



LOW IMPACT PUMPED STORAGE HYDROPOWER DEFINITION

2nd DRAFT FOR PUBLIC COMMENT

December 1, 2025

www.lowimpacthydro.org

1. Background

The Low Impact Hydropower Institute (LIHI) certification program is limited to evaluating conventional hydropower projects based on a set of eight science- and knowledge-based criteria to identify projects that have minimized or are taking action to minimize their environmental and social impacts. The current program explicitly excludes Pumped Storage Hydropower (PSH) primarily because fossil fuels supplied by regional electric grids were (and still are) the most common source of power for the PSH pumping cycle. Yet, recognizing the increasing penetration of wind and solar power since LIHI's founding in 1999, the idea of expanding the certification program to potentially include existing PSH projects was first considered as part of LIHI's Strategic Plan in 2018. Based on staff research, the limited number of existing PSH projects at that time¹, and the lack of meaningful incentives in many energy markets that could create value for LIHI certification, this avenue of inquiry was not pursued at that time.

Over the next several years, the penetration of wind and solar, along with PSH development activity in the US, increased dramatically and in 2022 LIHI reactivated the idea of evaluating the potential for a low impact PSH definition that could include both existing and new PSH projects. Unlike conventional hydropower and the first wave of PSH that were built prior to modern environmental laws², the current wave of proposed new PSH projects in the development pipeline presents a unique, limited-time opportunity to positively influence pumped storage design and operation to minimize its environmental and social impacts.

LIHI's 2023 Strategic Plan directed LIHI staff to conduct additional research into PSH and its potential environmental and social impacts in order to begin to define low impact PSH. With financial support from the Hewlett Foundation, LIHI built on its existing organization, board members, advisors, community of interested parties, and history of collaboration to initiate an inclusive process to work to develop a definition of low impact PSH. Through a combination of direct invitation and public solicitation for volunteers, LIHI assembled an external Advisory Group representing a cross-section of the hydropower community with subject matter and technical expertise. The Group met biweekly for a year to develop the low impact PSH definition provided below.

The definition has been structured purposely to be similar to the existing LIHI certification program with an outcome-oriented goal statement for each identified impact area, alternative standards by which a PSH project could achieve the goal, and a set of defined terms. The definition attempts to be as stringent as possible while also being achievable. An important consideration for the definition is that it be broad enough to apply to different PSH facility types - open-loop, closed-loop, underground, add-ons to existing hydro, etc.; and applicable to the different phases of PSH development - site selection, design, construction, and operation.

¹ 43 projects, all open-loop. United States Department of Energy. (2021). U.S. hydropower market report 2021 edition. p. 3, p. 99. <https://www.energy.gov/sites/default/files/2021/01/f82/us-hydropower-market-report-full-2021.pdf>

² e.g., Endangered Species Act, Clean Water Act, and the National Environmental Policy Act.

2. Introduction to the Definition

The PSH definition is intended to provide a voluntary guideline for project developers and interested parties to use to ensure that proposed and operating projects have taken action to reduce their environmental and social impacts. The impact areas (e.g., “criteria”), their outcome-oriented goals, and the associated alternative standards that are detailed below form the core of the low impact PSH definition. They have been developed by LIHI staff, informed by and reviewed by the external Advisory Group³, and vetted by the PSH Task Force of the LIHI Governing Board. Eleven impact areas are covered:

- Community and Tribal Engagement
- Socioeconomics
- Cultural and Historic Aspects
- Aquatic Ecology
- Terrestrial Ecology
- Water Quality
- Water Quantity and Availability
- Geology and Soils
- Air Quality and Noise
- Land Use and Aesthetics
- Recreational, Public, and Traditional Cultural Access

For purposes of this definition, a PSH “project” or “facility” includes all lands, waters, and other resources affected by the PSH development. This may include facility-owned or controlled transmission lines, offsite water sources used for reservoir fill and make-up water, and any non-project lands associated with the facility (e.g., offsite mitigation sites or recreation areas created in association with the facility). Different areas of the facility are called “Zones of Effect”, as in the current LIHI handbook for conventional hydro. In all cases, if the facility plans to acquire or has acquired lands by eminent domain⁴, LIHI will evaluate on a case-by-case basis whether the facility can satisfy the LIHI criteria.

The PLUS standard for most criteria is designed to capture “restorative” designs and other actions that may result in positive rather than negative impacts. However, a facility would still need to satisfy one of the numbered alternative standards before the PLUS standard can be used. In the current LIHI program, the PLUS standard provides for an extended LIHI certification term. Definitions for underlined terms are provided in Appendix A of this document. Additional guidance and examples of how a facility can demonstrate that it satisfies the criteria will be

³ Participation in the External Advisory Group does not imply that all individual members support all aspects of the draft definition as it is a work in progress.

⁴ See 16 USC 814: Exercise by licensee of power of eminent domain at:
[https://uscode.house.gov/view.xhtml?req=\(title:16%20section:814%20edition:prelim\)%20OR%20\(granuleid:USC-prelim-title16-section814\)&f=treesort&edition=prelim&num=0&jumpTo=true#amendment-note](https://uscode.house.gov/view.xhtml?req=(title:16%20section:814%20edition:prelim)%20OR%20(granuleid:USC-prelim-title16-section814)&f=treesort&edition=prelim&num=0&jumpTo=true#amendment-note)

developed after the draft goals and standards are finalized and approved by the LIHI Governing Board.

