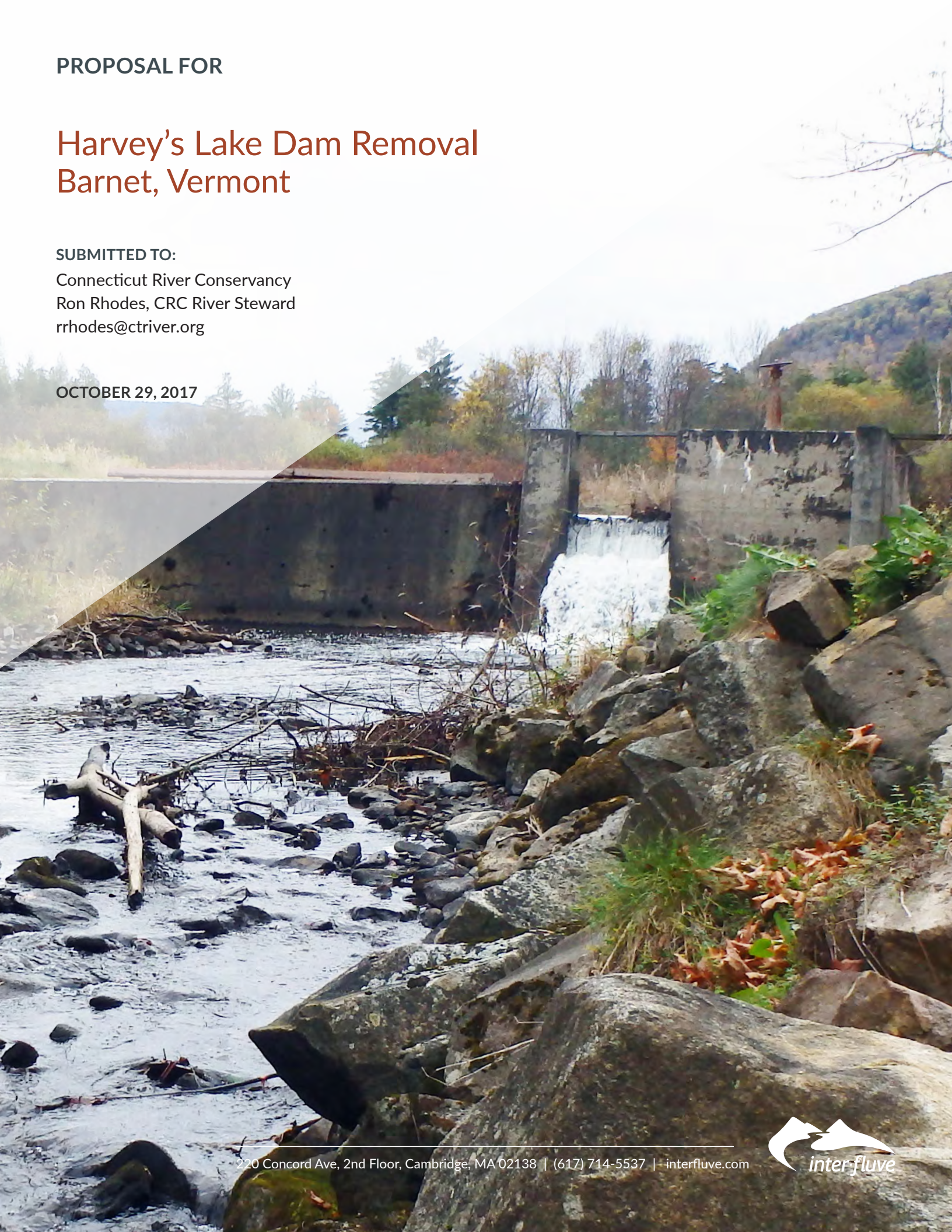
PROPOSAL FOR

Harvey's Lake Dam Removal
Barnet, Vermont

SUBMITTED TO:

Connecticut River Conservancy
Ron Rhodes, CRC River Steward
rrhodes@ctriver.org

OCTOBER 29, 2017



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interfluve

October 29, 2017

Connecticut River Conservancy
Ron Rhodes, CRC River Steward
15 Bank Row
Greenfield, MA 01301
rrhodes@ctriver.org

Dear Ron,

Thank you for the opportunity to submit our team's qualifications for the Harvey's Lake Dam Removal Preliminary Engineering and Design project.

Inter-Fluve, Inc. is a river and wetland restoration firm that focuses on geomorphically and ecologically sound design solutions to river impacts. Our approach is interdisciplinary, combining the fields of water resources engineering, hydraulic and hydrologic modeling, geomorphology, biology, wetlands science, botany, engineering design, and construction oversight and management.

We have been working on rivers and wetlands since 1983 and have successfully completed over 1800 projects around the country and around the world, including over 100 dam related projects since 1994, **with over 30 of those in New England**. These dam removal projects range from small lowhead dams; to the 106-foot San Clemente Dam in California; to the Eel River Dam Removal and headwaters restoration we completed in 2010, that resulted in the Coastal America Award in 2011, for the restoration of 60 acres of habitat and two miles of headwater stream. Our team also recently began work on the East Putney Brook Dam Removal in Westminster, Vermont. In our years of experience, we have become experts in performing feasibility studies, design and implementation of dam removal projects from coast to coast. We recognize that dam and structure removal requires careful attention to addressing accumulated sediments, altered sediment transport and hydrologic regimes, creation of new channels, associated streambank construction and adjacent bridge and building infrastructure stability.

In the attached proposal, we provide a Scope of Services that outlines our approach to the project. We also compiled an interdisciplinary project team to complete the tasks outlined in this RFP. The team includes our most experienced dam analysis and removal staff with myself as project manager and designer, Dan Miller, PE as lead engineer; Mike Burke, PE for engineering assistance; Candice Constantine, PhD, for fluvial geomorphology; and Kristen Coveleski, PE, PhD for modeling.

Please do not hesitate to call or email me if you have any questions regarding our submittal. Thank you again for reviewing our qualifications.

Sincere Regards,

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PROPOSAL FOR

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Barnet, Vermont

Submitted to

Connecticut River Conservancy
Ron Rhodes
CRC River Steward
rrhodes@ctriver.org
Ph: (802) 457-6114

Submitted by

Inter-Fluve, Inc.
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October 29, 2017

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Project Understanding and Approach

Project Understanding and Approach

Lake Harvey, in Barnet, is a 352-acre lake and is the largest lake in the Steven's River watershed. Greater than 50% of the shoreland around Lake Harvey is developed or managed as lawn. Harvey Lake outlets to South Peacham Brook which is a tributary to the Stevens River. The Brook is 4.5 miles long and has a 12.5 square mile watershed. The Phase II Stream Geomorphic assessment on this river indicated historic straightening and road systems as the primary stressors.

Harvey Lake dam is located approximately 1/3 mile downstream of the natural lake outlet, downstream of the confluence of the outlet stream and South Peacham Brook. The current location of the dam has been shown to cause backwashing of South Peacham Brook's flow into the lake during high flow events, which may deposit sediments and other constituents of runoff into the lake causing sedimentation to the south end of the lake by the outlet. The dam also prevents movement of sediments downstream which impacts the natural flow regime of the river and aquatic habitat, as well as blocks passage of fish and other aquatic organisms. South Peacham Brook and Harvey Lake are on the State of VT's list of flow-altered waters for water level fluctuations and flow alterations where dam management alters aquatic habitat.

Removal of the dam is proposed to address the issues listed above by stabilizing water level fluctuations to a run-of-river flow at the outlet of Lake Harvey, anticipated to lead to removal of both water bodies from the flow altered waters list. In addition, a hydraulic structure is proposed at the lake outlet to mimic a natural stream system, but would establish a low flow level at the outlet of the lake and would not require seasonal modification, while also providing for safe, timely and effective fish passage for the native fish population. The integration and veracity of the hydraulic lake level maintenance structure is an extremely important aspect of the overall project plan and will require careful attention in planning, public discussions, design, and ultimately construction.

Inter-Fluve staff visited the site on October 16, 2017, to form a better understanding of the constraints and opportunities associated with the project. Based on our field review and discussion with project stakeholders, we have developed the following approach and scope to efficiently deliver the tasks outlined in the RFP and provide the greatest benefit to the project and partners.

Inter-Fluve's expertise comprises a broad range of physical and biological science and engineering disciplines. Interdisciplinary collaboration with our project proponents is at the core of our professional practice. We truly believe, and have demonstrated through our firm's history, that project solutions developed through collaboration far exceed 'the sum of the parts.' We intend to follow a similarly collaborative project approach to arrive at the most beneficial suite of alternatives for management of the site. As a fully interdisciplinary firm, our core standard of practice relies on the key competences that the RFP highlighted as necessary for this project. That very standard of practice has evolved over our 32 years though successful completion of many studies with very similar focus to the Harvey Lake project.

Our process begins through meeting with project stakeholders to formalize goals and objectives for the site, and to establish a robust understanding of the site history. We will proceed with the assessment phase of the effort, exploring the physical function and ecological resources of the stream, and assessing its hydrology and hydraulics. We will then evaluate the identified alternatives based on the understanding we gain in the assessment phase, representing them through narrative reports of our evaluations, and depicting them through graphics. Based on review of the developed alternatives and discussion with the project partners to select a preferred option, we will then prepare the preliminary (30%) designs. All the while, we will check back with project stakeholders frequently to ensure that we continue to implement the vision that has been determined for the site.

All of our project locations in New England have direct interaction with infrastructure, such as is the case at Harvey Lake dam. We regularly perform analyses such as the bridge scour assessment that will be required on this project. All of our projects are located within sensitive resource environments and often involve substantial construction efforts including dam modifications. We are very familiar and experienced in navigating the regulatory framework which applies to projects such as that contemplated at Harvey Lake dam.

With specific reference to the desired hydraulic control structure at the lake outlet, Inter-Fluve pioneered the design and construction of constructed riffles that result in naturalized channel features. These riffles have a high degree of stability for application in situations where precise hydraulic control is required to facilitate lake level, aquatic restoration and stream stabilization objectives. Throughout our history, the number of similar features designed and constructed numbers well over one hundred. The principles and techniques applied to these projects also apply to design and construction of the proposed lake level structure, which requires a keen focus on substrate design for stability and to limit subsurface permeability, diversity in flow patterns, and precise hydraulic design of the transitions between the features and the surrounding lake, channel segments and/or infrastructure. Recovery of sensitive fish species is a central thread through all of Inter-Fluve's work, thus each of these applications required providing a high degree of fish passage potential for the applicable native fish community. Our approach results in structures that are consistent with morphologic features that the fish community would reasonably encounter elsewhere in the stream system, which in our experience facilitates utilization by the native fish community.

Some examples of this application include 1) hydraulic controls to maintain specified lake elevations while enabling construction of fish bypass channels around existing dams, 2) downstream hydraulic and base level control for culvert retrofits and stream simulation culvert replacements, 3) downstream base level control for dam removal projects to limit the evacuation of accumulated sediment, set lake levels, or to protect bridge foundations susceptible to scour, 4) hydraulic and hydrologic controls for incised channels that have been restored in wet meadow stream systems, 5) downstream hydraulic and base level control in incising/unstable streams to protect adjacent infrastructure such as bridges, and 6) downstream hydraulic and grade control for lateral stream habitats focused on rearing life stages, such as side channels and backwater alcoves, including in incising streams.

Scope of Work

TASK 1 – KICK-OFF MEETING

Inter-Fluve will attend one kick-off meeting with the project partners following receipt of a Notice to Proceed. It is envisioned that the kick-off meeting will involve a site visit including the dam, lake outlet and Harvey Mountain Rd. bridge. The kickoff meeting will be held to coincide with the field survey.

TASK 2 – FIELD SURVEY

This subtask includes collection and review of existing data, including obtaining utility information, flood maps, and Harvey Lake Dam and Harvey Mountain Rd. bridge as-builts if available.

Inter-Fluve assumes the survey data collected by MMI is sufficient for this phase of the project, with supplemental data collection over one day of field effort. We will use an RTK GPS to verify critical locations, but will use MMI's data for this phase of design. Through the design process, we will evaluate the need for additional survey and complete that in the next phase to support detailed design.

This task also includes a geomorphic and habitat assessment of the channel up and downstream of the impoundment and limited probing in the impoundment to characterize sediment thicknesses and texture.

Ideally, the project will be initiated to enable field data collection prior to onset of significant snow in early winter 2017 in order to facilitate advancement of the project schedule.

The field survey task will also include a boundary survey of the Town-owned parcel that the dam is located on. We have included the cost of the boundary survey in the fee estimate, and will ask the Town/partners which professional land surveyors they typically like to use for these tasks.

TASK 3 – HYDROLOGY AND HYDRAULICS

We will carry out a brief hydrologic assessment to estimate fish passage flows and flood discharges with recurrence intervals of 2, 10, 25, 50, and 100 years, primarily relying on the analysis completed by MMI in 2007-08 to estimate peak flood flows. The results will be incorporated along with the collected topographical information and publicly available LiDAR into a one-dimensional HEC-RAS hydraulic model that will be used to optimize the design and quantify the hydraulic effects of the preferred alternative. At the outset of this task, we will evaluate the full report and data resources generated by Milone and MacBroom (MMI) in their 2007-08 studies. We will ask the CRC to request the hydrologic and hydraulic models, and field survey data, developed by MMI. We will leverage this information to the extent practicable in development of hydrology and hydraulics specific to the current project proposal.

