



Proactive by Design



REPORT ON PERMITTING SMALL AND LOW IMPACT HYDROPOWER PROJECTS IN MASSACHUSETTS



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1.0 INTRODUCTION

This report was authored by GZA GeoEnvironmental, Inc. (GZA), with the assistance of Hydropower Consulting Specialists, LLC. (HCS), for the Massachusetts Department of Energy Resources (DOER) to fulfill the requirements of Section 47 of St. 209 of 2012 and assist DOER in responding to Executive Order 562. GZA's work was authorized under its contract with the Commonwealth RFR-ENE-2016-007, which was executed on December 14, 2015. This report is subject to the limitations in **Attachment 1**.

In preparing this report, the GZA team drew upon their own experiences as consultants in the hydropower industry, which has included interaction with state and federal permitting/regulatory processes and the Commonwealth's Renewable Energy Portfolio Standard Qualification process, as well as similar processes in other states. GZA also consulted with multiple stakeholders with interests in the Massachusetts hydropower industry via an on-line survey, written communication, and direct interviews. State and Federal agencies involved in the permitting and RPS qualification of projects, hydropower project owners, hydropower consultants, and others were also surveyed on their experiences and thoughts on the processes. These parties were asked a number of questions about their experience in the permitting of hydropower projects and on their experience with the RPS Qualification process. Surveyed parties were invited to provide feedback beyond the survey. Several parties met with or participated in a conference call with the authors of this report as a follow up to completing the survey.

Several sections of this report deal with topics related to the Massachusetts Renewable Energy Portfolio Standard (RPS). The RPS is a statutory obligation that suppliers (both regulated distribution utilities and competitive suppliers) obtain a percentage of electricity from qualifying generators for their retail customers. The RPS began with an obligation of one percent in 2003, and then increased by one-half percent annually until it reached 4% in 2009. In 2009, as a part of the Green Communities Act of 2008, the RPS was renamed RPS Class I, an RPS Class II was added, and the Class I obligation was set to increase by 1 percent annually. Each Class has a different compliance obligation percentage, as well as a different set of qualifying generation units. Small hydropower is a technology which is eligible for qualification under both Classes of the RPS. Suppliers meet their annual RPS obligations by acquiring a sufficient quantity of RPS-qualified renewable energy certificates (RECs) that are created and recorded at the New England Power Pool (NEPOOL) Generation Information System (GIS). Qualifying hydropower generation units can be located in Massachusetts, in another state within the ISO New England (ISO-NE) control area, or, with additional conditions, in a control area adjacent to ISO-NE (New York, Quebec, or the Maritimes).

This report was prepared by Kristina Ekholm, P.E. and Chad W. Cox, P.E. of GZA and Celeste Fay of HCS, with assistance from Christine Suhonen and Thomas Jenkins, P.E. of GZA and Quincy Vale, Esq. of Vale Law for Energy & the Environment. Oversight from DOER was provided by Joanna Troy, Howard Bernstein, and Michael Judge.

2.0 OBJECTIVE AND SCOPE

The objective of this report is to summarize the state and federal permitting processes and environmental assessments involved in the construction and operation a hydropower project in Massachusetts as well as the differences in such processes and assessments when applied to different types of hydropower projects. The report examines how "Low Impact Hydropower" is currently defined, summarizes the process for a hydropower project to become RPS qualified in the Commonwealth, and compares this process and benefits with those of other nearby states. This report is also intended to assist in identifying what, if any, duplicative processes may exist in the permitting and RPS qualification process and to provide options for changing DOER regulations while maintaining consistency with policy and environmental objectives. Based on the result of the research, stakeholder survey, and other input, concepts for streamlining the RPS qualification process are presented.



2.1 ECONOMICS OF HYDROPOWER DEVELOPMENT

Hydropower projects in the Commonwealth are primarily, though not exclusively, developed and owned by for-profit companies. The feasibility of both the development of new projects and the continued operation of existing projects is therefore dependent on both technical and financial factors. The financial viability of a hydropower project is a function of project development costs, operations and maintenance (O&M) costs, the total value of energy produced, and any available incentives. The development costs, as well as the O&M costs, will vary significantly depending on factors such as the project size, location, type of generation equipment, and transmission line requirements. Many of the older hydroelectric projects in Massachusetts have reached a stage when they must incur substantial rehabilitation costs (due to typical mechanical and civil lifespan issues) to maintain or restore the design generation capacity of the facility. Such life cycle costs must be considered as part of overall project economics.

Conventional hydropower projects currently in the licensing and permitting process go through rigorous environmental review which is described in detail below. This review is done to protect the watershed and the effort and studies can result in longer project development schedules and additional cost. Environmental mitigations can raise the cost of construction and reduce the project's potential for energy generation. A discussion of the types of studies that may be required is included in Section 6.1.3, 6.2.1 and 6.4.4. A discussion of the types of mitigations is included in section 6.1.3. Such mitigation structures may require additional operation and maintenance, raising annual operating costs. If a project is required to maintain certain minimum flows within bypassed reaches of the waterway or has other restrictions on water withdrawals, there may be reduced energy production.

2.2 VALUE OF ENERGY AND NET METERING

The value of energy will consist of both tangible and non-tangible components and will vary depending on the end user and contract conditions. The tangible product of a hydropower project is electricity that can be used on-site to offset an existing demand or sold to another entity for off-site use. Hydropower projects that offset on-site electricity demand (such as those directly associated with a factory, water treatment plant, etc.) will have a relatively high value of energy equivalent to a "retail" rate. Energy sold to another entity for use (typically the local electric service provider) can be contracted in several ways, including real time energy values (value fluctuates frequently) or through long term power purchase agreements (PPAs). When selling to a utility, the value of energy is lower and rates are considered "wholesale". Virtual net metering allows the generator to independently negotiate a power sales contract with a specific end user at a separate location. When virtual net metering is utilized, the value of energy is typically greater than wholesale but less than retail (unless the producer and consumer are the same entity in which case production simply offsets demand)¹.

Net metering for hydropower was repeatedly raised by a number of representatives of the hydropower community as a key regulatory issue that affects the financial performance and thus viability of existing and proposed hydropower projects. It has been suggested by a number of respondents that hydropower should be put on closer par with other types of renewable energy in terms of eligibility for net metering. This change would increase hydropower revenue potential and allow for long-term power purchase agreements which would provide more certainty and stability to hydropower projects.

¹ In Massachusetts, virtual net metering is limited to hydropower projects with a capacity of 60 kW or less. Massachusetts does not differentiate between virtual net metering and net metering. The Department of Public Utilities recently completed a Report to the General Court (D.P.U. 14-118-A, June 30, 2015) on net metering by small hydroelectric facilities. This report recommended a number of changes to the current net metering regulations as applied to hydropower.



On June 30, 2015, the Department of Public Utilities published an Investigation Regarding the Feasibility, Impacts and Benefits of Allowing Electric Distribution Company Customers to Net Meter Electricity Generated by Small Hydroelectric Facilities. The investigation included a recommendation to the Massachusetts Legislature that hydro project that meet RPS eligibility criteria should qualify as net metering eligible facilities.

2.3 RENEWABLE ENERGY CERTIFICATES

Renewable Energy Certificates (RECs) are tradable, non-tangible, energy commodities that are minted at the NEPOOL GIS. Each REC represents the renewable energy attributes of one megawatt hour (MWh) of electricity that was generated by an RPS-qualified renewable energy source. RECs are not required for or automatically created by hydropower generation, but qualifying for RPS and thereby obtaining and selling RECs can provide additional income for a hydropower project. RECs can increase the financial viability of construction, operation, and maintenance of a hydropower project. There are costs associated with qualification of RPS programs and typically short term REC contracts are more common than long term. To qualify for RPS in the Commonwealth, a hydroelectric project must meet the standards described in the Commonwealth's regulations. These regulations are further discussed in Section 6.4 below but broadly set limits on the size of the project and the date when the project came on-line and also require that the project has a low impact to the surrounding environmental resource. Hydropower is eligible for either Class I or Class II RECs, depending on the date of first operation or capacity increase. Massachusetts Class I RECs typically have a higher value, while Class II RECs typically have a lower value.

There are 62 MW of Class I Qualified Capacity for Hydroelectric Facilities, with just over 36 MW located in Massachusetts. This generation accounted for only 2.8% of the Class I RECs minted in 2014. The majority of Class I RECs are minted by wind generators (55.8%) with landfill Gas (17.7%) and solar PV (14.7%) being the second and third most common. Comparatively, Class II RECs are dominated by hydroelectric facilities as hydroelectric is the oldest productive renewable energy resource. There are 168.46 MW of qualified Class II capacity for hydroelectric generators. These Class II facilities minted just over 526,000 RECs (MWh) in 2014, accounting for 99.95% of all 2014 Class II RECs.

REC prices are a function of the market and the Alternative Compliance Payment (ACP) Rates. The ACP mechanism enables a Supplier to comply when, for whatever reason, it does not acquire sufficient RECs to meet its RPS compliance obligation in a given year. Massachusetts REC prices vary based on market conditions (supply and demand) and are effectively capped by the ACP Rate. REC prices are not reported publically but the ACP rate for 2016 Class I is \$66.99/MWh. The value of qualifying for the RPS and minting RECs will vary based on the facilities capacity, capacity factor (or operational efficiency), and the REC price. For example, a low-impact project of 2 MW with a capacity factor of 50% would be able to generate 8760 MWh in one year, minting 8760 RECs for \$438,000 assuming a \$50/MWhr REC price. Hydropower generated within the Commonwealth may qualify to earn and sell RECs in other ISO-NE states which have varying requirements for hydroelectric project qualification and associated REC values.

