

Groundbreaking Hydro Prize



Official Rules Document

September 2020



U.S. DEPARTMENT OF ENERGY

Preface

The U.S. Department of Energy's Groundbreaking Hydro Prize will be governed by this Official Rules document, which establishes the prize rules and requirements. The Prize Administrator reserves the right to modify this Official Rules document if necessary and will publicly post any such notifications as well as notify registered prize participants.

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Executive Summary

The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO) invites all innovators to compete in the Groundbreaking Hydro Prize. The prize offers up to \$300,000 in prizes and seeks to identify novel solutions to reduce costs, timelines, and risks associated with geotechnical foundations of new, low-head hydropower.

The goals of the Groundbreaking Hydro Prize are to:

- Develop transformative methods or technologies for geotechnical foundations that significantly reduce costs, risks, and time with a minimal environmental footprint.
- Identify high-impact opportunities to address key challenges for hydropower geotechnical foundations as identified in the [Hydropower Geotechnical Foundations report](#).¹
- Bring new innovators into the hydropower sector and help form new partnerships and collaborations between industry, academia, and government to accelerate innovative solutions for hydropower.

In order to achieve these goals, WPTO is looking for innovative and applicable solutions in all three of the following phases associated with development of geotechnical foundations for hydropower:

1. **Geotechnical Site Assessment:** Activities performed to obtain information needed to design and construct a foundation system.
2. **Foundation Design:** The process of using information from the site assessment to perform analyses and develop a cost-effective foundation system that meets the project design criteria.
3. **Foundation Construction:** Encompasses activities from mobilization through project commissioning, including pre-excavation activities, excavation activities, and foundation treatments.

The Groundbreaking Hydro Prize comprises a single stage in which competitors will submit a package that includes a detailed description of the challenge being addressed and its relevance to hydropower, a proposed solution that will address the challenge, and evidence of the concept's feasibility and commercialization potential, and a video pitching their solution. A total of \$300,000 in cash prizes will be awarded in the following categories:

Groundbreaking Prizes: Up to three winners will be awarded \$50,000 for the most impactful submission.

Innovator Prizes: Up to six winners will be awarded \$25,000 each for the most innovative submission.

Key Dates

- Submission Open: September 25, 2020
- Submission Close: January 31, 2021, at 5:00 p.m. Eastern Standard Time
- Judging and Review Complete: April 2021
- Winner Announcement and Awards: April 2021

¹ DeNeale, Scott, Norman Bishop, Larry Buetikofer, Richard Sisson, Colin Sasthav, Mirko Musa. 2020. *Hydropower Geotechnical Foundations: Current Practice and Innovation Opportunities for Low-Head Applications*. Oak Ridge National Laboratory. ORNL/TM-2020-1553. <https://info.ornl.gov/sites/publications/Files/Pub140772.pdf>.

Applications Not of Interest

The Groundbreaking Hydro Prize encourages competitors to submit unique ideas and novel concepts; however, submissions with the following technical characteristics are not of interest and will not be scored:

- Concepts that are only relevant to marine or in-river hydrokinetic devices, as opposed to hydropower applications. Hydrokinetic devices are placed directly in a river, current, or tidal current to extract the kinetic energy from moving water. Hydropower facilities—the focus of this prize—use structures to create hydraulic head and a turbine to convert the potential and kinetic energy of falling water into electricity.
- Concepts proposing modifications to existing water infrastructure.
- Concepts focused only on the hydropower superstructure (e.g., dam, spillway, powerhouse).
- Concepts that involve the lobbying of any federal, state, or local government.
- Concepts not based on sound technical principles.

Eligibility and Teams

The competition is open only to:

- Private entities (for-profits and nonprofits), nonfederal government entities such as states, counties, tribes and municipalities, academic institutions, and individuals subject to the following requirements:
 - Private entities must be incorporated in and maintain a primary place of business in the United States with majority domestic ownership and control. If an entity seeking to compete does not have domestic ownership and control but otherwise meets the eligibility requirements, the DOE Office of Energy Efficiency and Renewable Energy may consider issuing a waiver of that eligibility requirement. Details on this can be found in Appendix B.
 - Academic institutions must be based in the United States.
 - An individual prize competitor (who is not competing as a member of a group) must be a United States citizen or a legal permanent resident.
 - A group of individuals competing as one team may win, provided that the online account holder of the submission is a U.S. citizen or a legal permanent resident. Individuals competing as part of a team may participate if they are legally allowed to work in the United States.
 - All participants comply with the foreign involvement requirements contained in Appendix B.
 - DOE employees, employees of sponsoring organizations, members of their immediate families (i.e., spouses, children, siblings, or parents), and persons living in the same household as such persons, whether or not related, are not eligible to participate in the prize.
- Federal entities and federal employees, acting within the scope of their employment, are also not eligible to participate in any portion of the prize. DOE national laboratory employees cannot compete in the prize.
- Entities and individuals publicly banned from doing business with the U.S. government such as entities and individuals debarred, suspended, or otherwise excluded from or ineligible for participating in federal programs are not eligible to compete.

In keeping with the goal of growing a community of innovators, competitors are encouraged to form multidisciplinary teams while developing their concept. The [HeroX platform](#) provides a space where parties interested in collaboration can post information about themselves and learn about others who are also interested in competing in this contest.

Background

Hydropower has provided the United States with sustainable, reliable, and affordable power for over 100 years, and there are still many promising untapped opportunities for growth. New stream-reach development (NSD, i.e., “greenfield”) sites—defined as stream segments without hydroelectric facilities or other hydraulic structures—comprise the majority of the technical hydropower resource potential in the United States. The majority of NSD sites are characterized by low heads and varying flows and offer essential river functions and attributes that must be protected and preserved. Roughly 75% of identified NSD sites are “low head” (i.e., 30 feet or less of hydraulic head). Based on a recent assessment, roughly 78% of low-head NSD sites are located in valley terrain (Figure 1; stream gradient of 0.5% or less),² and roughly 81% are estimated to be sited on soil foundations. These characteristics present development challenges, because flatter streams typically yield lower energy densities, and soil foundations often prove to be more technically challenging and costly.