TASK 4 – SEDIMENT MANAGEMENT PLANNING

In this subtask, we will use the depth of refusal data collected in Task 2 to estimate the nature and volume of impounded sediment. We have included up to two (2) hours of discussions with the VT Department of Environmental Conservation in order to develop a recommended approach to sediment management.

TASK 5 – FEASIBILITY/ALTERNATIVES ANALYSIS AND CONCEPTUAL DESIGNS

The design process will involve a brief analysis of project alternatives, which will include options for the Harvey Lake outlet water control structure and for the Harvey Mountain Rd. bridge stabilization (if required), in addition to options for the dam removal and channel restoration aspects of the project. We suggest holding a conference call with partners following our initial analysis of field data to discuss a list of possible alternatives to narrow the options to two alternatives each for the water control structure, bridge stabilization, and dam removal/channel restoration.

We will then prepare a brief draft feasibility/alternatives analysis memorandum that will discuss the relative merits, pros/cons, uncertainties, relative costs, and risks for the alternatives for each project element. This will also include a discussion of permitting considerations. The draft alternatives analysis memo will include concept design graphics to represent the essential characteristics of each option, which may be in the form of linework overlain on aerial photography or typical sketches showing the intent of the alternative designs.

Inter-Fluve will attend a meeting with the project partners after the draft memo submission to collect feedback on the alternatives analysis and conceptual design options, and to facilitate selection of a preferred alternative for each project element. It is assumed that this meeting will be held to coincide with one of the public meetings (Task 9) to minimize travel resources.

The alternatives analysis memo will ultimately be integrated into the Basis of Design Memo (Task 7). Revisions and amendments to the draft alternatives analysis memo will be implemented as it is integrated into the Basis of Design Memo.

TASK 6 – PRELIMINARY DESIGNS (30%)

Inter-Fluve will develop the preferred option for the Harvey Lake outlet water control structure, Harvey Mountain Rd. bridge scour countermeasures (if necessary) and dam removal/channel restoration project elements to a 30% design level. It is assumed that bridge replacement will not be required as a result of the project. It is also assumed that structural engineering will not be necessary for this stage of the project.

Preliminary designs will include preliminary layouts of channel reconstruction features through the former impoundment and adjacent reaches, as needed. Habitat features and channel reconstruction will be designed to meet the objectives and design criteria that are set for these elements through coordination with the Stakeholders. This will include acceptable rate for change in channel condition, levels of stability for large wood, levels of infrastructure protection, and anticipated fish passage potential.

Based on the current understanding of the site, we do not expect the need for extensive geotechnical investigation to support development of the project to the preliminary design level. We have reviewed the existing borings that were previously collected near the dam and understand that some additional geotechnical information may be required to satisfy the grant which will support the design work. Therefore, in the fee estimate we have assumed one day of geotechnical borings exploration (1-2 borings), and an associated brief data report. We expect that the details of the geotechnical work will be refined following the initial data review and field reconnaissance, and discussions with project stakeholders.

The preliminary designs will include approximately seven (7) sheets:

- Cover sheet with site location (1 sheet);
- Existing conditions, access, and staging plan – survey control points, utilities, existing features, existing topography, regulatory boundaries, staging, and access (1 sheet);
- Proposed conditions and longitudinal profiles (2 sheets);
- Cross sections showing existing and proposed grades (1 sheet);
- Typical sections and details (1 sheet); and
- Floodplain restoration and planting plan (1 sheet).

Inter-Fluve will attend a 30% design review meeting after the draft design submission to collect feedback on the draft designs and basis of design memorandum. It is assumed that this meeting will be held to coincide with one of the public meetings (Task 9) to minimize travel resources.

TASK 7 – OPINIONS OF PROBABLE COSTS

We will develop opinions of probable costs for the alternatives considered for each of the project elements at the alternatives analysis stage, and for the preliminary design.

TASK 8 – DRAFT BASIS OF DESIGN MEMORANDUM

Inter-Fluve will prepare a draft of the basis of design memorandum that documents and summarizes the above subtasks. The memo will be a living document that progressively adds the work completed in each project step. The memo will include a summary of the hydrologic and hydraulic analyses; a summary of the alternatives analysis and conceptual design; discussion of regulated resource area impacts and permitting; recommendations for sediment management; a summary of the geotechnical work; a summary of the preliminary design; a discussion of post-removal habitat quality and aquatic passage; and opinions of probable cost.

TASK 9 - PUBLIC MEETINGS

Inter-Fluve will participate in three (3) public meetings to help facilitate the project process, including developing and delivering a PowerPoint presentation for each. It is assumed that one meeting each will be held after the alternatives analysis and preliminary design phases. The third meeting will be held with timing at the preference of the project partners.

Deliverables

- Minutes from the kick-off, alternatives analysis, and 30% design review meetings
- Attendance at three (3) public meetings
- Topographic and boundary survey (Town property)
- Conference call to discuss preliminary project options following field work to narrow alternatives to be considered
- Draft alternatives analysis and conceptual design memo (PDF)
- Draft and Final preliminary (30%) design plans (seven [7] 11x17 sheets delivered in PDF format)
- Draft and Final basis of design memorandum (PDF)
- Opinions of probable costs for inclusion in the basis of design memorandum

Assumptions

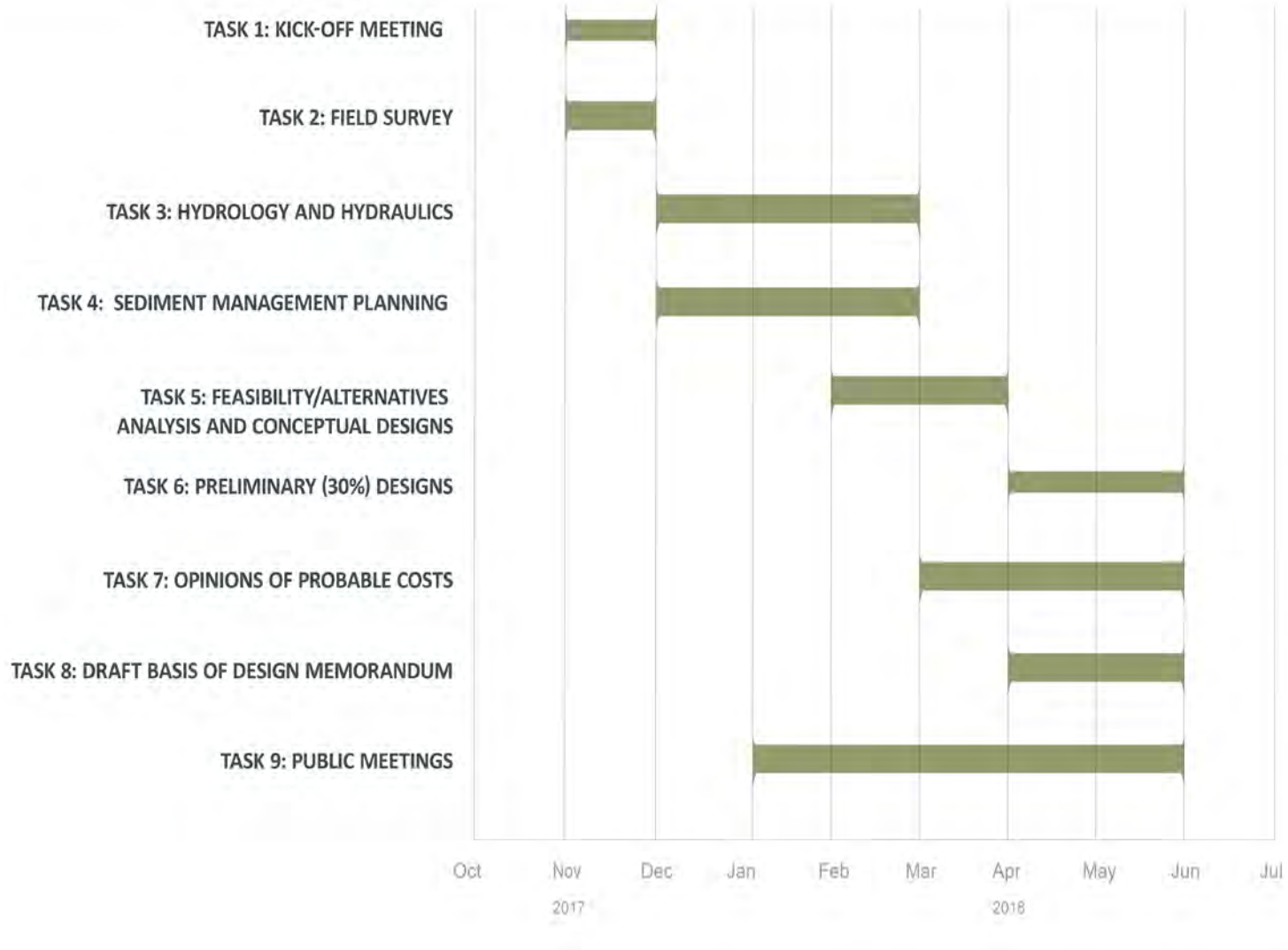
- CRC will develop agendas and schedule the review and public meetings. Inter-Fluve will lead the design-related discussions with CRC leading other discussion topics (e.g., local outreach, permitting). Alternatives analysis and preliminary design review meetings will be scheduled to coincide with public meetings. Kickoff meeting will be held to coincide with the field survey.
- Sediment sampling will not be required. If requested by permitting agencies, sediment sampling and testing can be added via addendum.
- Hydrologic and hydraulic models, and survey data prepared by MMI (2007-2008) will be requested by CRC and provided if available. We assume that the survey data and hydraulic model are accurate and usable for this phase of the project.
- Harvey Mountain Road bridge will not require replacement. Structural engineering will not be necessary during this phase of the project.
- Historical and cultural resources will not be a consideration at this site.
- Project management has been included within the budgets for the tasks.

*Nick, Candice, **and Mike** on site during construction of the Marland Place Dam removal.*

b | Schedule

Schedule

It is our intention to complete the final deliverables by May 31, 2018, depending on review schedules and assuming a contract by November 2017.



C Management

Management Plan

Our approach to management is focused on efficient and effective delivery of the project. To this end, we have proposed a team of experienced staff to help CRC manage and mitigate design and construction risks. We will start by developing a firm understanding of stakeholder objectives, mutual expectations, and team member roles, and establishing a detailed schedule of milestones during the kick-off meeting. We recommend bi-weekly check-ins (brief calls or email updates) with the CRC project manager and others as needed to ensure the project is on schedule and discuss any issues that may have arisen.

Our small but technically diverse team will lead the partners through the collaborative design process. We will identify measurable objectives and design criteria at the onset of the project through early consultation with stakeholders and permitting agencies. The design criteria will reflect the range of objectives, constraints, and relevant standards that relate to habitat targets, geomorphic function, engineering, safety, cost, and even social considerations. We will apply our significant experience of similar dam removals and associated infrastructure protection in New England to anticipate issues associated with each task and resolve these early in the design process.

Since 1983, Inter-Fluve has been pioneering engineering methods and practices for the design of stream, tidal, wetland, and other aquatic habitat restoration. As a result, we have an extensive library of corporate engineering templates that can be utilized to provide design efficiencies for dam removal, rock structure construction, large wood stabilization, bed and bank stabilization, and habitat creation.

Completed Howland Bypass Channel on the Piscataquis River, tributary to the Penobscot River, ME (right side of picture).

Qualifications

Inter-Fluve

Since our founding in 1983, Inter-Fluve has been on the forefront of river and stream restoration practice. It is all we do, every day. Our interdisciplinary team integrates biological and physical sciences with engineering and landscape design to develop solutions to complex puzzles interplaying between fish, wildlife and humans in systems ranging from alpine to coastal, rural to urban.

Our project portfolio is robust. For over 34 years we've worked on over 1,800 projects worldwide, ranging from improving Chinook salmon habitat in the Columbia River basin, restoring Blueback herring passage in Massachusetts, removing deteriorating dams in throughout the US, to improving angling opportunities in Argentina. The thread that weaves all our projects together is finding solutions that balance human and environmental needs while emphasizing minimal disturbance and rapid recovery of aesthetics, geomorphic function, and ecologic complexity.

Inter-Fluve's team of over 45 scientists and engineers maintain expertise in fish passage, large wood placements, hydraulic modeling, geomorphic assessment, bio-engineering, topographic and bathymetric surveying, stream simulation, as well as planning and implementation management. Known for our in-house, interdisciplinary approach, our engineers understand the complexities of working within dynamic natural environments and our scientists understand the importance of sound engineering design. Together, our project staff has completed projects ranging from simple pro-bono design and volunteer implementation to multi-year, multi-million dollar projects.