2.4 ESTIMATE OF HYDROPOWER POTENTIAL

In addition to facilities that are already qualified for the Massachusetts RPS, there are hydroelectric facilities authorized to generate electricity that are not currently part of the RPS, despite meeting the size and age requirements. There may be up to 291 MW of capacity in New England but only 9.5 MW in Massachusetts. While it is unknown why these facilities have not sought RPS qualification, they can be considered hydropower potential for the state's renewable energy portfolio.

Estimating the potential for further hydroelectric growth on existing, non-generating dams within Massachusetts is challenging as there is limited knowledge of the condition and location of existing dams. Estimates range from 8.7 to 67 MW of additional capacity potential. A technical objective of this study was to conceptually quantify the power



production potential if generation were restored at all dams in the Commonwealth that were historically used to generate hydropower.

There are approximately 3,000 dams in the Commonwealth of Massachusetts. Repowering those dams where hydropower was historically produced could be a means to increase the Commonwealth's capacity to generate renewable energy. An order of magnitude estimate of hydropower potential at dams that are believed to have likely historically produced hydropower was developed to support this assessment of such a scenario. The details on the assumptions and methodology used in generating this estimate are summarized in **Attachment 7**. The general procedure was to identify historic mills (from the Massachusetts Cultural Resources database) and then associate the mills with a nearby dam. Dams that also included the name "mill" were included in the list of dams. It was estimated that there are approximately 337 dams that may have historically been used for hydropower generation. These dams are predicted to generate approximately 20 MW of peak power. These figures do not include the dams that are currently producing hydropower. The list of dams and the estimated power at each dam is included in Attachment 7.

For comparison, a study published by the U.S. Department of Energy in 2012 presented the hydropower potential of dams in Massachusetts currently not being used for hydropower as 67 MW. This number is likely higher because it includes dams not associated with a mill or historic hydropower production. Another study performed by New England Hydropower Company presents the total hydropower potential of Massachusetts, at sites where their specific type of alternative generation equipment is applicable, as 8.7 MW.

3.0 DISCUSSION OF PERMITTING AND APPROVAL PROCESS

The permitting and approval process for developing and operating a hydroelectric project is a complex and lengthy process. Developers of potential hydropower facilities must assess and account for the uncertainties and lengthy timelines of the various processes as part of the assessment of the feasibility of a project. Permit and authorizations must be obtained from a variety of Federal, State, and municipal agencies. Because all new and reactivated projects, in any state, require authorization from the Federal Energy Regulatory Commission (FERC), it is important to first understand the federal permitting and licensing process.

3.1 FEDERAL JURISDICTION

Fundamentally, all hydroelectric projects will be subject to federal jurisdiction and FERC licensing requirements. Pursuant to Section 23(b)(1) of the Federal Power Act, 16 U.S.C. 817(1) (1982), a non-federal hydroelectric project must (unless it has a still-valid pre-1920 federal permit) be licensed by the US Federal government if it meets any one of the following criteria:

1. Is located on a navigable water of the United States;
 - *GZA commentary: The definition of navigable waters is a complicated legal issue as there are a wide array of interpretations of what constitutes a navigable waterway.*
2. Occupies lands of the United States;
 - *GZA commentary: This means a project that is built on federal land*
3. Uses surplus water or water power from a government dam; or



4. Is located on a body of water over which Congress has Commerce Clause jurisdiction, project construction occurred on or after August 26, 1935, and the project affects the interests of interstate or foreign commerce.
 - o *GZA commentary: Fundamentally all projects, by virtue of either being connected to the electrical grid or by offsetting electric consumption that would otherwise be purchased from a utility, are considered to affect interstate commerce.*

The FERC process to reactivate a historic hydropower project constructed prior to 1935 is objectively the same process as for the development of a new hydropower project despite the apparent grandfathering clause in the final criterion. While the Federal Power Act (FPA) of 1935 includes the above grandfathering clause that allows projects that were constructed prior to 1935 to be exempt from licensing requirements; in practice, only very specific projects will meet the highly restrictive conditions caused by the Commerce Clause. In order to determine if a project meets the requirements, an owner or developer may file a Declaration of Intention (DOI) with FERC to obtain an opinion regarding FERC jurisdiction. An affirmative response results in an “Order Finding of Licensing of Hydroelectric Project Not Required”. In responding to DOIs, FERC has stated that, “Construction activities that are required to restore generating facilities at an abandoned project constitute post-1935 construction within the meaning of the FPA section 23(b)(1)”. Therefore, there is virtually no circumstance where FERC would find a reactivation of a non-functioning, pre-1935 hydropower project exempt from its jurisdiction. Hydropower projects that have been non-operational for periods of time significantly exceeding normal maintenance downtime thus need to obtain FERC authorization which would not differ from a new hydropower project process. A project that has not been operating but has been maintained so as to be capable of being operated would be considered eligible for a favorable finding of Licensing Not Required, but this is a rare situation.

3.2 FERC AUTHORIZATIONS

The process of obtaining FERC authorization for a hydropower project is typically a multi-year process with numerous filings and meetings. FERC issues four types of authorizations, as recently modified by the Federal Hydropower Regulatory Efficiency Act of 2013:

1. Qualifying Conduit Hydropower Facility²

Certain hydropower facilities located on non-federally owned conduits with installed capacities up to 5 megawatts (MW) are not required to be licensed or exempted by FERC. The applicant must file a Notice of Intent to Construct a Qualifying Conduit Hydropower Facility with FERC, and show that the conduit is not primarily for the generation of electricity and was not licensed or exempted on or before August 9, 2013.

2. Conduit Exemption³

A small conduit hydroelectric facility up to 40 MW using a man-made conduit operated primarily for non-hydroelectric purposes may be eligible for a conduit exemption. The applicant must have all the real property interests necessary to develop and operate the project or an option to obtain the interests. The project work (i.e. part of the project structures

² Conduit projects are projects where hydropower is generated along a pipe, canal, or other conveyance structure that is constructed for reasons other than hydropower. Non-power purposes may include water supply, irrigation, etc. The MWRA hydropower project at Loring Road is an example of a conduit project

³ . Note that, for the purposes of Massachusetts RPS qualification, FERC conduit projects are considered to be Hydrokinetic projects and are not subject to the various conditions that the statute requires for hydroelectric generation. The FERC conduit information is provided here because, even if a developer of such a project chooses not to seek RPS qualification, it still has FERC requirements..



under FERC jurisdiction) does not include the conduit. Applications for exemptions of small hydroelectric conduits are categorically exempt from the National Environmental Protection Act (NEPA) requirement for an Environmental Assessment (EA) or Environmental Impact Statement (EIS) to be prepared by FERC. However, this does not mean that FERC cannot require an EA or EIS to be prepared if the project appears to have adverse effects on the environment.⁴ The Conduit Exemption is issued in perpetuity.

3. 10-MW Exemption

A small hydroelectric project of 10 MW or less may be eligible for a 10-MW Exemption. The applicant must propose to install or add capacity to a project located at a non-federal, pre-2005 dam, or at a natural water feature. The project can be located on federal lands but cannot be located at a federal dam. The applicant must have all the real property interests or an option to obtain the interests in any non-federal lands. To have all real property interest the project proponent must have the right to access and maintain the shoreline for the entire impoundment upstream of the dam which serves the project. Many dams in Massachusetts are run-of-river structures where the impoundment extends far upstream of the dam; in some cases the distance is several miles. Projects are subject to NEPA environmental review. The 10-MW Exemption is issued in perpetuity.

GZA notes that the term “Exemption” is misleading. A FERC Exemption does not exempt a project from the scrutiny that seeking a License would create. Projects that have a 10-MW Exemption are subject to many of the same consultation and environmental reviews as with a FERC License. A project proponent may elect to seek a License over an Exemption even if they meet all requirements for an Exemption if there are contentious issues surrounding the project and mediation may be used to resolve these issues.

4. Licenses

A license from FERC is required to construct, operate, and maintain a non-federal hydroelectric project that meets federal jurisdiction requirements and does not utilize one of the above Exemptions. Licenses may be issued for up to 50 year terms and must be renewed at the end of each term. A license gives the licensee the power of "eminent domain" to obtain lands or other rights needed to construct, operate, and maintain the hydroelectric project. If a project under 10-MW does not have all the real property interests, the project must seek a License instead of an Exemption.

Existing laws prohibit FERC from issuing a License or Exemption for projects within certain federal lands, including sites within the boundaries of National Wild and Scenic Rivers (per the Wild and Scenic Rivers Act, 16 U.S.C. §§ 1271-1287), Wilderness Areas (per the National Wilderness Act, 16 U.S.C. §§ 1131-1136) and National Parks (per the Energy Policy Act of 1992).

The Electric Consumers Protection Act (ECPA) of 1986 amended the Federal Power Act of 1920 by increasing FERC's regulatory and enforcement powers. As part of the ECPA the importance of environmental considerations in the licensing process was greatly increased and the role of the State and Federal fish and wildlife agencies was expanded. As a result, the FERC authorization process became more transparent and the public took a greater role in the authorization of projects. Further discussion of the federal environmental review and agency consultation process to obtain a license is described in detail below in Section 5.1: Federal Licensing.

