Analysis Summary of USACE TSP & Recommendation to Town Council

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Royal River Task Force

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1. Introduction and Purpose

The Yarmouth Town Council established the Royal River Task Force (RRTF) in October 2024, appointing six community members who bring together their expertise from various careers and life stories; a business owner, military veteran, conservation scientist, river restoration specialist, biologist, engineer, educator, pilot, outdoor enthusiasts, project manager, landowners, and abutters to the river.

The purpose of the RRTF and this document is to provide a review of the USACE Draft Integrated Detailed Report & Environmental Assessment released in October 2024[1], including an analysis of the Tentative Selected Plan (TSP), and provide a recommendation for the Town Council's consideration for the future of three town-owned impediments affecting the health of the Royal River: Bridge Street Dam (BSD), Middle Falls (MF), and East Elm Street Dam (EESD). This document summarizes the RRTF's review of the USACE report and recommendation to the Town Council.

2. Recommendation Summary

Site Location	RRTF Summary Recommendation
Bridge Street Dam	RRTF recommends full removal of the Bridge Street Dam (BSD) and fish ladder.
Middle Falls	RRTF does not recommend the implementation of the TSP that describes the construction of a four-foot-tall, 40' x 12' structure to divert flow to the side channel. RRTF recommends a monitoring and adaptive management plan at Middle Falls with the goal of first determining how fish pass after BSD removal. If problematic, then prioritize less invasive and less costly actions such as alterations to the ledge outcroppings and/or movement of large rocks as recommended by the USFWS in a prior recommendation.
East Elm Street Dam	RRTF finds that the TSP is the most cost-effective for meeting the USACE's ecological restoration goals. However, the details of two key public concerns that the town must address are inadequately documented in the TSP. The first concern includes design components needed to maintain flows around the north side of Gooch Island. The second concern is a more detailed explanation to support the USACE's decision to exclude a nature-like fishway option. One approach to evaluate a nature-like fishway may be to create a decision matrix that incorporates the diverse social, economic, and ecological benefits.

3. General Review of the USACE Draft Report

USACE report no. CEQ ID - EAXX-202-00-E6P-172863450, titled "Royal River, Yarmouth, Maine Section 206, Aquatic Ecosystem Restoration, Integrated Detailed Project Report & Environmental Assessment" was released to the public on October 11, 2024[1]. The report, whose primary audience is the USACE itself, addresses the technical and other requirements of Section 206 of the Continuing Authorities Program

(CAP), Water Resources Development Act of 1996. The report's recommendations are collectively referred to as the Tentatively Selected Plan or TSP.

The RRTF was formed at the request of the Yarmouth Town Council to help summarize and understand the voluminous content of the report and appendices. Over the past several weeks, RRTF has examined and debated the recommendations and underlying analysis contained in the report to assess its soundness and acceptability in supporting future action by the Town.

It is important for the reader to know that RRTF members all believe that river restoration and improved fish passage are beneficial to our community and those beyond our borders in the watershed upstream and downstream in the Gulf of Maine. This is an underlying premise to Section 206, but is a value that may or may not be shared by everyone in our town or surrounding community. The group also accepts the report's assertion that dam removal is superior to other mitigation strategies such as a fish ladder or nature-like fishway in regards to cost-effectiveness and river restoration efficiency. The challenge to consensus arises from the uncertainty regarding the magnitude of reported benefits from each mitigation option, and the secondary impacts to townspeople's experience. It is within this context of well-intentioned imperfection that the RRTF offers the following commentary.

The report focuses on three impediments to fish passage on the Royal River and contains a trove of interesting and relevant information about the hydrology, flora, and fauna of the river ecosystem. The report identifies the BSD, MF, and EESD as the three impediments and contemplates relative improvements that could be realized by various mitigation options such as no action, remove each of the dams, repair/upgrade fish ladders at each of the dams, or in the case of MF, to redirect a portion of the water flow to the side channel. USACE uses the alewife as a model species to evaluate and compare different options for improving fish passage at each location, presenting the findings in a way that is accessible to the average reader. Their assumptions regarding the feasibility and effectiveness of fish passage options through various structures are key to the report's recommendations, but they rely on a body of research external to the report and are not adequately referenced for readers who are not experts in the field. While undoubtedly satisfying the requirements of Section 206, the report's reliance on these assumptions required us to contact USACE for clarification and further explanation.

The TSP calls for the removal of both the BSD and EESD and the construction of a diversion feature at MF to force more volume of water to the side channel, which would then purportedly be more passable to fish. The RRTF has assessed the soundness and acceptability of each of these TSP components within the boundaries of the report itself and in the context of RRTF member expertise.