Although NSD hydropower development is technically feasible, the “2016 Hydropower Vision Report” suggested that new NSD project deployments would likely remain limited without the emergence of innovative—even transformational—advances in technologies that address these challenges. Among the challenges facing hydropower growth, civil works have represented a significant cost driver for new hydropower development, with the foundation system representing a major source of uncertainty. While foundations are central to dam safety, their design and construction can lead to major project delays and cost overruns, potentially jeopardizing a project’s success. Foundations must also be developed to minimize environmental disturbance, considering the various characteristics of the surrounding stream environment and subsurface. Beyond these technical and environmental considerations, developers must consider the interplay of cost, timeline, and risk for a project to prove economically feasible.

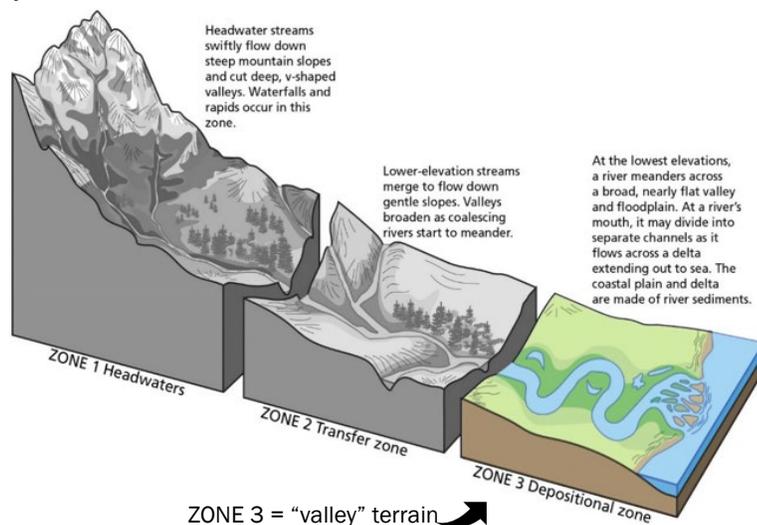


Figure 1. Coarse representation of a watershed's terrain classes in terms of sediment transport processes. Source: Trista L. Thornberry-Ehrlich, Colorado State University (modified); redrafted from Miller (1990).

In short, the technical, economic, and environmental challenges associated with geotechnical foundation design and construction present major challenges to new development, yet opportunities exist to develop innovative solutions. With this understanding, it is critically important to establish the current state of practice for hydropower geotechnical foundations, identify key challenges, and define opportunities for innovative solutions.

To this end, the Oak Ridge National Laboratory (ORNL) produced the U.S. Department of Energy (DOE)-funded [Hydropower Geotechnical Foundations report](#).¹ The report concisely summarizes key information and catalogs additional resources that provide insight into hydropower geotechnical foundations. An

² Miller, G.T. 1990. “Living in the Environment: An Introduction to Environmental Science.” Wadsworth Publishing, 60 pp.

[executive summary](#) of the report is also available.

The report:

- Covers background information on hydropower
- Describes various characteristics relevant to hydropower foundations for undeveloped U.S. streams
- Presents the current state of practice in foundation development
- Provides a representative assessment of conventional hydropower foundation costs and timelines
- Addresses key challenges facing conventional hydropower foundations
- Presents example opportunities for innovative hydropower foundation technologies while highlighting some advances in nonhydropower industries.

Hydropower Geotechnical Foundations Overview

As with other major construction projects, hydropower development requires thoughtful consideration of how the above-ground features will maintain stability, safety, and functionality. These objectives are accomplished through a well-engineered **geotechnical foundation system**, defined as the collection of engineered structural features constructed at or below the preconstruction ground surface that interfaces between the above ground (i.e., the *superstructure*) and the bed material below (i.e., the *subsurface*). An example schematic of a typical conventional hydropower facility is provided in Figure 2.

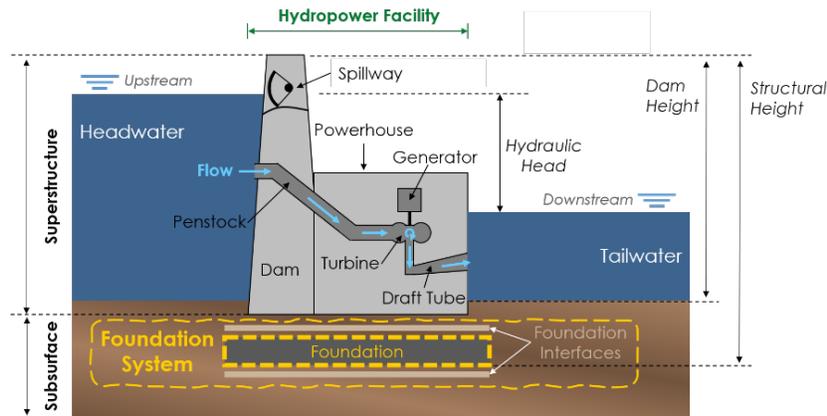


Figure 2. Conventional concrete-dam hydropower facility with important components indicated. Source: ORNL. Some facility components (e.g., abutments) are not illustrated. Not to scale.

Phase	Relative Timing →
Geotechnical Site Assessment	Starts at the beginning and continues through the end of the project.
Conceptual Design	Occurs early in the project, overlapping with site assessment.
Feasibility Design	Occurs after conceptual design, overlapping with detailed design.
Detailed Design	Occurs after feasibility design, overlapping with construction.
Construction	Occurs after detailed design, overlapping with reservoir filling.
Reservoir Filling	Occurs after construction, overlapping with commissioning.
Commissioning	Occurs at the very end of the project.

Figure 3. Representative sequence of principal phases for design, construction, and commissioning of small hydropower development. Source: ORNL.

Hydropower projects require various superstructures, such as an impoundment to store and control water, spillways to pass flood flows, and a powerhouse to generate electricity. Much like the roots to a tree, a well-engineered and constructed foundation will ensure the facility's structural stability, safety, and performance for decades. The hydropower geotechnical foundation development process comprises three phases:



Geotechnical Site Assessment: *Activities performed to obtain information needed to design and construct a foundation system. Key objectives of a geotechnical site assessment are to establish baseline information, model the subsurface geologic and hydrologic conditions, and evaluate engineering characteristics.*



Foundation Design: *The process of using information from the site assessment to perform analyses and develop a cost-effective foundation system that meets the project design criteria. Foundations are designed to be compatible with the structures they support, and each site has unique characteristics that the designer must consider in developing a design solution. Major design criteria include providing for structural stability and support and controlling seepage.*



Foundation Construction: *Activities to fully develop the foundation system, from mobilization through project commissioning. Foundation construction encompasses various pre-excavation activities, excavation activities, and foundation treatments. Pre-excavation activities include mobilization, site preparation, dewatering and coffer damming, and other best management practices to minimize ecological impacts during construction. Foundation treatments can include material excavation, surface (dental) concrete placement, anchoring, cutoff trenching, grout curtain/blanket placement, structural/relief wall construction, and combinations of multiple methods.*

These three development phases are generally sequenced, as shown in Figure 3. Geotechnical site assessment and foundation design represent concurrent rather than sequential tasks, comprising an iterative process to advance overall project design. As the foundation development progresses, additional geotechnical site assessments may be needed as additional information or conditions arise throughout the design and construction phases.