⁴ Project may receive a waiver of the three stage consultation process (40 MW only, no consultations required for 5MW or less).



3.3 OTHER FEDERAL APPROVALS

Clean Water Act and the Water Quality Certification - A Section 401 Water Quality Certification (WQC) is required under the federal Clean Water Act (CWA) for certain activities within wetlands and waters of the United States. Although the CWA is a federal law, the WQC process is administered by the Massachusetts Department of Environmental Protection (MassDEP). A WQC is necessary to operate all hydroelectric projects (due to discharge of water flows through a turbine) and is a prerequisite for FERC approval. A WQC may also be required if construction activities involve dredging or filling of waters or wetlands. A project must receive an Order of Conditions (see State/Local Approvals below) before a WQC can be issued.

Section 404 of the Clean Water Act - The USACE regulates the discharge of dredged or fill materials into Waters of the United States, including wetlands, under the jurisdiction of Section 404 of the CWA. The goal of the 404 program is to ensure protection of the aquatic environment while allowing for necessary economic development. Depending on the extent of thresholds triggered (e.g. volumes or areas of resource areas impacted), it may be necessary to seek coverage under one of the Massachusetts General Permits or file an application for an Individual Permit.

Section 408/Section 14 of the Rivers and Harbors Act of 1899 - If a private developer wishes to construct a hydropower facility at a USACE project, a request must be made under 33 U.S.C. 408.

Section 106 of the National Historic Preservation Act requires Federal agencies (such as FERC and the USACE) to take into account the effects of their proposed actions on historic properties and afford a reasonable opportunity to comment. In Massachusetts, the filing of a Project Notification Form (PNF) with the Massachusetts Historical Commission is the mechanism through which Federally-required consultation with the State Historic Preservation Officer is initiated. Conditions may be imposed on projects which are proposed at a site listed or eligible for listing as historic resources.

4.0 REGULATORY PROCESSES AND ENVIRONMENTAL STUDY REQUIREMENTS

Many environmental assessments may be required as part of both the federal and state approval process, including through the Massachusetts Environmental Protection Act (MEPA), FERC License Authorization, and the Low Impact Hydro Institute (LIHI) certification for the Massachusetts RPS qualification. Environmental assessments protect environmental resources but can also contribute to the effort, cost, and time required to permit a hydroelectric project. A discussion of the environmental assessment is included with the discussion of the authorizations.

4.1 FEDERAL LICENSING

4.1.1 FERC Application Processes

FERC has provided three application processes for obtaining FERC authorization: the Integrated Licensing Process (ILP), the Traditional Licensing Process (TLP) and the Alternative Licensing Process (ALP). The current FERC process for securing a License or Exemption typically starts with the filing of a Preliminary Permit. During this process, stakeholders, including Federal and state agencies, are notified and can comment on the proposed project and/or request future studies. Sometimes if stakeholder requests are considered too onerous, or if stakeholders appear to strongly object to the project, a project proponent may elect to abandon the project.

If the proponent chooses to proceed, the applicant will file for either an Exemption or a License, depending on project characteristics. FERC offers three different general "licensing processes" for obtaining authorization is a license is needed. The selection of which process to use is largely driven by whether the proponent expects to need assistance



from FERC in negotiating studies and terms and conditions (with stakeholders). Process flowcharts for the three processes are included in **Attachment 2**.

(1) Integrated (ILP)

- a. FERC indicates that this is the best license process for projects that expect the need for mediation between owner and stakeholder. This process has early FERC involvement (at Notice of Intent stage) and FERC involvement throughout.
- b. The process timeline is subject to defined deadlines for all parties, including FERC.
- c. The study plan is developed through meetings with stakeholders and is approved by FERC.
- d. There are several options for dispute resolutions:
 - i. Informal
 - ii. Formal – A three-member panel makes technical recommendations. The FERC Office of Energy Projects (OEP) opinion is binding.

(2) Traditional (TLP)

- a. FERC indicates this is the best process for projects where little disagreement with stakeholder is expected. FERC involvement is only after the application has been filed.
- b. There are Pre- and Post-filing deadlines for participants.
- c. The study plan is developed by applicant based on early stakeholder recommendations. There is no FERC involvement.
- d. FERC will offer dispute resolution upon request (by tribes/ agencies). FERC OEP will offer advisory opinion.

(3) Alternative (ALP)

- a. This process has early FERC involvement (at Notice of Intent stage).
- b. The project timeline is subject to timelines established by collaborative group.
- c. The study plan is developed by collaborative group and FERC is a resource.

The ILP became effective on October 23, 2003 and is currently utilized as the default process. Applicants may request the use of the other processes.

All processes involve a three stage pre-filing consultation process (unless project is a Qualifying Conduit Hydropower Facility). During the first stage, the applicant identifies project stakeholders. These stakeholders include but are not limited to state and federal fisheries agencies, the State Historic Preservation Officer (SHPO), and Native American tribes potentially affected by the project. A copy of the Initial Consultation Contact List for the Commonwealth of Massachusetts (as of December 2015) is included in **Attachment 3**. During the first stage, the applicant provides



stakeholders with initial information about the project (via the Preliminary Permit application and the Notice of Intent filings; and via the joint meetings). During the first stage, stakeholders have the opportunity to request studies.

During the second stage, the applicant conducts required studies and provides stakeholders with a draft of their application. If there are substantive disagreements, the applicant conducts a meeting to resolve them.

During the third stage, the applicant files the application with FERC. Once filed in its final form, FERC will review the application and issue authorization for the project and provide the terms and conditions for the construction and operation of the project. Unless FERC performs formal dispute resolution (via an Administrative Law Judge (ALJ) performing Administrative Dispute Resolution (ADR)), the conditions provided by the US Fish and Wildlife Service, National Marine Fisheries Service, and the state fish and wildlife agency will be included with FERC's terms and conditions. The FERC authorization cannot be issued until the state issues the Water Quality Certification (WQC) for the Project.

Once a project is authorized, modifications to a project, including changes in project structures, locations, or operations require an amendment to the License or Exemption from FERC. In some cases, the changes can be made without FERC's approval if:

- After being notified in writing by the FERC Exemption holder of its intended changes, the appropriate fish and wildlife agencies determine that the proposed changes would not cause the project to violate the terms and conditions imposed by the agencies; and
- The changes would not materially alter the design, location or method of construction or operation.

A "capacity related amendment" is required for projects that would increase the project's actual or proposed total installed capacity by 2 MW or more, and increase the project's maximum hydraulic capacity by 15 percent or more (18 CFS 4.2.01(b)). A "non-capacity related amendment" would be required for projects not meeting both the installed and hydraulic capacity criteria listed above (18 CFR 4.2.01(c)).

4.1.2 Terms and Conditions of Federal Authorization

The terms and conditions associated with FERC authorizations vary from project to project.

Existing Exemptions

Per Section 405 of the Public Utilities Regulatory Policies Act (PURPA, 16 U.S.C. 2705(b)), Exemptions are subject to the requirements of section 30(C) for the Federal Power Act (FPA, 16 U.S.C. 823a(c) which provides, among other things, that FERC "shall issue in any such exemption... such terms and conditions as the Fish and Wildlife Service, National Marine Fisheries Service, and the State [fish and wildlife] agency each determine are appropriate to prevent loss of, or damage to, such resources." Article 2 of all exemptions requires compliance with the terms and conditions filed by federal and state wildlife agencies to protect fish and wildlife resources. Projects that have existing FERC Exemptions have fixed terms and conditions. Because Exemptions are issued in perpetuity, there are no opportunities for stakeholders to revisit a project post-exemption and request any studies or design modifications. A number of Exemptions were issued prior to the Electric Consumers Protection Act (ECPA) Act of 1986 (discussed above) and therefore agencies that now have mandatory conditioning authority did not have an opportunity to provide conditions on a project.

New Exemptions



Similar to existing FERC Exemptions, new FERC Exemptions include the mandatory conditions of agencies such as USFWS and MassWildlife. New and recently issued Exemptions include a provision that allows for the USFWS or MassWildlife to prescribe upstream or downstream fish passage in the future meaning stakeholders have an opportunity to revisit the issue of fish passage at any time in the future. MassWildlife however has noted that, although they maintain the authority to require fish passage at an existing project under such a condition, it is a difficult avenue for the agency to pursue.

Existing Licenses

FERC Licenses are issued for a period of 30 to 50 years. All existing FERC licenses were issued with site-specific terms and conditions. Five years before a license expires, a licensee must file a Notice of Intent declaring whether or not it intends to seek a new license for its project. Two years before the license expires, the licensee files an application for a new license. The process for relicensing a project is the same as the process to file for an original license. During the licensing process, stakeholders have an opportunity to comment on the project and request studies or design/operation modifications. This engagement may result in different terms and conditions for a project after relicensing than the project's original terms and conditions. As discussed above, unless a FERC Administrative Law Judge performs Administrative Dispute Resolution, the conditions provided by the US Fish and Wildlife Service, National Marine Fisheries Service, and the state fish and wildlife agency will be included with FERC's terms and conditions.

New Licenses

New Licenses are issued for a period of 30 to 50 years. All new FERC licenses are issued with site-specific terms and conditions. During the licensing process, stakeholders have an opportunity to comment on the project and request studies or design/ operation modifications. As discussed above, unless a FERC Administrative Law Judge performs Administrative Dispute Resolution, the conditions provided by the US Fish and Wildlife Service, National Marine Fisheries Service, and the state fish and wildlife agency will be included with FERC's terms and conditions.