This integrated knowledge base is particularly important in dam removal, where effective communication of both scientific concepts and approaches is critical to project success. The public wants to know how dams will be removed, and what the short and long term effects will be to their community and their ecosystem. Roughly half of Inter-Fluve's business is dam assessment and dam removal design.

Inter-Fluve is a federally-recognized Small Business with offices in Hood River, OR; Bozeman, MT; Minneapolis, MN, Madison, WI, Cambridge, MA, and Damariscotta, ME. We believe in what we do and annually commit 1% of our revenue to non-profit organizations that educate people on the need for aquatic restoration activities.

Relevant Dam Removal Experience

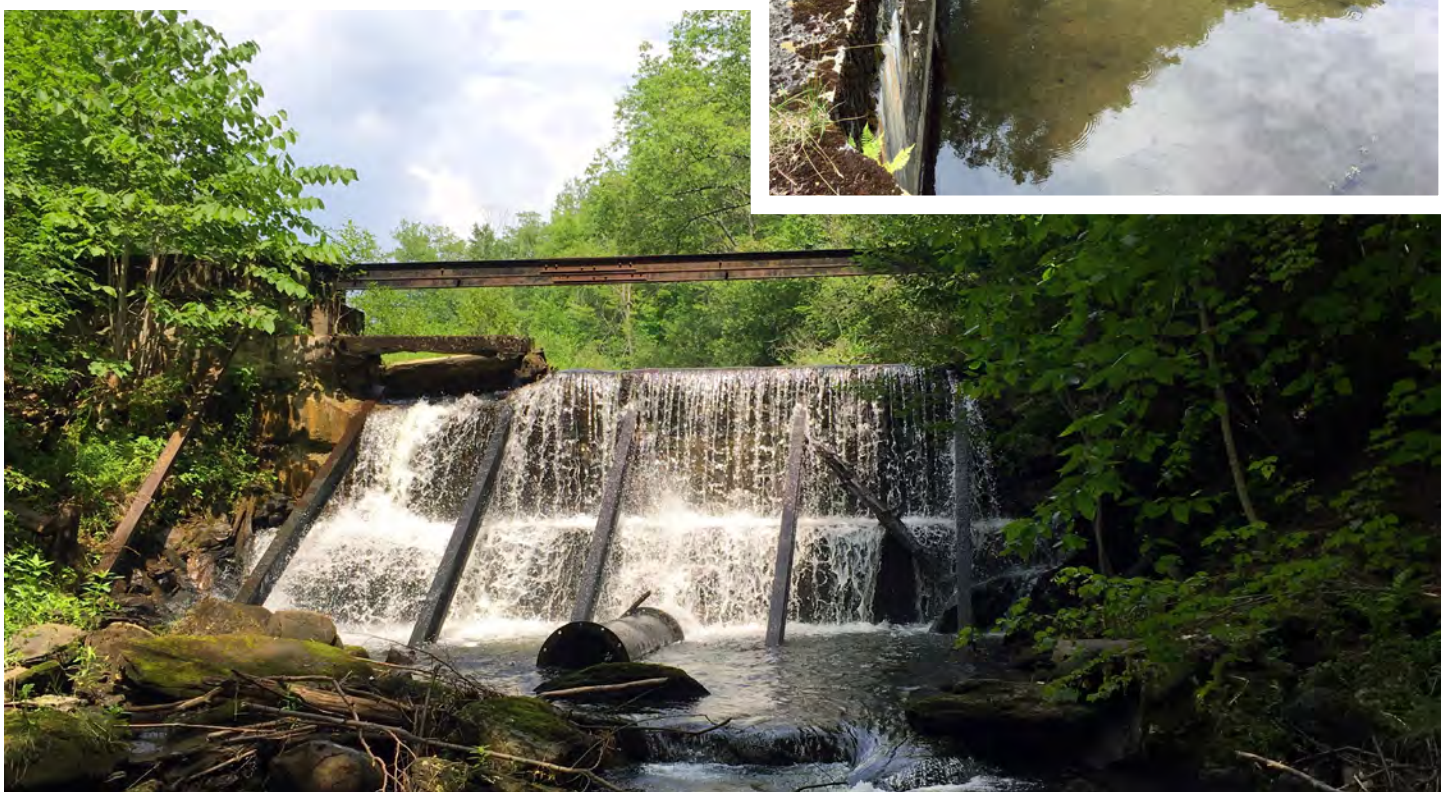
Inter-Fluve has worked on more than 100 dam related projects. The following describes similar regional projects to the Harvey's Lake Dam removal followed by a detailed table that provides a broader overview of dam removal projects our firm has completed and relevant experience we have gained from those projects.

East Putney Brook Dam Removal

WESTMINSTER, VT (2017-PRESENT)

***Client**: Connecticut River Conservancy*

The East Putney Brook Dam currently compromises biotic connectivity, interfering with the upstream movement of resident trout and impairing their life history functions. In addition to its impacts on aquatic resources, the dam's continued presence perpetuates a problem for sediment transport through the system. The Connecticut River Conservancy and its partners recently contracted Inter-Fluve to provide survey, sediment management planning, hydrology and hydraulic modeling, and construction-ready designs for removal of the dam structure and restoration of the brook through the former impoundment. The designs will consider impacts to upstream infrastructure, particularly culvert and dry hydrant replacement. Design and construction are expected take place in 2017 and 2018.



Top: Sediment build-up behind the dam wall. Bottom: Current state of the East Putney Brook Dam.

Marland Place Dam Removal

ANDOVER, MA (2016-2017)

***Client**: Marland Place Associates & Massachusetts Division of Ecological Restoration (MA DER)*

The Marland Place Dam was an 8-ft dam on the Shawsheen River dating back to the revolutionary war when it produced ammunition for the revolutionary army. The impoundment had mostly filled with sediment and the dam blocked fish and other aquatic organism passage. The dam had not been actively used for industry and the mill buildings on either side of the dam were converted to condominiums and a senior living facility. Inter-Fluve was contracted by MA DER and other partners to evaluate the fish passage options on this and two other dams on the Shawsheen River. Inter-Fluve collected the survey data, completed the hydraulic modeling and permitting, and completed the progress and final design packages. Inter-Fluve assisted the dam owner through the construction phase, which was completed in the spring of 2017. The construction included the removal of the stone dam and the construction of a rock riffle in its place. The riffle was designed to provide improved aquatic habitat and passage, but also help reduce the scour impacts to the road bridge that was about 75 feet upstream of the dam. In the first migratory period, herring were observed upstream of the former dam and upstream of this riffle. The designs also included the construction of channel banks and a vegetated floodplain.

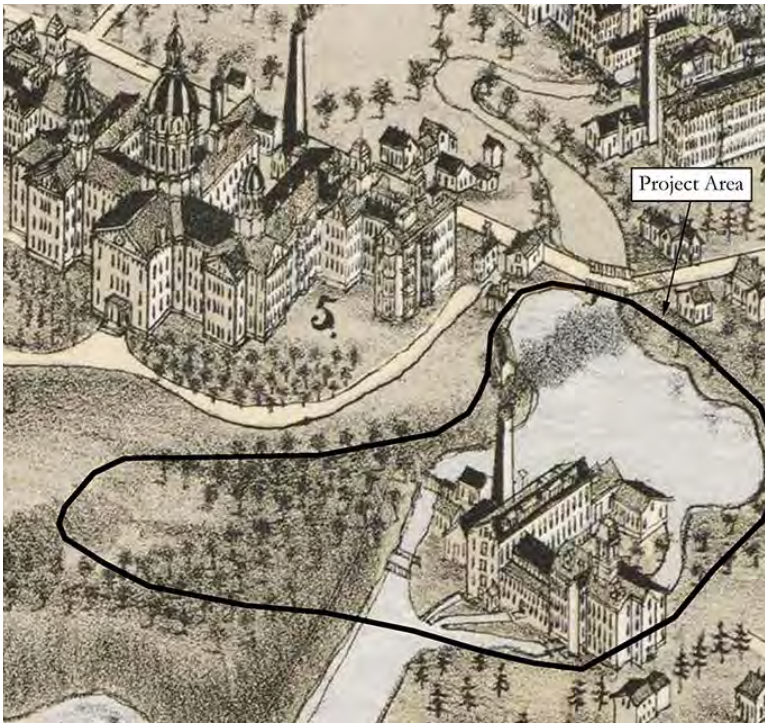
Top: After removal of the Marland Place Dam and construction of riffles. Bottom: Marland Place Dam before removal.

Mill River Fish Passage Feasibility Analysis & Dam Removal

TAUNTON, MA (2007-PRESENT)

***Clients**: Southeast Regional Planning and Economic Development District (SRPEDD), MA DER*

SRPEDD, MA DER, NOAA, American Rivers and other project partners contracted with Inter-Fluve to investigate the feasibility establishing fish passage on the Mill River in Taunton, Massachusetts. Inter-Fluve studied the three lowermost dams, the State Hospital Dam, West Britannia Dam and the Whittenton Pond Dam, all of which have been present in some form since the 1600s. Historical consultation and documentation has been extensive, with remnant mill foundation left in place to honor the site history when possible. State Hospital Dam was located on the former Hopewell Mills site, and was removed during the summer of 2012. During the first anadromous fish migration, hundreds of herring were observed upstream of the dam for the first time in hundreds of years. The Whittenton Mills Pond Dam was removed in late July 2013. We have completed the designs for the removal of West Britannia Dam and the permitting process. This project will be constructed Fall 2018.



Historical birds-eye view of State Hospital Dam. Photo credit: Bailey, O.H. 1875 View of Taunton, Mass. O.H. Bailey & Co., Boston, MA. On file, Massachusetts State Archives.

The first herring in over 200 years captured making its way up the Mill River after removal of the The Hopewell Mills Dam. - Photo Courtesy of MA DMF.

Shawsheen River Fish Passage Feasibility, Dam Removal & Design

ANDOVER, MA (2008-2017)

***Client**: MA DER, Center for Ecosystem Restoration and the Coastal America Foundation*

Inter-Fluve contracted with MA DER and project partners – to assess the feasibility of establishing fish passage options for three dams on the Shawsheen River. The analysis involved balancing restoring river processes and fish passage while maintaining stability of nearby infrastructure including roads, bridges, historic dam abutments, and adjacent historic buildings. As a result, one dam was removed and replaced with a rock ramp due to concerns over scour beneath a major bridge located immediately upstream of the dam. A second very small dam was removed outright. The third dam will be retained. Final designs were completed in 2016 and construction was completed Spring of 2017.

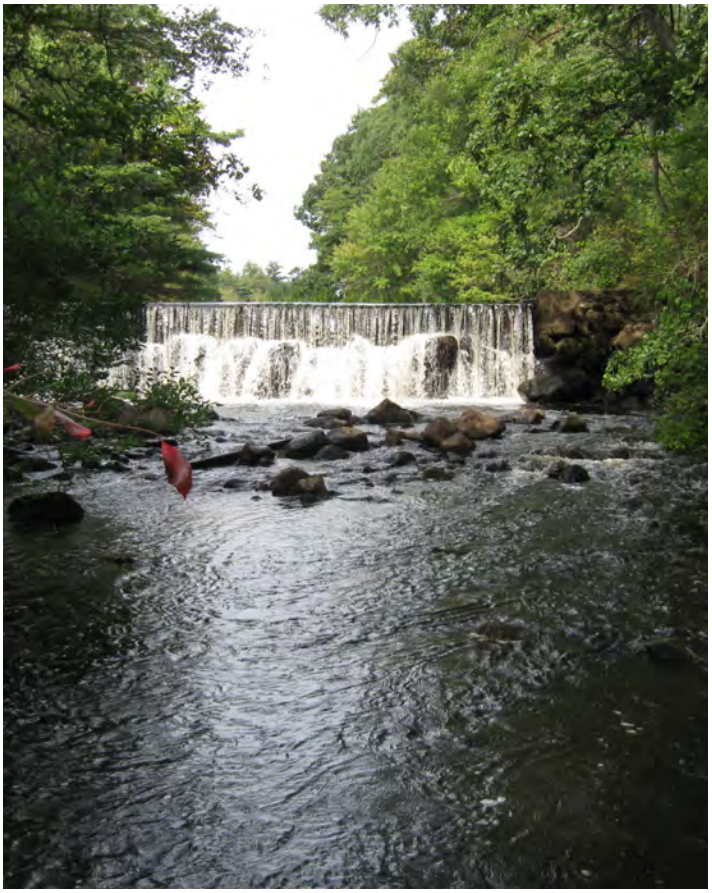
Lt. Bob Dalton, of Andover Fire & Rescue, was spending the evening catching trout and suckers along the Shawsheen River above the recently removed Balmoral Dam. Bob has been fishing the Shawsheen River since childhood and exclaimed finding fish this far up is a "Big Deal!" and enthusiastically shared he was the first to cross the site on canoe following the dam removal.

