composed of representatives of the FWS, Massachusetts DFW, Massachusetts DEP, Massachusetts Riverways, Housatonic Valley Association, and Trout Unlimited. Habitat mapping within the 2,500-foot-long bypassed reach was used to delineate the different mesohabitat types. Six transects were established representing the different habitat types. Two transects each were placed in riffle and run habitats while one transect was established in a pool and another in side channel habitat. A list of species potentially occurring in the bypassed reach was identified and grouped into five habitat guilds based on similar habitat preferences. Four evaluation species – brown trout, fallfish, white sucker, and longnose dace – were chosen from each of the four fish guilds to represent the habitat requirements of the guild. A fifth guild represented the habitat requirements of macroinvertebrates (mayflies, stoneflies, and caddisflies). Field data were collected at four flows: 70, 92, 174, and 299 cfs—which allowed extrapolation of habitat calculations over a range of flows from 28 cfs to 748 cfs.[3] Because the hydraulic model could not be extrapolated to flows less than 28 cfs, habitat results from the flow study could not be compared to the existing 10-cfs minimum flow condition. The flow corresponding to the maximum WUA for each species life stage; the percent of maximum WUA at several selected flows; and the percent of total habitat available at the maximum WUA[4] for each species are presented in table 3.

Table 3. Flows (cfs) corresponding to the maximum WUA for each species life stage evaluated, the percent of maximum WUA at several selected flows (proposed 90-cfs flow shaded), and the percent of total habitat available at the maximum WUA.

Species/life stage	Maximum WUA flow (cfs)	Percent of maximum WUA at 60 cfs	Percent of maximum WUA at 90 cfs	Percent of maximum WUA at 200 cfs	Percent of total habitat available at the maximum WUA
Brown trout					
Juvenile	150	83	91	96	48
Adult	180	73	86	100	36
Fallfish					
Spawning/Incubation	160	53	67	96	1
Fry	90	77	100	84	5
Juvenile	160	61	67	95	15

[3] The IFG4 hydraulic model used in the analysis permits calculations of habitat conditions over a range of flows from 40 percent of the lowest calibration flow (70 cfs) to about 250 percent of the highest calibration flow (299 cfs).

[4] Percent of total habitat available at the maximum WUA is calculated by dividing the habitat area at the maximum WUA flow by the total wetted area at the maximum WUA flow multiplied by 100.

Adult	200	79	89	100	26
White sucker					
Spawning/Incubation	110	82	97	87	2
Fry	50	99	90	72	39
Juvenile/Adult	60	100	96	95	17
Longnose dace					
Spawning/Incubation	130	64	86	96	12
Fry	120	56	84	77	5
Juvenile	110	84	98	73	11
Adult	130	79	93	93	27
Macroinvertebrates					
Ephemeroptera	100	92	100	90	42
Plecoptera	160	83	91	96	18
Trichoptera	140	87	95	95	48

A flow of 90 cfs would provide more than 80 percent of the maximum WUA for all but two of the sixteen species life stages evaluated and over 90 percent of the maximum WUA for 9 of the species life stages evaluated. For fallfish spawning/incubation and fallfish juveniles, the two species life stages with less than 80 percent maximum WUA at 90 cfs, 67 percent of the maximum WUA would be provided. However, even at 160 cfs, which provides the maximum WUA for those two species life stages, only 1 percent and 15 percent of the total wetted habitat in the bypassed reach would be available for those species life stages, respectively. These results indicate that the bypassed reach has very little habitat available for those species life stages regardless of the flow. In general, the bypassed reach has limited spawning and incubation habitat for most species, which is likely due to an absence of suitable substrate.

On the other hand, at flows producing the maximum WUA for five of the species life stages evaluated—brown trout juveniles (150 cfs) and adults (180 cfs), white sucker fry (50 cfs), and two families of macroinvertebrates (100 to 140 cfs)—36 to 48 percent of the total habitat present in the bypassed reach would be available for those species life stages. Therefore, with more suitable habitat potentially available in the bypassed reach, a minimum flow would be most beneficial for those species life stages. While a flow of 90 cfs would not provide the maximum habitat for any of these species life stages, it does provide 90 percent or more of the maximum WUA for all but brown trout adults (86 percent).