Goals and standards are intended to be stringent but achievable and are designed to encourage PSH developers to site, design, construct and operate projects in an environmentally and socially responsible way. The framework of the criteria, goals, and standards are structured to be consistent with and similar to the existing LIHI conventional hydro certification program. The language is purposely broad so as to be applicable to different facility types and different phases of development.

As with the existing LIHI program, the numbering and order of the alternative standards for each criterion (except for socioeconomics) is important. Applying a higher numbered standard implies that a lower numbered standard is not possible or appropriate. The first alternative standard, Standard 1 (“Not Applicable or De Minimis Effect”) recognizes that some facilities either do not impact a given criterion or that the impacts are so minimal they would be difficult to quantify. This standard provides a streamlined way to satisfy a particular criterion where circumstances justify it. Few PSH projects are likely to meet Standard 1 and those that do may be limited to some add-on or pump back type projects having two pre-existing reservoirs, or some underground projects. However, it does not matter which numbered standard is met.

3. Impact Area Goals and Alternative Standards

Community and Tribal Engagement:

Goal: The facility’s site selection, design, construction, and operations have been informed by a robust process that includes identification of, outreach to, and proactive relationship building with the Tribes (including those without federal or state recognition) and communities affected by the facility; inclusive participation by and collaboration with them; and meaningful coordination throughout each facility development stage with all parties affected by the facility and its operations. The purpose of engagement is to ensure that the facility is developed and operated in a manner that is sensitive to, respectful of, and consistent with the rights, needs, and priorities of those affected by it.

In all cases, the owner must demonstrate how the facility aligns with comprehensive plans applicable to the facility including but not limited to local, regional, state, federal, and Tribal land use plans, master plans, and FERC comprehensive plans. To demonstrate satisfaction of this goal, the owner must implement the Baseline Requirement:

Baseline Requirement: The owner demonstrates that it has identified and effectively engages with all affected parties on an ongoing basis, including all local communities and all affected Tribes, and has received their full, free, prior and informed written consent (e.g., as applicable within Indian country as defined or move to PLUS for outside of Indian country) for development of the facility and its operations.

In addition, the owner is implementing a detailed Community or Tribal Engagement Plan developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, and local community leaders. At a minimum, the plan(s) must identify all affected Tribes and communities, their leaders, and additional tribal points of contact specified under various federal and state compliance mandates; articulate a detailed, inclusive, and ongoing engagement process; provide a mechanism for affected parties to express and have their concerns addressed, including grievance mechanisms and conflict resolution procedures; and the plan(s) must include provisions for periodic evaluation, review and revision of the plan's effectiveness with input and consent from the parties to the plan(s).

PLUS Standard – In addition to satisfying the standard above, the owner has a dedicated community, and if applicable, tribal staff liaison trained in community engagement, and tribal engagement if applicable, and whose responsibilities include ongoing outreach, communication, and grievance resolution with the affected parties; or the owner provides sufficient funding to affected Tribes and local communities to support their own capacity building engagement efforts related to the facility's site selection, design, construction, and operations.

Socioeconomics:

Goal: The facility's site selection, design, construction, and operation have been developed in conjunction with affected tribal governments and affected communities to address all applicable socioeconomic impacts. The owner demonstrates tangible community benefits to affected Tribes and communities, ensuring that such benefits from the facility's presence and ongoing operations align with the principles of equity, sustainability, and shared prosperity for the affected Tribes and communities.

To demonstrate satisfaction of this goal, the owner must implement both the Baseline Requirement and the Community Benefit Requirement.

Baseline Requirement: The owner is implementing detailed plans developed with, acceptable to, and approved by the affected local community, relevant local, regional, and state commissions and agencies, and tribal governments to identify and address the adverse socioeconomic impacts associated with the facility (such as influx/outflux of construction workforce and attendant impacts on local infrastructure, services, public safety, and on culturally significant sites). These plans must identify each adverse socioeconomic impact associated with the facility and follow the mitigation sequence in identifying the measures planned or in place to address each impact. These plans must include provisions for ongoing monitoring, reporting, and determination of the effectiveness of implemented measures and assured, reliable and guaranteed pathways for making changes, if the implemented measures are deemed insufficient to address impacts.

Community and Tribal Benefit Requirement: The owner is implementing one or more plans, programs, initiatives, or efforts documented in a Community or Tribal Benefit Plan or Community or Tribal Benefit Agreement) that are developed with, acceptable to, and approved by the affected communities and Tribes, and which provide direct local benefits, especially for those in historically marginalized and disadvantaged communities. Such strategies may include:

- Hiring locally and providing access to job opportunities, at or above the prevailing wage, for the life of the facility.
- Partnering with the local community and affected Tribes to implement action plans that align with strategic local, regional, or state level plans on topics related to, but not limited to, community development, environmental justice, energy justice, and climate adaptation/resilience.
- Partnering with the local community and affected Tribes to implement action plans to support intangible benefits such as by providing apprenticeship or skill-based training, establishing learning demonstration sites, or providing retraining for workforce re-entry, particularly in changing resource economies.
- Reducing the local energy burden by implementing a long-term contract to provide a portion of the facility's generation locally at a rate that is affordable to the local community and affected Tribes.
- Contributing a portion of the facility's profits towards community and tribal development or benefit strategies for the life of the facility.
- Restoring or reversing previous harms of brownfield sites, if a facility is located at such a site with the consent of affected Tribes and communities .