South Middleton Dam – Ipswich River Fish Passage Feasibility & Dam Removal

MIDDLETON, MA (2010-PRESENT)

***Clients**: Ipswich River Watershed Association (IRWA) and MA DER*

Inter-Fluve completed an initial feasibility study for the establishment of fish passage at South Middleton Dam in 2010 and recently contracted with IRWA and MA DER to complete engineering designs and initiate permitting for the selected alternative which entails dam removal, a key element of which entails replacement of the fire suppression water supply for the adjacent industrial plant currently located on the impoundment with an off-channel storage system. The feasibility study and designs have included analysis of the quantity and quality of sediment within the dam impoundment, surveying for hydraulic modeling, hydrology and hydraulic analyses, and engineering designs. Located adjacent to one of the oldest continuously-used industrial sites in MA, the dam is no longer necessary and does not provide any fish passage. Upon removal of the Middleton Dam, 56-miles of the mainstem and tributaries of the Ipswich River will be open to migratory and resident fish. Project partners include IRWA, MA DER, Bostik, Inc., the US Fish & Wildlife Service, and the NOAA Restoration Center.



Inter-Fluve researched fish passage criteria for several species along the Ipswich River

Eel River Fish Passage & Dam Removal

PLYMOUTH, MA (2006-2010)

***Client**: Town of Plymouth*

Historically, the Eel River flowed uninterrupted to the Atlantic, supporting fish, wildlife, and wetland communities. Beginning in the early 1800s, the Eel River watershed became severely compromised when it was converted to cranberry bogs, which involved removing trees, channeling streams, and building berms and dams to control water. Restoring this 60-acre site (40 of which is cranberry bog) to pre-agriculture hydrology involved first conducting a preliminary engineering investigation and preparing the project design. Together with our project partners, we managed construction, which involved removing an old dam and nearby culverts; creating 8,000 feet of new stream channel; inchannel habitat improvement; installing two fish and wildlife-friendly culverts; and planting 17,000 Atlantic white cedar trees.

The project created critical habitat for Eastern box turtles, brook trout and bridle shiner, all species of special concern in Massachusetts. Other habitat elements included wildlife passage culverts, raptor perches, hummock and microtopography grading, open water features, and over 1,000 pieces of in-stream large wood. In 2010, the Secretary of the Interior awarded Inter-Fluve and its partners the 2010 Coastal America Foundation Award for our work on the project. Since construction, several rare plant species and all of the special concern animal species have been found on site.

*Above: **Drosera rotundifolia** - excellent butterfly habitat returning to the site. Below: Site where the 15-ft high stone Sawmill dam was removed - this project received the 2010 Coastal America Foundation Award.*

Sheepscot River, Head Tide & Coopers Mill Dams Visioning & Design

COOPERS MILLS & ALNA, ME (2015-PRESENT)

***Client**: Atlantic Salmon Federation*

Atlantic Salmon Federation and their partners the Coopers Mills Dam Committee and the Head Tide Dam Committee commissioned Inter-Fluve to assist with a collaborative visioning and site design processes for the management of two historical dam sites on the Sheepscot River. The river is home to nine species of migratory fish, including the ESA-listed Atlantic salmon and Shortnose sturgeon. The inter-disciplinary team is developing solutions to safeguard public safety and reduce the impacts on native fish populations, while also memorializing the quintessential history of the villages, promoting public use and access to the river for recreational purposes, and providing educational components. The removal design also needed to ensure adequate water levels to maintain functionality of a new dry hydrant. The two projects (one removal and one fish passage modification) are currently in the final design phase.

Coopers Mill Dam.

Satus Creek riffles after dam removal.

Satus Creek Dam Removal & Roughened Channel

YAKIMA BASIN, WA (2009)

***Client**: Yakama Nation*

Until it was removed in 2009, the Satus Creek Dam blocked passage for 93 miles of the most important salmon-spawning habitat in the Yakima Basin in central Washington. Initial field investigations, surveys, and hydraulic modeling led us to understand that dam removal would not only benefit fish passage, but would also improve river function. Acting as a retainer for sediment, the four-foot-high, 135-foot-long dam created a wider river upstream, and a constricted, channelized river downstream. Inter-Fluve was hired by the Yakama Reservation Watershed Project (YRWP) to oversee the dam removal process and restoration of spawning grounds. In partnership with Yakama Nation Fisheries, we designed and managed the dam-removal project and built 330 feet of instream roughened channel. This involved placing woody debris and vertical snags, and planting vegetation in the floodplain to slow water movement and floodplain erosion.

Penobscot River. Howland Fish Bypass Channel

HOWLAND, ME (2015-2017)

***Client**: Penobscot River Restoration Trust*

As the last of the four key elements of the Penobscot River restoration effort to be implemented, a major bypass channel was constructed around the Howland Dam. The overall Penobscot restoration effort resulted in a solution to better manage ongoing hydropower generation needs in the basin while facilitating the recovery of ESA-listed Atlantic salmon and other native fish. Substantial retrofits were required for the dam, while the 100-foot wide and 1000-feet long bypass channel was required to provide a high level of service, stability and function over a broad range in design flows spanning from 250 cfs to nearly 12,000 cfs in the bypass channel alone. In particular, the hydraulic design required maintaining the impoundment level at levels negotiated with the Town while maximizing the amount of water that was routed into the bypass channel to facilitate fish passage. Inter-Fluve designed the bypass channel, prepared construction documents for its implementation, and provided construction engineering. Key aspects of the channel design included development of an approach to result in safe, timely and effective fish passage while addressing extensive bedrock removal that was required for channel construction, and tailoring the construction documents to reduce construction risk due to unknowable subsurface and rock mass conditions.

Top: Upstream entrance to the Howland bypass channel. Right: Boulders placed in the bypass channel.

Simkins Dam Removal

ELLICOTT CITY, MD (2009-2010)

***Client**: American Rivers*

The removal of the 10-foot-high and 200-foot-wide Simkins Dam in M [illegible] part of a larger project to remove all four dams along 175 miles of the Patapsco River and restore habita to herring, shad, and eel. The dam–built to produce power–had not been used in decades. With help from the Ar erican Reinvestment and Recovery Act of 2009, we worked with American Rivers, NOAA, Maryland DNR fish ies, Baltimore/Howard counties, Patapsco Valley State Park staff, and the Friends of the Patapsco Valley State Pa k to develop designs for the removal of Simkins Dam. Simkins dam was removed in 2010. Our work include topographic and bathymetric surveying, sediment screening, geomorphic assessment, bank stabilization, and bration monitoring to prevent damage to a 42-inch sanitary sewer pipe. We partnered with Stillwater Scienc to model sediment transport using the DREAM-1 model. Today, Inter-Fluve and partners are designing plar for the removal of Bloede Dam. Removal of Bloede will leave Daniels Dam as the fourth, and last remaining da on the river. The project was funded through the American Reinvestment and Recovery Act of 2009.

Project Name	State	Relevant Project Elements															
		Dam removal with controlled release	Dam removal with rapid draw down	Bathymetric surveying	Sediment depth / volume assessment	Channel restoration	Feasibility studies	Legacy sediment / floodplain excavation	Grade drop: (ramp, vanes)	*Constructed channel: banks, riffles, pools, and/or bars*	*Bioengineering bank stabilization*	*Concept design*	*Final design*	*Historical / achaeological services*	*Permitting*	*Structural assessment*	*Dam height (ft)*
Balmoral Dam	MA		•	•	•		•		•			•	•	•	•	•	10
Barstowe's Pond Dam Removal	MA		•	•	•		•	•			•	•	•	•	•		8
Beaver Pond Dam	MA	•		•	•	•	•			•	•	•	•	•	•		15
Cole's Brook Dam Removal	MA		•	•	•		•	•	•	•	•	•		•	•	•	10
Coonamessett River (Fish Passage)	MA	•		•	•	•	•	•	•	•	•	•	•	•	•	•	6
Coonamessett River Lower Dam	MA	•		•	•	•	•	•	•	•	•	•	•	•	•		6
Fyfeshire Dam Removal	MA		•	•	•		•				•	•					6
Hamant Brook Dam Removal	MA						•					•					5
Hathaway Pond Dam Removal	MA		•	•	•		•	•	•		•	•				•	8
Hobbs Pond Dam Removal	MA		•	•	•	•				•	•	•				•	6
Marland Place Dam	MA	•		•	•	•	•	•	•	•	•	•	•	•	•	•	10
Red Brook Dam Removal (3 Dams)	MA		•	•	•		•			•	•	•	•	•	•		6
Sawmill Dam Removal	MA	•		•	•	•	•	•	•	•	•	•	•	•	•	•	15
South Middleton Dam	MA	•		•	•	•	•			•	•	•	•	•	•	•	8
State Hospital	MA	•		•	•	•	•	•	•	•	•	•	•	•	•	•	10
Wellingsley Brook Dam Removal	MA		•	•	•	•	•		•	•	•	•					5
Mill River - West Britannia Dam	MA	•		•	•	•	•			•	•	•	•	•	•	•	6
Whittenton Dam	MA		•	•	•	•	•	•	•	•	•	•	•	•	•	•	10
Bloede Dam Removal	MD		•	•	•	•	•	•		•	•	•	•	•	•	•	32
Simkins Dam Removal	MD		•	•	•		•				•		•	•	•	•	10
Howland Dam Bypass Channel	ME					•			•	•		•	•	•	•	•	13
Boyce Pond Dam	NH		•	•	•	•	•			•	•	•	•	•	•		7
McQuesten Pond Dams	NH	•		•	•	•				•	•	•	•	•	•		2
Forge Road Dam	NY		•	•	•		•	•	•		•	•		•	•	•	8
Moodna Creek Dam Removal	NY		•	•	•	•	•			•	•	•			•	•	3
Upper Mills Dam Removal	NY	•		•	•		•	•			•	•					8
Cacoosing Dam Removal	PA	•		•	•	•	•		•	•	•	•		•	•	•	8
Dundaff Dam Removal	PA		•	•	•		•	•	•		•	•		•	•		8
Kladder Dams	PA						•					•					7
East Putney Dam Removal	VT	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	17

The Inter-Fluve team maintains significant relevant project experience as depicted in the above matrix of dam related projects.

Nick Nelson, CERP - Sr. Fluvial Geomorphologist

Role: Project Manager, Fluvial Geomorphology

Nick has 10 years of experience as a fluvial geomorphologist, and manages Inter-Fluve's New England office in Cambridge, MA. He is currently working on all phases of 10 dam removal and river restoration projects in MA and around the country, leading project management, construction oversight, topographic surveying, and restoration design. His work with Inter-Fluve has focused on dam removal and urban channel restoration/ rehabilitation planning and design, cranberry bog restoration design, geomorphic and habitat assessments, and GIS analyses. Nick has taught at the University of Minnesota since 2007, at Northeastern University since 2014, and at the Harvard University Graduate School of Design since 2016. He is currently a technical advisor for the Fluvial Geomorphology Task Force with the UMass RiverSmart Communities program.

Dan Miller, PE- Sr. Water Resources Engineer (VT PE License 62726)

Role: Lead Water Resources Engineer

Dan has 26 years of experience in dam removals, applied open channel stream hydraulics, fish passage and sediment transport engineering analysis, and design along wild and urban stream systems. Dan's projects include dam removal analysis and design; preparation of construction documents; construction oversight for stream creation, relocation and restoration; streambank stabilization; fish passage; aquatic habitat enhancement; prediction of sediment transport loads/budgets; and assessment of stream process.

Mike Burke, PE - Sr. Water Resources Engineer (VT PE License pending)

Role: Water Resources Engineer

Mike is a professional engineer with 22 years of experience including every step in the project process: data acquisition, hydrologic, hydraulic and fluvial process analyses, applied restoration and fish passage planning and design, and construction oversight. Mike has extensive experience with detailed hydraulic and hydrodynamic modeling of regulated rivers across the country. His interests include addressing the ecologic impacts of water resources development and habitat restoration based on understanding of large scale physical influences and ecologic response. He has worked with diverse project partners throughout his career, including remote village councils in the mountains of Nepal, individual landowners, Native American tribes, local, state and federal agencies, water and power utilities, and regional transportation authorities.