Bridge Street Dam: The TSP recommends the removal of the BSD. This is the least controversial of the plan components, at least within the RRTF. Removal provides clear benefits to fish passage and a healthy river ecosystem while eliminating future maintenance costs associated with the structure. The RRTF concludes that negative secondary impacts to recreation, historical preservation, and aesthetics, are limited, though newly exposed riverbanks will likely require ongoing maintenance to mitigate invasive plant species at least for some time until native plants can establish.

Middle Falls: The RRTF does not support the proposed diversion solution as outlined in the TSP. The TSP describes a substantial man-made structure (40 ft length x 12 ft width x 4 ft high) to divert water flow to the side channel (USACE draft report, Appendix G). The report implies that the current MF configuration is as much of an impediment as the two dams and success of the overall effort is highly dependent on the

efficacy of the solution at MF. The supporting evidence for the specific solution described in the TSP seems limited. Based on a report from USFWS in October 2017, which is also referenced in the USACE draft report, the MF side channel appears passable to fish throughout most of its length. RRTF recommends fish passage monitoring and adaptive management at Middle Falls to determine fish passage efficacy in its current state. If necessary, RRTF recommends minimally invasive actions to optimize fish passage, which may include alterations to the ledge outcroppings and/or movement of large rocks as needed.

East Elm Street Dam: The below acknowledged limitations in the scope of the USACE report notwithstanding, the RRTF believes the TSP is an acceptable solution for river restoration and recommends the development of a "TSP-plus" plan that maintains seasonal flow levels around the northern channel around Gooch Island as well as a more complete analysis of costs, benefits, and drawbacks of a nature-like fish passage.

- **Gooch Island:** The ecological and cost benefits of the TSP recommendation for the removal of the EESD are significant and clear. However, as the TSP is written, there are no provisions to ensure flows around the north of Gooch Island or in the Foundry Channel. In addition, Gooch Island is accessible by foot during times of lower water and is somewhat isolated from easy foot traffic for substantial periods of time. This provides a less-disturbed habitat for birds and other wildlife on the island during those times. We recommend design components that would ensure normal flows around this northern channel of Gooch Island.

- **Nature-Like Fishway:** A nature-like fishway was considered by USACE but screened because, if implemented, it is significantly more costly to build, it is marginally feasible to build due to bedrock, it did not improve public safety and it carries long-term costs for operation, maintenance, dam repair, and ultimately dam replacement (USACE Draft report, p. 53-57). Some community members requested clarification on why the USACE screened a nature-like fishway. In response, the RRTF endeavored to address this concern, but we lacked the details of USACE's gathered information about the feasibility of building a nature-like fishway and the actual cost of constructing, testing, operating and maintaining a nature-like fishway as well as the estimated costs of maintaining and eventually replacing the remaining portions of the EESD. A nature-like fishway at EESD could preserve status-quo recreational uses, but at additional long term costs and ongoing uncertainty for fish passage, and without the many ecological benefits the Corps aimed to achieve upstream. Dam removal provides more obvious ecological and water quality benefits over a nature-like fishway, but the report does not provide enough information on the costs and benefits of a nature-like fishway for the town and townspeople to weigh this critical decision.

4. Primary Benefits of River Restoration

4.1. Overview of Primary Benefits:

The Royal River has been a significant place for millennia as freshwater and sea-run (migratory) fish and wildlife colonized Maine's rivers, post-glaciation over 14,000 years ago. Signs of the establishment and shifts in indigenous cultures show up shortly after, evidenced by 8,000 to 10,000-year-old hearth sites near Maine rivers and coastal areas. Throughout the world, we find that rivers, falls, and cascades have been

significant as travel and meeting places, and their visual and acoustic beauty attracted settlement sites. These are almost always also sites with an abundance of fish because of the intersection of marine and freshwater systems. In Maine in nearly every season, the migratory, sea-run fish pause on their landward migration at falls and rapids until adequate numbers of bold individuals make the charge upstream, and later downstream during the requisite out-migrations. This makes them excellent places for accessing fish, for people fishing and trapping or for predation by osprey, eagles, herons, otters and mink, striped bass, and in recent times species like brown trout, large-mouth, and smallmouth bass. Rivers and their riparian zones are also significant places for food, water, and shelter for more than 80% of Maine's wildlife. River mouths are also significant for fish moving along the coast, such as the endangered shortnose sturgeon that leapfrog their way along small and large estuaries between their spawning and wintering habitats (e.g. the Saco and the Kennebec). Lastly, river floodplains have always provided level ground and rich soils for farming wherever human culture evolved. The bounty of the Royal River and surrounding lands was assuredly part of the intense back-and-forth strife experienced here as it was taken over by European settlers.