PLUS Standard: In addition to satisfying the standards above, the owner has, or formally commits to, transferring ownership of support facilities and/or infrastructures built during facility construction to the local community and/or affected Tribes (e.g., housing, medical clinics, roads, etc.). Such structures should be built with future uses in mind and with input and approval from the local community and affected tribal governments.

Cultural and Historic Aspects:

Goal: The facility's site selection, design, construction, and operations have been developed in conjunction with and approved by affected Tribes, state historic preservation offices, applicable federal agencies, and local communities to address all impacts on historic and tribal properties and their viewsheds inclusive of Traditional Cultural Properties, historic properties, historic landscapes, cultural wealth, traditional cultural landscapes, tribal trust resources, tribal rights, and other cultural and historic resources and qualities identified by the affected parties.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not affect any cultural or historic resources or aspects of cultural wealth as identified by the affected Tribes and local communities; or does not create any new or exacerbate any existing adverse cultural or historic impacts; or that all potential adverse cultural and historic impacts have been identified and avoided.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations regarding cultural and historic resources. These recommendations may include provisions for ongoing monitoring, reporting, determinations of the effectiveness of implemented measures, and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed avoidance and treatment plan developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, applicable state and tribal historic preservation offices, and state and federal jurisdictional resource agencies. At a minimum the plan must identify each adverse cultural and historic impact and follow the mitigation sequence in identifying the measures and ongoing treatments planned or in place to address each impact. The plan or ongoing monitoring and reporting of the effectiveness of treatment measures must be developed in documented collaboration with the affected Tribes and local communities and must include adequate compensation for any monitoring and reporting conducted by them, and an adaptive management process to address ongoing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner has taken or is taking significant action to restore or enhance aspects of cultural wealth and/or cultural heritage in collaboration with and approved by affected Tribes and local communities. Such actions may include but are not limited to restoring or enhancing intangible and tangible cultural wealth and/or cultural heritage both in the facility-affected area or offsite.

Aquatic Ecology:

Goal: The facility is sited, designed, constructed, and operated to address all impacts on aquatic ecosystems. The structure, function, and processes of the affected aquatic ecosystems, including groundwater dependent ecosystems, are maintained or enhanced sufficiently to support healthy populations of native and managed species, including listed species and tribal trust species, and their habitats including migratory routes. In all cases, actions must be taken to avoid the introduction or transfer of invasive and exotic species.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not adversely affect any aquatic ecosystems; or that affected waterbodies did not support native or managed aquatic species and/or their habitats prior to the facility; or that all potential adverse impacts have been identified and avoided.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations regarding aquatic ecology. These recommendations may include provisions for ongoing monitoring, reporting, determinations of the effectiveness of implemented measures, and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, and local communities; as well as provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner has taken or is taking direct, ongoing action approved by resource agencies, affected Tribes, and affected communities to restore or significantly enhance one or more aspects of aquatic ecology such as, but not limited to, creation of new aquatic habitats or reintroduction of previously extirpated native species in the facility-affected area. The success of these measures must be monitored, and an adaptive management approach used to regularly evaluate and adjust actions as needed to ensure ongoing effectiveness over the course of the facility's life.

Water Quality:

Goal: The facility's site selection, design, construction, and operations have been developed in conjunction with resource agencies, affected Tribes, and local communities to address all impacts on water quality in all affected waters including as applicable: all surface waters, seeps, springs, wetlands, groundwater aquifers, hyporheic zones, offsite fill water sources, and nearshore marine areas for projects using a seawater reservoir.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not alter the physical, chemical, or biotic water characteristics necessary to support native and managed plant, fish, and wildlife (including riparian, littoral, and groundwater dependent) populations and applicable human water uses (e.g., water supply, recreation) in all facility-affected waters.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with all water quality conditions contained in a recent Water Quality Certification (if required for the facility) and is in compliance with facility-specific science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations, that provide reasonable assurance that water quality standards (including Clean Water Act Total Maximum Daily Loads (TMDLs) in facility-affected waters and applicable state and tribal groundwater quality standards) will be met for all facility-affected waterbodies. Such recommendations, whether based on a generally applicable water quality standard or one that was developed on a site-specific basis, must include consideration of all water quality components necessary to maintain healthy populations of the native and managed species, and applicable human uses. These recommendations may include provisions for ongoing monitoring, reporting, determinations of the effectiveness of implemented measures, and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, and local communities; and provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner is implementing a plan approved by resource agencies, affected Tribes, and affected communities to remediate previously contaminated waters associated with the facility, or that otherwise improves the ambient quality of all currently or previously affected waters.