Candice Constantine, PhD - Sr. Fluvial Geomorphologist

Role: Fluvial Geomorphology

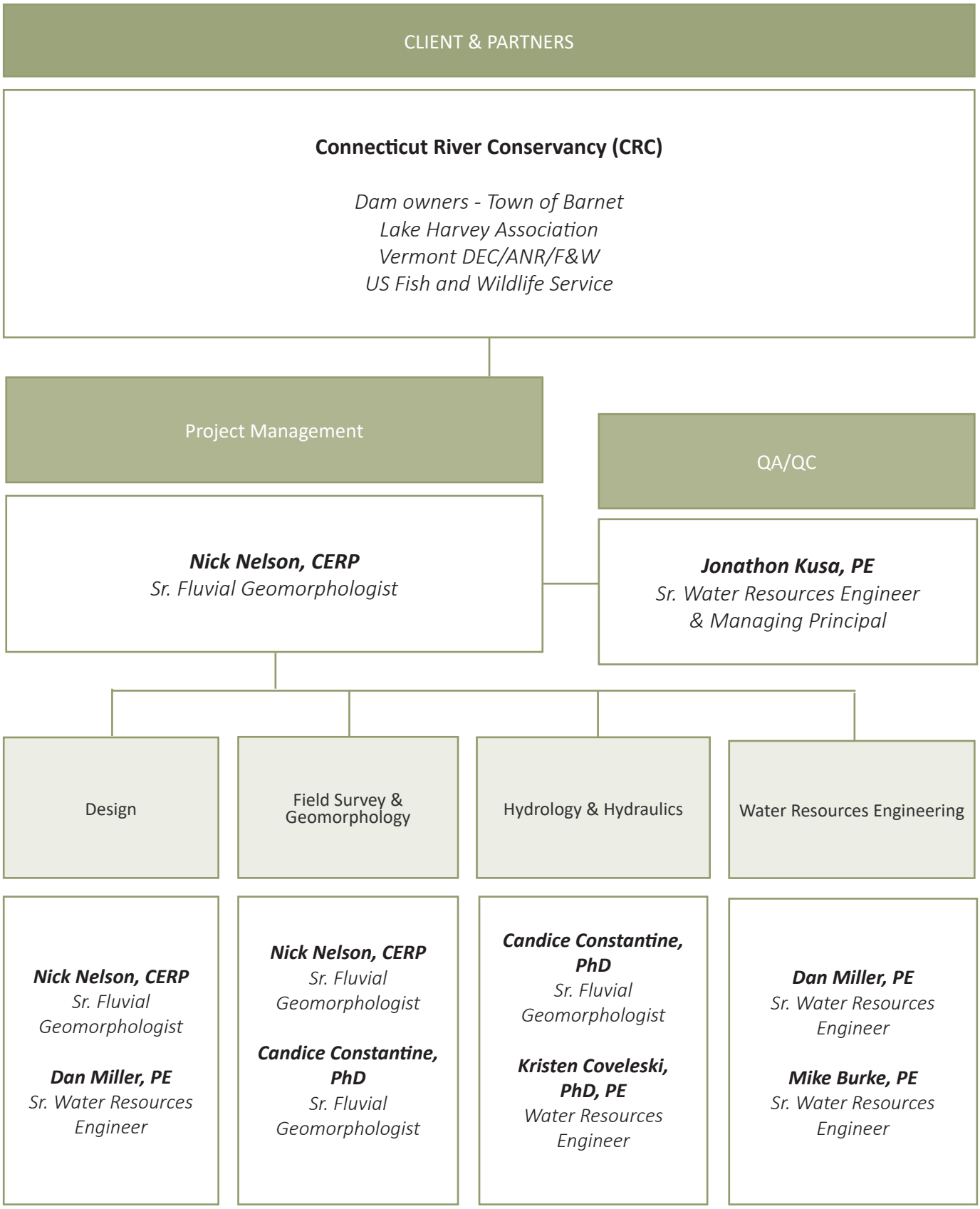
Candice is a geomorphologist with six years of experience in research and a further 11 years of engineering experience in the construction industry. Her technical expertise and project management experience encompass all stages of the project lifecycle from data analysis, modelling and conceptual design through to construction supervision. She is particularly interested in urban river restoration and the environmental, social and economic benefits such work brings to communities. Candice has a firm understanding of the legislative drivers, funding streams and other pressures that set the context for her work. She has worked effectively for and with a variety of organizations, including national and local government, private developers, community groups and utility companies in the US and abroad.

Kristen Coveleski, PhD, PE - Water Resources Engineer & Geomorphologist

Role: Modeling & Engineering Assistance

Kristen is a water resources engineer with emphasis in river restoration, dam removal, and stormwater monitoring. She has extensive scientific writing and communication skills with a focus on river restoration. Her PhD dissertation focused on identifying controlling parameters of downstream sediment transport and deposition following dam removal by analyzing flow regimes, sediment compositions and removal techniques. Her masters research focused on dominant processes surrounding channel formation within a reservoir following a dam breach and removal on the Coastal Plain of Virginia.

Team Organizational Chart



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Proposed Budget

PROPOSED TASKS		TASK TOTAL
Task 1: Kick-off Meeting	$	942
Task 2: Field Survey	$	5,650
Task 3: Hydrology and Hydraulics	$	2,776
Task 4: Sediment Management Planning	$	3,476
Task 5: Feasibility/Alternatives Analysis and Conceptual Design	$	3,596
Task 6: Preliminary (30%) Designs	$	8,596
Task 7: Opinions of Probable Costs	$	1,392
Task 8: Draft Basis of Design Memorandum	$	2,568
Task 9: Public Meetings (3)	$	2,930
Total Base Bid	**$**	**31,926**

Appendix - Project Team Resumes

Appendix

Project Team Resumes

SR. FLUVIAL GEOMORPHOLOGIST

Nick Nelson, CERP

Nick has over 10 years of experience as a fluvial geomorphologist and manages Inter-Fluve's New England office in Cambridge, MA. He is currently working on all phases of dam removal and river restoration projects around the country, leading project management, construction oversight, topographic surveying, and restoration design. His work with Inter-Fluve has focused on dam removal and urban channel restoration/rehabilitation planning and design, cranberry bog restoration design, geomorphic and habitat assessments, and GIS analyses. Nick has taught at Northeastern University, the University of Minnesota, Harvard University Graduate School of Design and was an invited instructor at Tongji University in Shanghai, China in 2017. Nick is currently a technical advisor for the Fluvial Geomorphology Task Force with the UMass RiverSmart Communities program.

EXPERTISE

Geomorphic Assessment

Channel migration

Floodplain and bar development

Identification of areas in need of restoration

Urban risk and hazard assessment

Effects of dams on river systems

Historic channel change

Floodplain inundation

Movement of bed material

GIS and GPS

Topographic and Bathymetric Surveying

Sediment Sampling& Sediment Transport

Hydrologic Analysis & Hydraulic Modeling

Project Management& Construction Oversight

EDUCATION

MS, Watershed Science
Utah State University, 2007

Teton Science Schools' Graduate Program in Enviro. & Experiential Education
Jackson, WY, 2004

BA, Geosciences
Williams College, 2003

PROFESSIONAL AFFILIATIONS & REGISTRATIONS

Society for Ecological Restoration, Certified Ecological Restoration Practitioner (CERP)

SELECTED PROJECT EXPERIENCE

East Putney Brook Dam Removal

Westminster, VT (2017-Present)

The East Putney Brook Dam currently compromises biotic connectivity, interfering with the upstream movement of resident trout and impairing their life history functions. In addition to its impacts on aquatic resources, the dam's continued presence perpetuates a problem for sediment transport through the system. The Connecticut River Conservancy and its partners recently engaged Inter-Fluve to provide survey, sediment management planning, hydrology and hydraulic modeling, and construction-ready designs for removal of the dam structure and restoration of the brook through the former impoundment. The designs will consider impacts to upstream infrastructure, particularly culvert and dry hydrant replacement. Design and construction are expected take place in 2017 and 2018. Nick is performing the geomorphic assessment.

Eel River Headwaters Restoration & Sawmill Dam Removal

Plymouth, MA (2007-2010)

The headwaters of the Eel River in Plymouth, MA consisted of seven cranberry bogs, downstream of which a historic dam prevented fish passage upstream. Restoring this 60-acre site (40 of which is cranberry bog) to pre-agriculture hydrology involved first conducting a preliminary engineering investigation and preparing the project design. Together with our project partners, we managed construction, which involved removing an old dam and nearby culverts; creating 8,000 feet of new stream channel; in-channel habitat improvement; installing two fish and wildlife-friendly culverts; and planting 17,000 Atlantic white cedar trees. Nick assisted with the surveying and construction oversight aspects of this project. This project was awarded the Coastal America Award in 2010.

Mill River Dams Removal

Taunton, MA (2007-Present)

This project targeted the removal of three dams in urban settings on the Mill River in southeastern Massachusetts to restore passage and habitat for alewife, river herring, and American eel. The dams are located along a 5-mile stretch of the river that saw significant impacts and the near loss of one dam during record flooding in 2005, resulting in evacuation of the Taunton city center. Inter-Fluve performed residential construction management on behalf of the project partners for the two dams removed to date, the first of which involved extensive channel restoration. The removal of West Britannia Dam will be the last of three dam removals completed by Inter-Fluve on the Mill River in southeastern Massachusetts. Removal of the dams will restore fish passage and habitat for alewife, river herring, and American eel along a 5-mile stretch of river. At the feasibility stage, Inter-Fluve provided survey, sediment testing and quantification, due diligence review, feasibility analysis, and concept plan development. Final design at West Britannia has included detailed geomorphic and hydraulic analysis and design, ecological restoration design, and development of construction documents. Nick collected the historical background information, completed a due diligence review of possible contaminants, assisted with the topographic and depth of refusal surveys, and led the collection of sediment samples. Nick also guided the permitting process, provided bid support, became project manager, and provided construction oversight. Nick is managing all aspects of the West Britannia Dam removal designs which began in 2013.

Nick Nelson

ADDITIONAL PROJECT EXPERIENCE

Shawsheen River Dam Removals & Fish Passage
Andover, MA (2008-2017)

Inter-Fluve conducted a dam removal/fish passage feasibility study on three small dams in urban settings along the Shawsheen River. Tasks to date include data collection, topographic, bathymetric and depth of refusal surveys, development of hydraulic models, concept drawings and detailed designs. Potential impacts to surrounding infrastructure such as existing river walls and bridges as well as public perception have been major considerations in developing the designs for and managing the construction of these removals. Removal of two of the dams is currently underway with construction to be completed in Spring 2017. Nick provided Project Management for this project.

Ipswich River, South Middleton Dam Removal
Ipswich, MA (2010-Present)

Inter-Fluve completed an initial feasibility study for the removal of South Middleton Dam in 2010. Following the study, Inter-Fluve contracted with IRWA and MA DER to complete engineering designs and initiate permitting. The feasibility study and designs included analysis of the quantity and quality of sediment within the dam impoundment, surveying for hydraulic modeling, hydrology and hydraulic analyses, and engineering designs. Located adjacent to one of the oldest continuously-used industrial sites in MA, the dam is no longer necessary and does not provide any fish passage. Upon removal of the Middleton Dam, 56 miles of the mainstem and tributaries of the Ipswich River will be open to migratory and resident fish. Project partners include IRWA, the Massachusetts Division of Ecological Restoration (DER), Bostik, Inc., the U.S. Fish & Wildlife Service, and the NOAA Restoration Center. Nick is the project manager.

Boyce Pond Dam Removal
Fitzwilliam, NH (2014)

The Inter-Fluve team provided engineering design, and permitting for the removal of Boyce Pond (also known as Horseshoe Pond) Dam and restoration of Kemp Brook. Boyce Pond was a 15-acre private impoundment of Kemp Brook. Over the years, Boyce Pond filled in with sediment allowing the shallow aters to super-heat during the summer months. These warm waters reduced the capacity to hold oxygen in solution and the pond was no longer capable of supporting many species of fish. The dam itself was constructed of earth and stone with a drainage area of 2.18 square miles. The maximum height of the dam was 11 feet with a length of 210 feet. Nick was project manager.

McQuesten Dam Removal
Manchester, NH (2013-2016)

The Inter-Fluve Team is providing engineering design, and permitting for the ultimate removal of the McQuesten Pond and McQuesten Brook Dams (three total dams) and restoration of McQuesten Brook located in Manchester, New Hampshire. This project is a component of the on-going McQuesten Brook Watershed Restoration effort. Goals specific to this project are to restore McQuesten Brook to a free-flowing condition, improve the overall ecology, remove barriers to diadromous and resident fish species, remove the liability associated with a failing dam structure, and to eliminate the existing impairment within the impoundment.Nick is project manager.

San Clemente Dam Removal & Carmel River Reroute
Carmel, CA (2007-2016)

This project alleviated critical dam safety concerns and restored passage for ESA-listed steelhead by removing the 106-foot tall dam constructed in 1921. From 2007-08, Inter-Fluve served as the primary technical advisor to the Coastal Conservancy in their evaluation of options for removing San Clemente Dam. In both the design and advisory roles, Inter-Fluve was key in transforming the project design into one that results in full-scale valley bottom restoration achieving a high degree of ecological integrity. This role has required extensive collaboration with project stakeholders, resource agencies, and technical review team. Our team assisted in concept development and evaluation of steelhead migration windows for this $84M project. I. Nick assisted with the topographic survey and geomorphic assessment.

Cotley River Dam Removal & Stream Restoration
Taunton, MA (2010-Present)

In an effort to improve the aquatic habitat for native fishes, Inter-Fluve was retained by Save the Bay to design the removal of Barstowe's Pond Dam on the Cotley River. The dam is the first and only impediment to stream fishes between the Taunton River and the headwaters of the Cotley River. Barstowe's Pond Dam is an 8-ft tall wooden dam that provides no fish passage on a tributary to the Taunton River in Taunton, MA. It is the only complete obstruction on the Cotley River, and with no obstruction on the Taunton River, removal of this dam could open miles of habitat for alewife and American Eel. Inter-Fluve was contracted to design the dam removal and restoration of the river upstream of the dam. Preliminary designs are complete and Inter-Fluve is currently filing permits. Nick is the project manager for this project, has conducted the initial fieldwork, oversaw the hydraulic and sediment transport studies, managed the design process, and is currently submitting permits.