As stated earlier, the foundation must be designed for the site's geologic and subsurface conditions. These conditions also dictate superstructure selection and design. For low-head NSD hydropower applications, cost-effective dam designs are typically limited to earthfill, rockfill, and concrete gravity dams. Modular superstructures, which are highlighted in [the 2020 ORNL technical report](#), represent a less conventional design approach; whereas modular designs represent a largely unproven paradigm, they offer potential cost and schedule reductions and are targeted primarily toward low-head hydropower applications.

Key Challenges

The main challenges associated with developing geotechnical foundations for hydropower are costs, risks, and timelines. Foundation system costs depend on the type of terrain and foundation (Figure 4), with permeable soil foundations in valley terrains representing the greatest percentage of total initial capital costs (ICCs). The major cost drivers identified include the care of water, foundation footprint size, subsurface characteristics, excavation depth, and foundation treatment extent. Construction activities and materials are found to represent the largest category of costs; however, any knowledge gaps, uncertainties, or other complexities involving geotechnical site assessments and foundation design could carry weight throughout the foundation development phases.

In addition to costs, development timelines also represent challenges, as documented in the 2020 [ORNL technical report](#). Overall foundation investigations and design work timelines typically vary from 12 to 18 months, with valley terrain (i.e., predominantly soil foundation sites) requiring a relatively longer process than mountainous terrain (i.e., predominantly rock foundation sites). With footprints spanning a stream or river, hydropower foundations require dewatering, which involves constructing temporary diversion structures upstream and often downstream (called cofferdams) and water diversion systems that route water around the construction site. These pre-excavation activities can prove costly and introduce risk should the design prove inadequate or a beyond-design flood occur. Moreover, dewatering and coffer damming can induce environmental disruptions and uncertainty, which carry risk for a project.

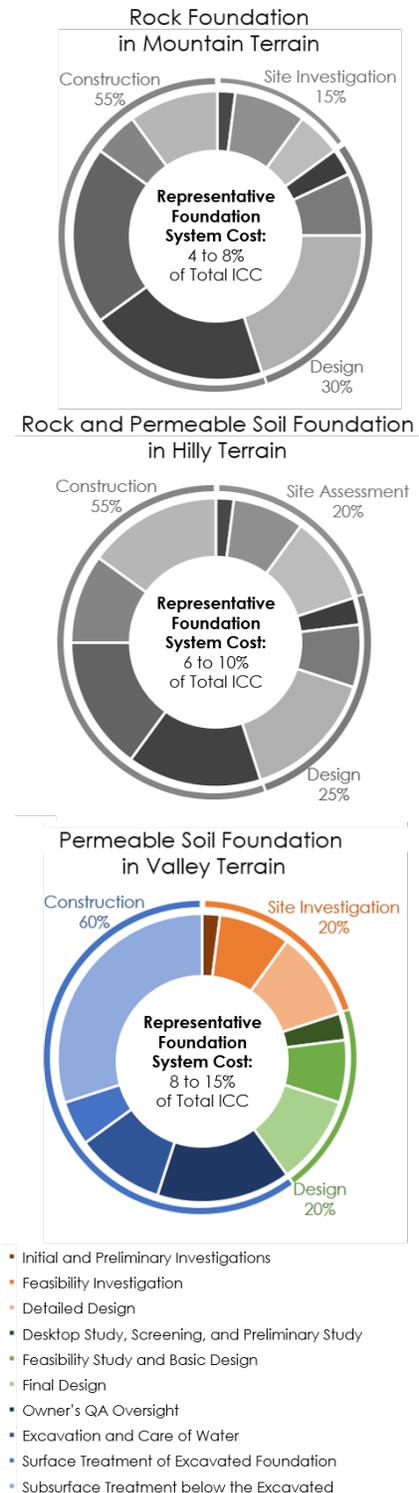


Figure 4. Representative foundation system cost breakdown by project type. Source: ORNL. Based on actual industry project experience (unpublished).

Further, each development phase has its own set of challenges that could be addressed through innovative solutions:

- **Geotechnical site assessment (off-site and on-site):** Challenges can involve site access difficulties; high-resolution satellite and/or aerial imagery; geophysical exploration limitations; soil and rock sampling reliability; rock joint strength; site material erosion; and modeling limitations, among others.
- **Foundation design and materials:** Challenges can include unexpected site conditions, as well as structural stability, strength, and seepage calculations for conventional and innovative designs.
- **Foundation construction and technology:** Challenges can include risk quantification and communication; unexpected geologic and subsurface conditions; construction scheduling delays; water diversion system installation costs and mitigation; and performance monitoring availability.

The Groundbreaking Hydro Prize aims to tackle challenges across all three development phases by identifying high-impact solutions for improving the cost, time, and risk performance of future projects.

See Appendix C for example solutions identified (the list is not exhaustive). These opportunities are not necessarily mutually exclusive (i.e., innovative solutions could span one, two, or all three areas).

Additional information is also provided in the [ORNL technical report](#).

Groundbreaking Hydro Prize Rules and Requirements

Introduction and Purpose

The DOE Water Power Technologies Office (WPTO) has designed the Groundbreaking Hydro Prize to incentivize innovations that reduce costs, risk, and timelines for hydropower geotechnical foundations by using innovative techniques, strategies, designs, and technologies. Targeting the largest opportunity for future hydropower growth, the prize seeks solutions for **low-head** (less than 30 ft) NSD opportunities, and prioritizes innovations applicable to **soil foundations**.³ Importantly, **superstructures (including dams) are excluded** from the prize scope.⁴ The Groundbreaking Hydro Prize solicits novel concepts applicable to the three development phases:

1. Geotechnical Site Assessment
2. Foundation Design
3. Foundation Construction.

Solutions may not necessarily be mutually exclusive (i.e., solutions could span one, two, or all three areas).