In addition to the IFIM study results, we considered how frequently spill flows would occur in the bypassed reach and what benefit, if any, these flows may have on the fish and macroinvertebrate life stages evaluated in the IFIM study. Based on the annual and monthly flow duration curves, flows in the Housatonic River would exceed the project's hydraulic capacity and proposed minimum flow about 45 percent of the time on an annual basis and between 50 and 75 percent of the time during the spring spawning

months of April and May. Therefore, spill flows would provide additional habitat for those species life stages whose maximum WUA occurred at flows higher than the proposed 90-cfs release.

Operation compliance monitoring plan

Littleville Power did not propose a means of ensuring compliance with its proposed operating mode.

Interior and Massachusetts DFW recommend under section 10(j) that Littleville Power prepare a plan for monitoring run-of-river operation and flow releases from the project. Interior and Massachusetts DFW recommend that the plan include a description and design of the mechanisms and structures to be used along with any periodic maintenance and calibration that would be necessary. Both agencies request that the monitoring data be made available for inspection.

Staff Analysis

A plan to monitor run-of-river operation and minimum flow releases developed in consultation with the relevant resource agencies that describes contingencies for emergencies (such as providing downstream flows during project shutdown), scheduled maintenance drawdowns, droughts, as well as reporting criteria, would minimize misunderstandings about operational compliance and help ensure that aquatic resources at the project are protected. Such a plan could include monitoring water surface elevations in the project's impoundment and tailwater, maintaining a log of impoundment and tailwater water surface elevations and project generation data, establishing a staff gage in the bypassed reach, and a means for providing the data to the resource agencies upon request.[5]

Short-term construction effects

Littleville Power states that the turbine generator unit installation would not require a drawdown and would be accomplished by enclosing the work area within a cofferdam installed upstream of the gatehouse. As such, the work area could be completely dewatered without affecting impoundment levels. In addition, Littleville Power proposes to undertake all necessary and reasonable measures to minimize the effects of short-term construction effects including, but not limited to, erosion, siltation,

[5] Littleville Power requests that the filing deadline for any operations compliance and monitoring plan be 6 months from license issuance, as opposed to 3 months, as recommended by Interior and Massachusetts; the due date for any required plans will be discussed in the license order.

LITTLEVILLE POWER COMPANY, INC.
A SUBSIDIARY OF ENEL GREEN POWER NORTH AMERICA, INC.

Green Power

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Via eFiling

March 14, 2011

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: Glendale Hydroelectric Project (FERC No. 2801-MA);
Updated Run-of-River and Minimum Flow Monitoring and Compliance Plan.

Dear Secretary Bose:

On August 19, 2009 the Federal Energy Regulatory Commission (FERC) issued a Subsequent License to Littleville Power Company, Inc. (LPC) for the Glendale Hydroelectric Project (FERC No. 2801).[1] In addition, on July 8, 2009 the Massachusetts Department of Environmental Protection (MDEP) issued a Water Quality Certification (WQC) for the project, which established the operating conditions deemed necessary to protect the water quality of the Housatonic River pursuant to Section 401(a) of the Clean Water Act. The FERC license incorporates the WQC Conditions at Ordering Paragraph (D).

LPC submitted its Run-of-River and Minimum Flow Monitoring Plan to the Commission on December 9, 2010, and simultaneously requested comments on the plan from the resource agencies. By this filing LPC submits the resource agency letters and email messages approving and commenting on the Plan, and has updated the Plan in response to agency requests for minor clarifications.