The Royal is the second largest source of freshwater for Casco Bay, after the Presumpscot. The Presumpscot had/has much larger falls that isolated headwaters from the ocean to create landlocked salmon populations identified globally with the scientific name *Salmo salar var. sebago*. And while the Royal River watershed is much smaller, its sea-run fish did not landlock but had free access to over a hundred miles of upstream habitat. It's not clear, but unlikely that with warming waters we should expect a re-establishment of a local sea-run salmon population. There are however, alewife, blueback herring (not well-noted in the USACE report), American eel (Maine's second most lucrative marine fishery with a significant harvest at the mouth of the Royal, but noticeably glanced over in the Corps report), as well as American shad, and likely (although not listed) sea lamprey, a native species that is often a significant ecosystem engineer for restoring small and medium streambed habitat during their nest building and filter feeding for as much as a decade in river beds before migrating out to sea to mature.

River herring (both alewife and blueback herring) are considered to be a keystone species because of their significant impact in rivers, but they are also very important at sea where they spend most of their lives. Key is their incredible productivity and high caloric value. Each female produces 60,000 –100,000 eggs, which enter the food web with great losses at each growth step in the 3-4 months leading up to and through out-migration to the Gulf of Maine. For every 100,000 eggs about 1,000, 4-5-inch-long, juveniles, nearly pure lipid fat and protein, enter the Gulf of Maine. They do this annually in ways that are predictable to predators foraging offshore such as striped bass, seals, birds, whales, tuna, cod, hake, halibut, mackerel, and these predators have been documented following the outflow and seaward migration of river herring adults and juveniles through captain's logs reaching back to the 1600's (Ted Ames MacArthur Awarded research[7]). Currently, most river herring are harvested for their use as lobster bait, Maine's most well-known and most lucrative marine resource. In the spring, river herring account for roughly half of the bait used, and that previously was imported. The sales of permits for a particularly large harvest in Benton, Maine provide significant funds annually to the town budget. While the Royal is no Kennebec or Penobscot River, it is an extraordinary source of freshwater and potentially forage for the ecology and human fishery of Casco Bay.

Mill Brook, which flows from Highland Lake, currently supports a large breeding population of river herring –mostly alewife. In 2020, an estimated 70,000 alewives returned to this stream to spawn[8]. Numbers there rebounded recently following the Smelt Hill Dam removal in 2002, and is highly variable as significant ledge drops and beaver dams are barely passable in dryer years. The Royal is much larger, with much

less challenging ledge drops (certainly more solvable ones) and it's also too large for beaver to dam until upstream areas in New Gloucester, Auburn, Poland, Durham and Gray. Whenever river herring and even more so sea lamprey are established within a watershed, they introduce vast amounts of beneficial marine-derived nitrogen, sulfur, carbon, and other nutrients that are often in short supply in rivers and streams. When these fish are restored to their historic habitats, the nutrients transported there are documented in freshwater mussels, snails, minnows, predatory fish, aquatic insects, river birds, and other nearby birds that feed on fish and hatches of aquatic insects. The richness of these nutrients is part of the reason they were and still are used in gardens and as fertilizer by local communities and Maine tribes.

The lower reaches of the watershed likely provide habitat for rainbow smelt, tomcod/frostfish, and although not recently documented, it would be logical habitat for migrating shortnose sturgeon (noted in the USACE Federal Interest Determination Report, 2022[10]) that are known to range between the Saco and Merrymeeting Bay with estuarine stopping points in between.

Within this vast period, the last few hundred years has seen intensive development and ecological disaster for the lower Royal River, impacting habitats from near the headwaters around the watershed to the marine habitats in the Gulf of Maine. This was due to the loss of habitat connectivity, pollution of the water from log drives, and then industrial and municipal wastes and toxins, accompanied by the complete manipulation of the riverbanks and stream channels. This is not at all unusual for Northeast U.S. rivers—by 1900, main stem dams were present on most major rivers in New England [6] and elsewhere in the U.S. In the many hundreds of stream surveys completed around the state, around 80% of the river networks surveyed by Maine Inland Fisheries and Wildlife (Eastern Brook Trout Joint Venture Surveys[14]), show signs of riverbank and river-bed manmade changes including bedrock manipulation. This is mostly in the form of stream straightening from the wide-spread use of dynamiting of ledge and in-stream boulders as well as the bulldozing of stream beds for ease of driving logs. While not investigated for the Royal, it's conceivable that through the development and re-development of numerous series of dams, mills, and factories, at first falls (Lafayette Street) through fourth falls (East Elm Street) falls were extensively modified to make early log-driving and navigation easier, as well as to channel water into and out of infrastructure including mill wheels, and later water intakes, and water and waste discharges.