Desirable goals to improve the geotechnical foundations development process include:

- Lower construction costs (e.g., through standardization or modularity)
- Lower overall construction times (e.g., through standardization or modularity)
- Reduced uncertainty related to foundation treatment costs, structure stability, and risk of failure
- Minimal ground excavation or create systems that require less excavation to avoid seepage
- Minimal disturbances in river connectivity during installation, operation, and maintenance.

To achieve breakthroughs, the prize seeks novel, emerging, and diverse solutions. These may stem from within the hydropower industry, or leverage lessons learned from other industries. A firm understanding of the multidisciplinary nature of foundation development and the unique, complex features of hydropower development is needed.

Prizes

The Groundbreaking Hydro Prize offers up to \$300,000 in prizes. From the submissions, up to six Innovator Prize winners will be selected to receive \$25,000 each, and up to three of the most impactful submissions will be selected as the Groundbreaking Prize winners and receive \$50,000 each.

Innovator Prize	Up to six awards of \$25,000 will be awarded to the top submissions across all development phases.
Groundbreaking Prize	Up to three awards of \$50,000 will be awarded to the most innovative and impactful submission.

³ See the ORNL report, “Analysis of Undeveloped Low-Head U.S. Stream-Reaches” (Section 3.3).

⁴ See the “Report Scope and Focus” text box in the ORNL report’s “Introduction” (Section 1).

How to Enter

Go to and follow the instructions for registering and submitting all required materials before the deadline in the Key Dates section in the Executive Summary or as displayed on the [HeroX website](#). Competitors also have the ability to form teams or find partners through the HeroX platform.

Important Dates

- Submission Open: September 25, 2020
- Submission Close: January 31, 2021 at 5:00 p.m. Eastern Standard Time
- Judging and Review Complete: April 2021
- Winner Announcement and Awards: April 2021

Note: Prize timeline subject to change as determined by DOE.

What to Submit

Participants will have 90 days to submit their concept, including a detailed description of the challenge being addressed and its relevance for hydropower, compelling information to demonstrate that the proposed concept is the right solution and would advance the state of the art, and evidence of the concept's feasibility and commercialization potential. Ideas will be evaluated based on three criteria: (1) challenge, (2) innovation, and (3) viability.

The following items comprise the submissions package for the Groundbreaking Hydro Prize and must be submitted through the HeroX platform. Each is described in more detail in Table 1.

Table 1. Components of the Submissions Package

Item	Will Be Made Public ⁵	Scored Item
Cover Page	Yes	No
Summary Slide	Yes	No
90-Second Video Pitch	Yes	Yes
Technical Narrative	No	Yes
Resources Needed Documentation (Optional)	No	No

Competitors may provide multiple submission packages for review; however, each submission must be materially different in content and the topic to be considered. If multiple submissions from the same competitor are too similar, only one will be scored and considered for an award at DOE's sole discretion.

⁵ Competitors who do not want the Technical Submission or other documents to be made public will need to mark them according to the instructions in Appendix A.

Cover Page Content

Table 2. Content to Include for the Cover Page

Cover Page - <i>List Basic Information About the Submission (Will Be Made Public)</i>
<ul style="list-style-type: none">• Title• Team name• Development phase(s) targeted• Short description• Link to 90-second video online• Key project members (names, contacts, and links to their professional online profiles)• Other partners (if any)• City and state

Submission Summary Slide

Table 3. Content to Include for the Submission Summary Slide

Submission Summary Slide (Will Be Made Public)
Make a public-facing, one-slide submission summary that contains technically specific details but can be understood by most people. There is no template, so competitors are free to present the information in any format. Any text must be readable in a standard printout and conference room projection and should have a font size of at least 14 pt.

Scored Items: 90-Second Video Summary and Technical Narrative

The scored Technical Submission includes a Written Narrative and 90-second Video Pitch, both parts of which will be scored. There are three criteria questions that need to be addressed in the Technical Submission:

- **Criteria 1: Challenge** – What is the challenge the proposed solution is addressing, and why is solving it important?
- **Criteria 2: Innovation** – How will the solution improve the state of the art?
- **Criteria 3: Viability** - How viable is the proposed solution?

Both pieces of the Technical Submission should collectively describe the idea and address all three criteria questions.

The 90-second Video Summary and Technical Narrative scoring will be used to calculate the final score, and related statements will each be rated on a score of 1–6, as shown in the following table.

Table 4. Scoring Scale

1	2	3	4	5	6
Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

Table 5 explains the manner in which the final scores for each submission will be calculated.

Table 5. Scoring Criteria and Points

Criteria Questions	Number of Scored Statements	Percentage of Total Score	Total Possible Points
90-second Video Summary	1	8.3%	6
Technical Narrative Total	11	91.7%	66
Criteria 1: Challenge	4	33.3%	24
Criteria 2: Innovation	3	25.0%	18
Criteria 3: Viability	4	33.3%	24
TOTAL	12	100%	72

90-second Video

Each team must produce a 90-second video that will help the reviewers and general public understand the concept. Be creative and convey information in a fun and engaging way, but do not expend time on labor-intensive activities that only improve production quality (i.e., technical elements such as décor, lighting, and cinematic techniques). Reviewers will focus on content, not the quality of video production. Upload the video online to a publicly accessible platform (e.g., YouTube, Vimeo).

The reviewers will score the video based on the content provided.

Table 6. Suggested Content for Video

<i>Scoring: Online Public Video—Describe the Solution in 90 Seconds</i>	
<p>Suggested Content:</p> <ul style="list-style-type: none"> • Concise summary of the challenge the concept addresses, the specific innovation, and technical viability • Introduction to the team 	<p>Each Statement Scored on a 1–6 Scale</p> <ul style="list-style-type: none"> • The proposed solution described in the video presents a clear and concise summary of the concept and introduces the project team

Technical Narrative

Write a detailed narrative describing the solution. There is a template on the HeroX platform to use in drafting the Technical Narrative. The total length of the Technical Narrative cannot exceed 2,500 words. Participants may include up to five supporting visualizations or graphics. The Technical Narrative must be submitted as a PDF onto the HeroX platform along with the other submission documents. Information contained in hyperlinks to external sources will not be reviewed or considered by the reviewers or judge.

The scoring criteria for the Technical Narrative are as follows:

- **Criteria 1: Challenge** – What is the challenge the proposed solution is addressing, and why is solving it important?
- **Criteria 2: Innovation** – How will your solution improve the state of practice?
- **Criteria 3: Viability** – How viable is the proposed solution?

