 square feet and can be intercepted within an accuracy of 3 feet. Moriah Hydro would use directional drilling to bore from a surface elevation of about +1,500 feet msl (+1,405 feet LMD) into the drift. Once intercepted, Moriah Hydro proposes to plug the drift along a length of 100 feet with non-segregating, high-strength, self-consolidating concrete.

In its comments on SD1, New York DEC recommends the use of microgravity, seismic, or electric resistivity surveying to determine the presence of hydraulic connections between the Harmony and New Bed mines, and suggests the method of electrical resistivity may be most useful due to its conceptual simplicity, low equipment cost, and ease of use. New York DEC also recommends that the locations and number of connections would need to be identified for a competent hydraulic isolation plan to be carried out.

In its filing of January 3, 2017, FWS recommends at least 3 years of pre-construction groundwater elevation monitoring in the New Bed Mine to record the seasonal variability and establish baseline conditions. FWS also recommends surveying the groundwater elevations in the Old Bed Mine and comparing them to the New Bed Mine groundwater elevations. In its comments filed on April 5, 2018, Interior recommends that Moriah Hydro develop a Bat Protection and Monitoring Plan, in consultation with FWS and New York DEC, because dewatering the project mines could adversely affect environmental conditions within the New Bed Mine bat hibernaculum.

Our Analysis

An open connection between the New Bed Mine and the Harmony Mine via the West Drift could only be assessed after first dewatering the Harmony Mine. Dye tests and water chemistry analyses proposed by FWS and New York DEC are not likely to be feasible approaches for assessing connectivity between the two mines through the drift due to access limitations, unknown groundwater hydrology patterns and travel times, and uncertainty about potential sources for biomarkers affecting the water in the Harmony Mine. Also, geophysical exploration mapping techniques (such as microgravity, seismic, or electric resistivity surveying) would likely be inconclusive for determining if the West Drift is open, because these tests would not have the amount of sensitivity or resolution to discern such a relatively small anomaly (7 foot by 7 foot shaft) at such a great depth (1,200 feet). The layered stratigraphy of soil over rock would also act to attenuate the geophysical signals.

Sealing the West Drift, as proposed by Moriah Hydro, could eliminate a potential pathway for groundwater exchange between the New Bed and Harmony mines, which could result in the alteration of water levels within the New Bed Mine and effect suitable

hibernation sites. It could also prevent movement of bats from the New Bed Mine into the Harmony Mine once it is dewatered to construct the project.

Moriah Hydro proposes to use a directional drill to intersect the drift before sealing it. However, use of directional drilling through at least 1,200 feet of Precambrian bedrock to the West Drift would be difficult to achieve. Moriah Hydro estimates the West Drift as having a cross-sectional area of 50 square feet; assuming the West Drift is 7 feet high, it would have a width of about 7 feet. Based on PTI (2014), conventional drilling practices achieve a borehole tolerance of 2 degrees. Considering that the proposed vertical borehole from the surface to the West Drift would be over 1,000 feet long, the drill bit could shift about 10 feet from its intended target. While directional drilling techniques are able to adjust the path of the drill bit, directing the drill bit within Precambrian bedrock that likely includes magnetite ore would be challenging. Aside from these drilling constraints, there could be additional inaccuracy in the historical mine survey data used to estimate the approximate location and size of the West Drift, so interception of the drift may require several trial borings. In terms of pumping grout or concrete over the distance of more than 1,000 feet to seal the West Drift, Moriah Hydro proposes high-strength, self-consolidating concrete. The concrete mix would need to be designed to form a water-tight seal in the drift while being placed in a flooded shaft.

Moriah Hydro's proposal to seal the West Drift could address a primary hydraulic connection between the project mines and the New Bed Mine bat hibernaculum, and minimize effects to hibernating bat species. However, developing a detailed protocol that addresses the challenges involved in physically sealing the shaft from a surface borehole, prior to dewatering and construction of the project and in consultation with FWS and New York DEC, would be necessary to ensure a successful seal.

Controlled Mine Discharge at Roe Shaft

In its March 3, 2017, filing, Moriah Hydro states that there is evidence of water flowing from a compromised seal at Roe Shaft, which accesses the New Bed Mine. Moriah Hydro postulates that groundwater and surface runoff would eventually fill New Bed Mine unless active management of hydraulic conditions within the New Bed Mine is established. Within 12 months of sealing the West Drift, Moriah Hydro proposes to seal Roe Shaft (see section 3.3.1, *Geology and Soils*) and establish a controlled mine discharge point to permit control of water outflow from, and maintain the water level within, the New Bed Mine.

Our Analysis

Moriah Hydro's Exhibit F-02 (Critical Energy/Electric Infrastructure Information or CEII),[96] filed on December 20, 2017, inferred that water level in the New Bed Mine is +1,165 feet msl (+1,070 feet LMD). This is also consistent with the estimate in Farrell (1992). However, for groundwater to be seeping from Roe Shaft, it would imply that the groundwater elevation in the New Bed Mine is similar to the surface elevation of Roe Shaft, which is reported in Exhibit F-02 at 1,312 feet msl (+1,217 feet LMD), about 147 feet higher than the water level within the New Bed Mine. Due to this discrepancy, it is unclear whether the purported seep from Roe Shaft represents outflow from the New Bed Mine, groundwater emanating from a nearby slope, flow from a natural spring, or another source of water. Moriah Hydro's proposal to seal Roe Shaft and construct a mine discharge point near the sealed shaft would not necessarily clarify the source of the purported seep; therefore, Moriah Hydro's proposed controlled mine discharge may not aid in regulating the water level within the New Bed Mine. However, establishing a groundwater elevation monitoring station at the site of the purported seep near Roe Shaft, prior to sealing West Drift and the dewatering of the project mines, would provide information on any change in the rate of flow from Roe Shaft during pre-construction activities and help determine whether construction of a mine discharge point at this location would effectively function as a means to regulate the water level within the New Bed Mine.

If the results of groundwater monitoring at Roe Shaft, in concert with water level monitoring within the New Bed Mine and locations designated within the groundwater monitoring plan (described above), indicate that water level fluctuations within the New Bed Mine are project-related, then methods to stabilize the water level within the New Bed Mine should be investigated, in consultation with FWS and New York DEC. These methods could include: (1) construction of a controlled mine discharge point at Roe Shaft to regulate the New Bed Mine outflow; (2) use of groundwater that is continually pumped out of the project mines during project operation (at an assumed rate of 0.7 cfs) to augment any loss of groundwater from the New Bed Mine (assuming water loss within the New Bed Mine is lower than 0.7 cfs.); and other methods.

[96] Critical Energy/Electric Infrastructure Information, or CEII, is specific engineering, vulnerability, or design information for a project, and may include details about the production, generation, transmission, or distribution of energy. Pursuant to section 215A(d) of the Federal Power Act, the Commission designates certain types of information as non-public CEII to protect energy facilities. See https://www.ferc.gov/legal/ceii-foia/ceii.asp.

Bat exclusion from the project mines

When dewatering of the project mines commences, there is a potential for bats to colonize the project mines. If hibernating or roosting bats were to occupy areas of the project mines where water levels fluctuate during project operation, there is a potential for direct mortality to bats. Therefore, Moriah Hydro proposes to exclude bats from colonizing the project mines during construction by securing all mine entrances with 0.25-inch mesh screen at all times. Moriah Hydro also states that it would secure any openings revealed by decreased water levels within the 21 Pit during the dewatering phase of construction by the same method, prior to the sealing of 21 Pit openings with rock mined during construction of the proposed powerhouse chamber and reservoir shafts.

In its comments on SD1, New York DEC requests that Moriah Hydro provide specific proposals on how it plans to seal any openings that are exposed when the project mine is dewatered, to ensure that bats do not enter the project mines.

During a January 10, 2018, meeting with the applicant (summarized in the March 9, 2018, Bat Plan), FWS asked how bat access to the project area would be prevented "at all times" and how it would be monitored, and for this detail to be included in a revised biological assessment.

Our Analysis

Moriah Hydro's proposal to use 0.25-inch mesh screen to secure all mine openings during project construction could exclude bats from entering the project mines. However, it is unclear whether this method of screening would be temporary or installed permanently to exclude bats from the project mines through the life of the project. Additionally, it is unclear how construction activities would occur at mine openings covered with mesh screen. Lastly, mesh screen could become weathered or damaged, and would likely need to be regularly inspected and maintained. Identifying the number and design of temporary and permanent bat exclusion devices to cover mine openings, through consultation with FWS and New York DEC, would minimize the potential for bat mortality due to entering active portions of the project facilities. Additionally, developing a protocol for inspection and maintenance of temporary and permanent bat exclusion devices would insure that bats would be unlikely to enter the project mines.

Bat surveys within the project area

Moriah Hydro's Bat Plan references winter bat surveys conducted within the New Bed Mine, and proposes to provide access to FWS and New York DEC to inspect and survey project mines after dewatering. However, there are numerous subsiding mine openings within the project area that could presently be suitable for roosting or hibernating bats. It is unclear whether New York DEC or FWS have conducted bat

surveys within subsiding mine openings on property currently owned by Solvay or other entities.

In its comments following its review of the draft license application, New York DEC states that many of the mines in the area surrounding the project site are occupied by bats, and only a bat survey performed during the hibernation season can adequately determine the impacts of the proposed project on hibernating bats. New York DEC states that bat surveys should be designed in consultation with itself and other participating agencies.

Our Analysis

Roosting or hibernating bats have the potential to use subsiding mine openings within the project area. Prior to placing mesh screens to exclude bats from entering the project mines during construction, described above, or implementing a mine shaft and pit resealing plan (see section 3.3.1.2, *Geology and Soils*, *Environmental Effects*), it is important to document the current level of bat use, either through direct survey (if the subsiding openings are safe for human access) or other methods. Designing a suitable bat survey of possible openings within the project area, in consultation with FWS, New York DEC, and relevant property owners, such as Solvay, would provide more comprehensive information on use of this habitat by roosting or hibernating bats.

Conclusion

Ultimately, implementing the proposed Bat Plan (in coordination with the New York DEC and FWS), with modifications, may minimize the potential to impact physical conditions within the New Bed Mine and on bat species that use the mine, including the endangered Indiana Bat and threatened northern long-eared bat. However, there is uncertainty regarding the number of potential inter-mine hydraulic connections involving the project mines, New Bed Mine, and other former mines in the project area. Due to the present flooded condition of the project mines, it is not possible to account for the specific potential effects that each stage of the project (dewatering, construction, and operation) may have on conditions within the New Bed Mine. Therefore, we conservatively conclude that licensing the construction of the proposed project under the staff alternative would be likely to adversely affect the endangered Indiana bat and threatened northern long-eared bat. In summary, these adverse effects include: (1) removal of suitable Indiana and northern long-eared bat summer roost and maternity colony habitat due to tree clearing associated with project construction and maintenance; (2) temporary to permanent displacement from suitable hibernation sites within the New Bed Mine due to fluctuation of water levels caused by project construction (e.g., sealing the West Drift and other inter-mine connections) and operation; (3) proliferation of *Pseudogymnoascus destructans* and an increase in WNS infection rates and bat mortality caused by project construction- or operation-related alterations in water levels,

temperature, humidity, or air flow and exchange; (4) reduced suitability of locations within the hibernaculum due to project construction- or operation-related vibration and noise; and (5) direct mortality of bats entering any unsealed entrances in the project mines during project construction and operation. Each of these adverse effects have the potential to effect most or all of the federally listed Indiana and northern long-eared bats presently using summer roost or maternity colony habitat near the project or hibernating within the New Bed Mine, which is the largest known overwintering population of Indiana bats in the northeastern U.S., and the largest known population of northern long-eared bats in New York.

3.3.4.3 Cumulative Effects

Based on our review of the license application and agency and public comments, we have identified two federally listed bat species (the endangered Indiana bat and threatened northern long-eared bat) and four non-federally listed bat species (the eastern small-footed, tri-colored, little brown, and big brown bat) (collectively, hibernating bat species) as resources that may be cumulatively affected by the proposed project in combination with other past, present, and foreseeable future activities.

As stated in section 3.3.4.3, *Threatened and Endangered Species*, *Cumulative Effects*, the geographic scope for cumulative effects on hibernating bat species includes New York State, as the New Bed Mine is one of the largest known hibernacula in the state. Construction and operation of the proposed Mineville Project would use the Harmony Mine as the upper project reservoir. As described above, the Harmony Mine is likely connected via the West Drift to the New Bed Mine, which supports six hibernating bat species, including the endangered Indiana bat and threatened northern long-eared bat. These species are experiencing modest to substantial declines due to WNS-related mortality and other factors, both in New York State and throughout their ranges. Due to the likely connection between the Harmony and New Bed mines, construction and operation of the project has the potential to result in the alteration of water levels, temperature, humidity, and other conditions within the New Bed Mine. Changes in water levels may result in inundation of mine areas currently used by hibernating bat species, or drive changes in microclimate conditions within the hibernaculum that may either affect the suitability of the mine for hibernating bat species, or create more favorable conditions for the fungus that causes WNS. The result to the bats would range from temporary to permanent displacement (e.g., from inundation of suitable hibernation sites within the New Bed Mine) to mortality (e.g., WNS-related death).