The above is based upon current Federal laws and regulations which are subject to change.

4.1.3 Studies Supporting FERC Authorization

All projects seeking new FERC authorization or relicensing must submit an application to FERC. The application must include an Exhibit E - Environmental Report. The Exhibit E must be prepared pursuant to *18 C.F.R §§ 4.38 and 4.61*. The report must include information on the following, commensurate with the scope and environmental impact of the project's construction and operation: vegetative cover, fish and wildlife resources, water quality and quantity, land and water uses, recreational use, socio-economic conditions, historical and archeological resources, and visual resources.

In-depth environmental studies may be required to support an application for FERC authorization. These environmental studies are typically requested by project stakeholders. During the FERC process, stakeholders request studies during the first stage of the consultation process. Stakeholders will request the studies after initial information about the project (formally known as the Initial Consultation Documentation (ICD)) is provided and stakeholders have an opportunity to view the site and meet with the project developer. If the stakeholders and the project developer are not in agreement on the scope of the requested studies, they can seek arbitration through a three member panel.

The types of studies vary from project to project and are frequently dependent upon the waterway where the project is located. The FERC authorization may require studies during the project operation phase (such as a water quality study). Many authorizations and 401 Water Quality Certifications require water quality studies, measuring dissolved oxygen and temperature, both with and without project operation. In cases where the study results may require design



modifications, FERC authorization will only be issued after the study is completed. Other studies that may be required include rare or endangered species evaluations, bypass reach studies, upstream and downstream fish passage studies and upstream and downstream fishway effectiveness testing.

Stakeholders involved in determining the specific parameters of environmental studies typically include federal agencies such as the U.S. Fish and Wildlife Service (USFWS) and agencies of the Massachusetts Executive Office of Energy and Environmental Affairs, such as the Division of Fisheries and Wildlife (MassWildlife) and the Department of Environmental Protection. When sufficient information is available to authorized agencies, they may provide preliminary terms and conditions along with their comments on the ICD.

For projects that are FERC regulated, MassWildlife has an opportunity to comment on new hydropower project licenses and has mandatory conditioning authority on new FERC Exemptions. For projects that do not impact Endangered Species, MassWildlife has no direct authority to regulate hydropower projects, unless they are subject to FERC authorization.

The National Environmental Policy Act (NEPA) is applied to any major project that involves permits issued by a federal agency. Through NEPA, FERC is required to prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS) for each project it authorizes. As required by NEPA, FERC will prepare an Environmental Assessment (EA) to support a FERC project authorization. FERC will prepare an Environmental Impact Statement (EIS) if the project will significantly affect the quality of the environment. The project terms and conditions will reflect the design or operations modifications deemed to appropriately address environmental concerns. FERC's analyses of environmental impacts are largely developed, based up on the Exhibit E information that is prepared by the Applicant. The results of the EA or EIS may result in the following enhancements/ mitigations:

- Minimum flow in bypassed reach;
- Operational compliance monitoring plan for reservoir water level fluctuation and bypass reach flow;
- New flow gage downstream of tailrace;
- Contribution to fish habitat enhancement fund;
- Fish passage considerations (e.g., ladders, fish lifts and downstream bypass facilities);
- Boat access; and
- Recreational trails.

4.2 STATE/ LOCAL APPROVALS

Whether a new project requires the various permits is project-specific and a function of the project impacts. Existing projects do not typically require any new state permits for continued operation unless project maintenance activities trigger a review (e.g. dredging, wetlands disturbance, etc.). Project modifications performed or required as part of re-licensing can trigger the needs for filing of state permits. Efficiency upgrades do not necessarily trigger the need for state agency review unless the efficiency upgrades exceed a MEPA threshold or the efficiency upgrades are of a nature that has direct impacts.

4.2.1 State Process

Order of Conditions



If a proposed hydroelectric project involves removing, dredging, filling, or altering a wetland, an Order of Conditions must be obtained from the local city or town Conservation Commission, with concurrence from MassDEP, in accordance with the Massachusetts Wetlands Protection Act (WPA) (M.G.L. Chapter 131, Section 40).

Massachusetts Endangered Species Act

The Massachusetts Endangered Species Act (MESA) (M.G.L. c.131A) protects rare species and their habitats by prohibiting the “take” of any plant or animal species listed as endangered, threatened, or of special concern by the MA Division of Fisheries and Wildlife (MassWildlife). If a project is located in either a Natural Heritage and Endangered Species Estimated or Rare Habitat area, a Rare Species Information Request form must be filed with Natural Heritage and Endangered Species Program (which is part of the MassWildlife).

Massachusetts Environmental Policy Act (MEPA)

The Massachusetts Environmental Policy Act (MEPA) requires that state agencies study the environmental consequences of their proposed actions, including permitting and financial assistance. A project is required to follow specific review procedures, such as the filing of an Environmental Notification Form and/or an Environmental Impact Report, if it equals or exceeds any of the MEPA thresholds. Under MEPA there are 12 threshold categories. A hydropower project has the greatest potential to trigger thresholds related to Wetlands, Waterways, and Tidelands; Energy; Historical and Archaeologic Resources; and Areas of Critical Environmental Concern. Note that the MEPA threshold for Energy is the construction of a new generating facility with a capacity of 25 MW or more. Many small hydropower projects do not trigger the need for MEPA review. A similar coordinating function is provided through the Massachusetts Energy Facilities Siting Board, as discussed below.

Chapter 91

Under Massachusetts General Law Chapter 91, the Commonwealth seeks to preserve and protect the rights of the public and to guarantee the private use of tidelands and waterways for proper public purpose. Chapter 91 regulations apply to the waterway on which the project is located. If the project involves construction, placement, excavation, addition, improvement, maintenance, repair, replacement, reconstruction, demolition, or removal of any fill or structures not previously authorized, or for which a previous grant or license is not presently valid, it is necessary to apply for a Chapter 91 Waterways License. Hydropower projects located within adjacent, existing mill-type structures typically do not require filing for a Chapter 91 Waterways License; however, a retroactive license for the dam may be required.

Dam Safety

The Massachusetts Dam Safety Statute (MGL Chapter 253 §§ 44-50) defines the responsibility of owners of dams within the Commonwealth that are not regulated by FERC. Of the approximately 3,000 dams in Massachusetts only approximately 60 are currently under FERC jurisdiction as hydroelectric dams. These projects are exempted from the Massachusetts Department of Conservation and Recreation Office of Dam Safety (ODS) authority. Dam safety requirements for these dams are defined and enforced by FERC once the project has a Federal authorization. All other dams are regulated by the ODS under Massachusetts dam safety regulations (302 CMR 10). A project must comply with ODS requirements and regulations (such as performing inspections, development of Emergency Action Plans, etc.) up until the point where the project receives a FERC authorization (License or Exemption). Unless a proposed hydroelectric project requires the construction or modification of a dam prior to obtaining FERC authorization, there is typically no need to file a Chapter 253 Permit application with ODS.

Massachusetts Energy Facilities Siting Board (EFSB)



The role of the Massachusetts Energy Facilities Siting Board (EFSB) in hydropower siting is to facilitate the review of hydropower facilities by state permitting and licensing authorities. A Hydropower Preliminary Notification Form (HPNF) must be filed with the EFSB and the proponent must attend a pre-licensing conference. The content of the HPNF is similar to that of a FERC Exemption or license application and the pre-licensing conference is similar to the FERC joint meeting.

Finally, if the project involves construction, alteration, repair, or demolition of a structure, a building permit must be obtained from the local city or town Building Department.

4.2.2 Studies Supporting State Permits

When proposed projects require an application for one or more of the permits described above, environmental assessments or studies may be necessary to provide a complete application. For example, a wetlands delineation is often required in support of a Notice of Intent. Sediment testing may be required to support any dredging permitted under the 401 Water Quality Certification Program, a federal permit administered by the Commonwealth's Department of Environmental Protection. The full need for such documentation may not be evident until the review agencies have considered the project's initial application materials.

MEPA requires that the developer of a new hydroelectric project with a capacity of 25 MW or more (i.e. a large project) file an Environmental Notification Form (ENF). An Environmental Impact Report (EIR) is also mandatory for these projects. An ENF addresses the following elements: Areas of Critical Environmental Concern, rare species, historical/archaeological resources, water resources, stormwater management, Massachusetts Contingency Plan, solid and hazardous waste, and Designated Wild and Scenic Rivers. The Scope of the EIR is defined by the MEPA secretary and specifies the form, content, level of detail and alternatives required for the EIR. The Scope of the EIR is based upon the issues identified of concern in the ENF. The EIR must include an Assessment of Impacts. The Assessment of Impacts is a detailed description and assessment of the negative and positive potential environmental impacts of the project and its alternatives. The EIR assesses (in quantitative terms, to the maximum extent practicable) the direct and indirect potential environmental impacts from all aspects of the project that are within the Scope. The assessment includes both short-term and long-term impacts for all phases of the project (e.g., acquisition, development, and operation) and cumulative impacts of the project, any other projects, and other work or activity in the immediate surroundings and region.