Suncook River Restoration
Epsom, NH (2011-Present)

In spring, 2006, a 100-year flood event on the Suncook River resulted in channel avulsion and abandonment of a 1.5-mile segment of the river. A headcut advanced, causing 10 feet of incision on the Suncook River, 3 feet on the Little Suncook River, and up to 20 feet on Leighton Brook. The incision on the Suncook River and Leighton Brook threatens to undermine important bridge infrastructure, and bank erosion has resulted in property loss. We were contracted to design and permit measures to stabilize the system for the protection of public infrastructure. Fluvial geomorphology was the foundational study driving the design of this project. We completed a geomorphic assessment of the study area, topographic surveys, hydrologic and hydraulic analyses, and analyzed existing studies. HEC-RAS modeling was completed for up to the 100- and 500-year flood events and a 2-dimensional hydraulic model was completed for one portion of the design area. We also provided technical support and developed a powerpoint for a public meeting. We are currently finalizing the 75% design plans and preparing to submit permits. Nick is project manager.

Howland Fish Bypass Channel
Penobscot River, ME (2014-2016)

As the last of the four key pieces of the Penobscot River restoration effort to be implemented, this project resulted in construction of a major bypass channel around the Howland dam. The 100-foot wide bypass channel is required to provide a high level of service, stability and function over a broad range in design flows spanning from 250 cfs to nearly 12,000 cfs in the bypass channel alone. Nick assisted with the site investigation.

SR. WATER RESOURCES ENGINEER

Dan Miller, PE

Dan has 26 years of experience in applied open channel stream hydraulics, fish passage and sediment transport engineering analysis, and design along wild and urban stream systems. Dan's projects include analysis and design; preparation of construction documents; construction oversight for stream creation, relocation and restoration; streambank stabilization; fish passage; dam removal; aquatic habitat enhancement; prediction of sediment transport loads/budgets; and assessment of stream process. He has managed a number of large-scale water resources projects. His projects are located throughout the Pacific Northwest and Alaska.

EXPERTISE

Channel Hydraulic Analysis & Modeling

River Engineering/Channel Relocation Design

Sediment Transport Analysis & Modeling

River Scour Analysis & Bridge Hydraulic Design

Fish Passage & Screening Design

Dam Removal

Watershed Hydrologic Analysis & Modeling

Wetland Mitigation Design

Groundwater Hydrologic Analysis & Well Design

Construction & Project Management

PROFESSIONAL AFFILIATIONS & REGISTRATIONS

Professional Engineer: AK, CO, FL, OR, WA, VT

River Restoration Northwest

EDUCATION

MS, Civil Engineering (Water Resources), Colorado State University, 1991

BS, Civil Engineering (Structures), Cornell University, 1987

SELECTED PROJECT EXPERIENCE

East Putney Brook Dam Removal

Westminster, VT (2017-Present)

The East Putney Brook Dam currently compromises biotic connectivity, interfering with the upstream movement of resident trout and impairing their life history functions. In addition to its impacts on aquatic resources, the dam's continued presence perpetuates a problem for sediment transport through the system. The Connecticut River Conservancy and its partners recently engaged Inter-Fluve to provide survey, sediment management planning, hydrology and hydraulic modeling, and construction-ready designs for removal of the dam structure and restoration of the brook through the former impoundment. The designs will consider impacts to upstream infrastructure, particularly culvert and dry hydrant replacement. Design and construction are expected take place in 2017 and 2018. Dan is engineer of record.

Durham Dam Removal, Fish Passage Restoration & Habitat Improvement

Yakima County, WA (2011)

The Durham irrigation dam on Toppenish Creek was no longer in use but continued to be a fish passage barrier. The Yakama Nation Fisheries Department contracted Inter-Fluve to conduct site investigations and prepare designs and construction documents for removal of the dam, restore fish passage, provide aquatic habitat, maintain stream and sediment transport processes, provide a ford for controlled vehicle and livestock crossing of the creek and a revegetation plan. Work included construction of a short reach of stream through a large scour pool to remove a sediment trap and allow continued transport of sediments, reducing tendencies for downstream erosion. The constructed stream section included a stream bank constructed of large woody debris, biodegradable fabric wrapped soil lifts, native riparian vegetation and a back water alcove. Dan was project manager, Engineer of Record and provided construction oversight.

Hogan Cedars Dam Removal & Fish Passage Improvement

Portland, OR (2001)

Dan was project manager and lead engineer for field investigations, design, permitting, and preparation of construction plans and specifications for removal of a small dam for the improvement of fish passage conditions. Design features included channel geometry to provide fish passage and habitat, channel stability during floods, no increase in regulatory flood water levels, and enhancement of riparian vegetation. The project included removal and disposal of a small dam, and excavation and offsite disposal of sediments accumulated upstream of the dam. Fish passage improvements were created by construction of 150-ft of stream riffle with a low flow channel. The riffles and channel were designed to remain stable and to provide fish passage for flows ranging from the summer low up to the 100-year flood. The constructed channel was also designed to prevent the formation and subsequent upstream migration of a head cut. An existing pool was enhanced for resting habitat with placement of large wood with attached root wad. Native vegetation was planted along the channel margins. Dan provided construction oversight.

Dan Miller, PE

ADDITIONAL PROJECT EXPERIENCE

Satus Creek Dam Removal
Yakama Nation Reserve, WA (2009)

Until it was removed in 2009, the Satus Creek Dam blocked passage for 93 miles of the most important salmon-spawning habitat in the Yakima Basin in central Washington. Initial field investigations, surveys, and hydraulic modeling led us to understand that dam removal would not only benefit fish passage, but would also improve river function. Acting as a retainer for sediment, the four-foot-high, 135-foot-long dam created a wider river upstream, and a constricted, channelized river downstream. We were hired by the Yakama Reservation Watershed Project (YRWP) to oversee the dam removal process and restoration of spawning grounds. We designed and managed the dam-removal project and built 330 feet of instream roughened channel. This involved placing woody debris and vertical snags, and planting vegetation in the floodplain to slow water movement and floodplain erosion. Dan was the engineer of record and provided construction oversight.

Calapooia River Fish Passage
Shedd, OR (2007-2008)

Dan developed concepts to provide fish passage past two dams along the Calapooia River and Sodom diversion ditch. The dams were built in 1956-57 and are 7-ft high by 40-ft wide and 11-ft high by 85-ft wide, respectively. The existing fish ladders are in a deteriorated condition and do not meet current fish passage criteria. Fish passage concepts included: 1) replace the existing fish ladders with new structures; and 2) remove a portion of the dam and construct a stream channel to provide passage. Planning level cost estimates were prepared for the concepts. The Watershed Council will use the fish passage concepts to pursue funding for formal design and construction.

Ship Creek Fish Passage Alternatives
Anchorage, Alaska (2004-2006)

The Kapp Dam is located .80 miles upstream from the mouth of Ship Creek in Anchorage, Alaska. It is the site of the second largest sport fishery in the state and impedes fish passage for collection at the Elmendorf State Fish Hatchery. The hatchery produces the bulk of the coho and Chinook salmon that return to Ship Creek each year. In addition to hatchery stock, there are wild runs of pink and chum with limited numbers of sockeye, coho, and Chinook. The dam also restricts the area of the intermixing zone for fresh and salt waters. Inter-Fluve was contracted to develop design alternatives to improve fish passage past the Kapp dam for the Anchorage Waterways Council and the Alaska Department of Fish & Game. The project goal is to allow important species to return to the hatchery, while maintaining sport-fishing opportunities vital to the economic health of the City of Anchorage.

Cooper Creek Sediment & Geomorphology Investigation
Kenai Peninsula, AK (2004)

In 2007–50 years after the 19.4-megawatt Cooper Lake Dam was built–the Federal Energy Regulatory Commission (FERC) required a relicensing of the project. As part of a larger "Cooper Creek Instream Flow Study" for the relicensing process, Inter-Fluve conducted a study to characterize streambed substrates and determine their suitability as spawning habitat for salmonids in Cooper Creek. Dan and a team member studied sediment conditions at 16 locations between Cooper Lake Dam and the mouth of Cooper Creek, looking at both present and potential future conditions. This work involved assessing the degree of embeddedness of stream gravels for salmonid spawning; quantifying the bed mobility and sediment transport conditions in existing and pre-dam hydrologic regimes; and conducting a geomorphic assessment of existing conditions. Dan served as the project manager.

Cedar River Sediment Transport Analysis
Seattle, WA (2000)

We conducted a field review and analyze sediment transport and geomorphic conditions at the Landsburg Diversion Dam on the Cedar River following concerns that large volumes of spawning gravels were retained behind the dam, adversely reducing downstream anadromous spawning gravels below the dam. Dan and Inter-Fluve's geomorphologist conducted a field review of the river through the impoundment area during a routine annual reservoir drawdown, and a reconnaissance level site analysis immediately upstream and downstream of the dam to collect sediment data where possible. Dan completed a reconnaissance level analysis of sediment load and analyses of the incipient motion particle sizes upstream and downstream of the dam for various flows. Inter-Fluve's work was incorporated into a subsequent more detailed study of gravel transport along the Cedar River.

Ocklawaha River Restoration & Reconstruction for Rodman Dam and Reservoir Removal
Talahasdsee, FL (1998)

The Rodman Dam was constructed in the early 1960's and floods nearly 22-miles of the Ocklawaha River and thousands of acres of floodplain. The floodplain vegetation was stripped or crushed prior to flooding removing most of the stabilizing vegetation. As a member of the design team to prepare the permit application for the removal of the dam, Inter-Fluve was responsible for preliminary design for the restoration or reconstruction of 26 miles of the Ocklawaha River and its tributaries to provide stability to the denuded floodplain and channel as the river is returned to a freely flowing condition. As project engineer for this effort, Dan was responsible for reviewing existing river hydrologic, hydraulic, sediment and soils data as well as historic pre-dam aerial photographs of the river to identify channel and floodplain stability issues. Preliminary designs for biotechnical bank reconstruction, riparian vegetation plantings and placement of woody debris and floodplain roughness elements were developed to provide channel stability necessary from floodplain clearing and grubbing as well as river channel obliteration by historic dredging.

Harborton Restoration
Portland, OR (2016-Present)

Historically the lower Willamette River has been the food, transportation, economic, cultural and recreational hub to the region. It has also provided critical habitat for salmon, lamprey, bald eagles and many other aquatic, riparian and upland wildlife populations. Yet for a century industries and public agencies dumped harmful pollution into the river resulting in a 10-mile stretch of the river being declared a Superfund site in 2000. Portland General Electric (PGE) is the owner of one of the primary restoration sites, a 73.8-acre Harborton Substation located at the confluence of the Willamette River and the Multnomah Channel. PGE contracted Inter-Fluve to design and acquire permits for habitat restoration and enhancement that includes the removal of fish passage barriers; in-channel, shoreline, riparian, floodplain and upland habitat enhancement; construction of a new tributary stream channel to establish a hydraulic connection to the Willamette River; and preservation, enhancement and creation of wetlands currently supporting a significant population of State listed red-legged frog (Rana aurora aurora). Dan is Lead Engineer, provided QA/QC, assisted in site investigations, participated in design, modeling and H&H, helped in writing the technical memo for this project and participated in stakeholder collaboration throughout.

SR. WATER RESOURCES ENGINEER

Michael P. Burke, PE

Mike Burke is a professional engineer with 22 years of experience including every step in the project process: data acquisition, hydrologic, hydraulic and fluvial process analyses, applied restoration and fish passage planning and design, and construction oversight. Mike has extensive experience with detailed hydraulic and hydrodynamic modeling of regulated rivers across the country. His interests include addressing the ecologic impacts of water resources development and habitat restoration based on understanding of large scale physical influences and ecologic response. He has worked with diverse project partners throughout his career, including remote village councils in the mountains of Nepal, individual landowners, Native American tribes, local, state and federal agencies, water and power utilities, and regional transportation

EXPERTISE

Water Resources Data Acquisition

Hydrologic, Hydraulic and Fluvial Process Analyses

Dam-Related Impacts Analysis

Dam Removal Planning

Applied Aquatic Restoration Planning

Stream Channel Design

Fish Passage Design

Project Management

Construction Oversight

EDUCATION

MS, Civil Engineering,
Center for Ecohydraulics Research,
University of Idaho, 2006

BS, Civil Engineering,
University of Wisconsin, 1993

PROFESSIONAL AFFILIATIONS & REGISTRATIONS

Professional Engineer: CA, ID, MA, ME, MD, MI, NH, OR, RI, WA, WI

American Society of Civil Engineers (ASCE)

American Council of Engineering Companies (ACEC) of Maine

International Association of Hydraulic Engineering and Research

SELECTED PROJECT EXPERIENCE

Mill River - West Britannia Dam Removal

Taunton, MA (2007-Present)

The removal of West Britannia Dam will be the last of three dam removals completed by Inter-Fluve on the Mill River in southeastern Massachusetts. Removal of the dams will restore fish passage and habitat for alewife, river herring, and American eel along a 5-mile stretch of river. At the feasibility stage, Inter-Fluve provided survey, sediment testing and quantification, due diligence review, feasibility analysis, and concept plan development. Final design at West Britannia has included detailed geomorphic and hydraulic analysis and design, ecological restoration design, and development of construction documents. Mike's role since 2007 has encompassed site assessment, flood impacts modeling and assessment, conceptual restoration design and cost estimation, quality assurance of the feasibility study documentation, detailed design, preparation of construction documents, and construction engineering. Mike was the Engineer of Record for two of the three dam removals, the last of which is in the final design stage.