These actions may further contribute to the cumulative adverse effects of ongoing mortality to hibernating bat species due to the effects of WNS within New York State. Moriah Hydro proposes to implement its Bat Plan to: minimize impacts to adjacent forested habitat likely used by Indiana and northern long-eared bats and other hibernating bat species in the New Bed Mine; isolate the New Bed Mine from the proposed project

and other potential inter-mine connections; monitor conditions and bat numbers within the New Bed Mine to determine the effects (if any) of the proposed Mineville Project; and establish groundwater monitoring locations, including at Roe Shaft, to identify groundwater movement within the project area that may be attributable to the project. Implementing the Bat Plan would establish specific protective measures and management goals to avoid ongoing project effects to hibernating bat species within New Bed Mine. Although further consultation with FWS and New York DEC is necessary to ensure that the Bat Plan is sufficient to minimize project effects to the New Bed Mine bat hibernaculum, such a plan would minimize project-related cumulative effects to the six hibernating bat species in New York State.

3.3.5 Recreation, Land Use, and Aesthetics

3.3.5.1 Affected Environment

Recreation

Regional and Local Recreation

The proposed Mineville Project would be located within the eastern Adirondack Mountains of New York. The region offers a diverse range of year-round recreation opportunities, including boating, fishing, swimming, camping, hiking, road and mountain biking, hunting, wildlife viewing, downhill and cross-country skiing, ice skating, and snow-shoeing. The proposed project would be located within Adirondack Park and near Lake Champlain.

Created by the State of New York in 1982, Adirondack Park is the largest publicly protected area in the contiguous United States and is a patchwork of public and private land. Of the park's 6 million acres, which are governed by the APA, 2.6 million acres are owned by the State of New York, and protected as the Adirondack Forest Preserve in order to remain "forever wild," and the remaining 3.4 million acres are privately held and include settlements, farms, timber lands, businesses, homes, and camps. There are more than 1,800 miles of marked trails located within the park and it is considered an aesthetic resource of statewide significance. The Adirondack Forest Preserve, part of which is located 2 miles from the proposed project site, is listed as a National Historic Landmark.

Lake Champlain is a natural, freshwater lake that forms the border between New York and Vermont, and the border between the United States and the Canadian province of Quebec. The lake has a maximum depth of 400 feet and is about 435 square miles in area, 110 miles in length, and 12 miles in width at its widest point. Access to the lake provides recreational opportunities such as fishing, water skiing, and powered and non-powered boating. Lake Champlain is located 5.8 miles by road (3.4 miles by air) from the proposed project site.

In addition to the many recreational opportunities provided by Adirondack Park and Lake Champlain, several smaller state and local parks offer numerous recreational opportunities near the proposed project site. Recreational land use in Essex County is dominated by several facilities operated by the New York DEC. These sites include seven campgrounds, three wildlife management areas, six wilderness areas, five primitive areas, five wild forests, two state historic areas, a submerged heritage preserve, the Mount Van Hoven Sports Facility, and the Whiteface Mountain Ski Center.[97] In addition, New York DEC operates 17 boat launches in Essex County, six of which provide access to Lake Champlain.

Closest to the proposed project, New York DEC operates a campground at Crown Point on Lake Champlain (about 10 miles from the project), a campground at Lincoln Pond in Elizabethtown (about 5 miles from the project), and the Sharp Bridge campground in North Hudson (about 8 miles from the project). The Town of Moriah maintains two campgrounds and boat launches on Lake Champlain: Champ RV Park and Campground in Port Henry (about 4 miles from the project) and Bulwagga Bay Campground and RV Park (about 5 miles from the project). Just south of the proposed project site, the Town of Crown Point operates the Putts Creek Wildlife Management Area. Other recreation sites within the Town of Moriah include the 1.5-mile-long Cheney Mountain Trail (about 2 miles from the project), Roe Pond in Witherbee (0.78 mile north of the project), and Linney Field (less than 1 mile from the project). Roe Pond is stocked annually and is designated as a children's fishing site; however, seniors 65 and over can fish there Monday through Thursday. The 7.4-acre Linney Field is located in the Hamlet of Mineville and is used for baseball and football activities.

Finally, the North Country National Scenic Trail was authorized by federal legislation in 1980 and is being developed and managed through a federal-state-local-

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[97] New York DEC facilities include: Bald Ledge Primitive Area; Blue Mountain Wild Forest; Camp Santanoni State Historic Area; Champlain II: Submerged Heritage Preserve; Crown Point Campground; Dix Mountain Wilderness; Giant Mountain Wilderness; Gooseneck Pond Primitive Area; Hammond Pond Wild Forest; Hoffman Notch Wilderness; Hudson Gorge Primitive Area; Hurricane Mountain Primitive Area; Jay Mountain Wilderness; Johns Brook Primitive Area; John Brown Farm State Historic Site; Lincoln Pond Campground; Lake Harris Campground; McKenzie Mountain Wilderness; Meadowbrook Campground; Mount Van Hoevenberg Sport Facility; Paradox Lake Campground; Pharaoh Lake Wilderness; Poke-O-Moonshine Campground; Putnam Pond Campground; Putts Creek Wildlife Management Area; Saranac Lakes Wild Forest; Scaroon Manor Campground; Sentinel Range Wilderness; Sharp Bridge Campground; Split Rock Mountain Wild Forest; Taylor Pond Wild Forest; Vanderwhacker Mountain Wild Forest; Whiteface Mountain Ski Center; Wickham Marsh Wildlife Management Area; and Wilmington Notch Campground.

private partnership with the National Park Service. When completed, the trail will stretch across the northern tier of the United States from New York to North Dakota. The trail's projected length is about 4,600 miles and about half of the trail miles have been completed. Although not yet constructed, the proposed route for the New York portion of the trail would include about 140 miles of trail through the Adirondack Mountains to Crown Point, in Essex County. This preferred trail route would cross through the Hammond Pond Wild Forest in the towns of Crown Point, Elizabethtown, Moriah, North Hudson, Schroon, Ticonderoga, and Westport. This proposed route would be about 8 miles south of the southernmost boundary of the proposed Mineville Project.

Recreation at the Proposed Project Site

There are no recreation sites located within the proposed project boundary. The proposed project would be constructed within a decommissioned, subterranean mine complex and does not include a surface reservoir or any aboveground facilities other than the entry and service building. There is a small stream that originates 1.2 miles northwest of the project site, identified by New York DEC as tributary C-86-5 to Mill Brook, and Roe Pond is located on this tributary. This tributary flows through the project boundary and is supplemented by groundwater exiting the project mines at the Don B outfall.

Recreation Use

The 2014–2019 New York State Statewide Comprehensive Outdoor Recreation Plan (New York SCORP) reveals that walking, including jogging and day hiking, is the recreational activity enjoyed most by New York State residents. The next most popular recreational activity is relaxing in parks (including picnicking, playground use, and visiting nature areas), followed by swimming, and then biking. When asked what recreation facilities were needed within 30 minutes of home, 27 percent of respondents thought that more local parks for picnicking and playground use were most needed, and 21 percent replied that more facilities with trails for hiking, biking, and equine use were needed. As anticipated from the previous 2009–2014 New York SCORP, the levels of usage for walking, jogging, and day hiking increased. Findings discussed in the New York SCORP anticipate that biking as a transportation component also is likely to increase in the future due to the high price of gasoline and other environmental concerns.

The New York SCORP considers recreational need based on the supply and demand of recreational facilities for each county in the state. The "Relative Index of Needs" is calculated using both current and projected population figures, in addition to other input variables. Results are projected on a numerical scale with +1 indicating the lowest level and +10 indicating the highest level of need. The statewide average is +5. The rated activities include park use, swimming, bicycling, golfing, walking, tennis, court games, field games, and equine sports. Also rated are historic site visits, camping, hiking, boating, fishing, miscellaneous winter activities, cross-country skiing, downhill

skiing, and snowmobiling. For Essex County, all categories were given a rating of +2, +3, +4, or +5, indicating that the need for recreation facilities in the county is less than or equal to the average for all of residents of New York State.

Land Use and Aesthetics

Essex County, the Town of Moriah, and the Hamlet of Mineville are located completely within the boundaries of Adirondack Park. The APA, which was created in 1971 by the New York State Legislature, governs land use within the boundary of the park and develops long-range land use plans for both public and private lands. For private land, APA uses the following land use classifications:

- Hamlet: the growth and service centers of Adirondack Park where the APA encourages development. Permit requirements are limited in hamlet areas, and activities requiring an APA permit include construction of buildings or structures over 40 feet in height; projects involving more than 100 lots, sites, or units; projects involving wetlands, airports, and watershed management projects; and certain expansions of buildings and uses.

- Low Intensity Use: most uses are permitted and residential development at a lower intensity than hamlet or moderate intensity is appropriate.

- Moderate Intensity Use: most uses are permitted and relatively concentrated residential development is most appropriate.

- Rural Use: most uses are permitted and residential uses and reduced intensity development that preserves rural character is most suitable.

- Resource Management: most development activities in resource management areas will require an APA permit and compatible uses include residential uses, agriculture, and forestry. Special care is taken to protect the natural open space character of these lands.

The proposed Mineville Project would be located between the hamlets of Witherbee and Mineville, which are considered urban areas. The majority of the proposed project area is surrounded by northern hardwood forest. To the north of the project area, lands are classified for low intensity use. To the east and south, lands are classified for moderate intensity use. To the west, lands are classified for rural use and resource management.

Other planning entities with jurisdiction of the project area include the Lake Champlain-Lake George Regional Planning Board (Regional Planning Board), which is one of nine regional planning and development organizations operating in New York State and covers Clinton, Essex, Hamilton, Warren, and Washington counties. This

planning board was created in 1967 and its mission is to promote sustainable economic development that strengthens communities, provides quality jobs, and preserves the unique natural, historical, and cultural characteristics of the region. In addition, the Town of Moriah has a town board. The Town of Moriah does not presently have an adopted comprehensive plan, zoning plan, or site plan review process. The Village of Port Henry Board of Trustees is considering implementing zoning regulations, but does not currently have any zoning restrictions.

There are no areas within or near the proposed project boundary that are included in, or have been designated for study for inclusion in, the National Wild and Scenic Rivers System. There are no areas within the proposed project boundary that are under the provisions of the Wilderness Act or that have been designated as wilderness area, recommended for designation as wilderness area, or designated as wilderness study area. The state-designated Hammond Pond Wild Forest is partially located in the Town of Moriah, but more than 5 miles from the proposed project site. A unit management plan was prepared for the Hammond Pond Wild Forest in 1988.

The proposed project would use the existing and decommissioned Harmony and Old Bed mines for its upper and lower reservoirs. The powerhouse would be constructed underground, adjacent to the mines, and the project would connect to an existing single circuit 115-kV transmission line located about 1 horizontal mile northeast of the powerhouse. Moriah Hydro proposes to run the interconnection between the powerhouse and the transmission line underground from the powerhouse electrical chamber through a tunnel beneath grade. Other than the entry and service building, which would be constructed in a previously disturbed area, Moriah Hydro does not propose to construct any aboveground structures.

3.3.5.2 Environmental Effects

Recreation

The Town of Moriah has requested that the applicant rehabilitate and expand an existing recreational area within the Hamlet of Mineville known as Linney Field. Linney Field, located about 0.5 mile from the proposed project site, is currently used for baseball and football activities. In response, Moriah Hydro proposes to commit $200,000 to planning and implementing recreational improvements at Linney Field, including the

construction of a multi-use recreation complex.[98] Moriah Hydro also proposes, as part of the HPMP (discussed further in section 3.3.6, *Cultural Resources*, to develop "historic industrial and interpretive displays." It states that it might develop these displays in coordination with the Iron Center Museum, located in Port Henry.[99]

In its April 5, 2018, letter providing recommendations, terms, and conditions, Interior recommends that Moriah Hydro work with New York DEC to explore fishing access opportunities inside and outside the project area. Interior also states that it supports Moriah Hydro's proposal to rehabilitate and expand Linney Field with a multi-use recreation complex. Interior recommends that existing wildlife and habitat resources be taken into consideration when planning for these improvements, stating that facilities should be sited in disturbed or low value habitat areas. Interior also recommends that Moriah Hydro submit a recreation management plan to document the proposed recreational improvements.

Our Analysis

The urban/industrial landscape of the project area, and the subterranean nature of the proposed project, makes recreation at the project difficult. The proposed project would use an existing, decommissioned subterranean mine. Because most of the project is underground, there would be no publically accessible reservoir or shoreline, as is usually associated with most hydropower developments. In addition, there is little recreation currently occurring within the project boundary; however, there are numerous recreational opportunities within 5 miles of the proposed project.