Table 7 describes the content that should be provided in the narrative to successfully address each criteria question. The right-hand column contains the scored statements that the reviewers will be using for each of the three criteria questions. Individual reviewers will assign a 1–6 score for each scored statement after reviewing the Technical Submission. The left-hand column includes suggested content for each criteria question. The suggested content provided is not mandatory and competitors will not be judged against it; these are examples of details to include to help guide your responses, but you are welcome to use other information as you see fit.

Table 7. Suggested Content for the Technical Narrative

Criteria 1: Challenge – <i>What is the Challenge the Proposed Solution is Addressing, and Why is Solving It Important?</i>	
<p>Suggested Content</p> <ul style="list-style-type: none"> ● Description of the challenge and how it relates to one (or more) of the development phases (geotechnical site assessment, foundation design, foundation construction), and a compelling argument for why solving the challenge is particularly urgent or critical. ● Identification of the types of geotechnical foundations and superstructures for which the proposed solution is applicable. ● Demonstration of the challenge’s relevance to the most common NSD opportunities (i.e., low-head valley terrain with soil subsurface), with supporting evidence (e.g., interviews with stakeholders, case studies, literature). ● Explanation of how the approach presents a solution pathway for increasing hydropower growth. 	<p>Each Statement Scored on a 1–6 Scale</p> <ul style="list-style-type: none"> ● The competitor identifies a critical challenge within one (or more) of the development phases with clear linkages and relevance to hydropower geotechnical foundations using compelling analysis. ● The competitor clearly identifies the potential geotechnical foundations and superstructures for which their solution is impactful. ● The proposed solution is broadly applicable to low-head NSD opportunities. ● The competitor shows a strong understanding of how incorporating their solution can provide a solution pathway for new, low-head hydropower development.

Criteria 2: Innovation – *How Will the Solution Improve the State of Practice?*

Suggested Content

- Description of the relevant current state of practice for hydropower geotechnical foundations, including estimates for baseline performance metrics (costs, timeline, and risk) by providing supporting data, calculations, and/or analysis.
- Description of how the proposed solution improves upon the current state of hydropower geotechnical foundation practice within one or more of the development phases.
- Description of the solution’s unique value proposition.

Each Statement Scored on a 1–6 Scale

- The relevant current state of practice and baseline performance metrics are clearly described.
- The solution improves upon the current state of hydropower geotechnical foundation practice by driving down cost, time, and/or risk associated with hydropower geotechnical foundations.
- The proposed solution provides unique value toward improving new hydropower feasibility.

Criteria 3: Viability – *How Viable is the Proposed Solution?*

Suggested Content

- Description of the expected costs, performance, and scalability of the proposed solution, backed up data, calculations, and/or analysis.
- Supporting drawings, figures, or documentation (e.g., three-dimensional CAD drawings, conceptual designs or layouts, Gantt charts, technology white paper) of the proposed concept and identification of novel concepts.
- Description of how the solution will be built, deployed, and maintained while meeting dam safety-related performance and minimizing environmental impacts.
- Description of the commercialization pathway for the proposed solution, including resources needed for realization (e.g., testing infrastructure, estimated financial support, potential partners, and end users).

Each Statement Scored on a 1–6 Scale

- Cost and performance goals and metrics are reasonable, ambitious, and attainable.
- The solution is based on reasonable technical assumptions, principles, and lessons learned from relevant experience and knowledge.
- The competitor has identified credible methods for implementing the proposed solution while meeting dam safety-related performance and minimizing environmental impacts.
- The competitor shows a strong understanding of the critical path to commercializing the proposed solution.

Resources Needed Documentation (Optional)

We invite competitors to submit supporting documentation that identifies resources needed for the prototyping and deployment of their ideas. There is a suggested template on HeroX for this documentation. Examples of resources needed include:

- Testing facilities
- DOE user facilities, like the Manufacturing Demonstration Facility at ORNL
- Specialized manufacturing equipment
- Specialized materials
- Software licenses for modeling and simulation
- Technical expertise from DOE national laboratories
- Other engineering expertise
- Investment amounts
- Introductions and connections to key stakeholders in the hydropower industry, manufacturing sector, and other relevant sectors
- Any other relevant services, infrastructure, or partners that might be needed.

Please limit responses to 1,000 words. This documentation will not count toward the submission's word limit and will not be made public, nor will it be included in the cumulative score; however, as DOE prepares for future funding opportunities, including future iterations of prizes for geotechnical foundations, we are seeking to better understand how to best support competitors in the designing, building, and testing of their ideas.

How We Determine Winners and Make Awards

The Prize Administrator screens all completed submissions and, in consultation with DOE, assigns subject matter expert reviewers to independently score the content of each submission. The reviewers will comprise federal and nonfederal subject matter experts with expertise in areas relevant to the competition. Reviewers will review Technical Narrative submissions according to the evaluation criteria described in Section 3.4.3.

Reviewer Panel Scoring

The scoring of submissions will proceed as follows:

- Reviewers will review the Technical Submission (Technical Narrative and video) individually and assess the competitors' response to each statement for all of the three criteria questions.
- Reviewers will score each statement between 1 and 6, depending on the degree to which the reviewer agrees that the Technical Submission (Technical Narrative and video) reflects the statement.
- Each statement score will be added together to generate a total score for the submission, ranging from 10 to 60.
- The total scores from each reviewer will be averaged to develop a final score for the competitor. This score will inform the judge's decisions on awarding prizes.

Interviews

WPTO may decide to interview a subset of competitors. These interviews would be held prior to the announcement of winners and would serve to help clarify questions the reviewers may have. Participating in interviews is not required and interviews are not an indication of winning.

Final Determination

The director of WPTO is the judge of the competition and will make the final determination of winners. Final determination will take into account the reviewers' scores, application of program policy factors, and the interview findings (if applicable).

Announcement

Approximately 30 days after the contest closes, the Prize Administrator will notify winners and request the necessary information to distribute the prizes. The Prize Administrator will then publicly announce winners.

Additional Terms and Conditions

See Appendix A for additional requirements. COMPETITORS THAT DO NOT COMPLY WITH THE ADDITIONAL REQUIREMENTS IN APPENDIX A MAY BE DISQUALIFIED.