Water Quantity:

Goal: The facility's site selection, design, construction, and operations have been developed in conjunction with resource agencies, affected Tribes, and local communities to address all impacts on water quantity and availability in all waters affected by the facility. In all cases, the facility is sited and designed to avoid areas with known surface water or groundwater scarcity.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not interfere with other existing water uses, beneficial uses, or water rights including unquantified tribal water rights, and it does not adversely affect existing groundwater or surface water availability, flow patterns, or surface-groundwater exchange processes in all facility-affected waters, including reservoir fill water from offsite sources.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations related to water quantity or availability (i.e. levels of water use, reserved rights, temporal and spatial withdrawal restrictions, reservoir fill timing and rates, infiltration/seepage, etc.). Such recommendations should include consideration of all applicable water quantity components, including those that may affect water quality, that are necessary to maintain healthy populations of native and managed species, and human uses. These recommendations may include provisions for ongoing monitoring, reporting, determinations of the effectiveness of implemented measures, and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, and local communities; and provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner is implementing a plan approved by resource agencies, affected Tribes, and affected communities to actively conserve facility-affected waters including as

applicable, managing the timing of withdrawals to protect water supplies, and minimizing consumptive use, evaporation, infiltration, and seepage.

Terrestrial Ecology:

Goal: The facility is sited, designed, constructed, and operated to address all impacts on terrestrial ecosystems. The structure, function, and processes of the affected terrestrial ecosystems, including groundwater dependent ecosystems are maintained or enhanced sufficiently to support healthy populations of native and managed species including listed species and tribal trust species, and their habitats, including migration corridors. In all cases, actions must be taken to avoid the introduction or transfer of invasive and exotic species.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not adversely affect any terrestrial ecosystems; or that affected lands did not support native or managed species and/or their habitats prior to the facility; or that all potential adverse impacts have been identified and avoided.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations regarding terrestrial ecology. These recommendations may include provisions for monitoring, reporting, and determinations of the effectiveness of implemented measures; and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, and local communities; and provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner is implementing a plan approved by resource agencies, affected Tribes, and affected communities to actively restore or enhance one or more aspects of terrestrial ecology such as, but not limited to, creation of new habitats or reintroduction of previously extirpated native species in the facility-affected area. The success of these measures must be monitored, and an adaptive management approach used to regularly

evaluate and adjust actions as needed to ensure ongoing effectiveness over the course of the facility's life.

Geology and Soils:

Goal: The facility is sited, designed, constructed, and operated to address all impacts on geology and soils including, but not limited to, impacts related to shoreline erosion, sedimentation, sediment transport and downstream geomorphology changes; spoils disposal, induced land subsidence, landslides and rock falls; aquifer degradation, induced seismic activity; and reservoir or penstock breaches.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not adversely affect pre-existing geologic and soil conditions or that all potential adverse impacts have been identified and avoided.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations regarding geology and soils. These recommendations may include provisions for monitoring, reporting, and determinations of the effectiveness of implemented measures; and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, and local communities; and provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner is implementing a plan approved by resource agencies, affected Tribes, and affected communities to protect, restore or enhance geologic or soil resources. This may include such actions as beneficial reuse of excavated materials, installation of seismic, subsidence, and leak detection sensors and equipment, slope restoration, or remediation/restoration of previously eroded sites.

Air Quality and Noise:

Goal: The facility is sited, designed, constructed, and operated to address all impacts on air quality, including but not limited to fugitive dust, air emissions from vehicles and equipment, and blasting, concrete or asphalt batching operations; as well as excessive noise generated from vehicles, equipment, blasting and batching operations, warning sirens (subject to public safety requirements, but minimized as much as possible), and from pumping, generation, and transmission operations. In all cases, air quality and noise impacts on affected Tribes, local communities, wildlife, and recreation must be addressed.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The owner demonstrates that the facility does not adversely affect ambient air quality or noise levels, or that all potential adverse impacts have been identified and avoided.

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations regarding management of air quality and noise, or any local, state, regional, or tribal government standards, regulations, ordinances, site-specific permits, or other restrictions regarding air quality and noise. These recommendations or requirements may include provisions for monitoring, reporting, and determinations of the effectiveness of implemented measures; and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations, ordinances, or regulations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts that have been developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, and local communities; and provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner is, or formally commits to, reducing greenhouse gas (GHG) emissions* from facility construction and operations, and open reporting of all facility-related GHG emissions over the course of the facility's life.

***Important Note:** A key component of a PSH project’s low-impact attribute is its GHG emission footprint. PSH projects are net energy consumers. The energy source used to pump water can be a major driver of a project’s GHG emissions, and, by extension, a PSH project’s climate benefits are tied to whether the project relies on (or advances) renewable energy generation. While the current definition lists GHG emission reduction under the PLUS Standard, it is important to note that the definition will be revised—and the goal statement and numbered standards may be updated—once further guidance and tools are available to undertake granular GHG accounting.

Land Use and Aesthetics:

Goal: The facility is sited, designed, constructed, and operated to maintain or enhance existing and planned land uses and aesthetics at and surrounding the project site. In all cases, light and noise (subject to public safety requirements, but minimized as much as possible), and other land and aesthetic impacts (e.g., viewshed impacts, fencing impacts, odor impacts) on affected Tribes, local communities, wildlife, and recreation must also be addressed.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The facility maintains the existing character of the landscape, has minimized its overall footprint, and does not otherwise adversely impact existing or planned land uses, viewsheds, and/or light and noise levels in the facility vicinity (see also the air quality criterion).