5.0 COMPARISON OF STATE AND FEDERAL DESIGNATION OF LOW IMPACT HYDROPOWER

Many hydroelectric facilities can obtain FERC licenses to operate but in Massachusetts only projects considered "low impact" can qualify for the Renewable Portfolio Standard (RPS) and receive the additional revenue from Renewable Energy Certificates (RECs). The Federal and Commonwealth have different definitions of a "low impact" hydroelectric facility. The criteria and performance standards for determining whether a hydroelectric facility is classified as "low-impact" have been reviewed and are discussed below.

5.1 FEDERAL THRESHOLDS

There is no published official Federal definition for Low Impact hydropower. However, information on a section of FERC's website⁵ lists four factors in a discussion of low impact conventional (non-conduit) projects. These are:

⁵ <http://www.ferc.gov/industries/hydropower/gen-info/licensing/small-low-impact/get-started/dam-safety.asp>



- Located at existing dams or conduits.
- Located on lands owned by the licensee/exemptee.
- Cause little change to water flow and use.
- Have no impacts on threatened or endangered species or fish passage.

Despite having no official definition of low impact hydropower, FERC is tasked with the protection of project resources including fish and wildlife resources (including spawning grounds and habitat), visual resources, cultural resources, recreational opportunities and other aspects of environmental quality. During the FERC authorization process, extensive project review completed by FERC through the public process and Agency participation acts to ensure.

As discussed, conduit hydropower (as defined by FERC) differs from more conventional hydropower development in that it is generally not located on natural rivers or waterways and therefore does not involve the type of environmental impacts that are associated with conventional hydropower⁶. The federal government has recognized this by modifying its approval processes. In-conduit projects that require FERC authorization and meet certain criteria can go through a more streamlined authorization process that only focuses on the powerhouse area. In some cases, a qualifying conduit project will not be subject to FERC regulation. Such projects are, by definition, recognized as having little to no impacts on any natural resources.

5.2 DAM SAFETY REGULATION

In Massachusetts, although most dams are regulated by the Department of Conservation and Recreation Office of Dam Safety (ODS), dams and reservoirs licensed by FERC are excluded from the Massachusetts Dam Safety regulations per 302 CMR 10.04. Therefore FERC authorized projects are subject to FERC standards for dam safety (which are similar to those required by the Commonwealth but differ in detail). The FERC guidance document for dam safety issues is the Engineering Guidelines for the Evaluation of Hydropower Projects.

FERC's definition of a low hazard dam is that the dam is low in economic and/or environmental losses and failure or mis-operation of the dam will not result in loss of life. FERC's dam safety, public safety, and security requirements for these dams are minimal (and, as FERC states, should not cause hydropower projects proposed at such dams to become infeasible). FERC dam safety requirements for significant and high hazard dams are much more substantial and include additional requirements in comparison to Commonwealth regulations. Examples of items often required by FERC that are either not required by the Commonwealth or that require a more rigorous approach include:

- Conferences every 5 years to inspect and evaluate the failure modes of the structure (Potential Failure Mode Analysis);
- Emergency Action Plans (EAP) (development, testing, annual updates, annual meetings, potential siren installation, etc.); [Massachusetts currently requires only a written EAP and only at High Hazard Dams] and
- Larger spillways to accommodate more significant runoff events.

⁶ Oak Ridge National Lab (ORNL). September 2014. Opportunities for Energy Development in Water Conduits, A Report Prepared in Response to Section 7 of the Hydropower Regulatory Efficiency act of 2013.



5.3 STATE THRESHOLDS

The process and requirements to qualify for RPS vary among all of the New England states and New York. Some states do not provide qualification for hydropower (whether large or small, “low-impact” or not) while others provide incentive through their RPS programs. In addition, some states require significant documentation that a hydropower project is “low-impact” while others require minimal documentation.

The requirements for qualifying for a state’s renewable portfolio standard can be complex. Understanding the overall RPS structure is helpful when comparing the different state programs because direct comparison can be difficult. Generally, the programs’ treatment of hydropower is differentiated by in-service date and power capacity, as well as some environmental impact related factors and the type of hydropower system (conventional, pumped storage). A summary of the RPS requirement for New England States and New York is included in **Attachment 8**.

Four mechanisms play into the definition of “low impact” hydropower in Massachusetts. The Massachusetts Electricity Utility Restructuring Act of 1997 (Chapter 164 of the Acts of 1997) is the original law authorizing the Massachusetts Department of Energy Resources (DOER) to define and operate the RPS. The Green Communities Act (GCA) (Chapter 169 of the Acts of 2008) expanded the RPS programs by establishing the RPS Class II program. The GCA also expanded the RPS programs to allow qualification for hydroelectric facilities that meet certain criteria. Further discussion of the Class I and Class II regulations as defined by DOER, including the Low Impact Hydro Institute (LIHI) certification required to meet the GCA eligibility criteria, is discussed below in Section 6.4.

5.3.1 Massachusetts Electric Utility Restructuring Act of 1997 and Green Communities Act of 2008

The Restructuring Act and the GCA establish the Renewable Energy Portfolio Standard (RPS) and provide site specific standards for a hydroelectric project to qualify for RPS. The laws, as codified in MGL Chapter 25a, §11F, includes the following text, which applies to both pre-1998 (Class II) and post-1997 (Class I) hydropower projects:

“...such existing facility shall meet appropriate and site-specific standards that address adequate and healthy river flows, water quality standards, fish passage and protection measures and mitigation and enhancement opportunities in the impacted watershed as determined by the department in consultation with relevant state and federal agencies having oversight and jurisdiction over hydropower facilities...”

“Relevant Hydroelectric Agencies” refers to the federal, state or provincial agencies with oversight over fish and wildlife, water quality, river flows, fish passage and protection, mitigation and enhancement opportunities.

DOER has promulgated the RPS Class I and Class II Regulations and implements the RPS.

5.3.2 Conduit Hydropower

Conduit hydropower is fundamentally different than conventional hydropower and is worth a separate discussion. A conduit hydropower project is typically located within a “conduit” (manmade water conveyance structure, typically pipe or canal) that is moving water for a purpose other than hydropower generation. Since the conduit’s primary purpose is not power generation (and therefore will exist regardless of whether energy is harnessed or not), incremental environmental impacts from power generation tend to be negligible or non-existent. Furthermore, the construction of a



conduit hydropower project is typically within a previously disturbed, man-made area (i.e. water treatment facility) eliminating any environmental impacts associated with construction activities.

The MA RPS statute has acknowledged these differences between conduit and conventional hydropower by listing conduit hydropower as item (c) within Marine and Hydrokinetic Energy. The GCA defines Marine and Hydrokinetic Energy by referencing MGL c. 25A §3, as follows:

“...electrical energy from: (a) waves, tides and currents in oceans, estuaries and tidal areas; (b) free-flowing water in rivers, lakes and streams; (c) free-flowing water in man-made channels; or (d) differentials in ocean temperature, called ocean thermal energy conversion.”

For conduit (and other Marine and Hydrokinetic Energy) projects to qualify for MA RPS, LIHI certification is not required. This is understood to be due to the fundamental differences in environmental resources and potential impacts associated with conventional versus conduit hydropower.

5.4 RENEWABLE ENERGY PORTFOLIO STANDARDS: CLASS I AND CLASS II

Massachusetts RPS regulations, in 225 CMR 14.00 for Class I and in 225 CMR 15.00 for Class II, reiterate the RPS statute’s eligibility criteria for hydroelectric projects to be considered for qualification. The regulations specify LIHI certification as the procedure by which DOER determines whether or not a project meets the statutory environmental criteria set forth in the GCA. If a project is denied certification, an owner can take an alternative path that includes providing DOER rationale on why the project should be eligible.

To qualify for RPS in the Commonwealth, a hydroelectric project must meet the following screening criteria before the “low impact” environmental evaluation: (a) meet a size limitation⁷, (b) not involve any dam or water diversion structure constructed after December 31, 1997, or any pumped storage of water, and (c) show that it has a low impact to the surrounding environmental resources, as defined in the RPS regulations in 225 CMR 14.05(1)(a)6.d for Class I RECs and 15.05(1)(a)6.d for Class II RECs. DOER primarily utilizes the Low Impact Hydropower Institute (LIHI) certification to verify “low impact” status. LIHI is an independent 501(c)(3) non-profit organization specializing in evaluating the environmental effects of hydroelectric facilities (see below). After “low impact” status and the other eligibility criteria have been met, DOER grants Class I qualification to new post-1997 hydropower projects that do not exceed 30 MW or to post-1997 capacity additions or efficiency improvements not exceeding 30 MW (crediting only the portion of their output that is attributable to such projects), and it grants Class II qualification to pre-1998 projects that do not exceed 7.5 MW.

If a projects has been denied a LIHI certification, then the RPS regulations provide an alternative procedure in 225 CMR 14.05(1)(a)6.ii for Class I, and in 225 CMR 14.05(1)(a)6.ii for Class II. The applicant must notify and seek input from Relevant Hydroelectric Agencies, which have 30 days to comment on the project. The applicant then has 30 days to respond to such comments to the satisfaction of DOER, after which DOER makes a finding of whether the project meets appropriate environmental safeguards.

5.4.1 Low Impact Hydropower Institute

Under the Low Impact Hydropower Institute Certification Program (LIHI Program), LIHI certifies hydropower facilities that seek to minimize the harmful impacts of their operations as compared to other hydropower facilities. Each project

⁷ 30 MW or less for Class I RECs; 7.5 MW or less for Class II RECs



is evaluated by a set of eight criteria: flows, water quality, fish passage and protection, watershed protection, threatened and endangered species protection, cultural resource protection, recreation, and Agency recommendation for removal. A discussion of the eight criteria is included in **Attachment 11**.