Appendix A. Additional Terms and Conditions

Universal Contest Requirements

Submissions are subject to the following terms and conditions:

- Competitors must post the final content of the submission or upload the submission form online before the relevant contest closes. Any other form of submission will not be accepted. Late submissions will not be accepted.
- By clicking “submit” in HeroX, the competitor is agreeing to make their video and cover page public.
- All submissions that competitors wish to protect from public disclosure must be marked according to the instructions in the upcoming section entitled, “Records Retention and Freedom of Information Act.” Unmarked or improperly marked submissions will be deemed to have been provided with unlimited rights and may be used in any manner and for any purpose whatsoever. The narrative, modeling documentation, letters of commitment/support, and résumés are not intended to be made public; however, see the section on Records Retention and Freedom of Information Act in this Appendix regarding the Freedom of Information Act.
- Competitors must include all the required submission’s elements. The Prize Administrator may disqualify the submission after an initial screening if the competitor fails to provide all required submission elements. Competitors may be given an opportunity to rectify submission errors because of technical challenges or to fix nonsubstantive mistakes or errors in their submission packages.
- Submissions must be in English and in a format readable by Microsoft Word or an Adobe Acrobat PDF viewer. Handwritten submissions will be disqualified.
- Submissions and competitors will be disqualified if any engagement with the Groundbreaking Hydro Prize—including but not limited to the submission, the HeroX forum, or emails to the Prize Administrator—contains any matter that, in the sole discretion of the U.S. Department of Energy (DOE) or National Renewable Energy Laboratory (NREL), is indecent, obscene, defamatory, libelous, lacking in professionalism, or demonstrates a lack of respect for people or life on this planet.
- If the competitor clicks “Accept” on the HeroX platform and registers for any of the contests described in this document, they are agreeing to be bound by these rules in addition to the existing HeroX Terms of Use for all purposes relating to these contests. The competitor should print and keep a copy of these rules. These provisions apply only to the contests described here and no other contests on the HeroX platform or anywhere else.
- As part of the submission to this prize program, the competitor will be required to sign the following statement:

I am providing this submission package as part of my participation in this prize. I understand that I am providing this submission to the Federal Government. I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules document. I further represent that the information contained in the submission is true and contains no misrepresentations. I understand false statements or misrepresentations to the Federal Government may result in civil and/or criminal penalties under 18 U.S.C. § 1001.

Verification for Payments

The Prize Administrator will verify the identity and role of all competitors before distributing any prizes. Receiving a prize payment is contingent upon fulfilling all requirements contained herein. The Prize Administrator will notify winning competitors using provided email contact information for the individual or entity that was responsible for the submission. Each competitor will be required to sign and return to the Prize Administrator, within 30 days of the date on the notice, a completed NREL Request for ACH Banking Information form and a completed Internal Revenue Service Form W-9 (<https://www.irs.gov/pub/irs-pdf/fw9.pdf>). In the sole discretion of the Prize Administrator, a winning competitor will be disqualified from the competition and receive no prize funds if: (i) the person/entity does not respond to notifications; (ii) the person/entity fails to sign and return the required documentation within the required time period; (iii) the notification is returned as undeliverable; (iv) the submission or person/entity is disqualified for any other reason.

In the event of a dispute as to any registration, the authorized account holder of the email address used to register will be deemed to be the competitor. The “authorized account holder” is the natural person or legal entity assigned an email address by an internet access provider, online service provider, or other organization responsible for assigning email addresses for the domain associated with the submitted address. All competitors may be required to show proof of being the authorized account holder.

Teams and Single Entity Awards

The Prize Administrator will award a single dollar amount to the designated primary submitter, whether comprising a single or multiple entities. The primary submitter is solely responsible for allocating any prize funds among its member competitors or teammates as they deem appropriate. The Prize Administrator will not arbitrate, intervene, advise on, or resolve any matters or disputes between team members or competitors.

Submission Rights

By making a submission and consenting to the rules of the contest, a competitor is granting to DOE, the Prize Administrator, and any other third parties supporting DOE in the contest, a license to display publicly and use the parts of the submission that are designated as “public” for government purposes. This license includes posting or linking to the public portions of the submission on the Prize Administrator or HeroX applications, including the contest website, DOE websites, and partner websites, and the inclusion of the submission in any other media worldwide. The submission may be viewed by DOE, the Prize Administrator, and judges and reviewers for purposes of the contests, including but not limited to screening and evaluation purposes. The Prize Administrator and any third parties acting on their behalf will also have the right to publicize competitors’ names and, as applicable, the names of competitors’ team members and organization, which participated in the submission on the contest website indefinitely.

By entering, the competitor represents and warrants that:

1. Competitor’s entire submission is an original work by competitor and competitor has not included third-party content (such as writing, text, graphics, artwork, logos, photographs, likeness of any third party, musical recordings, clips of videos, television programs, or motion pictures) in or in connection with the submission, unless (i) otherwise requested by the Prize Administrator and/or disclosed by competitor in the submission, and (ii) competitor has either obtained the rights to

use such third-party content or the content of the submission is considered in the public domain without any limitations on use.

2. Unless otherwise disclosed in the submission, the use thereof by Prize Administrator, or the exercise by Prize Administrator of any of the rights granted by competitor under these rules, does not and will not infringe or violate any rights of any third party or entity, including, without limitation, patent, copyright, trademark, trade secret, defamation, privacy, publicity, false light, misappropriation, intentional or negligent infliction of emotional distress, confidentiality, or any contractual or other rights;
3. All persons who were engaged by the competitor to work on the submission or who appear in the submission in any manner have:
 - a. Given the competitor their express written consent to submit the submission for exhibition and other exploitation in any manner and in any and all media, whether now existing or hereafter discovered, throughout the world;
 - b. Provided written permission to include their name, image, or pictures in or with the submission (or, if a minor who is not competitor's child, competitor must have the permission of the minor's parent or legal guardian) and the competitor may be asked by the Prize Administrator to provide permission in writing;
 - c. Not been and are not currently under any union or guild agreement that results in any ongoing obligations resulting from the use, exhibition, or other exploitation of the submission.

Copyright

Each competitor represents and warrants that the competitor is the sole author and copyright owner of the submission; that the submission is an original work of the competitor or that the competitor has acquired sufficient rights to use and to authorize others, including DOE, to use the submission, as specified throughout the rules; that the submission does not infringe upon any copyright or any other third-party rights of which the competitor is aware; and that the submission is free of malware.