Standard 2 – Resource Agency and Tribal Government Recommendations: The facility is in compliance with science-based resource agency and, if applicable, science-based or Indigenous Knowledge-based tribal recommendations regarding land use and aesthetics (note: viewshed considerations for historic properties, as well as Traditional Cultural Landscapes and Historic Landscapes are addressed separately in the Cultural Impacts criterion). These recommendations must include compliance with local land use planning and zoning requirements. The recommendations may include provisions for monitoring, reporting, and determinations of the effectiveness of implemented measures; and/or an adaptive management program.

Standard 3 – Approved Plan: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, the owner is implementing a detailed plan to address adverse impacts developed with, acceptable to, and approved by the affected tribal governments or their authorized designees, local community leaders, regional land use/planning commissions, and the state and federal jurisdictional resource agencies. At a minimum, the plan must identify each impact and follow the mitigation sequence in identifying the measures and treatments planned or in place to address each impact. The plan must include provisions for ongoing monitoring and reporting of the effectiveness of treatment measures to resource agencies, affected Tribes, local communities, and regional commissions; and

provisions for adaptive management to address existing and newly identified impacts over the course of the facility's life.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner is implementing a plan approved by resource agencies, affected Tribes, affected communities and regional land use/planning commissions to remediate and restore previously disturbed lands, or otherwise improve or enhance the aesthetic qualities of the landscape in the facility vicinity.

Recreational, Public, and Traditional Cultural Access:

Goal: To the extent that safety considerations allow, the facility does not negatively affect existing recreational or access opportunities. The facility accommodates recreational, public and traditional cultural and subsistence activities on lands and waters controlled by or otherwise associated with the facility and provides access to its associated lands and waters without fee or charge. In all cases, access must be maintained for the life of the facility.

Alternative Standards:

Standard 1 – Not Applicable/De Minimis Effect: The facility does not occupy lands or waters where safe access for the public or Tribal members is possible, and the facility does not otherwise adversely impact pre-existing recreational or access opportunities and activities in the facility vicinity.

Standard 2 – Resource Agency and Tribal Government Recommendations: The owner demonstrates compliance with resource agency and, if applicable, tribal government or authorized tribal designee recommendations for recreational, public, and traditional cultural access or accommodation, or any enforceable recreation, public and/or traditional cultural access plans or agreements in place for the facility's lands and waters.

Standard 3 – Assured Access, Accessibility, and Use: In the absence of resource agency or tribal government recommendations in Standard 2 that are specific to the facility or to specific impacts, and in the absence of a formal plan or agreement, the owner demonstrates that they have been, and formally commit to continue being responsive to reasonable requests from recreational interests, local community members, and affected tribal governments for access to lands and waters associated with the facility without fees or charges.

PLUS Standard – In addition to satisfying one of the numbered standards above, the owner has created significant new recreational, public, and/or traditional cultural access opportunities that go beyond those required by resource agencies and tribal governments, included in the facility's FERC license, exemption, water quality certificate, or required by other local, state, federal or tribal authorizations. These opportunities

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must be compatible with, and must not create unmitigated impacts on, other resources.

APPENDIX A – Terms and Definitions

Accessibility: Refers to all current applicable accessibility standards for the project, such as the Architectural Barriers Act (ABA) and the ABA Accessibility Standards, the Americans with Disabilities Act (ADA), and agency-specific standards for projects located on federal or state administered lands.

Adaptive management: A system of management practices based on clearly identified timeframes and outcomes with monitoring to determine if management actions are meeting outcomes, and, if they are not, facilitating management changes that will best ensure that outcomes are timely met, or to re-evaluate the outcomes. Adaptive management recognizes that knowledge about natural resource systems is not static and sometimes uncertain and is the preferred method of management in those cases.

Aesthetics: Refers to natural and human landscapes and how people see them. Aesthetics includes visual quality which is the value that people place on observing their surrounding environment.

Aquatic ecosystem: Refers to a biological community of organisms and their interactions within a water environment. It encompasses both freshwater (including groundwater and hyporheic zones) and marine ecosystems. Aquatic ecosystems consist of diverse habitats which support a wide range of plants, animals, and microorganisms. Aquatic ecosystems also include groundwater dependent ecosystems and those associated with remote areas from where fill and refill water is sourced and later delivered (e.g., via pipe, truck, rail) to the facility site.

Aquatic Species: Refers to any species of finfish, mollusk, crustacean, stream-dependent mammals and waterfowl, aquatic invertebrates, amphibians, reptiles, and aquatic plants.

Community Benefit Agreement (CBA), (see also Tribal Benefit Agreement definition below): A legally binding, enforceable contract negotiated between developers and community stakeholders—such as local residents, organizations, and sometimes governments.⁵ These agreements outline the specific benefits—monetary and/or non-monetary—that the developer agrees to provide to the community where benefits have been negotiated and tailored to meet the unique needs and priorities of the community. The agreement should be developed in collaboration with the communities identified in the Community Engagement Plan. The agreement should include mechanisms for monitoring the implementation of the agreed-upon benefits within the timelines prescribed in the CBA, addressing any challenges or gaps in implementation, and mechanisms for dispute resolution. In some cases, LIHI may consider a Community Benefit Plan in lieu of the CBA if the CBA is a component of the Community Benefit Plan or if the Community Benefit Plan outlines the timeline for the execution of a future CBA.