The Town of Moriah's request and Moriah Hydro's proposal to provide funding to rehabilitate Linney Field and construct a multi-use recreation complex would benefit the surrounding area and provide an enhanced recreational experience for those using the existing baseball and football fields. Ensuring these improvements are done in consideration of existing wildlife and habitat resources and documenting all recreational improvements through a recreation management plan, as recommended by Interior, would further enhance not just the recreational opportunities near the project, but also the

[98] On page 28 of the license application, Moriah Hydro states that it would donate $50,000 to the Town of Moriah for further development of Linney Field. However, on page 78 of the license application, Moriah Hydro states that it would commit $200,000 to planning and implementing recreational improvements to Linney Field. In this draft EIS, staff used the higher number because the proposed recreational improvements include a multi-use recreation complex, which is likely to cost more than $50,000.

[99] The Iron Center Museum is operated by the Moriah Historical Society and is located next to the Moriah Town Hall. The museum features exhibits highlighting the mining and railroad history of the Town of Moriah and is open June through October.

aesthetic and terrestrial resources. However, Linney Field is located 0.5 mile from the proposed project, outside of the project boundary, and its baseball and football fields have no direct connection to the proposed hydropower project. The 2014–2019 New York SCORP indicates that the need for additional recreation in Essex County is below average for the state, and many desired recreational opportunities are currently available near the proposed project site.

Interior recommends that Moriah Hydro work with New York DEC to explore fishing access opportunities inside and outside the project area. However, tributary C-86-5 is not suitable for fishing within the project boundary as the tributary passes through the project mine area and is located at the base of a 50-foot-high tailings pile. Further, the point at which water exits the project mine does not have the size or depth suitable for fishing, and the majority of the proposed project is underground and inaccessible to the public. Little recreational activity currently occurs within the project boundary, so construction of the project would not disrupt existing recreation. Also, because the majority of the proposed project would be underground, it would not offer the same recreational opportunities as conventional hydropower projects. For these reasons, Interior's recommendation to explore fishing access within and outside the project area to potentially create a new fishing opportunities for the local community would have no relationship to the proposed project or project effects.

As part of the HPMP (discussed in section 3.3.6, *Cultural Resources*), Moriah Hydro proposes to develop "historic industrial and interpretive displays," possibly in coordination with the Iron Center Museum, located in Port Henry. The proposed pumped storage project would be located in an area rich in mining history and the project itself is a unique design. Developing interpretive displays that highlight the extensive mining history of the area and adaptive reuse of these mines into a pumped storage project would educate the public and provide both an historic and recreational benefit to the area.

A recreation management plan, as recommended by Interior, would provide a way for Moriah Hydro to plan for recreation opportunities at the project. It could describe the recreation to be provided, a schedule for developing recreation at the project, and a description of how recreation would be managed at the project. However, with the lack of recreation opportunities within the project boundary a recreation management plan would be unnecessary.

Land Use and Aesthetics

The project would require the construction of several underground facilities (including a powerhouse) and one aboveground structure (the entry and service

building).[100] Moriah Hydro proposes to construct the entry and service building in a previously disturbed area, adjacent to the Town of Moriah's existing town garage. Moriah Hydro proposes to construct the new entry and service building of metal, with dimensions about 150 feet by 60 feet (9,000 square-feet), and states it would replicate and continue the architectural theme established by the existing town garage, conforming to the current and previous industrial character of the area. Moriah Hydro proposes to landscape after construction in order to add visual appeal to the facility. The proposed landscaping would be done in accordance with Moriah Hydro's proposed Erosion and Sediment Control Plan. Moriah Hydro also proposes to donate the new service and entry building back to the Town of Moriah upon completion of project construction and states that the existing town garage would be demolished.

Construction of the proposed project also would disrupt water flow in tributary C-86-5. To develop the upper reservoir, Moriah Hydro would need to partially dewater the existing mine. Tributary C-86-5 emanates from the northwest and basically travels southeasterly toward the project site. The tributary currently receives ground water overflows as a result of the mines being fully flooded. According to Moriah Hydro, dewatering the upper portion of the mine would involve a short-term increase in ground water discharges into this tributary. Moriah Hydro anticipates that dewatering would occur slowly (i.e., at a low flow rate) over a 2-year duration. After the upper reservoir has been completely dewatered, the lower mine reservoir would be dewatered by pumping the water it contains into the upper reservoir. Upon completion of the project, Moriah Hydro anticipates that normal (historical) seepage from the surface and overburden would be returned to tributary C-86-5. Moriah Hydro states that the pumping rate would equal the normal ground water infiltration seepage rate (about 320 gallons per minute or 0.7 cfs).

Our Analysis

Because most of the project would be underground and there would be no new visible transmission lines, the viewshed would not be greatly altered. However, construction activities could temporarily disrupt existing aesthetics in the immediate vicinity of the project. In addition, the two staging areas set up during construction would result in short-term visual impacts. Nevertheless, most of the project works

[100] In section E8 of the license application, Moriah Hydro describes two different aboveground structures, an "entry building, about 110 by 60 feet" (page 81) and a "metal building, with dimensions of about 200 by 100 by 40 feet" (page 82). Although there is a lack of clarity throughout the application regarding the number of aboveground buildings to be constructed (as discussed in footnote 31 in section 2.2.1), for the purpose of this draft EIS, staff assumes Moriah Hydro is proposing to construct a single, 9,000-square-foot, aboveground entry and service building.

currently exist and are not visible from nearby urban areas, including Witherbee and Mineville, the closest communities. Further, no proposed project facilities would be visible from the Adirondack Forest Preserve, which is about 2 miles from the project.

No existing aboveground structures would be impacted by construction of the proposed project. The proposed area where project construction would occur has been previously disturbed by mining activity and construction of the town garage. Minor land disturbances would occur during project construction, but these would be limited to the previously disturbed staging areas and underground facilities. Most disturbances would be temporary, and Moriah Hydro's proposal to construct the new entry and service building in the style established by the existing town garage, and repair and re-vegetate effected areas at the conclusion of construction activities, would ultimately enhance the aesthetics of the project area.

After completion of project construction, Moriah Hydro proposes to donate the entry and service building to the Town of Moriah to replace the town garage. As a result, the existing town garage would be demolished. This proposal would benefit the town by providing it with a new facility in which to store equipment. However, because the building is the entry building to the proposed underground pumped storage project, it would most likely need to remain a project facility and Moriah Hydro would need to retain the rights to access the building whenever it was needed for project purposes. The town garage is not a project facility, so demolishing it would not affect the project.

The proposed disruption of water flow in tributary C-86-5 also would affect the visual resources in the area; however, it would be temporary. For about 2 years, the flow would be increased while the mine is being dewatered. After the mine has been dewatered, Moriah Hydro states that the rate of release would return to current levels. Because the increased flow rate is expected to be slow and occur over 2 years and then return to historical levels, the effect on visual resources would be minimal.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the NHPA requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register prior to an undertaking. In this case, the undertaking is the issuance of an original license for the proposed Mineville Project. Project-related effects could be associated with the construction, operation, and maintenance of the project.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. Traditional cultural properties are a type of historic property eligible for the National Register because of their association with cultural practices or beliefs of a living community that are:

(1) rooted in that community's history or (2) important in maintaining the continuing cultural identity of the community. In this draft EIS, we also use the term cultural resources to include properties that have not been evaluated for eligibility for listing in the National Register. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register.

Section 106 also requires that the Commission seek concurrence with the New York SHPO, as appropriate, on any finding involving effects or no effects on historic properties, and allow the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, section 106 requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

Areas of Potential Effects

Pursuant to section 106 of the NHPA, the Commission must take into account whether any historic property could be affected by the issuance of a license within a project's area of potential effects. For the proposed Mineville Project, the APE includes the lands enclosed by the project's boundary.

Cultural History Overview[101]

The earliest evidence of human occupation in New York dates to the Paleoindian Period (ca. 12,000–9,000 Before Present [BP]), when the continental glaciers retreated at the end of the last ice age. The retreat of the Laurentide Ice Sheet, an ice mass that once covered the project area, allowed people from the south, and perhaps west, to begin moving into the area. These first people arrived with a distinctive stone technology and way of life that included a highly mobile settlement pattern, and a subsistence pattern adapted to hunting large mammals and exploiting local small animal populations.

A warming and more arid climate following glacial retreat led to increased ecological diversity during the Archaic Period (ca. 9,000–3,000 BP). The Archaic Period was characterized by the establishment of settlement patterns that focused on seasonal resource availability; during the warmer months, populations gathered in larger river valleys and along the shorelines of lakes, and during colder months, family groups would disperse into the uplands and smaller valleys.

[101] Unless otherwise indicated, information from this section was taken from the Reconnaissance Level Survey of Historic Resources in the Town of Moriah (Smith et al., 1989).

Following the Archaic Period, the Woodland Period (ca. 2,700 years B.P.–European contact) saw the development of horticulture and other intensive forms of subsistence technologies and provided the basis for semi-sedentary and sedentary village life that was characterized by widespread and significant changes in cultural patterns across the eastern United States (Ritchie, 1980).

The heavily forested Adirondack region, with its rich water and wildlife resources, offered a dependable hunting ground for two main groups of Indians—the Iroquois of central and northern New York, and the Algonquin of Canada. The region itself also acted like a physical boundary between these hostile tribes, both of whom claimed ownership of the land. But, because of the on-going hostilities, severe winters, and the presence of more easily cultivated lands on all sides of the Adirondack region, it appears that there was little or no permanent Indian settlement in the Adirondacks, including its eastern perimeter along Lake Champlain. In the region that is now present-day Moriah, Indians clearly frequented the area for hunting and fishing, but no permanent settlement has been discovered. These Indians were the first to discover the iron-bearing rock of the region and made some rudimentary use of it, later pointing it out to European and American explorers who were moving into the Champlain Valley.

European contact began in the early 1600s and, like the Indians, European settlers utilized the areas natural resources but no permanent settlements were established. It was not until 1784, after the Revolutionary War, that the first permanent settlement of Moriah occurred. The early settlers were drawn to the area because of the scenery, good soil, access to water, and extensive timber resources. The first permanent settler to Mineville arrived in 1810. The first settler associated with mining arrived in Moriah in 1805, but iron ore did not play a role in commerce until after 1820. The first blast furnace was constructed in 1824 and this was the beginning of serious iron mining and processing in the region. Lumber and agriculture continued to be the main economic drivers, but beginning in 1839, industrial development in iron mining and processing soon took over to become the economic foundation of the region. By 1869, Mineville had become an extensive industrial, commercial, and residential center because of iron ore mining. These ores were used throughout New England, as well as in the Mid-Atlantic and into the South and West. In 1869, except for mines located in Sweden, those of Moriah represented the largest bodies of magnetite ore in the world.

From 1870 through 1939, Moriah continued to grow and prosper because of the iron ore industry. The mining industry and furnaces, which represented some of the largest and most advanced in the country, provided the economic basis from which the town's commercial and residential development flourished. The Old Bed Mine, which was where some of the first iron ore was extracted in the early 1800s, was still being mined when the New Harmony Mine opened in 1904. By the mid- to late- 19th century, most of the development in Mineville was the result of the growing mining industry. The need for company housing led to the development of cement blocks made from iron

tailings and, between 1906 and 1910, 51 cement block houses were constructed. This was the last wave of significant residential development in the hamlets of Mineville and Witherbee.

Beginning in 1938, Republican Steel took control of mining operations in the area. The mines continued to be productive through the 1950s, but by the 1960s, mining operations began to falter. In 1971, Republican Steel decommissioned the mines and began to withdraw from the area.

Cultural Resources Investigations

Moriah Hydro searched the National Register in January 2015 and identified four listed sites located in the Town of Moriah. These are:

- The Van Ornam & Murdock Block (also known as Lee House Block), located in Port Henry, was added to the National Register in 1982.

- Witherbee Memorial Hall, located in the Hamlet of Mineville on Broad Street, east of the junction with Office Road, was listed in the National Register in 1991.

- The Central Powerhouse Building (also known as the Town of Moriah Water Department Building) located at the junction of Tracy Road and New Bed Road in the Hamlet of Witherbee, was added to the National Register in 1995.

- Five buildings in Port Henry were also added to the National Register in 1995: (1) the Delaware and Hudson Railroad Depot, (2) the Sherman Free Library, (3) the Moriah Town Office Building (also known as Witherbee Sherman & Company Office Building), (4) the Mount Moriah Presbyterian Church, and (5) the Port Henry Fire Department Building.