Due to the presence of most of the sea-run fish in or near the Royal, a largely forested, good-quality watershed with a great deal of riparian forest along the floodplains and stream banks, and because of relatively few dams for its 135 miles of stream network, the Royal ranks in the top 5% of over 13,800+ dams evaluated in the Northeast Aquatic Connectivity Assessment[11].

Restoring even modest populations of native fish is critical in these many mid-size and small-size rivers up and down the coast. When larger rivers were finally dammed and then deeply polluted, it was often the smaller streams that life-boated species through hundreds of fish generations until conditions allowed populations to expand into new territory. Since this is how fish re-established Maine rivers post-glaciation, they are particularly good at it and successful at persisting through what is always a fair amount of seasonal fluctuation. The timing for this and other projects in the Northeast is extremely timely on a global and state-wide scale. Globally, migratory sea-run fish populations have plummeted dramatically from 1970 to the present[3], by 84% on average (that's an increase in the rate of decline since the prior Living Planet Index figures from 2 years ago). What's even more alarming is that the numbers in 1970 were likely only 10% of what migrated into rivers and streams from pre-industrialization according to the Foster and Atkins report of 1869[4], the Brown report of 1887[2], and estimates by Hall and Jordaan in 2012[5].

One distinct shortcoming of the USACE report is the frequent reference to alewife, without adequate consideration of the other sea-run fish that likely used the upstream habitat in the Royal, namely, blueback herring, which are much more likely to spawn in and therefore return to the mainstem and tributary habitat than alewife, which spawn mainly in slack water. Other species expected, but poorly documented, include American eel, sea lamprey, and American shad, and both sea-run brook trout (salters or salts) and sea-run brown trout, which have naturalized in this river system. While the passage upstream was cut off by dams and ledge alteration at and between dam sites, or with passage severely limited because of inadequate fish passage, we have no clear idea what fish passage will be like with the ledge configurations left at each of the four falls, except we do know that fish will try. We are now better equipped than ever in our history of manipulating rivers to work in support of healthy fish populations by modeling hydrology and hydraulics with the range of flow conditions that fish are likely to migrate in, both upstream and downstream.

4.2. Benefits to Fish Passage, Riverine Ecosystems and Wildlife, Connectivity to Casco Bay:

The USACE's TSP for the Royal River focuses foremost on restoring ecological function although it is often focused on fish passage with analysis centered on one particular species, alewives. The RRTF and the USACE agree, however, that restoration will provide numerous benefits to a wide variety of species beyond just alewives. For example, RRTF believes there is much more habitat for blueback herring in the main stem and larger tributaries compared to alewives (which prefer stillwater habitat for spawning) and additional habitat for American shad[18]. The TSP highlights the clear benefits of restoring free-flowing conditions, particularly in our case, with reconnection to the ocean. This restoration supports in-stream fish populations, freshwater and marine ecosystems, avian species, and other wildlife, as well as human communities around the watershed and those relying on marine fisheries for recreation and commercial use.

There are co-benefits to Yarmouth residents and even more to the upstream communities throughout this watershed who also have a stake in restoring this river system. However, most upstream communities have long forgotten the benefits of sea-run (migratory) fish, since fish passage was blocked several hundred years ago. We know from other restoration projects in Maine and elsewhere that the return of sea-run fish (fish that spend most of their lives at sea) benefits in-stream ecosystems by improving habitat quality (i.e., sea lamprey nesting), nutrient enhancement of primary producers from the base of the food chain through aquatic insects, freshwater mussels (important filter feeders), crayfish, as well as direct forage for birdlife (osprey, eagles, kingfisher, blue herons, night-herons, tree swallows, flycatchers, etc.), resident fish, and mammals. Though difficult to quantify, past historical data reports from both Ted Ames[5] & Caroline Hall[5] indicate that historic runs of sea-run fish populations strongly benefited marine fisheries of Casco Bay and the Gulf of Maine. Restored sea-run fish, along with the input of nutrients and habitat conditioning, enhance the size, productivity, abundance, and overall health of both sea-run and local fish populations. Recreational/commercial fishing for native and also non-native fish (small- and large-mouth bass) improves in restored river systems. Likewise, improvements are seen in biodiversity and production/abundance in associated estuarine and offshore ecosystems and fisheries.

The RRTF agrees that the TSP provides adequate justification for improved fish passage and river function at the three current obstacles, while recognizing that options for MF and EESD can undergo refinement as the town moves forward into the design and engineering phases, which will further define options and timing. For instance, removing the BSD and assessing fish movement upstream, would help

determine the passability of the MF side channel for all expected up- and downstream migrating species (MF has likely been modified multiple times as noted above).