⁵ See generally, U.S. Department of Energy, FAQ: Community Benefit Agreements. Available at: <https://www.energy.gov/sites/default/files/2024-12/CBA%20Guidance%20FAQ.pdf>

Community or Tribal Engagement Plan: A structured, inclusive, and collaborative framework developed with, acceptable to, and approved by affected Tribal governments (or their authorized designees) and/or local community leaders. Given that Tribes are sovereign nations, there may be unique requirements for engaging with Tribes and in some cases, a project may need a separate Tribal Engagement Plan along with a Community Engagement Plan for non-Tribal impacted communities. The Community or Tribal Engagement Plan serves as a guiding document to ensure meaningful, ongoing, and culturally appropriate engagement with all identified Tribes and communities impacted by the project. At a minimum, the plan must:

- Identify all affected Tribes and communities, their leaders, and additional tribal points of contact specified under various federal and state compliance mandates.
- Detail a transparent, inclusive, and continuous process for engagement that honors the unique cultural, historical, and legal contexts of the involved communities or Tribes. The process may outline how project-related information will be communicated on an ongoing basis. The process may also outline circumstances where formal consultation and consent may be required throughout the life of the project.
- Establish mechanisms for expressing concerns, including accessible grievance procedures and conflict resolution methods, to ensure that all parties can participate in decision-making and have their voices heard.
- Include provisions for regular evaluation, review, and revision of the plan's effectiveness, with the active input, participation, and consent of all parties to the plan.

Cultural resources: A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites (including Traditional Cultural Properties), buildings, structures, objects, cultural landscapes, and ethnographic resources. Intangible cultural resources include such things as language, teachings, songs, practices, Elders, children, and other forms of cultural wealth.

Cultural wealth: Includes but is not limited to physical locations and the cultural values that make a place, landscape, practice, attribute, or aspect significant to a Tribe and/or a local community. Cultural wealth is holistic and can include the local waters, lands, air, and viewsheds; community elders and children; traditional animal and plant relations; languages, beliefs, spiritual qualities and values; as well as archaeological sites, burial grounds, traditional hunting, fishing, or gathering grounds, and other place-based cultural aspects of importance.

Enforceable (also enforceable protection): For LIHI purposes, enforceable protection means a legally enforceable agreement, restriction, permit, authorization, or covenant that requires certain actions by the facility owner on facility lands or waters so as to achieve ecological land protection for water quality, wildlife, aesthetics, low-impact recreation, or other resource values. Examples include permanent conservation easements, habitat or species protection plans, public or traditional cultural access agreements, and shoreline permit programs.

Extirpate (also extirpated and extirpation): To completely remove or locally eliminate a species population from an area.

Groundwater dependent ecosystems: (GDEs) include terrestrial, aquatic, and coastal ecosystems that require access to, replenishment or benefit from, or otherwise rely on subsurface stores of water to function or persist (Howard and Merryfield, 2010).

Cultural Landscape (also Historic Landscape): A geographic area (including both cultural and natural resources and the wildlife or domestic animals therein), associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes. Historic vernacular landscapes evolved through use by the people whose activities or occupancy shaped it, and ethnographic landscapes contain a variety of natural and cultural resources that associated people define as heritage resources.⁶ Used here, cultural or historic landscapes refer to non-indigenous landscapes. For indigenous landscapes see Traditional Cultural Landscape definition below.

Historic Property: An historic property is a pre-contact or historic district or historic site (inclusive of Traditional Cultural Properties), building, structure, site, object, or district included in, or eligible for inclusion in, the National Register of Historic Places, including artifacts, records, and remains related to such a property or resource.

Hyporheic zone: Refers to aquifers beneath and adjacent to stream and river channels through which surface water exchanges and mixes with groundwater. The hyporheic zone represents an ecotone between surface (stream) and groundwater ecosystems, primarily in sand and gravel-bed rivers. Exchange of water, nutrients, heat, and organisms between this subterranean zone and the water column above is crucial to the ecosystem's overall health. Because it lies between two heavily exploited freshwater resources—rivers and groundwater—the hyporheic zone is vulnerable to impacts coming to it through both of these habitats.

Indigenous Knowledge-based (also includes Traditional Knowledge-based or Traditional Ecological Knowledge-based): Refers to tribal recommendations based on the body of observations, oral and written knowledge, innovations, practices, and beliefs that promote sustainability and the responsible stewardship of cultural and natural resources through relationships between humans and their landscapes. Indigenous knowledge cannot be separated from the people inextricably connected to that knowledge. It applies holistically to phenomena across biological, physical, social, cultural, and spiritual systems. Indigenous peoples have developed their knowledge systems over millennia and continue to do so based on evidence acquired through direct contact with the environment, long-term experiences, extensive observations, lessons, and skills.

Listed Species: Listed species are those species that have been designated by the appropriate federal or state agency as either “Endangered” and in danger of extinction throughout all or a significant portion of their range, or “Threatened” and likely to become endangered in the foreseeable future throughout all or a significant portion of their range. See also Tribal Trust

⁶ See Birnbaum and Peters. 1996. https://www.nps.gov/parkhistory/online_books/hps/contents.pdf

Species below.