The LIHI process consists of three phases (intake review, formal application and recertification), described below, includes input from relevant state and federal resource agencies and other stakeholders, and provides for public comment on posted draft certification. Based on information obtained during the stakeholder survey and discussions with LIHI, it is understood that no project which has submitted a final application to LIHI has been denied certification by LIHI.

5.4.2 Low Impact Hydro Institute Certification Process and Fees

The LIHI process includes three parts, as follows:

- Part 1 consists of an Initial Intake Review, which allows the applicant to submit a questionnaire and receive a preliminary non-published review of the facility. This provides a preliminary indication of whether a project may qualify for LIHI certification and, thereby, screens out projects that likely will not qualify or warns of the need for significant modifications and investment. This also provides an estimate of the fee to be charged for the formal application. The applicant can then decide whether to proceed with the higher effort and expense of the formal application phase.
 - *The Intake Review is informal and confidential. At the end of the review, LIHI provides the applicant with a report identifying any weak points with the application and makes recommendations for the project to address them. LIHI also gives the owner an estimate of the cost for the review of the formal LIHI application (Part 2). Survey results (see below) note that the Intake Interview was helpful.*
 - *LIHI noted that the time period between Part 1 and Part 2 is based upon the applicant's timeline to complete the formal application and that this range has varied from a few weeks to years.*
- Part 2 is the submission of the formal LIHI application. The application is based on the questionnaire from the intake review but includes all the necessary back-up documentation necessary to demonstrate compliance and may include Agency consultations. Back up documentation can include engineering analysis, Agency correspondence, and copies of permits and other approvals.
 - The formal application and supporting documentation are published for a 60-day comment period during which state and government agencies, NGOs and any other interested party may provide input on whether the Applicant is adequately meeting the criteria. The date that LIHI receives a complete application file and fee is noted in the public filing, as that date will become the Certificate Effective date if the Certificate is issued.
 - *After the 60-day public comment period, LIHI has 60 days to complete their review. There is a 30 day appeal period after LIHI completes its review.*
 - *LIHI noted that the timing and responsiveness of agency staff (whose comment are needed) varies greatly and often adds delay to the processing of applications.*
 - Certification is typically valid for a period of 5 years, although there are opportunities for longer terms under certain condition, and recertification is required for continued LIHI status after that term.



- Part 3 is the review of an application for additional terms, referred to as Recertification. Approximately six months prior to the expiration of the term, the facility owner is invited to apply for Recertification. During recertification, the criteria for resource protection are reviewed, as with the initial certification. Unless there have been significant changes within the river basin, the level of effort on the Applicant is typically reduced during a recertification as compared with in initial certification. This is because most of the required documentation will have been developed during the initial application.

The LIHI certification process involves fees for the initial intake review, formal application, and for compliance. The fee for the intake review is a fixed fee of \$950 regardless of project size. The fee for the formal Certification Application phase, is a cost-based fee and ranges from \$2,500 to \$10,000 (according to LIHI). Therefore the total cost to apply ranges between \$3,450 and \$10,950 for both application steps. These costs exclude the any expenses incurred to prepare the application and/or complete studies requested by LIHI.

Some applicants prepare the applications using in-house staff. Other applicants use outside consultants and attorneys to assist them in developing their applications and in maintaining their certification. The costs of these professional services are beyond the fees that are paid to LIHI.

In addition to applications fees, LIHI also charges annual certification fees, which provide revenue to keep the Institute operating. The annual fee consists of two fee types: (1) the annual maintenance fee (which is a \$/MWH rate using the facilities Average Annual Generation (AAG), and (2) active conditions fees, which are assessed only to projects with conditions specific to each project and designed to cover LIHI's cost in reviewing the conditions state each year. LIHI has indicated that they receive virtually no other sources of revenue outside the fees collected from Certificate applicants and Certificate holders, and the annual maintenance fee is the primary source of operating income for the Institute.

The annual maintenance fee has a floor (minimum) of \$1,000 per year, and a cap (maximum) of \$30,000 per year, and are calculated as follows:

$$\text{Base Rate} = \$0.0175/\text{MWH} * \text{Average Annual Generation}$$

Market Participants:

$$\text{NEPOOL} = \$0.10/\text{MWh} * \text{AAG}$$

$$\text{PJM-GATS} = \$0.05 \text{ MWh} * \text{AAG}$$

$$\text{All Others} = \$0.03/ \text{MWh} * \text{AAG}$$

The above maintenance fees were obtained from the LIHI website at the time that this report was prepared (January 2016). Note that the annual maintenance fee varies depending on in what electric market the project is located. Projects in Massachusetts and other NEPOOL states pay maintenance fees that are approximately three times larger than the fees paid by those in some other states.

The range of active condition fees is between \$0 and \$1,000 per condition.

Survey results indicate that the total cost (fees, studies, and necessary project modifications) for RPS qualification through LIHI varies greatly among projects. Qualification fees range from \$3,350 (Winchendon Hydroelectric) to \$250,000 (Collins Hydroelectric Facility). Refer to question 13 in the survey responses (**Attachment 4**).



As part of the survey, project owners were asked if they had been denied a LIHI certification. The survey did not identify any project owners that had been specifically denied LIHI certification. During the interview with LIHI, LIHI indicated that they have never denied a project. LIHI prefers to work with project owners to make the project meet the environmental standards. LIHI acknowledged that some project owners decided not to go beyond the Intake Review. Baystate Hydropower Association stated during an interview that they had not heard of a project having been rejected by LIHI. They too acknowledged that some projects do not proceed past the Intake Review step and thus are not technically “rejected”. Refer to the case study for an owner of a hydropower project in **Attachment 5**.

If a project is not formally rejected by LIHI, that project cannot proceed through the RPS alternate path for RPS Class I qualification. It is GZA’s understanding that LIHI certification is currently the only pathway which has successfully been used for RPS qualification of a hydropower facility.

5.4.3 Studies Supporting Applications for Low Impact Hydro Institute Certification

The Low Impact Hydro Institute (LIHI) works with a number of agencies and non-profits to assess whether or not a hydropower project is considered to have low impact. Like FERC, LIHI seeks the input of USFWS and state agencies such as MassWildlife and MassDEP. LIHI also allows for a public comment period to solicit input from conservation groups such as American Rivers, as well as any other interested party. As discussed in Section 7.5.1, there are eight criteria that a project must meet to obtain certification.

Most of the eight criteria can be satisfied with support letters from the relevant Agencies. Projects which have recently received FERC authorization (Original License, Original Exemption, License/Exemption amendment, or Relicense) will likely have much of the required documentation available. Because the project will have gone through a recent Agency consultation, the applicant typically has an awareness of potential issues at the project (if any) or may be in compliance with recent requirements which can facilitate being able to procure support letters.

For projects which have not had any recent Agency consultation (for example, a project with an older FEC Exemption that does not have mandatory fishway prescriptions), the LIHI process may be the first such opportunity in many years for Agencies to influence the project design and operations. In this case, the LIHI application opens a discussion between Owners and Agencies to make environmental improvements at the project. Agencies may request a variety of flow modifications, infrastructure changes and/or operational modifications prior to supporting LIHI certification.

Studies may be requested by Agencies responding to LIHI’s request for comment. Generally, these are the same type of studies which may be requested during the FERC licensing process. Studies requested could include:

- Water quality testing (field or desktop)
- Field study to gather dissolved oxygen data
- Instream flow study (field)
- Bypass flow evaluation (desktop)
- Turbine survival estimates (desktop)
- Turbine survival estimates balloon tag (field)
- Recreational use study (desktop or field)



- Endangered/threatened species presence study (field), e.g., threatened mussel ID study
- Endangered/ threatened species protection (desktop)
- Historic review (desktop)

The cost of these studies will vary, with the field efforts generally costing more than desktop analysis. The study findings may result in Agencies determining that modifications to the projects must be required. Modifications could include an increase in bypass flows, intake modifications, recreational improvements, mandatory shutdowns, upstream fish passage installation and other protection measures. Modifications such as fish passage construction will have a direct cost for capital improvements. Operational changes such as increased conservation flows may result in reduced energy generation.

5.4.4 Renewable Energy Portfolio Standard Qualification Process

Once a hydroelectric project receives LIHI certification, the next step is the submission of the Statement of Qualification Application (SQA) to DOER. This process includes notification of Relevant Hydroelectric Agencies that the applicant has submitted its SQA and provides 30 days for comment to DOER and the applicant. No studies or mitigations are required as part of this process. Survey feedback indicates that the SQA form is relatively straightforward and easy to use.⁸

6.0 COMPARISON OF FEDERAL AND COMMONWEALTH PROCESSES

Redundant steps in permitting generate extra effort and costs for a hydropower developer without an increase in environmental protection. Redundancies in the consultation processes can create unnecessary work for fish and wildlife and other regulatory agencies. In some cases, particularly for very small facilities, the extra effort and cost may negatively impact the feasibility of the development, reactivation, or upgrade of a project. Under certain circumstances, the potential for redundancy with federal activities has been identified in the LIHI portion of the DOER RPS qualification process.