Project Description

The Glendale Project is located on the Housatonic River in Stockbridge, Berkshire County, Massachusetts. The major project features include: a 250-foot-long, 30-foot-high concrete gravity dam with a 182-foot-long spillway; a 23-acre reservoir; a gatehouse at the right (northern) dam abutment; a 1,500-foot-long intake canal; a penstock intake structure with trashracks; a 250-foot-long steel penstock; a powerhouse containing four identical turbine-generator units; a 300-foot-long tailrace; and an approximately 2,500-foot-long bypassed reach of the Housatonic River extending from the dam to the end of the tailrace. The existing turbine-generator units have a combined capacity of 1,140 kW and a total hydraulic capacity of approximately 400 cfs. The subsequent license authorizes LPC to install a new turbine-generator unit at the gatehouse adjacent to the dam, which will be used to meet the bypass reach minimum flow requirement of 90 cfs. The project is operated in a run-of-river mode using automatic pond level control.

[1] 128 FERC ¶ 62,123

Operating Requirements Under Subsequent License

The operating conditions under which the project is required to operate under the subsequent license are set by the Conditions of the WQC. The pertinent WQC Conditions are:

- Condition 14, which requires the project to be operated in a run-of-river mode:

  The Project Owner shall operate the project in a run-of-river mode such that inflow to the project equals outflow from the project on an instantaneous basis and fluctuations of the head pond water level are minimized. This operating regime may be temporarily modified by approved maintenance activities, agreement between the Project Owner and appropriate state and/or federal resource agencies, or by extreme hydrologic conditions or emergency electrical system conditions, as these terms are defined below.

- Condition 15, which requires the project to release a minimum flow of 90 cfs, or inflow, if less, to the bypass reach downstream of the dam.

  The Project Owner shall release to the project bypass reach a continuous minimum flow of 90 cfs, or inflow, if less, for the protection and enhancement of fish and aquatic life habitat. Minimum flows may be temporarily modified by approved maintenance activities, by agreement between the Project Owner and appropriate state and federal resource agencies, or by extreme hydrologic conditions or emergency electrical system conditions, as these terms are defined below.

- Condition 18, which establishes operating conditions for refilling the impoundment after a drawdown:

  During refilling of the project reservoir after dam maintenance or emergency drawdown, the Project Owner shall operate the project such that 90% of inflow to the project is released below the project and the impoundment is refilled on the remaining 10% of inflow.

WQC Conditions 14 and 15 each allow temporary modification of the specified operating requirements for approved maintenance activities, by agreement between the licensee and the MDEP, the Massachusetts Division of Fisheries and Wildlife (MDFW) and the U.S Fish and Wildlife Service (USFWS), or by "extreme hydrologic conditions or emergency electrical system conditions" as defined in the WQC. License article 401(b) requires the licensee to notify the FERC prior to implementing any such temporary modifications, or within 10 days following an emergency.

New Minimum Flow Unit

As proposed in LPC's relicensing application, the minimum flow unit will be installed in a new powerhouse constructed downstream of the gatehouse (Attachment A). The unit will draw water through two unused waste gate openings at the southerly end of the gatehouse and will discharge to the dam's tailwater area and bypass reach downstream of the gatehouse. As required under Article 403 and WQC Condition 21, 1-inch clear space trashracks will be installed upstream of the waste gate openings to prevent fish entrainment through the new unit.[2] Water will initially flow into a small forebay before being drawn through the unit and passed downstream.

The minimum flow unit will be a vertical Francis turbine having a rated flow of 90 cfs and a rated output of 165 kW at a net head of 24 ft. The unit will be equipped with adjustable wicket gates which will allow it to track reduced inflows down to approximately 60 cfs (projected figure based on

[2] LPC will submit design drawings of the trashracks to the resource agencies and the FERC 90 days before starting construction, as required under Article 403.

manufacturer's specifications). It is expected that the minimum flow unit will normally operate at full load for most of the year.