In 1989, a *Reconnaissance Level Survey of Historic Resources in the Town of Moriah* was prepared for the Town of Moriah with the assistance of the Preservation League of New York. The survey was commissioned as the first step in identifying historic resources in Moriah. The methodology used was consistent with the New York SHPO's guidelines and standards for a reconnaissance level survey. The survey was intended to locate, identify, and describe concentrations of historic resources, identifying significant individual properties and representative examples of typical property types and styles of architecture. The survey includes an overview of Mineville, stating "virtually all of the buildings and structures once associated with the actual mining and processing operations – mills, engine houses, shafts, conveyors, railroad tracks, and sidings – have been demolished and removed. The lack of these buildings and structures is particularly evident on the vast and now vacant main industrial site, located in a small

valley which divides Mineville from Witherbee" (Smith et al, 1989). This is the proposed location of the Mineville Project.

3.3.6.2 Environmental Effects

In order to protect cultural resources at the project and highlight the historic mining character of the project area, Moriah Hydro developed an HPMP that includes the following preservation-related measure: provide interpretive historic signage within 2 years of license issuance. In addition, Moriah Hydro highlights the following safety and aesthetic-related proposals that it states also would benefit historic resources: (1) place all power lines underground, (2) install security cameras, (3) install outdoor lighting, and (4) repair and replace-in-kind any areas disturbed by construction of the underground power lines. In addition to the proposed actions, the HPMP includes an overview and executive summary; a project description; a description of the intent of the HPMP; a summary of the identification of historic properties; a description of project-related effects, historic property management measures; a section on responsibility, reporting, and review; and a literature reviewed section.

In a letter dated June 26, 2006, the New York SHPO confirmed that there are no existing aboveground structures to be impacted by the proposed project. In that letter, the New York SHPO stated that the area has been previously disturbed by mining related activities and all mine support buildings were previously demolished and removed. In a follow-up letter dated July 23, 2015 (and filed by the applicant on September 1, 2015), the New York SHPO states that a Phase 1A archaeological survey of the project's APE is not needed and, based upon its review, the proposed project would have no effect on historic resources, with the condition that the proposed HPMP be implemented.

Our Analysis

According to a search of the New York SHPO's Cultural Resources Information System,[102] within the project's APE, there are two archeologically sensitive areas, one National Register-eligible historic district (Wasson & West Streets Historic District), and one National Register-listed building (Witherbee Memorial Hall). Although most of the project construction would be underground and Moriah Hydro only proposes to construct one aboveground structure, project construction and operation could still disturb the archeologically sensitive areas and the eligible and listed properties. As discussed in section 3.3.1, *Geology and Soils*, project construction and operation could potentially induce seismicity and exacerbate ground subsidence. While those effects are expected to be minimal, if they occur, historic properties could be shifted and potentially damaged. To protect cultural resources, Moriah Hydro developed an HPMP that includes goals for operating the project and guiding historic preservation within the APE. It also identifies

[102] https://cris.parks.ny.gov/. Accessed November 27, 2018.

historic resources that require special consideration and states that consultation with the New York SHPO would continue throughout implementation of the HPMP.

While the HPMP includes many of the necessary components, and the proposed safety and aesthetic actions contained within the HPMP would provide additional protections to cultural resources, the HPMP would benefit from some revisions. As discussed below, background information, including the project description, the history of the project area, and historic properties located within the APE, is not complete and there are several measures, including those related to inadvertent discoveries and the public interpretation program, which would benefit from clarification and/or more detail.

For example, in section 2, *Project Description*, the HPMP references both a 110- by 60-foot entry building and a 12,000-square-foot service building. As discussed throughout this draft EIS, Moriah Hydro describes the entry and service building in various ways and the license application provides conflicting information about its size and whether it is a single building or multiple buildings. Further, as discussed above in section 3.3.1, *Geology and Soils*, the applicant is proposing to conduct additional geotechnical investigations. The results of these investigations could change the final project design. Providing an updated project description in the HPMP, once the project is approved and final details have been worked out, would provide a more complete picture of the project's components. Further, while section 4.2.2 of the HPMP includes a *Prehistoric Overview* of the project area, the HPMP does not include any background information on the more recent history of the area, including the extensive mining history. Adding a section in the HPMP that provides an overview of both the prehistoric and historic background of the area would provide some historical context of the project area.

The HPMP also does not list any of the known historic properties in the APE. According to the New York SHPO's Cultural Resources Information System, there is one National Register-eligible historic district and one National Register-listed building located within the project's APE. Including a description of these properties and their significance and public values would enhance understanding of the historic resources in the area.

The HPMP also does not describe any cultural resources training for Moriah Hydro employees and contractors. Providing training to staff about the history of an area and how to protect cultural resources would facilitate protecting cultural resources at a project and educate non-cultural resource staff about the proper procedures to follow when archaeological and historic resources are encountered. Including a provision for cultural resource training in the HPMP would allow it to be incorporated in project implementation planning and ensure that all staff who work on the Mineville Project would have a consistent understanding of the cultural history of the area and how to implement the HPMP.

Under section 6.2 of the HPMP, *Inadvertent Discoveries*, Moriah Hydro states that in the event an undocumented archaeological resource is discovered within the project area, an accredited archaeologist would evaluate the discovery. However, Moriah Hydro does not elaborate on the details of how such an evaluation would be conducted. Updating this section to state that, in the event an undocumented archaeological resource is discovered, work in the area of the discovery would be stopped immediately until the artifact or area is evaluated would more fully protect any inadvertent discoveries. Adding a provision stating that if the discovery is related to the area's tribal history, the appropriate tribe would be contacted and consulted would also provide more complete evaluation and protection of the resource.

Under section 6.5 of the HPMP, *Measures to Address Ongoing Effects*, the applicant states that there are no structures located within the project area that are eligible for listing on the National Register. However, based on staff's review of the New York SHPO's Cultural Resources Information System, this appears to be incorrect. Staff has identified the following structures that are eligible for listing on the National Register: (1) the National Register-eligible Wasson & West Streets Historic District, and (2) the National Register-listed Witherbee Memorial Hall. Updating this section to list these properties, which are located within the APE, would provide a more complete picture of the historic resources that are located near the proposed project.

Finally, as part of the HPMP, Moriah Hydro proposes to implement a public interpretation program that has the goal of increasing public awareness and appreciation for cultural resources and the mining history of the site and surrounding region. To accomplish this, Moriah Hydro proposes to place interpretive signs outside of the project area entrance within 2 years of license issuance. In the license application, Moriah Hydro states that these interpretive historic signs might be developed in coordination with the Iron Center Museum, which is operated by the Moriah Historical Society. Providing interpretive signs would help educate the public about the area's extensive mining history and the innovative reuse of two of the area's decommissioned mines by turning them into a pumped storage project. However, the HPMP does not provide enough detail about how these signs would be developed and exactly where they would be placed. Updating the HPMP to include more details about the signs, including a detailed development schedule, who would be consulted during development, and the specific location of their placement, would ensure that the signs are as effective and educational as possible.

Updating the HPMP with the above revisions would ensure that it includes a complete and accurate description of the project, a comprehensive overview of the history of the area, and adequate measures to protect historic resources. Moriah Hydro also could review the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Projects* (Advisory Council and FERC, 2002). This document was developed to assist licensees and applicants in developing

comprehensive HPMPs and would provide answers to any questions about the necessary components of an HPMP.

3.3.7 Socioeconomic Resources

3.3.7.1 Affected Environment

The proposed Mineville Project is located in the Town of Moriah, Essex County, New York. Founded in 1799, Essex County lies on the western shore of Lake Champlain and comprises about 1,779 square miles of land in the Adirondack Mountains.

Population and Housing

In 2016, Essex County's population was estimated to be 38,598 (U.S Census Bureau, 2016), with the Town of Moriah comprising 4,753 individuals (table 3-7). Both areas have experienced little change in population size. Of the 2,305 housing units[103] within the town, 23.9 percent (550 units) are vacant, representing a 7.1-percent increase since 2010. The 2016 vacancy rate is higher than that of the State of New York (11.3 percent) and the United States (12.2 percent), but markedly lower than Essex County (40.6 percent). However, the U.S. Census Bureau (2010) estimates that 53 percent of vacant units in the Town of Moriah and 81.9 percent in Essex County were used as recreational, seasonal, or occasional use residences.

Employment and Income

Essex County's unemployment rate in 2016 was 7.5 percent (table 3-8) (U.S. Census Bureau, 2016). In the Town of Moriah, unemployment has increased from 5.0 percent in 2010 to an estimated 9.1 percent in 2016. Nearly 48 percent of the town's residents are high school graduates and 13 percent have completed a bachelor's degree or

Table 3-7. Population and total housing unit values in the Town of Moriah and Essex County, New York. (Sources: license application and U.S. Census Bureau, 2016).

Year	Population		Total Housing Units		Percent Vacant Housing Units	
	Town of Moriah	Essex County	Town of Moriah	Essex County	Town of Moriah	Essex County
2016	4,753	38,598	2,305	25,756	23.9	40.6
2010	4,798	39,370	2,373	25,312	16.8	36.5
2000	4,879	38,851	2,253	23,115	15.9	35.0

[103] Housing units are defined as a house, apartment, or mobile home or trailer; a group of rooms; or a single room occupied as separate living quarters.

Table 3-8. Unemployment and median household income values in the Town of Moriah and Essex County, New York. (Sources: license application and U.S. Census Bureau, 2016).

Year	Individuals Unemployed[a]		Median Household Income[b]	
	Town of Moriah	Essex County	Town of Moriah	Essex County
2016	9.1	7.5	$53,969	$53,244
2010	5.0	7.2	$40,169	$45,216
2000	12.0	6.8	$31,903	$34,823

[a] Expressed as the percent of the civilian labor force for all individuals age 16 years and over.

[b] Median household income values.

higher. About 28 percent of employment supports educational services or the health care and social assistance industries, followed by manufacturing, which accounts for 17 percent of the area's jobs.

Median annual household income in the Town of Moriah is $53,969, compared with $53,244 for Essex County and $60,741 for the State of New York (table 3-8) (U.S. Census Bureau, 2016). Based on these data, about 8.3 percent of the town's residents and 6.4 percent of the county's residents live below the poverty level.

3.3.7.2 Environmental Effects

Effects of Project Construction and Operation on Socioeconomics

Construction of the Mineville Project would employ an average of 100 workers over a 30-month period, with the weekly payroll averaging about $200,000. Project operation would produce an average payroll of about $10,000 per month.[104]

Moriah Hydro does not propose any mitigation measures related to socioeconomic parameters such as employment, income, or local government services.

Our Analysis

Project construction and operation would have a beneficial effect on local employment and income. Moriah Hydro expects that most of the general labor required during construction would be available from the labor pool within the town and county. Some skilled trades (e.g., geotechnical engineers and heavy equipment operators) and

[104] The project application does not include the number of employees required for project operation. However, during scoping Moriah Hydro estimated the number of long-term maintenance and operation positions to be 15.

management and support personnel would be provided from regional sources. Any workers requiring short-term housing would find lodging in the available houses, rental units, or hotel/motel rooms that are locally abundant.

The socioeconomic effect of the project during the operation phase would be less than during the construction phase. The small labor force would not create any effects on housing, schools, and other public services within the project area. However, ongoing expenditures for project supplies, materials, and services would generate direct and indirect benefits within the region.

Because there would be little to no effect on municipal services and infrastructure, the effect on local municipal costs during construction is expected to be insignificant; further, as described below, it would be offset by anticipated tax revenues.

The project would contribute to the revenues of county and local governments primarily through the payment of property taxes and sales and use taxes. With respect to property taxes during construction, the assessed valuation of the project and the associated property tax payments would rise on an annual basis, in proportion to the construction completed. Moriah Hydro states that the total cost to complete the project would increase the town's taxable assessment by an estimated $260,000,000.

There would be no displacement of residences or business establishments due to construction and operation of the project.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Mineville Project would not be constructed. Environmental resources in the project area would not be affected and electrical generation from the project would not occur.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we discuss what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corporation*,[105] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corporation*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower projects' power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the Draft EIS for the protection, mitigation and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECTS

Table 4-1 summarizes the assumptions and economic information we use in our analysis. Moriah Hydro provided this information, except as noted, in its license application and subsequent submittals. We find that the values provided by Moriah Hydro are reasonable for the purposes of our analysis. Cost items common to all alternatives, except the no-action alternative, would include: taxes and insurance costs, net investment (the total investment in power plant facilities remaining to be depreciated), estimated future capital investment required to maintain and extend the life of plant equipment and facilities, normal operation and maintenance costs, and licensing costs.

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[105] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

The ability of pumped storage facilities to be switched from pumping to generating and back again very quickly, as needed, provides unique benefits to the electrical grid. The Mineville Project can provide a number of ancillary services to the grid and therefore generate additional revenues in the electric market. Among these services are spinning reserve, non-spinning reserve, frequency regulation, voltage support and regulation, load following capability, peak shaving, and black-start capability. We used a value of $59 per kilowatt per year for ancillary services. This represents the revenues that Moriah Hydro estimated it would receive for providing ancillary services to the grid based on the values of various services. At the above rate, ancillary services

Table 4-1. Parameters for the economic analysis of the Mineville Project (Sources: Moriah Hydro and staff).