The task force agrees that the TSP option to remove the EESD would provide the most cost-effective solution to restoring fish passage and the river habitat in the 6 mile EESD impoundment. However, we recognize that there is more to consider regarding how much of the dam should be removed, as the TSP would likely transform a portion of the river habitat in the Gooch Island back channel into wetland and cause the Foundry Channel in Royal River park to become dry. Although the RRTF agrees that EESD removal is the most cost effective option, there were questions about constructing a nature-like fishway at the EESD.

4.3. Benefit to Water Quality:

The TSP expresses the value of water quality in the river above each barrier. The Royal River in Yarmouth is designated as a Class B river (draft report p.19). When water is held in a dam's impoundment, dissolved oxygen in the water declines due to heating and reduced turbulence, flow, and therefore mixing and aeration. This results in lower water quality, which can stress fish and other aquatic species, leading to increased levels of disease and quicker fatigue, creating conditions that are challenging for plant and animal survival. The river habitat is especially poor for cold-water fish like brown trout, Eastern brook trout, and Atlantic salmon. USACE notes that increasing average temperatures from climate change could exacerbate negative environmental impacts (USACE draft report p.85-86) as warmer water can hold less dissolved oxygen.

Although USACE did not test dissolved oxygen levels in the dam impoundments, a 2023 report[12] certified by the Maine DEP[15] shows that for extended periods, a 1.5-mile stretch of the lower EESD impoundment fails to meet Class B Maine river standards for dissolved oxygen. In addition, E.coli levels in the river adjacent to the Yarmouth History Center periodically exceed Class B levels and pose health risks to swimmers, due in part to the stagnant river creating conditions favorable for bacterial growth. By removing the dams and restoring the river's natural flow, water temperatures are expected to decrease due to increased water velocity (USACE draft report p.86), which shortens the residence time of water in the impoundment and facilitates the mixing of cooler, deeper water. In addition, lower water levels will boost the cooling effect of groundwater infiltration into the river and expose riffles and cascades that will increase turbulence and aeration, further improving water quality (USACE draft report p.86). Together these changes create conditions that support a healthier river habitat while mitigating the factors that encourage bacterial growth. An extensive study by Abbott et al[13] in 2022 showed that dam removal leads to a dramatic increase in dissolved oxygen levels. This increase in oxygen levels, along with anticipated improvements in water flow, mixing, and cooling, highlights the potential for significantly improving water quality and enhancing conditions for aquatic life in the Royal River ecosystem if the dams in Yarmouth are removed. Any restoration alternative that retains the dams will fail to improve water quality and riverine habitat, leaving the river out of compliance with Maine's Class B standards and creating conditions less suitable for the health of aquatic organisms.

The report states that during the construction phase, water turbidity would increase around the dams and MF, however, this will be temporary and would not change the long-term water quality of the river. Measures will be taken to reduce turbidity, including erosion control and pre-dredging any build up of sediment around the dams (USACE draft report p.110).

5. Project Costs

5.1. TSP Expresses the Future Cost to Maintain River Structures after TSP Implementation:

The USACE report does not address the magnitude of future costs associated with the maintenance of any of the Alternative Plans considered in the report. Accounting for these costs seems to be outside the USACE scope as the report states that, “The town is also responsible for 100% of operation and maintenance costs for the 50-year life of the project. With regard to the specifics of the TSP, the removal of both BSD and EESD would eliminate the operation and maintenance costs associated with the dams. However, the substantial structure proposed to be constructed at Middle Falls (USACE draft report, Appendix G) will likely require some ongoing maintenance, the cost of which is not accounted for. The report does acknowledge the need to manage shoreline invasive plant species in the Monitoring and Adaptive Management Plan and states, “Additionally, management strategies will be used to deter invasive plant species from colonizing the exposed riverbanks of the East Elm Street Impoundment”. The limits of these additional management strategies, in terms of cost coverage, are not clear.

Based on figures provided by the USACE, the project markup is shown below (USACE draft report, Appendix E, p.5). Certain portions of the project incur both prime and subcontractor markups totaling 75%. For example, the USACE costs for the TSP at Middle Falls is approximately $1.5M.