A 3 ft wide by 4 ft high bypass slide gate will be installed on the river side of the forebay, which will automatically open to pass the minimum flow to the bypass reach in the event of minimum flow unit trip or shut-down. The bypass gate will be have automatic pond level control capability, which will allow it to track inflows in order to prevent a partial drawdown of the impoundment during low flow periods. The gate will also be provided with a backup power supply to ensure that it will open in the event of a power outage.

Design details and flow calculations for the bypass gate, as currently designed, are provided in Attachment B. As shown in Attachment B the invert of the gate would lie at El. 803.0, such that the gate would provide a maximum flow of 167 cfs when fully opened, and 90 cfs when opened 2.04 ft under normal pond conditions. LPC is considering raising the gate invert to El. 805.46 ft which would reduce its maximum flow capacity to 125 cfs; in this raised position the gate would need to open 2.63 ft to meet the 90 cfs minimum under normal pond conditions. The gate is being slightly oversized to ensure that it will be capable of maintaining the minimum flow requirement even with head losses occurring between the headpond and forebay.

LPC is presently finalizing the engineering design details for installation of the new minimum flow unit. Furthermore, LPC is initiating permitting activities to obtain all necessary local, state and federal approvals for the construction activities at the dam.[3] It is anticipated that installation will commence in Spring, 2011.

At this time LPC does not anticipate that any impoundment drawdowns will be necessary to install the minimum flow unit. As currently planned, all construction work will be accomplished "in the dry" behind cofferdam(s), possibly in combination with "in the wet" construction by divers. Therefore, we do not anticipate that it will be necessary to invoke the special drawdown provisions under WQC Condition 18 to facilitate installation of the minimum flow unit.

Project Operations

Run-of-river compliance will continue to be accomplished by passing all inflows either through the project's available turbines, over the spillway when all units are off-line, or via both turbines and spillway when inflow exceeds the hydraulic capacity of the available turbines. Compliance with the bypass reach minimum flow requirement will be accomplished by passing 90 cfs or inflow, which ever is less, either through the new minimum flow unit, through the bypass gate or over the spillway. Since the project operations necessary to comply with the run-of-river and bypass minimum flow requirements will be determined by the availability of the minimum flow unit, this plan addresses the proposed compliance measures with and without the minimum flow unit installed and available.

1. Minimum Flow Unit Not Installed or Unavailable

This section describes the interim measures which have been followed since the effective date of the license (November 1, 2009) and will continue until the new minimum flow unit is installed and commissioned. This section will also apply for any periods when the minimum flow unit is installed but unavailable and its intake has been sealed off and the forebay dewatered.

[3] In addition, per license Article 303 pre-construction documents (Contract Plans and Specifications, Quality Control and Inspection Program, Temporary Construction Emergency Action Plan, and Soil Erosion and Sediment Control Plan) will be submitted to the Regional Engineer for approval at least 60 days prior to the commencement of construction, and cofferdam plans will be submitted for approval at least 30 days prior to construction pursuant to Article 302.

At present the bypass minimum flow of 90 cfs or inflow, whichever is less, is released over the spillway. During the instream flow study conducted in support of its relicensing application, LPC's consultant measured a flow of 91 cfs in the bypass reach and simultaneously surveyed the headpond level at 811.25 ft NGVD, i.e., 0.35 ft above the dam's spillway crest elevation of 810.90 ft NGVD. Therefore, on the effective date of the subsequent license (November 1, 2009) the minimum spill setpoint in the control system for the project's existing four main units was raised to 0.35 ft above the spillway crest in order to meet the new bypass minimum flow requirement.

As previously described in the license application, the minimum output of each of the project's four main units is approximately 55 cfs. In order to minimize flow fluctuations downstream of the project, the control system is programmed to initially start a unit at 55% gate, then gradually increase its output to 80% gate (best efficiency) if sufficient flow is available, while maintaining the pond level at or above the minimum spill setpoint necessary to meet the bypass minimum flow requirement. To accommodate the increased bypass flow required under the subsequent license, the control system setpoint for starting a unit has been raised to provide for a minimum of approximately 145 cfs of spillage (90 cfs bypass minimum flow plus 55 cfs minimum operating flow for one unit). As before, the control system sequentially brings additional available units on-line in a similar fashion if inflows continue to increase, while maintaining the minimum flow requirement.