Economic Parameter		**Value** [a]
Period of economic analysis (years)		30
Term of financing (years)		20
Federal income tax rate (percent)[b]		21.00
Local tax rate (percent)[b]		3.00
Insurance rate		Included in the operation and maintenance cost
Pumping ratio (MWh pumping/MWh generating)		1.32
Energy rate ($/MWh)	On-peak	79.68
	Off-peak	39.57
Capacity rate ($/kilowatt-year)		179.24
Ancillary services value ($/kilowatt-year)[c]		59
Interest rate (percent)		6.00
Discount rate (percent)[d]		6.00
Initial construction cost		$264,182,000 (2015)
Operation and maintenance ($/year)		$1,000,000 (2015)
Cost to prepare license application[e]		$750,000 (2015)

[a] Values provided by the applicant in the license application, unless otherwise noted.
[b] Assumed by staff.
[c] Calculated by staff based on the ancillary service values (New York ISO, 2018).
[d] Assumed by staff to be same as interest rate.
[e] Excludes protection and mitigation measures.

revenues could contribute toward offsetting pumping and other costs of the project during each year of the 30-year period.

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 summarizes the installed capacity, annual generation, annual pumping, dependable capacity, cost of alternative power, estimated total project cost, and the difference between the cost of alternative power and total project cost for each of the alternatives considered in this Draft EIS: Moriah Hydro's proposal and the staff alternative.

Table 4-2. Summary of the annual cost of alternative power and annual project cost for alternatives for the Mineville Project (Source: Staff).

	Moriah Hydro's Proposal	Staff Alternative
Installed capacity (MW)	240	240
Annual generation (MWh)	421,000	421,000
Annual pumping (MWh)	554,000	554,000
Dependable capacity (MW)[a]	200	200
Annual cost of alternative power ($)[b] ($/MWh)	69,393,430 164.83	69,393,430 164.83
Annual project cost ($) ($/MWh)	57,327,570 136.17	57,357,040 136.24
Difference between cost of alternative power and project cost ($) ($/MWh)	12,065,860 28.66	12,036,390 28.59

[a] Value provided by the applicant.
[b] Calculated based on the "On Peak" value of power provided by the applicant.

4.2.1 No-action Alternative

Under the no-action alternative, the project would not be constructed and would not produce any electricity. The only cost associated with this alternative would be the cost to prepare the license application.

4.2.2 Applicant's Proposal

Moriah Hydro proposes numerous environmental measures, as presented in table 4-3. Under Moriah Hydro's proposal, the project would have a total capacity of

240 MW, a dependable capacity of 200 MW, an average annual generation of 421,000 MWh, and pumping energy requirements of 554,000 MWh. The average annual cost of alternative power would be $69,393,430, or $164.83/MWh. In total, the average annual project cost would be $57,327,570, or $136.17/MWh. Overall, the project would produce power at a cost that is $12,065,860, or $28.66/MWh, less than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative includes the same development proposal as Moriah Hydro and, therefore, would have the same capacity and energy attributes. Table 4-3 shows the staff recommended deletions and modifications to Moriah Hydro's proposed environmental protection and enhancement measures, and the estimated cost of each.

Based on a total capacity of 240 MW, a dependable capacity of 200 MW, an average annual generation of 421,000 MWh, and pumping energy requirements of 554,000 MWh, the average annual cost of alternative power would be $69,393,430, or $164.83/MWh. In total, the average annual project cost would be $57,357,040, or $136.24/MWh. Overall, the project would produce power at a cost that is $12,036,390, or $28.59/MWh, less than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 gives the cost of each of the environmental enhancement measures considered in our analysis. All dollars in table 4-11 are year 2018. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4-3. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of operating and maintaining the Mineville Energy Storage Project (Source: Moriah Hydro and staff).

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
Geology and Soil Resources				
1. Conduct geotechnical investigations.	Moriah Hydro	$209,584[c]	$0	$10,917
2. Develop a geotechnical investigation plan to include data collection on seismic risk, induced seismicity, and subsidence from project construction and operation over three stages prior to construction, and within the two project reservoirs (Harmony and Old Bed mines) after each dewatering stage.	Staff	$419,168[h]	$0	$21,834
3. Develop a groundwater monitoring plan to investigate and analyze groundwater between the project mines, the New Bed Mine, and 21 Pit.	Staff	$47,156	$26,198[d]	$8,549
4. Seismic monitoring from 2 months prior to construction to 12 months after completion of project construction.	Moriah Hydro	$104,792[c]	$0	$5,458
5. Develop a seismic monitoring plan to include siting and monitoring seismographs throughout the project area and reporting during construction and the first 10 years of operation.	Staff	$209,584	$20,958	$26,845

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
6. Reseal historical water-bearing seams and bedrock discontinuities to reduce groundwater intrusion into the project mines after dewatering.	Moriah Hydro, Staff	$104,792[c]	$0	$5,458
7. Develop a project mine sealing plan to: (1) reseal seams and discontinuities within the project mines after dewatering, including the previously sealed West Drift; and (2) periodically inspect and grout any leaks in the bedrock of the project mines during project operation, particularly in the upper reservoir closest to the New Bed Mine.	Staff	$20,958	$2,096	$2,685
8. Reseal all mine shafts and openings within the project boundary (except the 21 Pit), and Roe Shaft associated with the New Bed Mine.	Moriah Hydro	$209,584[c]	$0	$10,917
9. Develop a mine shaft and pit resealing plan to reseal Moriah Hydro's proposed mine shafts and pits, with the addition of shafts associated with the Welch mines.	Staff	$1,257,504	$0	$65,501
10. Extend the municipal water distribution system along Witherbee Road, Chipmunk Street, and Lower Silver Hill Road.	Moriah Hydro	$1,152,712	$0	$60,042
11. Implement the Erosion and Sediment Control Plan filed February 24, 2015.	Moriah Hydro	$167,667[e]	$10,479[f]	$16,697
12. Modify the Erosion and Sediment Control Plan to address all areas where ground-disturbing activity	Staff	$187,667	$10,479	$17,739

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
associated with sealing mine openings and construction of project facilities.				
Aquatic Resources				
13. Develop a Stream Monitoring Plan in consultation with FWS and New York DEC.	Interior	$0 [g]	$0	$0
14. Conduct water quality monitoring at the Don B outfall and tributary C-86-5 during construction and over the life of the project.	Moriah Hydro	$78,594	$26,198	$24,004
15. Develop a water quality monitoring plan in consultation with FWS and New York DEC.	Staff	$15,719	$0	$819
16. Construct a step tray aeration and detention facility near the Don B outfall to treat groundwater overflow during project construction and operation.	Moriah Hydro Staff	$52,396	$10,479	$10,693

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
Terrestrial Resources and Threatened and Endangered Species				
17. Implement Moriah Hydro's March 9, 2018, Bat Plan, for the purpose of limiting project effects on bats.	Moriah Hydro	$0	$0	$0
18. Modify Moriah Hydro's March 9, 2018, Bat Plan, to include the following measures (see numbers 19 to 29 below).	Staff	$26,198[h]	$0	$1,365
19. Establish seasonal restrictions on tree clearing, consistent with FWS and New York DEC guidance, to minimize effects on Indiana and northern long-eared bats, per the Bat Plan.	Moriah Hydro, Staff	$0	$0	$0
20. Identify project-related ground disturbance and tree clearing that would occur during each phase of construction to clarify the specific areas and seasons in which tree clearing should be avoided, consistent with FWS and New York DEC guidance.	Staff	$0	$0	$0

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
21. Monitor conditions in the New Bed Mine, per the Bat Plan, including: (1) development of a preconstruction monitoring database that incorporates existing New York DEC data; and (2) installation of equipment to monitor water level (two locations), temperature (four locations), humidity (two locations), seismic activity (one location), air flow and exchange (two locations), and bat presence (via acoustics and infrared video monitoring, two locations each) for 3 years prior to construction to at least 5 years after construction.	Moriah Hydro	$78,594[c]	$10,479[c]	$8,657
22. Modify Moriah Hydro's proposed New Bed Mine monitoring to include consultation with FWS and New York DEC over the number and location of monitoring devices within the New Bed Mine.[106]	Staff	$88,594	$11,479	$13,339
23. Seal the West Drift between the New Bed and Harmony mines, per the Bat Plan.	Moriah Hydro, Staff	$523,960[g]	$0	$27,292
24. Develop a controlled mine discharge point at the sealed Roe Shaft to permit control of water outflow from the New Bed Mine, per the Bat Plan.	Moriah Hydro	$41,917[c]	$0	$2,183
25. Per the Bat Plan, establish a groundwater monitoring well at Roe Shaft to determine the need for a controlled mine discharge point.	Staff	$31,438	$0	$1,638

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
26. Exclude bats from colonizing project-related mine openings during construction, per the Bat Plan.	Moriah Hydro	$20,958[g]	$524[g]	$1,490
27. Per the Bat Plan, identify the appropriate design, location, and maintenance for bat exclusion devices, through consultation with FWS and New York DEC.	Staff	$30,958	$524	$2,011
28. After dewatering, provide access to the project mines for FWS and New York DEC for inspection and bat monitoring, per the Bat Plan.	Moriah Hydro, Staff	$0	$0	$0
29. Prior to excluding bats from mine openings and implementing the mine shaft and pit resealing plan, identify the need for bat surveys at subsiding mine openings and pits within the project area.	Staff	$31,438	$0	$1,638
30. Develop a Bat Protection and Monitoring Plan in consultation with FWS and New York DEC.	Interior	$0[g]	$0	$0
Recreation, Land Use, and Aesthetic Resources				
31. Provide support to the Town of Moriah for development of a multi-use recreational complex at the existing Linney Field.	Moriah Hydro	$209,584[i]	$0	$10,917

[106] In the summary of Moriah Hydro's January 10, 2018, meeting with New York DEC and FWS, filed with the March 9, 2018, Bat Plan, Moriah Hydro agreed to install 40 temperature sensors, which differs from the number of devices mentioned elsewhere in the Bat Plan.

Enhancement / Mitigation Measure	Entity	Capital Cost[a] (2018$)	Annual Cost[a] (2018$)	Levelized Annual Cost[b] (2018$)
32. Repair, revegetate, and landscape aboveground construction areas (environmental landscaping).	Moriah Hydro, Staff	$0[j]	$0[j]	$0
33. Construct the entry and service building to replicate the architectural theme established by the adjacent town garage.	Moriah Hydro, Staff	$0[k]	$0[k]	$0
Cultural Resources				
34. Implement the Historic Properties Management Plan.	Moriah Hydro	$209,584	$0	$10,917
35. Revise the Historic Properties Management Plan to update the project description, provide an overview of the historic background of the area, provide a description of the National Register-listed properties that are located in the APE, include a provision to provide cultural resources training to all staff, update the inadvertent discovery section to provide more detail, and include more details about the interpretive historic signs.	Staff	$214,584[l]	$524[l]	$11,575

[a] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis. All capital and annual costs were escalated to 2018 dollars.

[b] All capital and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing costs.

[c] Capital cost estimated by Moriah Hydro in its December 20, 2017, additional information response.

[d] Cost estimated by staff assumes $26,198 in years 1 through 5.

[e] Capital cost estimated by staff from measures in the proposed Erosion and Sediment Control Plan filed February 24, 2015 (Appendix 7 of the license application). Capital cost includes Moriah Hydro's estimated cost of $50,000 for environmental landscaping (Exhibit D, Section D4.5), and $10,000 for development of the plan.

[f] Annual cost estimated by staff from measures in the proposed Erosion and Sediment Control Plan filed February 24, 2015 (Appendix 7 of the license application).

[g] Interior's recommendation was not specific enough to determine costs.

[h] Cost estimated by staff.

[i] On page 28 of the license application, Moriah Hydro states that it would donate $50,000 to the Town of Moriah for further development of Linney Field. However, on page 78 of the license application, Moriah Hydro states that it would commit $200,000 to planning and implementing recreational improvements to Linney Field. Staff used the higher number because the improvements discussed by Moriah Hydro included an entertainment complex.

[j] The costs for the environmental landscaping are included within the proposed Erosion and Sediment Control Plan (number 12).

[k] The costs of designing the two aboveground metal buildings to replicate adjacent Town of Moriah buildings is included in the initial construction costs discussed in table 4-1 of this draft EIS.