PRIME (main contractor) Total 47%–Job office overhead 25%, Home office overhead 10%, Profit 10%, Bond & Insurance 2%
SUBCONTRACTOR Total 28% – Job office overhead 8%, Home office overhead 10%, Profit 10%

5.2. TSP Expresses the Future Cost to Manage RR Park and Riverbanks after TSP Implementation:

The expected drawdown from the removal of BSD and EESD dams would expose approximately 5 acres of riverbank spread out along both sides of the six miles of river now impounded by the dams. This bank will be hydroseeded from the river with a Northeast Wetland Seed mix to revegetate and help prevent the expansion of existing invasive species and stabilize exposed sediment as the natural succession occurs (USACE draft report, p.121). The TSP includes bank stabilization and native planting restoration in disturbed areas upstream and downstream of the EESD with the goal “to minimize any impacts to property owners”, as well as along the north and south banks at the BSD site (USACE draft report, Appendix E p.3-4; and Project Cost Summary p.3). Data, images, and assessments from other river restoration sites show that river-dispersed seeds of native and non-native plants quickly establish on newly exposed banks, river bars, and floodplains in the first growing season after drawdown. Often, planted materials (shrubs and trees) are outcompeted by seeds and sprouted stems of native species transported from upstream.

As part of the 5-year Adaptive Management Plan, the USACE will monitor invasive plant growth and control the colonization of invasive plants on exposed riverbanks upstream of the EESD. Following the 5-year Adaptive Management Plan, some additional Town funding will be needed to increase the invasive plant control currently implemented by the Parks Department. The primary goal will be to stabilize stream banks and improve chances for the native species establishment.

6. Additional Considerations

6.1. Recreation Changes above East Elm Street dam:

Removing the East Elm Street Dam (EESD) would alter but not eliminate recreational activities on the river. These changes would be noticeable to the community, with differing opinions on whether they are positive or negative.

- **Water Flow and Depth:** Near the canoe launch at the historical society, the water currently flows very slowly at about 0.2 mph. Without the dam, it would flow at 0.9 mph—still slower than walking speed. Above the canoe launch and in North Yarmouth, most areas will have flow speeds below 0.3 mph, with some spots reaching 1.5 mph, similar to a slow walk. Water levels near the canoe launch would decrease by 4 feet at median flow. However, the water level could be further reduced by about 1 ft under extreme drought conditions (USACE Draft report, Appendix C2, compare p.25 with p.77). During low flow conditions there will be exposed riverbed that would require portaging in numerous locations. The draft plan also says to expect future "lower summer stream flows and more frequent drought conditions" (USACE draft report, p. 83) as well as changes to river character during normal and low flow conditions resulting in "shallower and narrower" flows than the existing condition (USACE draft report, p.90).

Summary of Expected Recreational Changes

- **Paddling:** The river below the EESD would shift from a slow-water paddling experience to a mix of slow and for experienced paddlers fast-water paddling through the newly exposed cascade. River speeds upstream of the History Center, extending to the town line, are expected to increase from approximately 0.2 miles per hour to 0.9 miles per hour.
- **Fishing:** Fishing opportunities would transition from primarily warm-water species like smallmouth bass to a mix of warm-water and cold-water species such as brook and brown trout and seasonal migrations of sea-run fishes; American eel, American shad, and river herring.
- **Winter Activities:** Ice skating and Nordic skiing, which occur occasionally, although less as the years go by, are likely to become less frequent, at least from the History Center. A narrower river with faster flow in some areas would reduce the likelihood of ice forming in those sections.
- **Swimming:** Swimming will still be possible in many sections above the EESD impoundment. The RRTF recommends the town clearly indicate that jumping from bridges is prohibited due to shallow water.
- **Wildlife Viewing:** Bird and other wildlife-watching is expected to improve around newly exposed ledges. Similar to other free-flowing parts of the river, birds, mammals (e.g., mink, otter) and turtles use the exposed ledge and logs for hunting. Improved water quality and increases in migratory fish runs improve bird and other wildlife abundance and health in other restored rivers by creating more

abundant seasonal food sources of fish, aquatic insects, freshwater mussels, crayfish, and enhanced food-web dynamics from the influx of otherwise limited marine nutrients. Bald eagles and osprey benefit as well as great blue herons, night herons, kingfishers, tree and bank swallows, along with otters, mink, and painted turtles.

- **Movement of Trees and logs downstream:** Trees and logs regularly fall into the river and create habitat, but occasionally are obstacles to paddlers. Often the first spring runs of paddling the river require cutting through upstream logjams. This will likely continue or could increase due to a slightly narrower and shallower channel. While logs would not get hung up on removed dams, they would still get snagged on the ledge, remnant factory debris, and the downstream stream banks. They will also continue to occasionally wash into the estuary as they do now creating hazards for boating as well as cost and damage to the marinas. While not addressed in depth in the Report, this is a known and potentially unavoidable concern.
- **Boat launch at Yarmouth History Center:** With the implementation of the TSP, the water level at the Yarmouth History Center canoe launch site will be lowered by 4 feet during average conditions with even lower water during low flow conditions. "Areas across from the Yarmouth History Center canoe launch and towards the Elm Street Bridge could be problematic for paddling" (USACE draft report, Appendix C1). It is unclear whether modifications to the site will be needed to accommodate paddlers. Additionally, a new location, such as the Sligo Road public lands upstream, may need to be considered.
- **Aesthetics and Phonaesthetics:** There will be noticeable changes to the water levels, in-river natural bedrock, cascades, dam & fish ladder structures, and man-made channels like the Foundry Channel near EESD. In addition, sounds of water movement will change throughout the lower section of the river.