As discussed above, the FERC process for a new or modified hydropower project typically requires three stages of consultations during which numerous parties are invited to comment on the project, request studies and make recommendations for project modifications. The required stakeholder consultation process is extensive. Unless a FERC Administrative Law Judge performs Administrative Dispute Resolution, the mandatory conditions provided by the US Fish and Wildlife Service, National Marine Fisheries Service, and the state fish and wildlife agency will be included with FERC's license terms and conditions (Federal Power Act Section 4(e) and Federal Power Act Section 18). All Exemptions will include mandatory conditioning by these agencies (Federal Power Action Section 30c). Projects authorized by FERC since the Electric Consumers Protection Act (ECPA) of 1986 have had the opportunity to be reviewed by Commonwealth and Federal fish and wildlife agencies. Projects authorized prior to this date may not have been subject to the same level of review.

The LIHI process is similar to the process that virtually all hydroelectric projects *currently* go through to receive a License or Exemption from FERC. Both the RPS qualification process through LIHI certification and FERC environmental review include agency and stakeholder engagement. After performing the LIHI Intake Review and submitting the formal LIHI application, relevant resource agencies (including fisheries agencies, etc.) and the public are invited to comment on the

⁸ As discussed above, Hydrokinetic projects (such as conduit projects) do not need to achieve LIHI certification before submitting the SQA.



project. New, repowered, or modified hydropower projects must provide information on environmental impacts as part of their FERC application process and must solicit comments from relevant resource agencies and the public.

Both LIHI and FERC processes require the completion of studies. A project may be required to perform studies in order to prove that it meets the LIHI standards. In some cases, the owner can submit the studies that were performed in support of a recent application to FERC. In other cases, the owner must perform new studies. It is noted that it is possible that a project may also be required to make project modifications beyond that which is required by the projects FERC authorization. For example, eel ladders have been required for LIHI certification where not required in the FERC authorization.

LIHI certification of projects for which new FERC License or Exemptions have been issued (which also requires a state-issued WQC) could be considered redundant. Likewise, it was stated by several respondents to the survey that FERC Licenses and Exemptions issued following the passage of the ECPA of 1986 included a process of environmental vetting that is very similar to the one performed by LIHI. Therefore it was suggested by some survey respondents that the LIHI process of low impact certification is redundant for projects authorized after 1986.

Once a project receives LIHI certification, the next step is for the applicant to submit a Statement of Qualification Application (SQA) to the DOER for qualification under the Commonwealth's RPS program, and to notify all Relevant Hydroelectric Agencies of the application, providing 30 days for comment to DOER and the applicant. The second notification provides the agencies with the opportunity for comment on previously unknown environmental issues or on issues raised in but unresolved by the LIHI process. It was noted by some survey respondents that they felt the process results in some redundancies in that the same agencies are asked to comment twice on the same project. The two comment periods are for separate and distinct certification processes. The first notifications are in regards to the project's merits for LIHI certification and the second is in regard to the project's RPS certification. DOER has never received new Agency objections to an RPS application, but it has received reiteration of an objection raised already in the LIHI process. To date, no qualification has been denied by DOER after LIHI certification, although an additional mitigation commitment was once obtained from an applicant.

When DOER qualifies a hydroelectric project for RPS, it provides a Statement of Qualification that reminds the project owner of its relevant regulatory obligations, which include periodically renewed LIHI certification.

7.0 SURVEY AND CASE STUDIES OF SUCCESSFUL AND UNSUCCESSFUL PROJECTS

7.1 SURVEY

State and Federal agencies involved in the permitting and RPS qualification of projects, hydropower project owners, the Low Impact Hydro Institute, and hydropower consultants were surveyed on their experiences and thoughts on these processes. These parties were asked a number of questions about their experiences in the permitting of hydropower project and on their experiences in the RPS Qualification process. The survey was accessed by 54 entities. Two entities accessed the survey twice. For those entities, only their second response was included. The complete list of questions and results of the survey are included in Attachment 4. Survey respondents identified themselves as follows: Owner (58 percent), Government (21 percent), Consultant (11 percent), other (11 percent). It is noted that the survey period was approximately two weeks and included the New Year's holiday period.

The survey included questions aimed at soliciting opinions regarding the utility of the FERC and LIHI processes providing for environmental protections. The following summary statements are based on GZA's interpretation of the survey feedback from the state and federal fisheries agencies and from Commonwealth DEP staff:



- For projects that have recently been subject to the FERC review process two-thirds (MassDEP and MassWildlife) feel that their input to the LIHI process is redundant with input provided with the FERC process. One third did not feel that their input was redundant (USFWS).
 - Both MassDEP and MassWildlife felt the input can sometimes be redundant and would be open to a time period for which they would consider FERC authorization sufficient to meet low impact criteria.
 - Neither responded provided a suggestion for such a timeframe.
- MassDEP and MassWildlife agree that if a project has not recently been subject to the FERC review process, that their input during the LIHI process adds to the projects protection of the environment. USFWS does not agree.
- All (MassDEP, MassWildlife, and USFWS) agree that if agencies and owners are in agreement on project operation and environmental mitigations, the LIHI process has added value.
- MassWildlife provided the following statement, “LIHI helps improve environmental conditions at project with FERC Exemptions which never come up for renewal”.
- In a telephone follow-up, a representative of MassWildlife stated that the LIHI process was particularly helpful when out-of-state hydropower projects are seeking qualification under the Massachusetts RPS system because Massachusetts agencies have no capability for assessing such projects.

The survey included questions for owners aimed at assessing the permitting and RPS qualification process. The following statements are based upon the survey feedback provided by owners:

- Approximately 47 percent of responding owners have FERC Small Hydropower Exemptions. Seven percent of respondents represented owners of conduit projects. Forty percent of owners have licenses. Seven percent of respondent represent owners of non-jurisdictional projects. (15 owners responded to this question).
- On average, owners rated the difficulty of the RPS qualification process as 7.9 out of 10 (with 1 representing an easy process and 10 representing a hard process). Owner responses ranged from 3 to 10.
- Approximately 60 percent of owners developed the LIHI application themselves (using in-house resources). Twenty percent of owners used a consultant to develop the LIHI application and 20 percent used another means to develop their application (15 owners responded to this question).
- Agency consultations were required for 93 percent of projects going through the RPS qualification process (15 owners responded to this question).
- The reported duration of the LIHI certification process for 12 projects was 5 years. Two projects had a LIHI duration of 8 years.
- Approximately 53 percent of owners were required to make structural or operational changes in order to obtain LIHI certification (15 owners responded to this question).
- For projects where structural or operational modifications were needed, 45 percent resulted in a loss in energy generation, 55 percent did not result in a loss in energy generation (9 owners responded to this question).



- Owners with RPS qualified projects in other New England states and Massachusetts found the Massachusetts RPS process to be more difficult than other states. (12 owners responded to this question).
- Approximately 7 percent of owners who responded are net metering. The general consensus for a reason as to why they are not net metering is that the cap for net metering is 60 kW. (15 owners responded to this question).

The survey included questions for consultants aimed at understanding their view of the permitting and RPS qualification process.

- Consultants were split as to whether the LIHI filings were duplicative with the FERC process (2 consultants responded to this question).
- Consultants were split as to whether, for projects that were not recently subject to the FERC review process, the LIHI process adds to the projects protection of the environment. (2 consultants responded to this question).

The survey included questions that were applicable to all.

- Thirty percent of respondents felt that all projects are held to the same standards by LIHI. Seventy percent did not feel that they were held to the same standard (10 survey responses).
- Survey respondents also provided the following:
 - *Suggestions for improving the RPS qualification process;*
 - *Thoughts on what works well in the RPS qualification process;*
 - *Additional comments on the RPS qualification process; and*
 - *Suggestions for streamlining the state permitting process.*

The raw results are included in **Attachment 4**. The common themes and general input have been incorporated throughout this report.

Beyond the survey, GZA participated in conference calls/ meetings with the following: Baystate Hydropower Association, the Low Impact Hydro Institute, a representative of one state natural resource agency, two owners of small hydropower projects, and an owner representative of conduit hydroelectric projects.

Written comments were provided by the Low Impact Hydro Institute and a combined response by The Nature Conservancy, Appalachian Mountain Club, Massachusetts Rivers Alliance and Trustees of Reservations and Mass Audubon. This feedback is included in **Attachment 6**.

Based on the results of the survey and also self-identification by Owners, several projects were developed as case studies. A summary of the case studies is included in **Attachment 5**.

8.0 REVIEW OF POLICY AND ENVIRONMENTAL OBJECTIVES

In the realm of hydropower development and operation, laws, policies, and regulations set the framework that influences project development. Laws, policies, and regulations may unnecessarily hamper the development of hydropower projects by creating a significant cost and time burden to project developers, which in turn can make the projects infeasible, without adding any environmental benefit. Laws, policies and regulations that do not allow for adequate review and control of project development may result in the development of projects that have adverse



impacts to the environment or human populations. In the review of the objective of laws, policies and regulations pertaining to hydropower, three broad categories have been identified: coordination, regulation, and licensing. A specific law, policy, or objective can fulfill more than one of these functions.

8.1 COORDINATION

Laws, policies and regulations that are classified as having an objective of coordinating are those that allow for multiple agencies (outside the host agency that is receiving an application) to be notified of a project and have an opportunity to receive information on and comment on that project. The following filings are considered to have a coordinating objective: Massachusetts Environmental Policy Act (MEPA), Hydropower Preliminary Notification Form (HPNF), and FERC application for authorization.