Mitigation Sequence: For LIHI purposes, the mitigation sequence refers to measures taken to avoid creating environmental, social or cultural impacts from the outset of development activities through the life of the facility. Where impact avoidance is not possible, implementation of measures or treatments that prioritize rehabilitation and restoration of previously impacted conditions first, if feasible, followed by impact minimization; and as a last resort, by offsets and/or compensation for any residual adverse impacts that can be addressed, recognizing that in some cases no acceptable mitigation is possible (e.g., some impacts on cultural wealth). In all cases, measures and treatments must be maintained for the life of the facility.

Native and managed species: Refers to all species that were formerly or are currently present, and are either native to a particular area, or non-invasive introduced and managed species including listed species, tribal trust species, and rare and special status species.

Rare and Special Status Species: A species that: a) naturally occurs in a narrow geographical area; b) occupies only one or a few specialized habitats; c) forms only small population(s) in its range; or d) is otherwise listed as rare, special status, or a species of conservation concern by a resource agency or Tribal Nation.

Resource agency and tribal government recommendations: Formal recommendations, permits, authorizations, or other conditions for facility operation, maintenance, or construction that are issued by local, regional, state, or federal agencies or by Tribal Nations affected by the facility or its operations. Resource agency and tribal government recommendations considered by LIHI must be:

- ***Formally issued.*** Resource agency and tribal government recommendations are those issued by resource agencies having jurisdictional authority and the governing bodies of affected Tribal Nations, or by their respective authorized designees. Recommendations may be issued pursuant to a legal or other administrative proceeding, issued as part of a tribal council resolution or contained in other formal agreements made between the facility owner/operator and resource agencies or Tribal Nations. The recommendation must be made on official letterhead and signed by an individual with authority, as defined by each resource agency or Tribal Nation, to submit formal correspondence on their behalf. The proceedings anticipated to apply for most facilities are a FERC licensing, exemption, or amendment proceeding. Formal recommendations issued specifically as part of LIHI project reviews can also be used provided that, for agencies, they can demonstrate that the recommendations are based on the best available scientific information. Tribes can also demonstrate that their recommendations are science-based or based on Indigenous Knowledge. For a FERC-regulated facility, these recommendations could include proposed or mandated license conditions submitted through the FERC licensing or other processes pursuant to Federal Power Act Sections 4(e), 10(a), 10(j), or 18; Clean Water Act (CWA) Section 401; the Endangered Species Act Section 7; or other state, federal, or tribal laws, and their associated regulations,

permits, or published standards. For both FERC-regulated and non-FERC-regulated facilities, these recommendations may also derive from consultation⁷ pursuant to the Endangered Species Act, CWA Section 401 proceedings, the National Historic Preservation Act, the National Environmental Policy Act, Northwest Power Act proceedings, or other state, federal, or tribal proceedings, or from direct engagement with resource agencies or Tribal Nations which result in specific formal agreements related to the facility and/or its operations. Recommendations that are subsequently vacated by a judicial proceeding cease to be valid for purposes of LIHI project reviews.

- ***Recent.*** If a single resource agency or the governing body of a Tribal Nation, or their authorized designee has made multiple recommendations, their most recent formal recommendation shall generally apply. This principle also applies when there is a settlement agreement. If a resource agency or Tribe is party to a settlement, or formally concurs in a settlement, the settlement terms in effect at the time of LIHI application submittal will be considered the most recent resource agency or tribal recommendation. If, however, a resource agency or Tribal Nation is not party to a settlement and does not formally concur in the settlement, a subsequent formal science-based recommendation by that agency, or a science-based or Indigenous Knowledge-based recommendation by that Tribal Nation will still be considered in the project review.
- ***Most stringent.*** In addition to being the most recent recommendation, the most stringent resource agency or tribal government recommendation for a particular resource will apply. If a condition in the facility's FERC license or exemption (or other operating requirement) is less stringent than another science-based resource agency recommendation, or science-based or Indigenous Knowledge-based tribal recommendation, the more stringent recommendation will be considered in the project review. For a simplistic example, if the U.S. Fish and Wildlife Service originally recommended a 100-cfs minimum flow, and the state Department of Fish and Wildlife recommended 50 cfs, then the U.S. Fish and Wildlife Service revised its recommendation to 80 cfs based on the results of an instream flow study, but FERC issued a license with a 40-cfs minimum flow, the facility must release a minimum flow of 80 cfs to satisfy the Flow Regimes criterion.
- ***Consistent with and supportive of resource management goals and objectives.*** Resource agency and tribal government recommendations must align with the relevant formal management goals and objectives for the resource(s) in question as they relate to the facility or its operations (e.g., fishery management plan, species recovery plan). The specific recommendation for the facility must also demonstrate how the recommendation supports achievement of the relevant resource management goals and objectives.

⁷ Consultation with Tribal Nations is a formal, two-way, government-to-government dialogue between official representatives of Tribes and Federal agencies to discuss Federal proposals before the Federal agency makes decisions on those proposals.