Note: USACE recommends the installation of signage and safety precautions at the Yarmouth Historical Center to alert boaters to the downstream cascades. With water level changes at the canoe launch site, a new access location may or may not need to be developed on Sligo Road townlands upstream.

6.2. Recreation Changes below East Elm Street Dam.

The removal of the BSD will lead to changes in water depth of approximately four feet from the BSD to the ledge drop just upstream of the Beth Condon Pathway pedestrian bridge. The water levels and velocity upstream of that will fluctuate as it currently does.

Key Observations for MF to BSD Section

- **Low Recreational Use:** Unlike the impounded river reaches upstream of EESD, the stretch below EESD is rarely used for recreational boating. This suggests that the changes in water levels and flow may have minimal direct impact on paddling. The Beth Condon Pathway pedestrian bridge is sometimes used to jump into the river. With slightly lower river levels here, that would be even more dangerous than it currently is. Signage indicating lower water would be needed.
- **Expected Recreational Changes:** For the limited users of this section, the adjustments to activities are likely to align with those outlined in Section 6.1. This means a potential shift in paddling conditions from slow water to mixed flow and improved fishing and nature watching opportunities as habitat conditions evolve.

Key Observations for MF to EESD Section

- **No changes** to recreational activities are anticipated in the river segment between MF and EESD, as the river conditions in this stretch are not expected to be directly affected by actions taken at MF. However, this could become a viable white-water boating area for experienced paddlers with moderately high flow conditions. Fishing and birding should improve in this reach with seasonal fish migrations.

7. Risk Evaluation

7.1. Access Requirements to Execute TSP:

Access requirements for construction at the BSD, EESD, and MF sites are manageable due to the proximity of public lands. These lands provide convenient entry points, facilitating work on both dam removals and activities at MF without anticipated access issues. The RRTF foresees no significant challenges related to site access, allowing for efficient movement of materials, equipment, and personnel to each project location

7.2. Contamination from Sediment into the Royal River Estuary:

The RRTF agrees with the USACE assessment, which indicates that sediment contamination in the EESD and BSD impoundments poses minimal potential risk to the estuary, the boatyard dredge, and the marine environment.

a. The 2024 USACE sediment testing and sampling report (USACE draft report, Appendix B) states that based on the available information including the environmental setting, bulk chemical concentrations, and volumes of material that might be mobilized and transported downstream, the USACE finds that the sediments from the study area pose minimal potential risk to the marine environment in the Royal River estuary and Casco Bay under any of the restoration alternatives (USACE draft report, p.115).
b. The USACE draft report states: “In general, bulk chemical concentrations documented in sediment samples from both study areas were very low” (USACE draft report, Appendix B, p.15), meaning that, overall, the total collective amount of chemicals present in the sediment from both study areas was very low.
c. Threshold Effect Concentrations (TEC) and Probable Effect Concentrations (PEC) were selected as screening values because they are often more stringent than NOAA’s screening values for marine and estuarine sediments and ensure a higher margin of safety when evaluating sediment quality, minimizing the risk of underestimating potential environmental harm (USACE draft report, Appendix B, p.8).
d. These USACE 2024 test results align with previous sediment test results conducted in 2010[9], 2013[16], and 2016 by Stantec[17]. These studies conclude that there is minimal potential risk to aquatic life related to the EESD and BSD impounded sediments (USACE Draft report p.111; Appendix B, p.8-15). The combined sediment testing efforts from the impoundments have met and in some cases, exceeded the industry standard (1 sample/1,000 cy sediment). Together, these studies provide a comprehensive evaluation of potential risks to the aquatic environment and

mitigate the risk of more costly sediment disposal methods, if contaminated sediment moved downstream to the harbor.