The sole objective of the HPNF is to provide for coordination among Commonwealth agencies. The HPNF filing is potentially redundant with the FERC filing because it requires much the same information and the same notifications. As noted above, for projects that are not located on waterways where endangered species may be impacted, MassWildlife conditioning authority primarily is a function of FERC regulations. MEPA filings are not typically required for small hydropower projects. Therefore, the MEPA and FERC processes do not generally overlap for small hydropower projects.

8.2 REGULATION

Another type of objective is that of regulation. With the exception of some maintenance authorizations, they typically regulate a one-time event. For hydropower projects, such an event is frequently adjacent to existing structures such as the construction of a new powerhouse, or the installation of new trashracks. The following Commonwealth filings are considered to have the objective of regulating a project: WPA Notice of Intent (NOI), Project Notification Form (PNF) and the RPS Statement of Qualification Applications (SQAs). A regulatory prerequisite for the RPS SQA is that a project receives Low Impact Hydro Institute (LIHI) Certification. Only projects which meet certain requirements can obtain a LIHI Certification. The laws, policies and regulations behind the NOI and PNF do not appear to be more stringent than Federal requirements and likely do not result in projects being more protective of the environment, in terms of a facility's impact.

Under the Commonwealth's Green Community Act (GCA), a project must meet four specific standards while the LIHI process for certification covers eight categories. Several survey respondents from the hydropower owner community expressed the opinion that the eight criteria considered by LIHI extend beyond the four standards referenced in the Green Communities Act. LIHI criteria not included in the GCA include, at least, recreation and cultural resources. The criteria referenced by both the GCA and LIHI are currently considered in the review of FERC applications for authorization.

When projects are subject to Administrative Dispute Resolution, requested federal and state conditions may not be included in the project terms and conditions. The Discussion section of a FERC License will indicate whether or not Administrative Dispute Resolution was performed. FERC has indicated it is rare for a project to undergo Administrative Dispute Resolution. For such a project, the RPS qualification process (by virtue of requiring LIHI certification) is more stringent than the FERC process. When federal and state agency conditions are mandatory, such as with the TLP and FERC Exemptions, the LIHI aspect of the RPS qualification process is similar to the FERC process.

LIHI is understood to solicit feedback from non-governmental agencies and non-profits (in addition to the required Commonwealth and Federal agencies). This potentially provides for input to the Certification/Qualification process by groups beyond those envisioned as Relevant Hydroelectric Agencies (as defined in 225 CMR 14.02). Survey respondents



indicated that in certain cases LIHI has required studies or modifications before comments were received from Relevant Hydroelectric Agencies. The LIHI process is therefore considered by some hydropower stakeholders as more stringent than the GCA. In the case where the mandatory conditions are not accepted by FERC but are imposed by LIHI, or conditions requested by groups other than Relevant Hydroelectric Agency are imposed by LIHI, the LIHI process is more stringent and is more protective of the environment.

The following Federal filings are considered to have the objective of regulating projects: Section 401 Water Quality Certification, Section 404 Dredge and Fill Permit, and Section 408 Request. A FERC License or Exemption can also be considered to have the objective of regulating. The terms and conditions provided with the authorization regulate how the project is developed and operated.

8.3 LICENSING

Another objective is that of licensing. Licenses typically provide authorization for an activity to take place. Some are in perpetuity and some must be renewed. A type of license issued by the Commonwealth which could apply to hydropower projects is a Chapter 91 license. Federal licenses include the 401 Water Quality Certification (issued by the states) and FERC authorization. The above referenced Commonwealth laws, policies and regulations do not appear to be more stringent than the Federal counterparts and do not provide for additional environmental protection. Qualification for eligibility to sell RECs under the Massachusetts Renewable Energy Portfolio Standard could also be considered a type of licensing.

9.0 STAKEHOLDER SUGGESTIONS FOR STREAMLINING AND EXPEDITING PERMITTING AND APPROVAL

This report has summarized the process to license, permit, and then qualify a hydroelectric facility for the Massachusetts RPS. This summary informs the Massachusetts Department of Energy Resources of the many steps projects in Massachusetts face and helps identify possible regulatory streamlining. The following suggestions for regulatory change focus exclusively on the part of the process where DOER has regulatory authority, the RPS qualifications. These suggestions are summarized from research, survey feedback, and information gathered during calls and meetings.

Some of these items are direct input from survey respondents or stakeholders with whom GZA met in person or through conference call. Although the solicited stakeholder feedback included recommendations covering the entire licensing and permitting process, only those that relate to the RPS are mentioned below. Other stakeholder feedback is not under the jurisdiction of DOER. We thank the stakeholders for providing their feedback and include these stakeholder recommendations in **Attachment 9** as reference. Examples of options not included are modifications to any other agency regulations or procedures, for example the HPNF requirement, and any modifications to the LIHI process. Also excluded are options that would require Massachusetts legislative changes.

If DOER determines that the current RPS qualification procedure best ensures the environmental protection standards of the GCA while balancing the development and operation of hydropower facilities, than no action must be taken. The options presented below are not exclusive to one another. Multiple options could be implemented. The options are presented below with comments explaining whether the suggestion should or should not be investigated further.

Summary of Regulatory Change Suggestions:

- Eliminate the need to recertify a project with LIHI after initial successful application for Mass RPS qualification.

Policy Change Recommended: The general LIHI process would remain in effect as the initial screening mechanism for low impact status. However, LIHI Certification would be necessary only for the initial RPS



application and eliminate the requirement to recertify with LIHI every five years to maintain RPS qualification. Thereafter projects would self-certify to DOER at specified intervals that the project continued to meet any conditions imposed and continued to operate in a manner consistent with the initial certification. This would reduce the financial burden on low impact projects by eliminating LIHI annual fees and eliminating re-certification fees and expenses.

This is a viable recommendation as capital investments to achieve low environmental impact will likely be completed during the first LIHI certification process and recertification generally ensures operational compliance. This recommendation also decreases burden on existing Class II facilities that are incentivized with a lower REC value. It may be within DOER and other state agency capacity to ensure operational compliance by other means. DOER would need to investigate further the regulatory changes and staff time that would need to complete this recommendation while ensuring that all GCA environmental protection standards are still met.

- Newly constructed projects or modifications to existing projects resulting in additional capacity in Massachusetts could be eligible to apply for Class I RPS status without LIHI certification, while out-of-state projects must proceed through the LIHI process.

Not Recommended: New projects and capacity increases (i.e. 2016 and after) in Massachusetts would be eligible for Class I RPS status without the need to go through the LIHI process in order to submit a Statement of Qualification Application (SQA) to DOER. Relevant Agencies would retain the opportunity to comment on the SQA Application before its approval. This is not recommended because, although Relevant Hydroelectric Parties in Massachusetts would still have opportunity to contribute feedback during the FERC process, the FERC process alone does not necessarily ensure the GCA standards are met.

- State resources (with nominal fee) should be utilized to review the environmental criteria of in-state projects while requiring LIHI only for out-of-state projects.

Not Recommended: Projects in Massachusetts would not need to go through the LIHI process, but projects outside of the Commonwealth would need to go through the LIHI process. Projects in Massachusetts would essentially skip the LIHI process and go directly to the SQA. Applicants would pay a nominal fee for their application to be reviewed by Commonwealth staff. This is not recommended as state agencies generally cannot collect fees without express authorization from the legislature.

- Projects under 1 MW could apply to qualify for RPS Class II without requiring prior LIHI certification.

Not Recommended: Under this option projects less than 1 MW would be eligible for Class II RECs without obtaining LIHI certification. This is not recommended because DOER would need to find a justification for waiving environmental standards set forth in the GCA for projects under this size threshold.

- Projects with FERC Exemptions issued after the Electric Consumers Protection Act (ECPA) of 1986 could apply to qualify RPS Class I or II without requiring prior LIHI certification.

Not Recommended: Projects that have received a FERC Exemption post ECPA 1986 would not require LIHI certification to receive Class I or Class II RECs, but all projects will be required to file an SQA. Although the ECPA instituted more rigorous environmental review in the FERC licensing process, the FERC process alone does not ensure the GCA standards are met. While these projects have been reviewed by State and Federal fish and wildlife agencies, not all projects would be subject to all desired conditions.



- Projects with FERC Licenses issued after the ECPA of 1986 could apply for RPS Class I or II qualification without requiring prior LIHI certification.

Not Recommended: Projects that have received a FERC License post ECPA 1986 would not require LIHI certification, but all projects will be required to file an SQA. Although these projects have been reviewed by State and Federal fish and wildlife agencies, there is a potential that State or Federal conditions may not be included in the project terms and conditions if an Administrative Law Judge performed Administrative Dispute Resolution regarding the project. This would not ensure that GCA standards are met.

- Chose a different, more recent, date than 1986 for FERC licenses and exemptions to enable a project to apply for RPS Class I or II qualification without requiring prior LIHI certification.

Not Recommended: Projects that have received a FERC Exemption or License after a certain post-1986 date would not require LIHI certification, but all projects will be required to file an SQA. This is also not recommended because even the current FERC process alone does not ensure the GCA standards are met.

10.0 SUMMARY AND CONCLUSIONS

Based on the information presented herein, it is recommended that the DOER and the Commonwealth further study and consider modifications to the RPS qualification process for hydropower projects, specifically around LIHI recertification. Additional changes may be considered to other regulatory processes that apply to approval of and sale of power from hydropower projects. Such changes could encourage the development of additional renewable energy resources and the maintaining the operation of existing resources in the Commonwealth.