2. Minimum Flow Unit Installed and Available

As part of the installation of the minimum flow unit at the dam, the project's control system for the existing four units will be modified and expanded to monitor and control the minimum flow unit and bypass gate, so that there will be a central control and monitoring capability for the entire project.

Once installed and operational, the minimum flow unit will normally have first on / last off priority in the control system. Under low flow conditions between approximately 60 cfs and 90 cfs with the main units off-line, the minimum flow unit will operate in pond level control mode, maintaining the pond level at the spillway crest. As inflows increase and the minimum flow unit reaches full load, pond level control will shift to the main units. The control system will sequentially bring the available main units on-line as described above, maintaining the pond level at or above the spillway crest.

When the minimum flow unit is off-line and unavailable, the main units will operate in automatic pond level control mode as described above. If the bypass gate is open the control system will maintain the pond level at or above the spillway crest; however if the bypass gate is closed the control system will maintain the pond at or above El. 811.25 in order to maintain the 90 cfs minimum flow over the spillway, as described above.

As discussed above, a bypass gate will be installed in the minimum flow unit's forebay wall. The gate will open automatically upon unit shut-down or trip to ensure continuous release of the 90 minimum flow requirement. If all project units are off-line (e.g., in the event of a utility outage) all flow in excess of the gates' capacity would pass over the spillway.

Compliance Monitoring

Compliance monitoring and documentation will be performed by the project's control system. Data electronically recorded by the control system at half-hour intervals will include the following parameters for compliance monitoring purposes:

- Date and time
- Headpond level (feet NGVD)
- Minimum flow unit output (kW)
- Bypass gate status (open or closed)

- Total output of main units (kW)

The logged data will be stored in the powerhouse for compliance record-keeping purposes. The data will be available for on-site agency inspection. Furthermore, LPC will make the compliance data available to the FERC or MDEP in paper or electronic format within 30 days of request, or as otherwise required by the FERC.

Compliance with run-of-river operating conditions will be confirmed by demonstrating that the headpond level is at or above the spillway crest at all times when any units are operating, such that spillage of all inflow (via the spillway and/or the automated bypass gate) will occur shortly after unit trip. When the units are off-line all inflow will be passed over the spillway and/or via the automated bypass gate.

Compliance with the bypass minimum flow requirement will be documented by showing that a minimum of 90 cfs or inflow, whichever is less, is being passed via the minimum flow unit, the bypass gate or over the spillway. This will be confirmed by demonstrating one of the following conditions is true at all times:

- the minimum flow unit is on-line at full load; or
- the minimum flow unit is off-line and the bypass gate is open; or
- the minimum flow unit is on-line at reduced load, and the main units are off-line, and the pond level is at or above the spillway crest (i.e., under low inflow conditions between 60 and 90 cfs); or
- the minimum flow unit is off-line, the bypass gate is closed, one or more main units are on-line and the pond level is at or above El. 811.25 ft NGVD, demonstrating that 90 cfs is being passed over the spillway; or
- all units (minimum flow and main) are off-line and the pond level is above the spillway crest (El. 810.90 ft NGVD).

Following the installation and commissioning of the minimum flow unit, LPC will perform streamflow gauging measurements in the bypass reach, to determine the relationship between unit kW output and operating flow and to confirm that operation of the unit meets the specified 90 cfs minimum flow. LPC will also confirm that the flow through the bypass gate meets the 90 cfs minimum flow requirement.

As an additional quality control measure, the pond level transducer reading will be periodically compared to the pond level staff gage mounted on the gatehouse, to confirm that the pond levels recorded by the control system accurately reflect actual pond level conditions.