- ***Resolution of conflicting recommendations.*** In instances of conflicting resource agency and/or tribal government recommendations, and the conflict cannot be resolved by applying the most recent and most stringent tests, the conflict will be resolved by applying the recommendations in this order: 1) based upon the health of threatened, endangered, or tribal trust species; 2) based on the health of other rare or at-risk species; 3) based on traditional and cultural resources; and 4) based on recreation and access; unless there is a statutory mandate to resolve the conflict otherwise. For example, recommendations designed to protect threatened or endangered species (i.e., a species recovery plan) would generally prevail over recommendations regarding recreation and access, although LIHI reserves the right to use its discretion in making a final determination. If a conflict still exists among resource agency(ies) and/or tribal government recommendations, LIHI will determine which recommendation will apply for the purpose of project reviews.

Science-based: Science-based agency or tribal recommendations can be based on relevant peer-reviewed and published studies; principles, methods, or techniques generally accepted within the scientific community; other technically sound best management practices; or on facility-specific studies. In all cases, the recommendation must be based on rigorous, systematic, and objective methodologies to obtain reliable and valid knowledge that demonstrates that the design and operations of a facility would be expected to achieve the LIHI criterion goals.

Terrestrial Ecosystem: Refers to the natural community living on or related to land. It is the land-based community of organisms interacting with biotic and abiotic components of the environment. Terrestrial ecosystems also include groundwater dependent ecosystems. Examples include tundra, taiga, temperate deciduous forest, tropical rain forest, grassland, deserts. The type of terrestrial ecosystem found in a particular place is dependent on the temperature range, the average amount of precipitation received, the soil type, and the amount of light it receives.

Traditional (or Tribal or Indigenous) Cultural Landscape: Any place in which a relationship, past or present, exists between a spatial area, resource(s), and an associated group of indigenous people whose cultural practices, beliefs, or identity connects them to that place. A traditional cultural landscape is determined by and known to a culturally related group of indigenous people with relationships to that place.

Traditional Cultural Property (TCP): Any property that is eligible for inclusion in the National Register of Historic Places based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. TCPs are rooted in a traditional community's history and are important in maintaining the continuing cultural identity of the community. Many TCPs can only be identified by the affected community(ies) themselves. Members have specialized expertise regarding properties that play important roles in their historically rooted beliefs, customs, and practices. While certain properties may be documented in the historic literature or through previous ethnographic or archeological studies,

certain information regarding these and other properties has only been passed down through generations by oral history or practice.

Tribal Benefit Agreement (TBA): A legally binding, enforceable contract negotiated between developers and a Tribal Nation, designed to respect the Tribe's sovereignty, consider relevant Tribal laws and regulatory interests, and align with its self-determination goals, priorities, and cultural values.⁸ The agreement ensures that projects on or near Tribal lands provide tangible benefits to the Tribes—monetary and/or non-monetary—that are negotiated and tailored to the Tribes' unique needs and priorities. The development of the agreement should follow the process for engaging with the Tribe and obtaining consent as outlined in the Tribal Engagement Plan (see Community or Tribal Engagement Plan definition above). The agreement should include clear, measurable commitments for delivering specific benefits. The agreement should include mechanisms for monitoring the implementation of the agreed-upon benefits within the timelines prescribed in the TBA, addressing any challenges or gaps in implementation, and mechanisms for dispute resolution. The agreement may include provisions for long-term evaluation of the benefits and adaptation throughout the project's lifecycle, as needed. In some cases, LIHI may consider a Tribal Benefit Plan in lieu of the TBA if the TBA is a component of the Tribal Benefit Plan or if the Tribal Benefit Plan outlines the timeline for the execution of a future TBA.

Tribal Trust Resources: Tribal trust resources refer to resources, the collective rights to their use and management, and access to traditional areas and times for their harvest, procurement or gathering that have been associated with a Tribal Nation's sovereignty since time immemorial. The term includes inherent rights or inherent rights expressly or impliedly reserved via treaty, Executive Order, or statute associated with usual, accustomed, and traditional territories. In addition, tribal trust resources include areas important to traditional cultural practices and the natural and cultural resources associated with those practices including plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes. Resources may also include archaeological or historic sites or Traditional Cultural Properties associated with tribal use and sites considered sacred by Tribes. Resources, archaeological sites, Traditional Cultural Properties, Traditional Cultural Landscapes, and natural resources often can be interconnected and overlapping.

Tribal Trust Species: A species protected under tribal reserved rights. This term is a subset of Tribal Trust Resources and used in conjunction with Listed Species. Tribes identify species of cultural importance for ceremonial, subsistence, and/or commercial purposes that need protection. The federal government coordinates with Tribes on a government-to-government basis in efforts to protect them and their associated habitats.

Tribal Nation (or Tribe): Any state or federally recognized American Indian Tribe, Alaska Native entity, or Native Hawaiian organization. **NOTE:** Tribes and Tribal Nations that are not federally

⁸ See generally, Tallgrass Institute, 2025, Tribal Benefit Agreements: Designing for Sovereignty. Available at: <https://static1.squarespace.com/static/67228f0f7192a401a75ff94a/t/686ee7e32f6026214414227f/1752098803037/Tribal+Benefit+Agreements+Tallgrass+Institute+FINAL.pdf>

or state recognized, as well as other historic tribal groups having interests in the facility area must still be identified and included in engagement processes.