[l] The costs for a revised HPMP, as recommended by staff, include an additional $5,000 to revise the HPMP, as well as an additional $500 annually for providing cultural resources training to all staff.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the Mineville Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review and evaluation of the environmental and economic effects of the proposed action and its alternatives, we selected the staff alternative as the preferred alternative for the Mineville Project. We recommend this alternative because: (1) issuance of an original license for the project would allow Moriah Hydro to operate the project as a beneficial and dependable source of electric energy; (2) the public benefits of this alternative would exceed those of the no-action alternative; and (3) the recommended measures would protect geology, aquatic, terrestrial, threatened and endangered species, aesthetic, and cultural resources at the project.

In the following section, we make recommendations as to which environmental measures proposed by Moriah Hydro, or recommended by agencies or other entities, should be included in any license issued for the project. In addition to Moriah Hydro's proposed environmental measures listed below, we recommend additional staff-recommended measures to be included in any license issued for the project.

5.1.1 Measures Proposed by Moriah Hydro

Based on our environmental analysis of Moriah Hydro's proposal, as discussed in section 3, *Environmental Analysis*, and the costs presented in section 4, *Developmental Analysis*, we recommend including the following environmental measure proposed by Moriah Hydro in any license issued for the Mineville Project:

- Design the entry and service building to replicate and continue the architectural theme established by the existing and adjacent town garage.

5.1.2 Additional Measures Recommended by Staff

Under the staff alternative, the project would be operated with Moriah Hydro's proposed measure, as identified above, and the following additions or modifications:

- Development of a geotechnical investigation plan to evaluate subsurface conditions above and within the project mines, to include:
    - Moriah Hydro's proposed boring and testing of overburden and underlying bedrock and development of a 3-D model of the project mines, following license issuance;
    - an analysis of the number and placement of borings to inform the project's final design;
    - an analysis of the need to lower the upper reservoir's maximum elevation, to avoid regular wetting of the glacial overburden overlying the project mines during project operation, resulting in the potential for surface subsidence and flooding.
    - additional testing within the project reservoirs after dewatering to determine:
        - the compressive strength of support pillars within the project mines;
        - the seismic site class of the overburden and underlying bedrock;
        - the presence of marble within the project mines that may dissolve during project operation; and
        - the appropriate design of a rock support system to stabilize the project mines.
- Development of a seismic monitoring plan to include installation of a seismic monitoring network within the project area with additional seismographs to determine locations of induced seismic activity from construction and project operation to provide additional protection to local residents, for a period of 10 years after construction.
- Development of a mine shaft and pit resealing plan after issuance of a license, prior to final design, integrating available historical information and site-specific investigations for all mines potentially affected by the project

(i.e., Harmony, Old Bed, 21, and Welch mines) to address the range of approaches required for the various shafts and pits prior to implementation.

- Development of a project mine sealing plan to minimize groundwater intrusion into the project mines, to include: (1) grouting leaking seals of major water-bearing seams, discontinuities, and any incidental inter-mine connections (including the previously sealed West Drift) after dewatering; and (2) during project operation, intermittent inspections and grouting of the upper reservoir to maintain isolation of the project mines from groundwater intrusion.

- Development of a groundwater monitoring plan to gain a spatial understanding of groundwater hydrology and investigate connectivity among the project mines, the New Bed Mine, 21 Pit, and other locations (e.g. Welch Mine, tributary C-86-5). Moriah Hydro's proposed flow monitoring would be included and modified to limit post-construction monitoring to a 3-year period with options to extend, if necessary.

- Modification of the Erosion and Sediment Control Plan to include site-specific measures for all locations with ground-disturbing activities (including areas on the surface necessary for sealing the West Drift, resealing all subsiding mine connections, constructing the proposed electrical vault at the existing substation, and other facilities) and a plan for the disposal or reuse of excavated materials.

- Development of a water quality monitoring plan through consultation with FWS and New York DEC that would include PCB monitoring and would modify the proposed monitoring and treatment to 1 year prior to construction, during project construction, and for 3 years during project operation with options to extend, if necessary.

- Modification of Moriah Hydro's March 9, 2018, Bat Plan, through consultation with FWS and New York DEC, to include: (1) identification of all project-related ground disturbance and tree clearing that would occur during each phase of construction, to clarify the specific areas and seasons in which tree clearing should be avoided (consistent with FWS and New York DEC guidance); (2) identification of the number and location of devices to monitor New Bed Mine conditions; (3) development of a protocol to seal the West Drift that identifies all aboveground and underground activities associated with sealing the drift; (4) prior to dewatering, establishment of a groundwater elevation monitoring station at the site of the purported seep near Roe Shaft to determine the need for a controlled mine discharge point, following analysis of groundwater data within the project area; (5) prior to dewatering, identification of the number and design of bat exclusion devices to be constructed and

maintained at mine openings; and (6) prior to implementing staff's recommended mine shaft and pit resealing plan, identification of the need for bat surveys at all shafts and pits proposed for resealing.

- Revision of the proposed HPMP to: (1) update the project description; (2) provide an overview of the historic background of the area, including the extensive mining history; (3) provide a description of the National Register-listed properties that are located in the APE and explain their significance and public value; (4) include a provision to provide cultural resources training to all staff, describe how often the training would occur, who would provide it, and what it would entail; (5) update the inadvertent discovery section to provide more detail, including that work in the area of the discovery would be stopped immediately until the artifact or area is evaluated, and that if the discovery is related to the area's tribal history, the appropriate tribe would be contacted and consulted, in addition to the New York SHPO; (6) include more details about the interpretive historic signs, including a detailed development schedule, who would be consulted during development, and the specific location of their placement; and (7) make all revisions in accordance with the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Projects*. Making these revisions would create a more comprehensive HPMP and ensure greater protection of historic properties.

Below, we discuss the basis for our staff-recommended measures and the rational for modifying Moriah Hydro's proposal.

Geotechnical Investigation Plan

The Mineville Project would be constructed in an area with several former iron ore mines. Although historical mine survey data exist, these data alone do not provide sufficient detail to support development of the final project design. Additionally, the two mines that would be used as the project's upper and lower reservoirs are presently flooded and unable to be surveyed. Therefore, it is necessary to collect geotechnical and geographic information regarding the project mines and adjacent mines.

Moriah Hydro proposes to conduct geotechnical investigations after license issuance to inform the final design of the project, including: (1) drilling and sampling a minimum of five borings through the glacial overburden, each with a minimum depth of 50 feet into the underlying rock; (2) determining the composition and permeability of overburden material from the boring samples; (3) determining the permeability, compressive strength, rock quality designation of the underlying rock; and (4) preparing a detailed 3-D geographic and geotechnical model of the project based on the borings and available mine mapping. While this approach may provide the design parameters needed for construction of below-ground project facilities, the stability of structural components

within the project mines cannot be fully assessed until the mines are dewatered and can be entered. Additionally, it is not clear that Moriah Hydro's proposed geotechnical investigations would produce enough information to inform the project's final design.

Therefore, we recommend that Moriah Hydro develop a geotechnical investigation plan to assess seismic risk, induced seismicity, and the potential for subsidence and stability of structural components within the upper reservoir (Harmony Mine) and the lower reservoir (Old Bed Mine). The geotechnical investigation plan should be conducted in three stages (prior to dewatering, and after dewatering of the upper and lower reservoirs, respectively) and include the following: (1) a thorough review of existing geological information and mapping of the area and the proposed mines (including historical geological information and mapping from the Republic Steel Corporation); (2) boring and testing of the overburden and underlying bedrock prior to dewatering; (3) development of a 3-D geotechnical and geologic model of the project mines; (4) the need for lowering the maximum elevation of the project's upper reservoir to avoid reaching into the overburden; and (5) testing within the project reservoirs after dewatering to determine the compressive strength of support pillars within the project mines, the seismic site class of the overburden and underlying bedrock, the presence of marble within the project mines that may dissolve during project operation, and the appropriate design of a rock support system to stabilize the project mines.

Prior to dewatering

As part of the initial post-licensing geotechnical investigation, we recommend that Moriah Hydro: (1) assess the number and placement of borings necessary to fully describe the overburden and underlying bedrock at, and adjacent to, the Harmony and Old Bed mines, and conduct boring and testing to determine the composition and permeability of the overburden, and the compressive strength, permeability, and quality of the underlying bedrock; (2) conduct a seismic risk analysis, to include a seismic refraction survey to determine the elevation of overburden/bedrock interface between the Harmony and New Bed mines and depth to groundwater to assess whether the overburden could present a pathway for groundwater between the two mines; (3) assess the ability of the bedrock to transmit water through visual observation (via video within the boreholes) of rock type, and evaluation of discontinuities, in-situ fractures, voids, and weathered zones; and (4) create a detailed 3-D model of the project based on the boring data and existing mine mapping.

Additionally, historical mine maps indicate that the Harmony Mine does not have much storage capacity at elevations above +895 feet msl (+800 feet LMD). This implies that the benefit of pumping water to shallower depths (such as to +1,095 feet msl [+1,000 feet LMD] as proposed by Moriah Hydro) would be limited during project operation. Conversely, pumping water to elevation +1,095 feet msl (+1,000 feet LMD) would add stress in the mined-out space and could open up fractures in the bedrock to the

glacial overburden layer, potentially increasing the mobilization of fine sediment particles from the overburden. Therefore, we recommend that Moriah Hydro assess whether there is a need to lower the top of the upper reservoir, based on examination of historical mine maps and data from borings during the geotechnical investigations prior to final design.

After dewatering (two stages)

Support pillars and bedrock within the project mines must have an adequate margin of safety under all expected loads from project construction, operation, and natural or induced seismicity. Therefore, after dewatering, we recommend that Moriah Hydro conduct the following additional geotechnical analyses within the mined-out spaces of the Harmony and Old Bed mines: (1) assess the rock types and structural characteristics of the geology in the project mines (i.e., orientations and characteristics of the joint system, faults, dikes, and foliation planes), to inform the project's final design; (2) update the detailed 3-D model of the project with the additional information accordingly; (3) test the compressive strength of the support pillars and of the bedrock above and below the mined-out space to determine their stability under static loads and their margin to accommodate seismic loads; (4) survey the existing condition of the support pillars and excavation surfaces, using visual inspection and core samples, to allow for an assessment of the erosion potential resulting from discharged flow exiting the penstocks, particularly in the lower reservoir; (5) analyze the geology and rock types within the project mines to determine the presence of marble; (6) assess the need for specific treatments to stabilize bedrock within the project mines after geotechnical surveys, which could include encapsulating support pillars in concrete or equivalent materials to protect against erosion due to water flow during project operation, bifurcation of the end of the steel penstock or use of another type of energy dissipater to reduce the velocity of the water impinging on the pillars, or mitigation to ensure structural integrity of any areas containing marble; (7) conduct a seismic risk analysis using geophysical surveys (i.e., seismic refraction) to determine the seismic site class of the bedrock and overburden, and the potential for hydrodynamic loading on the support pillars from possible sloshing of water in the reservoirs during an earthquake; and (8) conduct an analysis for induced seismic risk from the dewatering during construction and the cycling of water between the upper and lower reservoirs during operation.

The plan should also include a provision for Moriah Hydro to submit reports to the Commission, EPA, New York DEC, and FWS within six months after each of the three geotechnical investigations—before final design, after first dewatering stage (upper reservoir), and after second dewatering stage (lower reservoir)—for review and comment.

We estimate that the levelized annual cost for the geotechnical investigations would be $21,834, and conclude that the benefits of the measures of the plan would outweigh the costs.

Seismic Monitoring Plan

Project construction and operation have the potential to cause induced seismicity in the project area. Moriah Hydro proposes to monitor seismicity with two installed seismographs, from 2 months prior to construction to 12 months after construction. However, two seismographs would not provide adequate spatial coverage to detect induced seismicity within the project area, or to identify the precise location of any seismic activity. Additionally, 12 months of monitoring would not be sufficient to determine the effects of project operation as seismic activity in the area has been sporadic, with recurrence intervals often exceeding 12 months.

Therefore, we recommend that Moriah Hydro develop a seismic monitoring plan, to include: (1) determining the number and placement of seismographs necessary to create a seismic monitoring network surrounding the project; (2) installing the seismographs, both at the surface and underground, to identify developing rock mass instabilities; and (3) monitoring to determine any induced seismic activity during project construction and operation, including that resulting from blasting for power facilities, collapses within the project mines, rock bursts, and project operation. We recommend seismic monitoring of project operation for a period of 10 years to help assess risk to the project facilities and nearby residential communities due to induced seismicity.

The seismic monitoring plan should include a provision for Moriah Hydro to submit reports with the results of seismic monitoring to the Commission, EPA, New York DEC, and FWS, within 6 months after construction and on an annual basis during project operation for a period of 10 years, with the potential to extend the monitoring as necessary. We estimate that the levelized annual cost for the seismic monitoring plan would be $26,845, and conclude that the benefits of the measures of the plan would outweigh the costs.