Agency Consultation

Pursuant to the consultation requirements of Article 401(a), LPC submitted this plan to the MDEP, the MDFW and the USFWS for their review and comment. Copies of all comments received are provided in Attachment C. All three agencies approved the proposed plan. In its email response dated December 17, 2010, the MDEP specifically stated that the "plan as presented meets the MA water quality certificate conditions." The MDFW responded by letter dated December 16, 2010 and stated that the plan "will result in compliance with both the Run of River and Minimum Bypass Flow conditions contained in the project's FERC license and 401 Water Quality Certificate." The USFWS also approved the proposed plan by letter dated January 14, 2011, and recommend LPC make minor adjustments to the final plan prior to submitting it to the Commission for approval. Each of these recommendations have been addressed in this revised plan as follows:

- *although the Plan states that electronic records will be stored in the project powerhouse, there is no provision for providing those records to FERC or resource agencies. The final Plan should specify how, and in what form, those records will be provided to the agencies (e.g., data logs, in hard copy format, will be provided to agencies within seven days of receiving a request);*

  The description under Compliance Monitoring, above, has been modified to provide that the compliance data will be available for on-site inspection, and furthermore that LPC will make the compliance data available to the FERC or MDEP in paper or electronic format within 30 days of request, or as otherwise required by the FERC.

- *the Plan should include details on the slide gate dimensions and a calculation sheet verifying that the gate will be sized to pass 90 cfs; and*

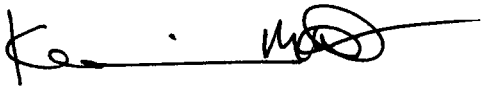
  Details of the bypass gate's dimensions and flow calculations are provided in Attachment B and are discussed under New Minimum Flow Unit, above.

- *it would be helpful to include a plan-view drawing of the project that delineates the headpond, gatehouse, new forebay and associated structures, and the location of the headpond sensor.*

  A plan view of the gatehouse showing the above features is provided in Attachment A.

Thank you for your consideration of this proposed monitoring and compliance plan. If you have any questions concerning this plan please do not hesitate to contact me at (978) 681-1900, extension 809 or via email at kevin.webb@enel.com.

Sincerely,
Littleville Power Company, Inc.