Contest Subject to Applicable Law

All contests are subject to all applicable federal laws and regulations. Participation constitutes each participant's full and unconditional agreement to these Official Contest Rules and administrative decisions, which are final and binding in all matters related to the contest. This notice is not an obligation of funds; the final award is contingent upon the availability of appropriations.

Resolution of Disputes

DOE is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

Neither DOE nor the Prize Administrator will arbitrate, intervene, advise on, or resolve any matters between team members or among competitors.

Publicity

The winners of these prizes (collectively, "winners") will be featured on the DOE and NREL websites.

Except where prohibited, participation in the contest constitutes each winner's consent to DOE's and its agents' use of each winner's name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media worldwide, without further permission, payment, or consideration.

Liability

Upon registration, all participants agree to assume any and all risks of injury or loss in connection with or in any way arising from participation in this contest. Upon registration, except in the case of willful misconduct, all participants agree to and, thereby, do waive and release any and all claims or causes of action against the Federal Government and its officers, employees, and agents for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential, and whether foreseeable or not), arising from their participation in the contest, whether the claim or cause of action arises under contract or tort.

In accordance with the delegation of authority to run this contest delegated to the director of the Water Power Technologies Office, the director has determined that no liability insurance naming DOE as an insured will be required of competitors to compete in this competition per 15 USC 3719(i)(2). Competitors should assess the risks associated with their proposed activities and adequately insure themselves against possible losses.

Records Retention and Freedom of Information Act

All materials submitted to DOE as part of a submission become DOE records and are subject to the Freedom of Information Act (FOIA). The following applies only to portions of the submission not designated as public information in the instructions for submission. If a submission includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, DOE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for review of the application or as otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

Submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose.

The submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure.” In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets.

Competitors will be notified of any Freedom of Information Act requests for their submissions in accordance with 29 C.F.R. § 70.26. Competitors may then have the opportunity to review materials and work with a FOIA representative prior to the release of materials.

Privacy

If the competitor chooses to provide HeroX with personal information by registering or completing the submission package through the contest website, they understand that such information will be transmitted to DOE and may be kept in a system of records. Such information will be used only to respond to the competitor in matters regarding their submission and/or the contest unless they choose to receive updates or notifications about other contests or programs from DOE on an opt-in basis. DOE and NREL are not collecting any information for commercial marketing.

General Conditions

DOE reserves the right to cancel, suspend, and/or modify the contest, or any part of it, at any time. If any fraud, technical failures, or any other factor beyond DOE’s reasonable control impairs the integrity or proper functioning of the contests, as determined by DOE in its sole discretion, DOE may cancel the contest.

Any performance toward contest goals is conducted entirely at the risk of the competitor and DOE shall not compensate any competitors for any activities performed in furtherance of this prize. Although DOE may indicate that it will select up to several quarterfinalists, semifinalists, finalists, and winners for each contest, DOE reserves the right to only select competitors that are likely to achieve the goals of the program. If, in DOE’s determination, no competitors are likely to achieve the goals of the program, DOE will select no competitors to be quarterfinalists, semifinalists, finalists, or winners and will award no prize money.

Program Policy Factors

While the scores of the expert reviewers will be carefully considered, it is the role of the prize judge to maximize the impact of contest funds. Some factors outside the control of competitors and beyond the independent expert reviewer scope of review may need to be considered to accomplish this goal. The following is a list of such factors. In addition to the reviewers’ scores, the following program policy factors may be considered in determining winners:

- Geographic diversity and potential economic impact of projects.
- Whether the use of additional DOE funds and provided resources are nonduplicative and compatible with the stated goals of this program and the DOE mission generally.
- The degree to which the submission exhibits technological or programmatic diversity when compared to the existing DOE project portfolio and other competitors.
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers.

- The degree to which the submission is likely to lead to increased employment and manufacturing in the United States or provide other economic benefit to U.S. taxpayers.
- The degree to which the submission will accelerate transformational technological, financial, or workforce advances in areas that industry by itself is not likely to undertake because of technical or financial uncertainty.
- The degree to which the submission supports complementary DOE-funded efforts or projects, which, when taken together, will best achieve the goals and objectives of DOE.
- The degree to which the submission expands DOE's funding to new competitors and recipients who have not been supported by DOE in the past.
- The degree to which the submission enables new and expanding market segments.
- Whether the project promotes increased coordination with nongovernmental entities for the demonstration of technologies and research applications to facilitate technology transfer.
- Whether submission content sufficiently confirms the competitor's intent to commercialize early-stage technology and establish a viable U.S.-based business in the near future.

National Environmental Policy Act Compliance

DOE's administration of the American Made Challenges: Groundbreaking Hydro Prize is subject to the National Environmental Policy Act (NEPA) (42 USC 4321, et seq.). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website at <http://nepa.energy.gov/>.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all participants will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their participation in the prize competition. Participants may be asked to provide DOE with information on fabrication and testing of their device such that DOE can conduct a meaningful evaluation of the potential environmental impacts.

Return of Funds

As a condition of receiving a prize, competitors agree that if the prize was made based on fraudulent or inaccurate information provided by the competitor to DOE, DOE has the right to demand that any prize funds or the value of other noncash prizes be returned to the government.

ALL DECISIONS BY DOE ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CONTEST.

Appendix B. Foreign Involvement Requirements and Request to Waive the “Domestic Ownership and Control” Eligibility Requirement

Additional foreign involvement requirements:

- Entities identified on a Department of Homeland Security (DHS), Binding Operational Directives (BOD) as an entity publicly banned from doing business with the United States government are not eligible to compete. See <https://cyber.dhs.gov/directives/>;
- Entities and individuals using “covered telecommunications equipment or services,” as defined in Section 889 of Pub. L. 115-232, National Defense Authorization Act of 2019⁶ are not eligible to compete; Entities and individuals identified as a restricted party on one or more screening lists of Department of Commerce, State and the Treasury are not eligible to compete. See Consolidated Screening List;
- This prize is expected to positively impact U.S. economic competitiveness. Participation in a foreign government talent recruitment program⁷ could conflict with this objective by resulting in unauthorized transfer of scientific and technical information to foreign government entities. Therefore, individuals participating in foreign government talent recruitment programs of

⁶ Pub. L. 115-232, Section 889 (f) provides the following definitions:

(3) Covered telecommunications equipment or services. The term "covered telecommunications equipment or services" means any of the following:

(A) Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(B) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(C) Telecommunications or video surveillance services provided by such entities or using such equipment.