Mine Shaft and Pit Resealing Plan

Following the acquisition of property rights, Moriah Hydro proposes to reseal all mine shafts and openings in the project boundary (with the exception of the 21 Pit) and certain shafts necessary to access New Bed Mine to prevent future subsidence and cave-ins. Moriah Hydro would employ the following methods: (1) excavate all shafts to their base; (2) construct a work platform at the shaft base using steel beams and plates; (3) construct shear keys into surrounding rock using grouted rebar; (4) construct a structural reinforced concrete floor slab with a depth of twice the maximum span; (5) use granular soil cement (made with the rock fines from the power chamber and shaft excavations) to fill the shaft to a depth of 24 inches below the ground surface; and

(6) construct a 24-inch-thick, reinforced concrete surface cap that extends a distance of 10 feet beyond the edge of the shaft in all directions. Moriah Hydro states that final design of resealing activities would be based on location-specific field measurements and conditions.

The process of resealing may vary for different shafts to achieve the goal of preventing future subsidence or cave-ins. For example, B Shaft would require excavation of 266 feet to reach the overburden/bedrock interface. Sealing Don B Shaft could also be more complex because the shaft penetrated the glacial overburden at an oblique angle and therefore may have a large opening at the surface. The shaft was originally constructed with structural steel shaft sets and reinforced concrete lining, but the state of the lining of the approximately 80-year-old shaft is unknown.

Moriah Hydro provides a general protocol for resealing mine shafts and openings, using a standard technique. However, from the limited information available, it appears that Republic Steel Corporation used diverse materials and techniques to fill the shafts and pits in 1979 and earlier years. Several of these seals have failed, and continue to subside, in various ways (e.g., some failed seals are restricted in surface area, while others have subsided hundreds of feet in diameter around the shaft at the surface). Thus, it is unclear that Moriah Hydro's general approach would be adequate for sealing each shaft within the project area.

Therefore, we recommend that Moriah Hydro develop a mine shaft and pit resealing plan after issuance of a license, but prior to final design. The plan should be based on available historical information, as well as field measurements and an assessment of site conditions as proposed by Moriah Hydro, for the purpose of resealing mine openings within the project area, stabilizing collapsing shafts and pits, and minimizing the contribution of surface water from mines that are known to be, or may be, hydraulically connected to the project mines.

We recommend that the plan include a provision to reseal the following shafts: (1) the three shafts that penetrate into the Harmony Mine, which would contain the upper reservoir (B Shaft, Don B Shaft, and A Shaft); (2) the three shafts that access the Old Bed Mine (which would contain the lower reservoir) and 21 Mine (Clonan Shaft, Bonanza Shaft, and Joker Shaft); and (3) one shaft connected to the New Bed Mine (Roe Shaft). The latter four shafts would not be within the operational zone of the upper reservoir, but pumping the groundwater out of the combined mines during dewatering would also remove groundwater from these shafts, increasing the effective stress in the fill.

Rather than Moriah Hydro's proposal to reseal shafts by completely removing the fill in the shaft and replacing it with a cement-fill mixture, we recommend that the plan consider an alternative method of injecting grout through multiple boreholes to consolidate the fill in some of the shafts, particularly narrow shafts with vertical walls,

assuming that the upper reservoir elevation is lowered to +895 feet msl (+800 feet LMD) (see *Geotechnical Investigation Plan* above).

Based on our recommended monitoring of groundwater elevation in the Welch Mine to determine its hydraulic connectivity to the project mines (see *Groundwater Monitoring Plan* below), resealing may also be necessary for Welch Mine shafts (i.e., the Welch and Brinsmade shafts) that extend to depths deeper than the existing groundwater elevation in the area of about +1,170 feet msl (+1,075 feet LMD). If the results of the groundwater monitoring plan indicate that the Welch Mine is hydraulically connected to the project mines, we recommend that the mine shaft and pit resealing plan include a provision to reseal the deeper shafts and pits that access the Welch Mine prior to the dewatering of the project mines.

The mine and pit resealing plan should also include provisions to continually inspect and maintain the resealed shafts and pits in the event of further settling, and address new incidences of subsidence and cave-ins of undocumented mine structures near the project, over the term of any license issued for the project.

We recommend that Moriah Hydro's mine shaft and pit sealing plan be developed in consultation with New York DEC. The plan should include provisions for: (1) documenting the specific sealing approach (including the quantity and type of materials used) to reseal each shaft and pit; (2) filing a post-construction report, including the specific sealing information for each resealed shaft and pit, with the Commission and New York DEC within 6 months after completion of all resealing; and (3) reporting any additional resealing activity (i.e., due to settling at recently resealed shafts, or resealing of previously undocumented mine structures) within 90 days of the activity, over the term of any license issued.

We estimate that the levelized annual cost for the mine shaft and pit resealing plan would be $65,501, and conclude that the benefits of the measures of the plan would outweigh the costs.

Project Mine Sealing Plan

Following the end of mining operations in the 1970s, the project mines filled with water. During the dewatering stage of project construction, it is possible that the mined-out bedrock could contain seams that would allow groundwater to enter the project mines. Moriah Hydro proposes to address this issue, after dewatering the project mines, by grouting leaking seals of major water-bearing seams and discontinuities and sealing all incidental inter-mine connections to minimize groundwater leakage into the project mines. However, it is unclear what areas of the project mines would be included in this sealing activity, and how the need for additional sealing in the project mines would be addressed over the license term.

Therefore, we recommend that Moriah Hydro develop a project mine sealing plan to isolate the Harmony and Old Bed mines from larger groundwater intrusion. The plan should include provisions for the following activities after dewatering: (1) Moriah Hydro's proposed sealing of seams and discontinuities within the Harmony and Old Bed mines; (2) inspection of the seal in the West Drift placed via a surface borehole (see *Bat Plan* below) by accessing the drift from the dewatered Harmony Mine, and strengthening the seal as needed; and (3) inspection of the bedrock in the northwestern corner of the Harmony Mine (at elevations above +170 feet msl [+75 feet LMD]) to identify leaks along fractures, and grout larger leaks. Additionally, the plan should include a provision for intermittent inspections and grouting of larger leaks in the bedrock of the Harmony Mine during project operation, particularly along the northwestern side closest to the New Bed Mine, to continue to maintain isolation of the project mines from groundwater intrusion.

We estimate that the levelized annual cost for sealing the project mines during construction and operation of the project would be $8,142, and conclude that the benefits of the measure would outweigh the costs.

Groundwater Monitoring Plan

The current system of former mines within the project area may be hydraulically connected in a number of ways. For instance, historical mining maps suggest that the mined-out Welch orebody is connected to the adjacent 21 Pit, which is connected to the two project mines. After Republic Steel Corporation ceased mining operations, it also ceased pumping out the mines, and as a result the project mines filled completely with water by 2003. The sources of the water that filled the project mines are a combination of surface water and groundwater, but the specific pathways that water entered the mines are not well understood. Moriah Hydro proposes to monitor groundwater pumped from the Don B outfall into tributary C-86-5 during project construction (dewatering) and during operation throughout the license term, and would also monitor fluctuations in water levels within the New Bed Mine and certain connected shafts (see *Bat Plan* below), but these activities alone would not provide information on the complex pattern of groundwater flow from other, hydraulically connected mines into the project mines.

Therefore, we recommend that Moriah Hydro develop a groundwater monitoring plan, in consultation with FWS and New York DEC, to monitor water levels at several locations within and just outside the project boundary:

- An area between the Harmony and New Bed mines, by converting one or more boreholes from previous surveys (see the *Geotechnical Investigation Plan* above) into monitoring wells, as well as the borehole used to seal the West Drift (see *Bat Plan* below), to observe the effect of the mine dewatering and

project operation on the groundwater table between the Harmony and New Bed mines.

- 21 Pit—monitor water levels within the open 21 Pit to record water level changes that are expected to occur during dewatering of the project mines.

- Welch Mine—install a groundwater monitoring well that accesses the Welch Mine in the vicinity of two deeper shafts (i.e., Welch and Brinsmade shafts) to observe the effect of the mine dewatering and project operation on the groundwater elevation within the Welch Mine.

Groundwater monitoring should include Moriah Hydro's proposed flow monitoring at the Don B outfall and tributary C-86-5. Implementation of the groundwater monitoring plan, in conjunction with the proposed groundwater level monitoring in New Bed Mine (discussed below in *Bat Plan*), would provide a spatial understanding of groundwater hydrology in the project area and allow evaluation of the potential effects from mine dewatering and project operation.

We recommend that groundwater elevation monitoring be conducted from 3 years prior to construction (to establish an understanding of the variability in groundwater elevations), during project construction (to determine any groundwater elevation changes after sealing of the project mines and resealing of mine shafts and pits), and for 3 years during project operation, with an option to extend monitoring, if necessary. The groundwater monitoring plan should include the following: (1) the exact locations of the groundwater monitoring stations; (2) the procedures used to install the additional monitoring stations; (3) the type of instruments to be used for continuous, automatic data logging and defined QA/QC procedures; (4) a description of the monitoring intervals; (5) the filing of annual summary reports for each year that monitoring is conducted; and (6) the conditions under which post-construction monitoring would be extended.

We estimate that the levelized annual cost for the groundwater monitoring plan would be $8,549, and conclude that the benefits of the measures of the plan would outweigh the costs.

Erosion and Sediment Control Plan

Moriah Hydro proposes to implement the Erosion and Sediment Control Plan filed on February 24, 2015, to avoid or minimize soil erosion and sedimentation due to project-related construction. The plan assumes that surface development is limited to a single small structure at the proposed entrance to the facility and that two staging areas would be located at an unvegetated site adjacent to the town's waste transfer station. However, project construction would involve additional sites, such as the site for the construction of the electrical/transmission tunnel, multiple sites of former mine shafts that Moriah

proposes to reseal, and a staging area and drill site for sealing the West Drift, likely in the Mount Tom area.

Therefore, we recommend that Moriah Hydro modify its Erosion and Sediment Control Plan to include the development of site-specific measures, in consultation with FWS and New York DEC, for all locations with construction activities and a plan for the disposal or reuse of excavated materials to protect all soil resources and the stream channels in the area. Specifically, we recommend that Moriah Hydro modify the plan to: (1) identify all locations with construction activities and show the footprint of these locations on maps (on top of aerial photographs); (2) specify the type of construction activity that would occur at each location; (3) estimate the volumes of excavated materials; (4) describe activity-specific erosion and sediment control measures during construction; (5) describe the use and/or disposal of excavated material; and (6) describe the approach to be used in rehabilitating or revegetating all construction sites. We also recommend that the plan include Moriah Hydro's proposal to provide post-construction landscaping to add visual appeal to the aboveground facilities.

We estimate that the levelized annual cost for the modified Erosion and Sediment Control Plan would be $17,739, and conclude that the benefits of the measures of the plan would outweigh the costs.

Water Quality Monitoring Plan

Water currently exiting the project mines at the Don B outfall is thought to represent recent groundwater infiltration. It is consistent with state standards for Class D streams and requires no treatment prior to entering tributary C-86-5. However, as dewatering of the project mines progresses, groundwater quality is likely to degrade in response to increasing depth, stagnation, and prolonged exposure of the water to the minerology of the adjacent rock. Mobilization of contaminants, particularly PCBs, which have been documented in the project mines, could also occur as a result of dewatering or through turbulent flows under project operation.

Moriah Hydro proposes to conduct water quality monitoring (temperature, pH, conductivity, turbidity, DO, TOC, iron, and manganese) at the Don B outfall and at locations upstream and downstream of the outfall on tributary C-86-5 during construction and for the life of the project to ensure that aquatic resources of the tributary are protected. Moriah Hydro would treat any overflow water that fails to meet state water quality standards or other limits stipulated by New York DEC through a proposed step aeration and detention facility, but anticipates that iron and manganese would be the only constituents of concern.

Interior recommends that Moriah Hydro develop a Streamflow Monitoring Plan in consultation with FWS and New York DEC to ensure that mine dewatering activities do not impair the water quality of Mill Brook.

Moriah Hydro expects that groundwater from the project mines would not require treatment, but states that iron and manganese concentrations would be adequately managed by the proposed step aeration and detention facility. It is unclear, however, how the remaining proposed water quality parameters would be treated if found to be inconsistent with state water quality standards or stipulated limits. Moriah Hydro's proposal also does not specify the value, or range of values for each parameter that would initiate treatment, nor does it describe conditions under which a temporary stoppage or termination of dewatering would occur due to water quality concerns. PCB monitoring has not been proposed by Moriah Hydro, despite having been documented in the project mines. Similarly, Interior's recommended monitoring plan, does not specify the parameters that would be monitored, where monitoring should occur, or the timeframe over which monitoring would take place.