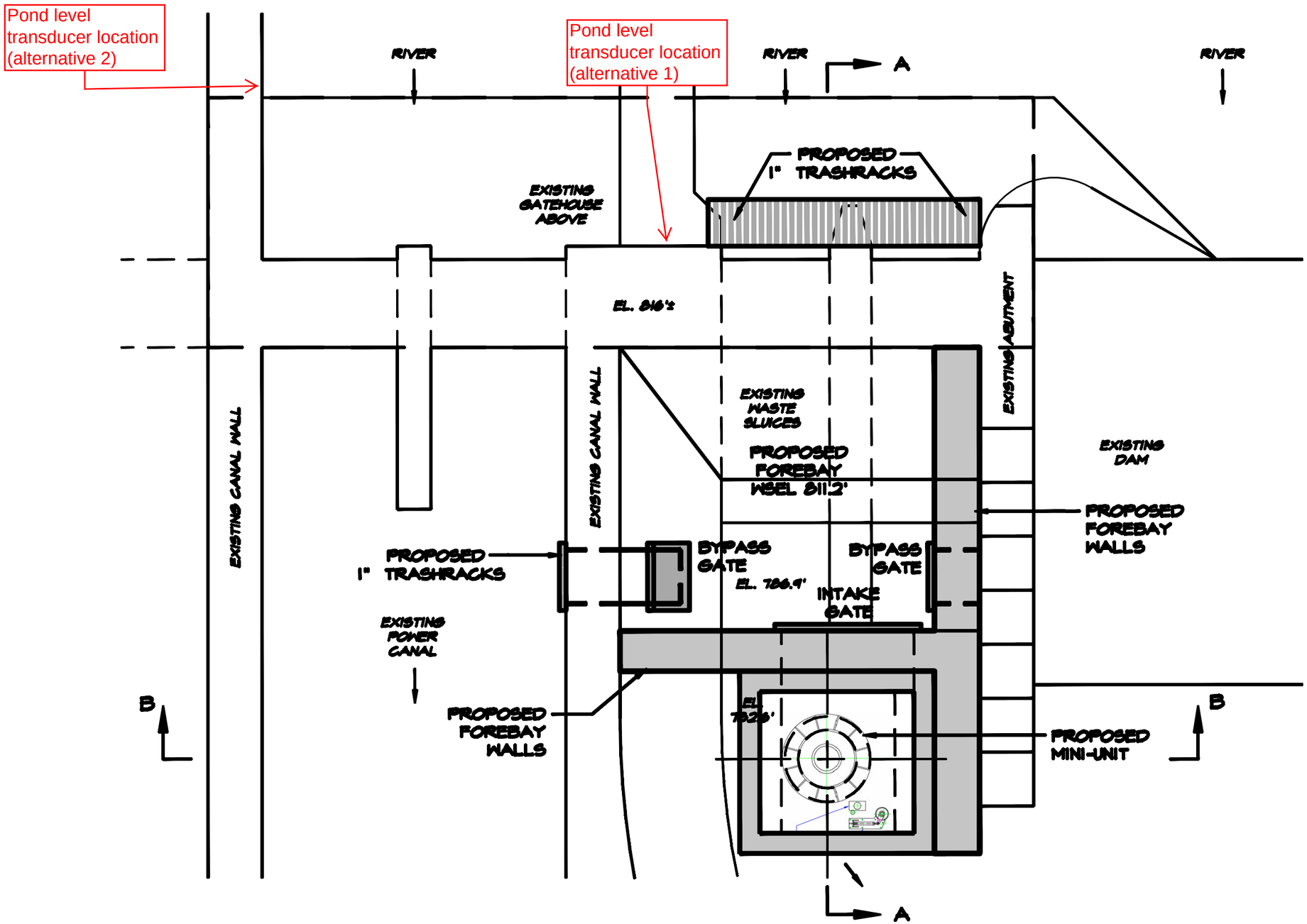


Kevin M. Webb
Environmental Affairs Coordinator

cc: V. Engel, LPC
S. Michaud, LPC
R. Kubit., MDEP
C. Slater, MDFW
M. Grader, USFWS

Attachment A

Minimum Flow Unit General Arrangement



MINI-HYDRO CONCEPT A

UNIT LAYOUT PLAN

SCALE: 1/8" = 1'-0"

REV#	DATE	REVISION DESCRIPTION
0	07/2021	CONCEPTUAL
1	09/2021	REVISED CONCEPTUALS
2	04/2022	REVISED LAYOUTS

DESIGNED BY: ____ LMB

DRAWN BY: ____ LMB

CHECKED BY: ____

SCALE: 1/8" = 1'-0"

JOB #: ____

GLENDALE HYDRO
STOCKBRIDGE MA

HYDRO DEVELOPMENT GROUP, INC.
c/o ENEL NORTH AMERICA, INC.
ONE TECH DRIVE, SUITE 220
ANDOVER MA 01810
phone (978) 681-1900