(D) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

⁷ In general, foreign government talent recruitment programs include any foreign-state-sponsored attempt to acquire U.S. scientific-funded research or technology through foreign government-run or funded recruitment programs that target scientists, engineers, academics, researchers, and entrepreneurs of all nationalities working or educated in the United States. These recruitment programs are often part of broader whole-of-government strategies to reduce costs associated with basic research while focusing investment on military development or dominance in emerging technology sectors.

Distinguishing features of a foreign government talent recruitment program include:

a) Compensation provided by the foreign state to the targeted individual in exchange for the individual transferring their knowledge and expertise to the foreign country. The compensation can take several forms, such as cash, research funding, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration.

b) Recruitment in this context refers to the foreign-state-sponsor's active engagement in attracting the targeted individual to join the foreign-sponsored program and transfer their knowledge and expertise to the foreign state. The targeted individual may be employed and located in the United States or in the foreign state. Recruitment would not necessarily include any invitation for engagement extended by the foreign state, for example, an invitation to attend or present work at an international conference.

c) Many, but not all, programs aim to incentivize the targeted individual to physically relocate to the foreign state. Of particular concern are those programs that allow for continued employment at U.S. research facilities or receipt of U.S. Department of Energy research funds while concurrently receiving compensation from the foreign state.

foreign countries of risk⁸ are not eligible to compete. Further, teams that include individuals participating in foreign government talent recruitment programs of foreign countries of risk are not eligible to compete.

Waiver

If an entity seeking to compete does not have domestic ownership and control but otherwise meets the eligibility requirements, EERE may consider issuing a waiver of that eligibility requirement where the entity submits a compelling justification. Entities seeking a waiver should include a justification along with their submission. EERE may require additional information before making a determination on the waiver

request. There are no rights to appeal DOE's decision on the waiver request.

The justification must address the following waiver criteria and content requirements:

Waiver Criteria

Entities seeking a waiver must demonstrate to the satisfaction of U.S. Department of Energy Office of Energy Efficiency and Renewable Energy that its participation: (1) has a high likelihood of furthering the objectives of this prize competition and (2) aligns with the best interest of the U.S. industry and U.S. economic development.

Content for Waiver Request

A waiver request must include the following information:

- a. Entity's name and place of incorporation;
- b. The location of the entity's primary place of business;
- c. A statement describing the extent the entity is owned or control by a foreign government, agency, firm, corporation, or person who is not a citizen or permanent resident of the United States, including the applicable percentage of ownership/control;
- d. A compelling justification that addresses the waiver criteria stated above;
- e. A description of the project's anticipated contributions to the U.S. economy;
- f. A description of how the entity has benefitted U.S. research, development, and manufacturing, including contributions to employment in the United States and growth in new U.S. markets and jobs; and
- g. A description of how the entity has promoted domestic manufacturing of products and/or services.

⁸ Currently, the list of countries of risk includes Russia, Iran, North Korea, and China.

Appendix C. Example Solutions

Opportunities exist to improve the cost, time, and risk performance of future, low-head hydropower projects through foundation technology innovation. Examples of these opportunities are summarized in Table C-1 (with categories generally consistent with the three foundation development phases). The list is not exhaustive, and categories are not necessarily mutually exclusive (i.e., innovative solutions could span one, two, or all three areas).

Table C-1. Examples of Innovative Solutions

Offsite (Desktop) Geotechnical Assessment	Improved remote and/or aerial imaging, sensing, and collection technologies (e.g., lidar, sonar, Synthetic Aperture Radar/Interferometric Synthetic Aperture Radar, photogrammetry)
	Advancement of geophysical methods and data processing techniques and methods (including artificial intelligence, or AI) to improve the efficiency of surface and subsurface characterizations
	More accurate desktop assessments to quantify take-offs for borrow areas, site access, and excavation
	Development, incorporation, and use of extensive database of existing dams and construction techniques, paired with on-site characterization serving as a predictive and/or guidance tool for improved siting
	Advanced techniques for testing area selection, which could include automatic recognition of fractures, ground-penetrating radar, processing of data using decision-based AI techniques based on neural network applications of historical projects, and improved data visualization. Such solutions could be related to (1) data mining of existing data sets, (2) novel data acquisition techniques, such as remote sensing/geophysics or improved sensors, and (3) data processing using AI or other technological approaches like traditional remote-sensing analyses, among others.
On-Site Geotechnical Assessment	Advancements in the use of condition monitoring and control systems for real-time dam foundation hazard monitoring and longer-range forecasting and mitigation
	Nascent technologies for minimally invasive subsurface site investigation (includes minimization or replacement of boring/drilling studies applications, accurate determination of the depths to competent rock, nondestructive analysis or other possible approaches to appropriately characterize and improve confidence in bearing strength of foundation materials and identification of potential failure mechanisms)
Foundation Design	Integration and use of prefabricated and modular applications (e.g., foundation components, drainage components, concrete forms)
	Innovations that incorporate typically temporary structures (e.g., cofferdams, forms, scaffolding) for permanent use and subsequent function for the hydropower facility
	Custom foundation design based on existing site terrain and stream features (facilitated by advanced sonar, underwater lidar, or other surveying techniques)
	Approaches for adaptively modifying design on-site based on in situ conditions and configurations
Materials	Improvements in concrete-to-rock bonding agents, slurries, and other materials that improve seepage control performance or facilitate adequate and safe drainage
	Development of geotextile materials for subsurface stabilization and seepage applications
	Improved and cost-effective applications of high-flow grout and environmentally friendly compounds for treatment of seepage
	Use of ultrahigh-performance concrete
Construction Methods	Improved methods for rating geologic complexities to improve communication and shared understanding of uncertainties to decrease owner/contractor overall perceived risks and costs
	Improved environmental best management practices and mitigation techniques for foundation site investigation and construction, such as minimizing or eliminating the use of cofferdams
	Advanced bedrock anchoring techniques for rigid structures (e.g., concrete or modular components)
	Techniques for the application and use of 3D underwater concrete printing of a foundation component

Construction Technology	Advanced sensing/monitoring technologies to enable real-time quality control of on-site concrete, material, and other placement efforts
	Technologies for underwater equipment applications that may limit the need for cofferdams
	Deployment of self-operating equipment in open-pit excavations, mixing and placement of mass concrete, and placement of embankment fill for continuous 24-hour operation
	Other applications for self-operating, potentially autonomous technologies, such as for excavation, soil compaction, or various treatments