Therefore, we recommend that Moriah Hydro develop a water quality monitoring plan in consultation with FWS and New York DEC that would include PCB monitoring and would modify the proposed monitoring to 1 year prior to construction (to develop an understanding of current conditions and seasonal variability), during project construction (to detect any changes in water quality), and for 3 years during project operation, with an option to extend monitoring beyond the 3-year period, if necessary. The modified timeframe would adequately document existing conditions and capture any changes in water quality due to construction and operation of the project, which would be expected to occur during those periods, if at all, and would allow monitoring to be extended. At a minimum, the plan should include the following: (1) the exact locations of the proposed monitoring sites at the Don B outfall and upstream and downstream of the outfall on tributary C-86-5; (2) the type of monitoring instruments used and defined QA/QC procedures; (3) continuous, real-time monitoring of temperature, pH, conductivity, turbidity, and DO at all monitoring locations; (4) a schedule and defined sampling methods for monitoring parameters that do not yield immediate results, including TOC, iron, manganese, and PCBs; (5) conditions under which Moriah Hydro's proposed water treatment facility would be operated; (6) identification of water quality conditions, if any, that would result in a temporary stoppage or termination of dewatering during construction and operation; (7) the filing of annual summary reports for each year that monitoring is conducted; and (8) the conditions under which monitoring would be extended beyond a 3-year period.

We estimate that the levelized annual cost for a water quality monitoring plan would be $35,516, and conclude that the benefits of the measures of the plan would outweigh the costs.

Bat Plan

Six species of bats, including two federally listed bat species (the endangered Indiana bat and the threatened northern long-eared bat), a New York State species of

special concern (eastern small-footed bat), and other bat species (tri-colored bat, little brown bat, and big brown bat) hibernate in the New Bed Mine, likely hydraulically connected to the Harmony Mine, which would function as the Mineville Project's upper reservoir. Moriah Hydro proposes to seal a drift that connects the Harmony and New Bed mines to avoid draining groundwater from the New Bed Mine during dewatering of the project mines, in addition to sealing several subsiding mine openings and pits within the project area that may also be hydraulically connected to the project mines. Construction of the Mineville Project could alter conditions within the New Bed Mine bat hibernaculum and affect the six bat species known to hibernate there, and could result in the clearing of forested habitat near the project that is likely used by bats for summer and maternity roosts.

Moriah Hydro's March 9, 2018, Bat Plan includes measures to: (1) limit tree clearing activity near the project, consistent with FWS and New York DEC guidance regarding tree clearing restrictions; (2) monitor water level, temperature, humidity, air flow and exchange, and bat activity within the New Bed Mine; (3) seal the West Drift between the New Bed and Harmony mines; (4) exclude bats from colonizing project-related mine openings with mesh screen; (5) establish a controlled mine discharge point at Roe Shaft to help maintain water levels within the New Bed Mine; and (6) after dewatering the project mines, provide access to FWS and New York DEC for inspection and bat monitoring.

However, Moriah Hydro's Bat Plan does not provide: information on the specific areas and seasons in which tree clearing should be avoided, consistent with FWS and New York DEC guidance; how project-related effects to forested habitat likely used by bats would be minimized; the number and location of monitoring devices within the New Bed Mine; a specific protocol to seal the West Drift; information indicating that the New Bed Mine is the source of the observed seep at Roe Shaft; the design, location, and maintenance of bat exclusion structures for project-related openings; or the need for bat surveys at subsiding mine openings near the project.

Therefore, we recommend the following modifications to Moriah Hydro's Bat Plan, to be prepared in consultation with FWS and New York DEC, to avoid or minimize effects to bat species: (1) identify all project-related ground disturbance and tree clearing that would occur during each phase of construction to clarify the specific areas and seasons in which tree clearing should be avoided, both within the project boundary and 0.25-mile of New Bed Mine, consistent with FWS and New York DEC guidance; (2) identify the number and location of devices to monitor New Bed Mine conditions; (3) identify all aboveground and underground activities associated with sealing the West Drift; (4) prior to dewatering, establish a groundwater elevation monitoring station at the site of the purported seep near Roe Shaft to determine the need for a controlled mine discharge point, following analysis of groundwater data within the project area; (5) prior to dewatering, identify the number and design of bat exclusion devices to be constructed

and maintained at mine openings; and (6) prior to implementing staff's recommended mine shaft and pit resealing plan, identify the need for bat surveys at all shafts and pits proposed for resealing.

We estimate that the levelized annual cost for the Bat Plan would be $47,283, and conclude that the benefits of the measures of the plan would outweigh the costs.

Aesthetics

The proposed project would use an existing, decommissioned subterranean mine, and most of the project features would be underground (except the aboveground entry and service building), and there would be no new visible transmission lines. Therefore, the viewshed would not be greatly altered. However, construction activities could temporarily disturb aesthetics in the immediate vicinity of the project and the two staging areas set up during construction would cause short-term visual impacts. In addition, the constriction of the entry and service building would result in a new, permanent aboveground building. Moriah Hydro proposes to construct the new entry and service building in the style established by the existing town garage and repair, revegetate, and landscape aboveground construction areas at the conclusion of construction activities, which would ultimately enhance the aesthetics of the project area. The costs to design the entry and service building in the style of the existing town garage and landscaping the construction area once construction is complete are incorporated in the costs of project design and in the Erosion and Sediment Control Plan, respectively. We therefore conclude that the benefits of these measures outweigh the costs.

Historic Property Management Plan

To ensure the protection of cultural resources at the project, Moriah Hydro developed an HPMP that includes goals for operating the project and guiding historic preservation within the APE. It also identifies historic resources that require special consideration and states consultation with the New York SHPO would continue throughout implementation of the HPMP. In a letter dated July 23, 2015, and filed by the applicant on September 1, 2015, the New York SHPO states that the proposed project would have no effect on historic resources with the condition that the proposed HPMP is implemented. The proposed HPMP, however, would benefit from some revisions and updates. In order to ensure the comprehensive protection of cultural resources, we recommend the HPMP be revised as follows: (1) update the project description once the project design is finalized and approved; (2) provide an overview of the historic background of the area, including the extensive mining history; (3) provide a description of the National Register-listed properties that are located in the APE (the National Register-eligible Wasson & West Streets Historic District and the National Register-listed Witherbee Memorial Hall) and explain their significance and public value; (4) include a provision to provide cultural resources training to all staff, describe how

often the training would occur, who would provide it, and what it would entail; (5) update the inadvertent discovery section to provide more detail, including that work in the area of the discovery would be stopped immediately until the artifact or area is evaluated, and that if the discovery is related to the area's tribal history, the appropriate tribe would be contacted and consulted, in addition to the New York SHPO; (6) include more details about the interpretive historic signs, including a detailed development schedule, who would be consulted during development, and the specific location of their placement; and (7) make all revisions in accordance with the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Projects*.

A revised HPMP that includes the above measures would serve as a guide for Moriah Hydro and provide a framework for consultation with the New York SHPO to ensure required approvals are received and appropriate measures are implemented to protect cultural resources. It also would provide measures to educate the public about the area's extensive mining history. We estimate that the levelized annual cost to develop an HPMP would be $11,575, and conclude that the benefits of the plan would outweigh the costs.

5.1.3 Measures Not Recommended by Staff

Rehabilitation of Linney Field

The Town of Moriah's request, Moriah Hydro's proposal, and Interior's recommendation for Moriah Hydro to provide $200,000 toward the rehabilitation of Linney Field and construction of a new multi-use recreation complex at the site would benefit the surrounding area and provide an enhanced recreational experience for those using the existing baseball and football fields. Ensuring these improvements are done in consideration of existing wildlife and habitat resources and documenting all recreational improvements through a recreation management plan, as recommended by Interior, would further enhance not just the recreational opportunities near the project, but also the aesthetic and terrestrial resources. However, Linney Field is located 0.5-mile from the proposed project, outside of the project boundary, and its baseball and football fields have no direct connection to hydropower. Further, the 2014–2019 New York SCORP indicates that the need for additional recreation in Essex County is below average for the state, and there are many public recreational opportunities currently available near the proposed project site, including numerous camping and boating facilities in Adirondack Park and on Lake Champlain. Therefore, we conclude that there is no justification for requiring Moriah Hydro to rehabilitate Linney Field. However, that does not prevent Moriah Hydro from entering into an agreement with the Town of Moriah outside of any license issued for the project to provide funding for the rehabilitation.

Interior recommends that Moriah Hydro work with New York DEC to explore fishing access opportunities inside and outside the project area. However, tributary

C-86-5 is not suitable for fishing within the project boundary as this is at the location where the tributary passes through the project mine area and is located at the base of a 50-foot-high tailings pile. Further, the small size and shallow depth of the tributary at the point where the water exits the project mine is not suitable for fishing. Interior also recommends that Moriah Hydro submit a recreation management plan to document the proposed recreational improvements. However, little recreational activity currently occurs within the project boundary, so construction of the project would not disrupt existing recreation, and because the majority of the proposed project would be underground, it would not offer the same recreational opportunities as conventional hydropower projects. Therefore, we conclude that there is no justification for requiring Interior's recommendation to explore fishing access opportunities because it would have no relationship to the proposed project or project effects. We also conclude that a recreation management plan, as recommended by Interior, would be unnecessary because of the lack of recreation opportunities within the project boundary.

5.2 UNAVOIDABLE ADVERSE EFFECTS

The groundwater elevation in the glacial overburden in the northern part of the project area would drop as a result of the dewatering of the project mines. The extent of the drop would depend in part on the permeability of the glacial overburden and the underlying bedrock, as well as the rate of recharge from rainfall and through water-bearing layers from the area surrounding the northern project area. The drop would likely be largest in the areas above the upper reservoir within the Harmony Mine, above the 21 Mine, and above the northernmost part of the Old Bed Mine.

Tremors from stress changes due to construction of project features and porewater pressure fluctuations due to project operation are possible during the life of the project. Overall, while potential seismic events during project construction could develop from excavation-related stress changes, these events are expected to be small and the probability of triggering large earthquakes is low. Also, considering that adjustments of stresses from mining, and subsequently from natural filling of the mines with groundwater since mining ended in the 1970s, would have been accommodated through induced seismic events over time, any induced seismicity from largely dewatered mines during project operation is expected to be small. Lastly, potential roof collapses during project operation might induce small earthquakes during the life cycle of the project.

The sealing of subsiding shafts and pits, as well as the sealing of the West Drift during project construction would require the removal of vegetation and soil disturbance, and result in some temporary erosion in construction areas. Soil erosion would largely be minimized by implementation of the proposed Erosion and Sediment Control Plan.

Hydraulic connectivity among the project mines, New Bed Mine, 21 Pit, and other former mines in the project area is not well understood. Therefore, stabilizing subsiding

shafts and pits, grouting water-bearing seams within the project mines, and isolating the project mines from the New Bed Mine may change hydraulic connectivity within this complex system. This may result in changes to water level, temperature, humidity, and other variables that currently represent suitable conditions for hibernating bats (including the endangered Indiana bat and threatened northern long-eared bat) within the New Bed Mine. Although the recommended Bat Plan may aid in avoiding or minimizing effects of project construction and operation on bats, and the recommended monitoring of conditions within the New Bed Mine could identify environmental changes and allow for the mitigation of effects, alteration of the current system may result in unavoidable changes to the New Bed Mine bat hibernaculum.

5.3 SUMMARY OF SECTION 10(j) RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

In response to our February 5, 2018, notice soliciting comments, recommendations, terms and conditions, and prescriptions, Interior filed two section 10(j) recommendations for the project on April 5, 2018. Table 5-1 lists the recommendations filed subject to section 10(j), and indicates whether the recommendations are included under the staff alternative.

Table 5-1. Analysis of fish and wildlife agency recommendations for the Mineville Project (Source: staff).

Recommendation	Agency	Within the scope of 10j?	Annualized Cost[a]	Adopted?
Develop a Streamflow Monitoring Plan for Mill Brook to ensure that water pumped from the mine does not impair the water quality of Mill Brook.	Interior	Yes.	$35,516	Yes.
Develop a Bat Protection and Monitoring Plan to protect and monitor bats during pre-construction dewatering, during construction activities, and during project operation, and including collecting baseline and post-construction data on environmental conditions and bat numbers within the hibernaculum.	Interior	Yes.	$47,283	Yes.

[a] Cost estimated by staff (see section 5.1.2 above).

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C.§ 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed eight comprehensive plans that are applicable to the Mineville Project, located in New York.[107] No inconsistencies were found.

[107] (1) National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993. (2) U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986. (3) U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C. (4) New York Department of Environmental Conservation. 1985. New York State Wild, Scenic, and Recreational River System Act. Albany, New York. March 1985. (5) New York Department of Environmental Conservation. 1986. Regulation for administration and management of the wild, scenic, and recreational rivers system in New York State excepting the Adirondack Park. Albany, New York. March 26, 1986. (6) New York State Office of Parks, Recreation, and Historic Preservation. New York Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2003-2007. Albany, New York. January 2003. (7) Adirondack Park Agency. 1985. Adirondack Park state land master plan. Ray Brook, New York. January 1985. (8) Adirondack Park Agency. n.d. New York State wild, scenic, and recreational rivers system field investigation summaries. Albany, New York.

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