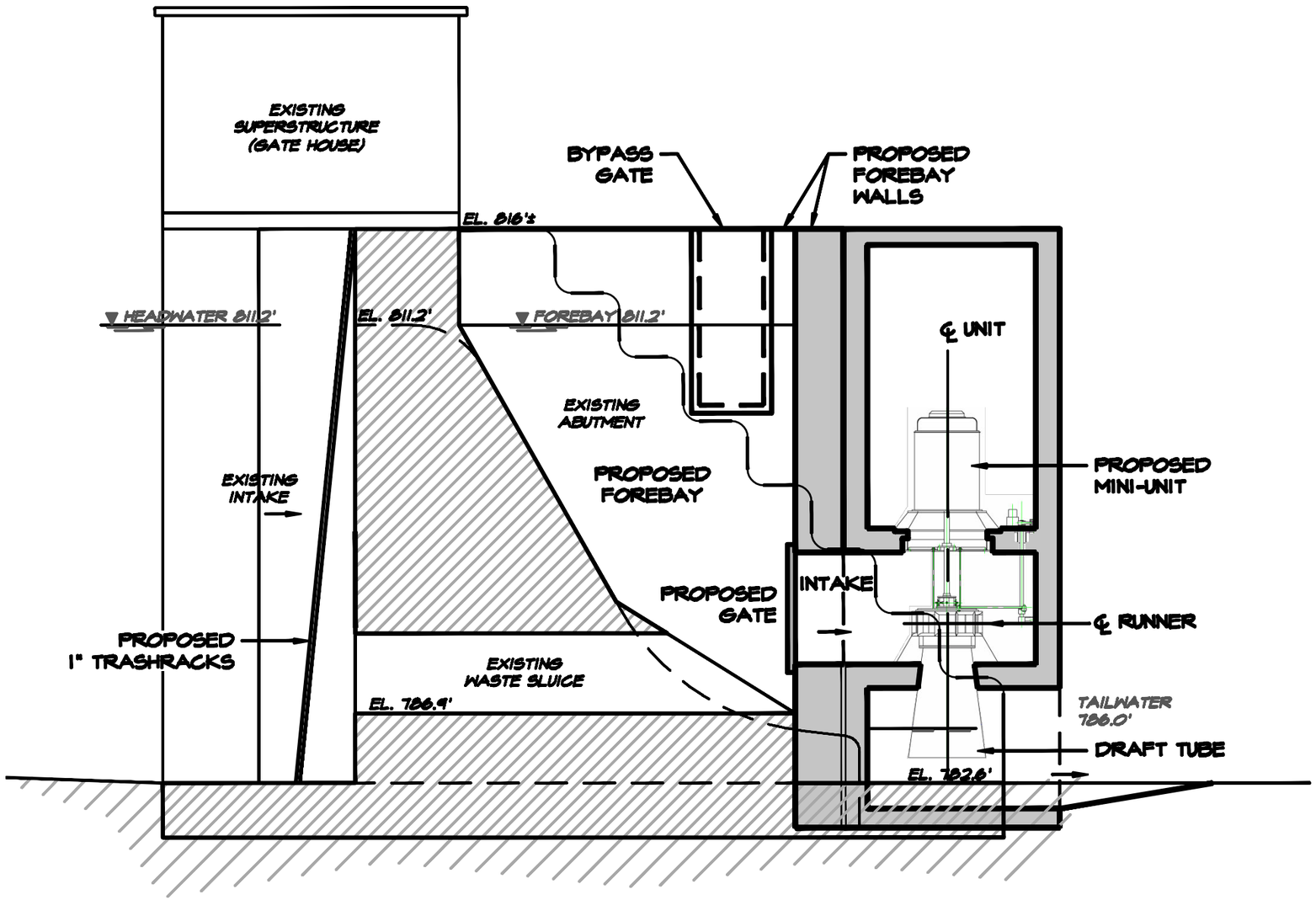
FIGURE 4
UNIT PLAN - CONCEPT A

CONCEPTUAL SITE IMPROVEMENTS
FERC NO.

REVISION #2

T4

SHEET 4 OF 6



MINI-HYDRO CONCEPT A

LONGITUDINAL UNIT SECTION A-A

SCALE: ⅛" = 1'-0"

REV#	DATE	REVISION DESCRIPTION
0	07/2021	CONCEPTUAL
1	09/2021	REVISED CONCEPTUALS
2	04/2022	REVISED TURBINE

DESIGNED BY: ____ DRAWN BY: LHB CHECKED BY: ____ SCALE: 1/8" = 1'-0" JOB #: ____

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FIGURE 5
UNIT SECTION - CONCEPT A

CONCEPTUAL SITE IMPROVEMENTS
FERC NO.

REVISION #2

F5

SHEET 5 OF 6