Ipswich River, South Middleton Dam Removal Final Design

Ipswich, MA (2010-Present)

Inter-Fluve completed an initial feasibility study for the removal of South Middleton Dam. The study included analyzing the quantity and quality of sediment within the dam impoundment, and making recommendations for future phases of the project. Located adjacent to one of the oldest continuously-used industrial sites in MA, the dam is no longer necessary and does not provide any fish passage. Upon removal of the Middleton Dam, 56 miles of the mainstem and tributaries of the Ipswich River will be open to migratory and resident fish. Project partners include IRWA, the Massachusetts Division of Ecological Restoration (DER), Bostik, Inc., and the NOAA Restoration Center. Mike was the Engineer of Record, and performed H&H, and design oversight.

Sheepscot River, Coopers Mills & Head Tide

Alna, ME (2015-Present)

The Atlantic Salmon Federation and their partners the Coopers Mills Dam Committee and the Head Tide Dam Committee commissioned Inter-Fluve to assist on a collaborative visioning and site design processes for the management of two historical dam sites on the Sheepscot River. The river is home to twelve species of migratory fish, including the ESA-listed Atlantic salmon and Shortnose sturgeon. The inter-disciplinary team is developed solutions to safeguard public safety and reduce the impacts on native fish populations, while also maintaining fire protection water supply, memorializing the quintessential history of the villages, promoting public use and access to the river for recreational purposes, and providing educational components. Inter-Fluve is presently preparing final designs for both sites, which include removal of Coopers Mills Dam and modification of Head Tide Dam. Construction is planned for 2017. Mike is project manager, technical lead, and engineer of record.

Michael P. Burke, PE

ADDITIONAL PROJECT EXPERIENCE

Royal River Dam Fishway Assessment & Cost Analysis
Yarmouth, ME (2016)

The lower dams of the Royal River have been ranked as high priority for removal or alteration based on the Nature Conservancy's assessment of potential fish habitat and migration routes. Inter-Fluve has been tasked with preliminary fish assessment surveys and cost analyses for TNC and its collaborators. Inter-Fluve is developing four dam modification alternatives based on preliminary surveys of potential fish passage configurations, assessment of current fish ladder operation, and analytical assessments of these field data. Mike is project manager and technical lead.

Howland Fish Bypass Channel
Penobscot River, ME (2014-2016)

As the last of the four key pieces of the Penobscot River restoration effort to be implemented, this project resulted in construction of a major bypass channel around the Howland dam. The 100-foot wide bypass channel is required to provide a high level of service, stability and function over a broad range in design flows spanning from 250 cfs to nearly 12,000 cfs in the bypass channel alone. Mike has led the design of the bypass channel and assisted the Penobscot Trust through project construction, during 2014-2016.

Simkins & Bloede Dam Removals
Patapsco River, MD (2011-Present)

The Simkins Dam removal, a project funded through Economic Recovery Act Funding that involved American Rivers, NOAA, Maryland DNR Fisheries, and the Friends of the Patapsco River Valley State Park, involved the 2011 removal of the 12 feet high by 180 feet long concrete structure, crossing an active, 42-inch diameter above ground sewer to access the dam, and passive transport of 60,000 cubic yards of sediment downstream. Dam rubble was used to build artificial oyster reefs in Chesapeake Bay. Bloede Dam is now the last major fish passage barrier in the lower Patapsco watershed and is currently in the final design phase. The overarching goals for the removals are restoration of fish and aquatic organism passage and habitat conditions on the Patapsco River. Mike has served in an independent engineering QA/QC role for the final designs and construction documents for these projects.

Boardman River Dam Removals
Traverse City, MI (2013-Present)

Inter-Fluve leads the channel restoration and sediment management design tasks for the removal of Boardman and Sabin Dams on the Boardman River in northern Michigan. We worked with numerous stakeholders, including the Traverse City, Grand Traverse County, US Army Corps of Engineers (USACE), the Conservation Resource Alliance, and the Grand Traverse Band of Ottawa and Chippewa to provide historic, topographic, bathymetric, sediment, hydrology/hydraulic analyses, detailed design and construction documents to support the removal projects. The involvement of the USACE in these projects is extensive, as they are the lead entity procuring the construction of the two projects. Leading the Inter-Fluve team, Mike is the Engineer of Record and project manager for these efforts, including ongoing coordination with USACE. Mike is also the senior engineer on the Brown Bridge large wood enhancement which supplements habitat development following removal of the Brown Bridge dam in 2013.

Tidmarsh Farms Dam Removal & Brook Restoration
Plymouth, MA (2011-2016)

We developed concept and final design plans for the restoration of the Tidmarsh Farms, a 250-acre cranberry bog complex slated to be converted into a conservation easement. The project included developing detailed conceptual designs, collecting field survey data, and performing a geomorphic assessment. Using what we learned on the Eel River project, the final design incorporates channel restoration, hydrologic control, and native plant revegetation throughout the property. Designs include 20,000 feet of stream channel restoration; 250 acres of fen and Atlantic white cedar bog restoration; sphagnum reintroduction; fish passage design; and the removal of a 20-foot-high dam in the headwaters. Over 2,000 pieces of large woody debris will be incorporated into the stream channel restoration. The project involves collaboration with scientists from UMass-Amherst Geosciences regarding spring flows and stream temperature, and the MIT Media Lab who are conducting various remote sensing operations. Final designs were completed in Fall 2013. Construction began in October 2015 and was completed in September 2016. Mike performed senior level QA/QC and construction engineering.

San Clemente Dam Removal & Carmel River Reroute
Carmel, CA (2007-2015)

Removal of the 106-foot tall San Clemente dam alleviatesd critical dam safety concerns, and restored passage for ESA-listed steelhead. The removal design required the bulk of the impounded sediment (~2 million CY) to be sequestered in the impoundment, with 3,000 feet of the Carmel River re-routed around the stabilized sediment mass in a bypass channel that rejoined the historic channel just upstream of the former dam. Inter-Fluve developed the channel design to the 60% level of completion, before preparing the contract documents for design-build procurement. We performed geomorphic reconnaissance, channel survey, alternatives analysis, hydraulic modeling, and fish passage design and channel design. As the proposed channel was a steep (2.5%), boulder-based mountain river, extensive analyses and consultation were involved to provide assurance of the fish passage performance of the channel. Mike was Inter-Fluve's project manager, lead technical staff, and project engineer.

Hemlock Dam Removal
Carson, WA (2007-2009)

Decommissioning of the 26 foot-high concrete arch Hemlock dam restored passage and habitat for steelhead through removal of approximately 100,000 cubic yards of impounded sediment, and restoration of approximately 2,000 feet of stream channel (1.5% grade). We performed field investigations, geomorphic and fish passage design, hydrologic and hydraulic modeling, and detailed dam removal and channel restoration design. Mike served as the field project manager during the decommissioning, providing construction oversight and field engineering to adjust the design to subsurface conditions as the impounded sediment was removed and the underlying bedrock geology of the reach was revealed.

Kickapoo River Dam Flood Impacts Assessment
Gays Mills, WI (2009)

The Village of Gays Mills, WI was subjected to record flooding in 2007 and again in 2008. Inter-Fluve conductedan assessment of the effect of the Kickapoo River Dam on flooding conditions in the village utilizing existing data resources. Mike was project manager.

SR. FLUVIAL GEOMORPHOLOGIST

Candice Constantine, PhD

Candice is a geomorphologist with six years of experience in research and a further 11 years of experience in the construction industry. Her technical expertise and project management experience encompass all stages of the project lifecycle from data analysis, modelling and conceptual design through to construction supervision. She is particularly interested in urban river restoration and the environmental, social and economic benefits such work brings to communities. She has also recently been involved with a number of projects and initiatives focused on improving upland land management practices to protect and enhance water resources. Candice has a firm understanding of the legislative drivers, funding streams and other pressures that set the context for her work. She has worked effectively for and with a variety of organizations, including national and local government, private developers, community groups and utility companies in the US and abroad. Candice is a registered professional engineer in the UK and is currently pursuing registration in the US.

EXPERTISE

Hydrological and Hydraulic Analyses

Sediment Transport, Scour and Meander Migration Analyses

Feasibility Assessment

Watershed Management and Source Water Protection

Urban River Restoration Design

Fish Pass Design

Scour Repair and Erosion Protection

Project Management

Construction Supervision

EDUCATION

PhD, Earth Science, Univ. CA, Santa Barbara, 2006

MS, Geology, Univ. CA, Davis, 2001

BS, Geological Sciences and Environmental Sciences (Summa cum Laude), Tufts Univ., 1999

PROFESSIONAL AFFILIATIONS & REGISTRATIONS

Professional Engineer (UK) and Member of the Institution of Civil Engineers

Member American Society of Civil Engineers

Chartered Water and Environment Manager (UK) and Member of the Chartered Institution of Water and Environmental Management

Engineer-in-Training (EIT), California

SELECTED PROJECT EXPERIENCE

East Putney Brook Dam Removal

Westminster, VT (2017-Present)

The East Putney Brook Dam currently compromises biotic connectivity, interfering with the upstream movement of resident trout and impairing their life history functions. In addition to its impacts on aquatic resources, the dam's continued presence perpetuates a problem for sediment transport through the system. The Connecticut River Conservancy and its partners recently engaged Inter-Fluve to provide survey, sediment management planning, hydrology and hydraulic modeling, and construction-ready designs for removal of the dam structure and restoration of the brook through the former impoundment. The designs will consider impacts to upstream infrastructure, particularly culvert and dry hydrant replacement. Design and construction are expected take place in 2017 and 2018. Candice is project manager.

Mill River West Britannia Dam Removal

Taunton, MA (2007-Present)

The removal of West Britannia Dam will be the last of three dam removals completed by Inter-Fluve on the Mill River in southeastern Massachusetts. Removal of the dams will restore fish passage and habitat for alewife, river herring, and American eel along a 5-mile stretch of river. At the feasibility stage, Inter-Fluve provided survey, sediment testing and quantification, due diligence review, feasibility analysis, and concept plan development. Final design at West Britannia has included detailed geomorphic and hydraulic analysis and design, ecological restoration design, and development of construction documents. Candice is managing the current phase of the project which involves completing the regulatory review process, updating the construction documents to 100% design, and developing a bid package.

Shawsheen River Dam Removals & Fish Passage

Andover, MA (2008-2017)

Inter-Fluve conducted a dam removal/fish passage feasibility study on three small dams in urban settings along the Shawsheen River. Potential impacts to surrounding infrastructure such as existing river walls and bridges as well as public perception were major considerations in developing the designs for and managing the construction of these removals. Two dams of three have been removed and the third dam will be retained. Final designs were completed in 2016 and construction was completed Spring of 2017. Candice co-managed the construction phase and played a significant role in the bid-phase services and construction observation and coordination.

Ipswich River Mills Dam Removal

Ipswich, MA (2016-Present)

Working with Horsley Witten Group, Inter-Fluve is assisting with a feasibility study and leading the development of concept designs for removal of the Ipswich Mills Dam near the center of town in Ipswich. Candice is Inter-Fluve's project manager and responsible for carrying out the hydrologic and hydraulic analyses, assessing fish passage, and producing concept designs. The dam removal is expected to be completed this Fall.

Candice Constantine, PhD

ADDITIONAL PROJECT EXPERIENCE

Cotley River Dam Removal & Stream Restoration
Taunton, MA (2010-Present)

Barstowe's Pond Dam is an 8-ft tall wooden dam that provides no fish passage on a tributary to the Taunton River in Taunton, MA. It is the only complete obstruction on the Cotley River, and with no obstruction on the Taunton River, removal of this dam could open miles of habitat for alewife and American Eel. Inter-Fluve was contracted to design the dam removal and restoration of the river upstream of the dam. Designs are complete, and Candice is involved in current construction observation.

Hayden Pond Fish Passage Alternatives
Plymouth, MA (2015-Present)

The Town of Plymouth would like to better understand the fish passage alternatives at the Hayden Pond Dam on the Eel River. Inter-Fluve has completed initial bathymetric and topographic surveys and sediment testing and will be developing a hydraulic model in the next phase of the project. Candice assisted with the topographic survey and geomorphic assessment of the site and will be developing the hydraulic model.

Tidmarsh Farms River & Wetland Restoration
Plymouth, MA (2011-2016)

Inter-Fluve developed concept and final design plans for the restoration of the Tidmarsh Farms, a 250-acre cranberry bog complex converted into a conservation easement. The final design incorporates 20,000 feet of stream channel restoration; 250 acres of fen and Atlantic white cedar bog restoration; sphagnum reintroduction; fish passage design; and the removal of a 20-foot-high dam in the headwaters. Candice conducted as-built survey and provided construction supervision in Fall 2016.

EXPERIENCE PRIOR TO JOINING INTER-FLUVE

Nant Ddu Landslip
Brecon Beacon National Park, Wales, UK (2016)

Lead engineer responsible for assessing the feasibility of rehabilitating an area of the national park affected by a large landslip. The aim of the project was to help reduce silt delivery to a downstream water treatment plant. Worked with a specialist contractor to develop a scope of work that could be quickly implemented and was appropriate in this sensitive environmental. The scope included hydroseeding, planting and biodegradable erosion control measures. Candice's work is being used by the water company as the basis for an emergency protocol to deal with future landslips before water supplies are affected.

The Mill Sluice Removal
Cardiff, Wales, UK (2015-2016)

Lead engineer in developing the detailed designs for removing an historical sluice structure forming the downstream most barrier to fish passage on the River Ely. The work included directing trial pits on site to investigate the construction of the existing structure. Developed detailed designs for removing the bed of the structure and enhancing the ecological value of the concrete walls to remain as a result of constraints at the site. The bed will be reinstated using natural material to form a passable low-flow channel. Construction will start in Fall 2016.

Ystrad Barwig Isaf
Wales, UK (2014-2015)

Assessed the hydromorphological and ecological impacts of the developer's flood risk management proposals which included significant earthworks on the floodplain and modifications to a stream channel. Developed concept designs for mitigation measures encompassing floodplain habitat enhancements and bank stabilization and naturalization.

Habitats Directive Enhanced Reservoir Releases to the Usk & Wye
Brecon Beacons, Wales, UK (2014-2016)

Project manager leading a multi-disciplinary team of engineers and environmental scientists to assess the feasibility of augmenting flow releases from four water supply reservoirs. The aim of the project is to improve downstream habitat conditions while ensuring supply resilience and maintaining hydropower capacity. Led coordination between designers, contractor, and client's dam safety, water resources, security, operations and energy teams to incorporate all requirements, ensure compatibility with other planned work and deliver efficiencies to reduce the construction cost from the initial estimate of £5m.

Connswater Community Greenway
Belfast, Northern Ireland, UK (2014-2016)

Technical reviewer of contractor's detailed design submissions for this £40m design and build project to reduce flood risk, restore rivers, create parkland and revitalize East Belfast. Reviewed submissions for in-river work including temporary works, river restoration elements, channel reinstatement and erosion control measures. Advised the employer on matters related to bioengineering, permitting and in-river construction, including health and safety with regard to the temporary and permanent works proposals.

M4 Corridor
Newport, Wales, UK (2014-2016)

Provided advice on the scour protection requirements around a new floodplain pier as part of this £750 highway improvement scheme. Developed recommendations for bioengineering measures to protect the pier and maintain the existing habitat.

A26 Dualling Northern Ireland
Northern Ireland, UK (2014-2016)

Responsible for ensuring contractor compliance with environmental requirements on this 7.8km highways project affecting numerous watercourses and involving the realignment of a river meander. Advised on geomorphologically sensitive bank protection design.

South West Gauging Weirs
Wales, UK (2014-2016)

Project manager and technical lead in developing detailed designs and specifications for works to repair three gauging weirs, including bank repairs and fish passage. Advised on constructability, environmental impacts and health and safety considerations. Provided design support during construction.

WATER RESOURCES ENGINEER / GEOMORPHOLOGIST

Kristen Coveleski, PhD, PE

Kristen (Cannatelli) Coveleski is a water resources engineer with emphasis in river restoration, dam removal, and stormwater monitoring. She has extensive scientific writing and communication skills with a focus on river restoration. Her PhD dissertation focused on identifying controlling parameters of downstream sediment transport and deposition following dam removal by analyzing flow regimes, sediment compositions and removal techniques. Her masters research focused on dominant processes surrounding channel formation within a reservoir following a dam breach and removal on the Coastal Plain of Virginia. Kristen's project experience includes geomorphic assessments, dam removal design, hydraulic modeling, sediment transport prediction analysis, development of construction documents, and construction oversight and management.

EXPERTISE

Effects of Dam Removal on River Systems

Small Dam Removal Planning

Sediment Transport

Hydraulic Modeling

Geomorphic Assessment

Natural Channel Design

Project Management

Construction Oversight

Water Resources Data Acquisition

Hydrologic, Hydraulic and Fluvial Geomorphic Process Analyses

Topographic and Bathymetric Surveying

PROFESSIONAL LICENSES

North Carolina PE # 043768

EDUCATION

PhD, Civil & Environmental Engineering
University of Virginia, 2013

MS, Civil & Environmental Engineering
University of Virginia, 2010

BCE, Civil Engineering
University of Delaware, 2007

SELECTED PROJECT EXPERIENCE

East Putney Brook Dam Removal

Westminster, VT (2017-Present)

The East Putney Brook Dam currently compromises biotic connectivity, interfering with the upstream movement of resident trout and impairing their life history functions. In addition to its impacts on aquatic resources, the dam's continued presence perpetuates a problem for sediment transport through the system. The Connecticut River Conservancy and its partners recently engaged Inter-Fluve to provide survey, sediment management planning, hydrology and hydraulic modeling, and construction-ready designs for removal of the dam structure and restoration of the brook through the former impoundment. The designs will consider impacts to upstream infrastructure, particularly culvert and dry hydrant replacement. Design and construction are expected take place in 2017 and 2018. Kristen is providing H&H and engineering assistance.

Mill River - West Britannia Dam Removal

Taunton, MA (2013-Present)

The removal of West Britannia Dam will be the last of three dam removals completed by Inter-Fluve on the Mill River in southeastern Massachusetts. Removal of the dams will restore fish passage and habitat for alewife, river herring, and American eel along a 5-mile stretch of river. At the feasibility stage, Inter-Fluve provided survey, sediment testing and quantification, due diligence review, feasibility analysis, and concept plan development. Final design at West Britannia has included detailed geomorphic and hydraulic analysis and design, ecological restoration design, and development of construction documents. Kristen performed the as-built survey for one of the completed dam removals and is part of the design team working to develop a dam removal plan for the third. She completed the design survey, is leading the hydraulic modeling, and will closely assist the engineer of record with completion of the construction documents.

Ipswich River, South Middleton Dam Removal

Ipswich, MA (2010-Present)

Inter-Fluve completed an initial feasibility study for the removal of South Middleton Dam in 2010. Following the study, Inter-Fluve contracted with IRWA and MA DER to complete engineering designs and initiate permitting. The feasibility study and designs included analysis of the quantity and quality of sediment within the dam impoundment, surveying for hydraulic modeling, hydrology and hydraulic analyses, and engineering designs. Located adjacent to one of the oldest continuously-used industrial sites in MA, the dam is no longer necessary and does not provide any fish passage. Upon removal of the Middleton Dam, 56 miles of the mainstem and tributaries of the Ipswich River will be open to migratory and resident fish. Project partners include IRWA, the Massachusetts Division of Ecological Restoration (DER), Bostik, Inc., the U.S. Fish & Wildlife Service, and the NOAA Restoration Center. Preliminary designs were submitted in spring of 2015 and construction is targeted for 2016. Kristen performed field survey work, performed an analysis of the hydrology, completed a hydraulic model, worked on the designs, prepared permits, attended stakeholder meetings, and coordinated with local land owners.

KRISTEN COVELESKI, PHD, PE

ADDITIONAL PROJECT EXPERIENCE

Shawsheen River Dam Removals & Fish Passage
Andover, MA (2008-2017)

Inter-Fluve conducted a dam removal/fish passage feasibility study on three small dams in urban settings along the Shawsheen River. Potential impacts to surrounding infrastructure such as existing river walls and bridges as well as public perception were major considerations in developing the designs for and managing the construction of these removals. Two dams of three have been removed and the third dam will be retained. Final designs were completed in 2016 and construction was completed Spring of 2017. Kristen performed the survey, assisted with modelling, and design.

Sheepscot River, Coopers Mills & Head Tide Dam Removals
Alna, ME (2015-Present)

The Atlantic Salmon Federation and their partners the Coopers Mills Dam Committee and the Head Tide Dam Committee commissioned Inter-Fluve to assist on a collaborative visioning and site design processes for the management of two historical dam sites on the Sheepscot River. The river is home to twelve species of migratory fish, including the ESA-listed Atlantic salmon and Shortnose sturgeon. The inter-disciplinary team is developed solutions to safeguard public safety and reduce the impacts on native fish populations, while also maintaining fire protection water supply, memorializing the quintessential history of the villages, promoting public use and access to the river for recreational purposes, and providing educational components. Inter-Fluve is presently preparing final designs for both sites, which include removal of Coopers Mills Dam and modification of Head Tide Dam. Construction is planned for 2017. Kristen assisted with hydrology and the hydraulic modeling and worked with the engineer of record .

Cotley River Dam Removal & Stream Restoration
Taunton, MA (2010-Present)

Barstowe's Pond Dam is an 8-ft tall wooden dam that provides no fish passage on a tributary to the Taunton River in Taunton, MA. It is the only complete obstruction on the Cotley River, and with no obstruction on the Taunton River, removal of this dam could open miles of habitat for alewife and American Eel. Inter-Fluve was contracted to design the dam removal and restoration of the river upstream of the dam. Preliminary designs are complete and Inter-Fluve is currently filing permits. Kristen updated the hydrology and the hydraulic modeling and worked with the engineer of record to update the designs.

Tidmarsh Farms Dam Removal & Brook Restoration
Plymouth, MA (2011-Present)

We developed concept and final design plans for the restoration of the Tidmarsh Farms, a 250-acre cranberry bog complex slated to be converted into a conservation easement. The project included developing detailed conceptual designs, collecting field survey data, and performing a geomorphic assessment. Using what we learned on the Eel River project, the final design incorporates channel restoration, hydrologic control, and native plant revegetation throughout the property. Designs include 20,000 feet of stream channel restoration; 250 acres of fen and Atlantic white cedar bog restoration; sphagnum reintroduction; fish passage design; and the removal of a 20-foot-high dam in the headwaters. The project involves collaboration with scientists from UMass-Amherst Geosciences regarding spring flows and stream temperature, and the MIT Media Lab who are conducting various remote sensing operations. Kristen has conducted field surveys and analysis, prepared construction documents and continues to provide construction oversight.

Boyce Pond Dam Removal
Fitzwilliam, NH (2014)

The Inter-Fluve team provided engineering design, and permitting for the removal of Boyce Pond (also known as Horseshoe Pond) Dam and restoration of Kemp Brook. Boyce Pond was a 15-acre private impoundment of Kemp Brook. Over the years, Boyce Pond filled in with sediment allowing the shallow aters to super-heat during the summer months. These warm waters reduced the capacity to hold oxygen in solution and the pond was no longer capable of supporting many species of fish. The dam itself was constructed of earth and stone with a drainage area of 2.18 square miles. The maximum height of the dam was 11 feet with a length of 210 feet. Kristen was responsible for technical specifications and the as-built survey.

McQuesten Dam Removal
Manchester, NH (2013-2016)

The Inter-Fluve Team is providing engineering design, and permitting for the ultimate removal of the McQuesten Pond and McQuesten Brook Dams (three total dams) and restoration of McQuesten Brook located in Manchester, New Hampshire. This project is a component of the on-going McQuesten Brook Watershed Restoration effort. Goals specific to this project are to restore McQuesten Brook to a free-flowing condition, improve the overall ecology, remove barriers to diadromous and resident fish species, remove the liability associated with a failing dam structure, and to eliminate the existing impairment within the impoundment. Kristen is responsible for hydraulic modeling, engineering design and construction documents.

Howland Fish Bypass Channel
Penobscot River, ME (2015-2017)

As the last of the four key pieces of the Penobscot River restoration effort to be implemented, this project results in construction of a major bypass channel around the Howland dam. The 100-foot wide bypass channel is required to provide a high level of service, stability and function over a broad range in design flows spanning from 250 cfs to nearly 12,000 cfs in the bypass channel alone. Kristen conducted hydraulic modeling and analysis.

Hoosic River Naturalization
North Adams, MA (2015-2016)

Located along the Hoosic River in the Berkshires of western Massachusetts, the City of North Adams has in recent years become a center for tourism, culture and recreation. To build on that vision, Inter-Fluve is leading a team that includes Sasakai & Associates and HR&A Advisors to bring transformative change and additional investment into the downtown. The Hoosic River has been an important resource to early settlers and residents of the region providing a transportation corridor, power to run industrial mills, and recreational opportunities. The power of the Hoosic River is also well known to residents who have lived close to the river and witnessed devastating floods instigating the construction of concrete flood chutes in the 1950s. This project provides an opportunity to reconnect residents and visitors to the Hoosic River, identify opportunities for riverfront redevelopment, connect different parts of the city, create economic development and restore some of the functionality of a river ecosystem without compromising the chute's current flood capacity. Kristen has conducted field surveys, hydraulic analysis and is working with the engineer of record.

Eel River, MA
The Secretary of the Interior awarded Inter-Fluve and their partners with the 2010 Coastal America Foundation Award for restoration excellence.

inter·fluve

OREGON . MONTANA . MINNESOTA . WISCONSIN . MASSACHUSETTS . MAINE