e. USACE compared the 2024 sediment test results with NOAA sediment quality guidelines, and sediment data from other dredging projects disposed of at the Portland Disposal site. Based on this comparison, USACE indicated that sediments from all study areas would be suitable for unconfined open water placement, even at the documented concentrations in their current location (USACE draft report, p.115). This means that even if these sediments were to move downstream and later be dredged in the estuary, they could be disposed of as usual, without incurring extra containment costs, or increasing environmental risk.
f. The report notes that concentrations of chemicals found by USACE were lower than the concentrations found by Stantec in 2015. USACE suggests that the older sediments may have been transported downstream to the estuary and deeper sea bottom in Casco Bay during any of the severe storm events since 2015 (USACE draft report, Appendix B, p.15). The USACE did not find elevated mercury concentrations in any of the sediment samples (including a sample from downstream of the BSD).
g. USACE quotes a 2017 memo from The Nature Conservancy, which states *"The DEP's review supports Stantec's conclusion of minimal potential risk to aquatic life related to impounded sediments at the Bridge Street Dam. Moreover, the Department concluded that overall, the site is clean, and is in fact cleaner than sediment [from the harbor] tested prior to the harbor dredge in winter 2015-16."*
h. The chemical composition of river sediment released during construction at any of the project sites is not predicted to affect water quality of the Royal River (USACE draft report, p.111).

7.3. Sediment Impacting Marina Operations and Dredging:

We agree that the USACE report adequately addresses the concern of sediment transport and production and agree there is minimal risk of sediment impacting marina operations and dredging frequency. USACE concludes, "it is unlikely that dam removal would result in measurable adverse shoaling within the estuary as a result of the erosion of sediment in the immediate vicinity of the dams" (USACE draft report p.114, and Appendices B and C1) and there is little potential for an increase in river sediment production due to the removal of the dams. The USACE results are supported by previous studies by Stantec in 2013[16] and 2016[17], indicating that dam removal is unlikely to significantly enhance sediment transport through the impoundment area or increase sediment delivery to the harbor.

The 2023 study by Stantec assessed the sediment near BSD and EESD by measuring sediment thickness, soil types, and creating profiles upstream of the dams with AutoCAD Civil3D (USACE draft report, Appendix B memo attachment). Their findings showed that erodible sediment was mainly located along the riverbanks, with little to none across most of the river bottom. This was consistent with USACE's 2023 findings, which found that the riverbed "consisted primarily of scoured bedrock and coarse substrate, with a fringe of sediment along portions of each bank". The USACE report estimates approximately 5,400 cubic yards (cy) of sediment could potentially migrate downstream based on core samples taken directly behind the dams. By comparison, the last Federal Navigation Project (FNP) dredging cycle removed around 45,000 cy, and marina dredging volumes typically range from 5,000 to 18,000 cy (USACE draft report, p.114). During the dam removal process, USACE will mitigate any temporary impact of sediment erosion with turbidity control measures and pre-dredging any build-up of sediment around the dams

(USACE draft report, p.110). USACE further indicates that (1) not all sediment is expected to erode; (2) of the eroded sediment, much would settle along the river rather than reaching the estuary; (3) any sediment reaching the estuary would arrive gradually over many years; and (4) sediment reaching the estuary may not deposit within the FNP or marina areas (USACE draft report, p.114).

Sediment accumulation (shoaling) in the estuary, which comes from the Royal River, upland sources, and coastal areas, is managed through routine dredging, which has been happening for decades with the dams in place (USACE draft report, p.115). The FNP shoals at an average rate of 5,300 cy per year, while the marinas accumulate about 4,200 cy per year, totaling 9,500 cy annually. Given this rate, the potential short-term addition of 5,400 cy of potentially erodible sediment due to dam removal is relatively minor (keep in mind pre-dedging at each dam will occur). The USACE concludes that dam removal is unlikely to result in a measurable increase in estuary shoaling due to sediment erosion near the dams (USACE draft report, p.116). Under the 'No Action Plan' and fish ladder construction alternatives, sedimentation patterns within the estuary would remain the same. The RRTF agrees that with or without the dams, greater storm frequency and severity brings increased amounts of water, sediment, and debris moving through the river and estuary and out into deeper marine habitats of Casco Bay.

Production of sediment throughout the watershed was assessed by a research scientist from the USACE's Engineering Research and Development Center. Based on the geology, historic stability, tributary structure, and anticipated changes to the flow regime, there is limited potential for increases to riverine sediment production specifically as a result of removing the dams. The dam removal alternatives are expected to have negligible adverse impact on the amount of sediment that will move downstream into the estuary (USACE draft report, p.115). This aligns with a previous report completed by Field Geology Services, which was included as part of the 2013 Stantec[16] and referred to in the USACE draft report.

7.4. Public Safety:

The incorporation of the TSP for the Royal River reduces several key public safety risks. First, by removing the dams, the risk of flooding around and upstream of dams is mitigated due to improved natural river flow, which lessens pressures on structures during high-water events and provides greater access to some natural flood plains. Additionally, the potential for dam structural failure is minimized, protecting downstream infrastructure from a catastrophic failure event which would release a massive amount of water and large debris in a single pulse. With the removal of the dams and fish ladder structures, personal injuries or accidents by accessing dam sites and fishways will be eliminated, improving overall public safety and possible liability to the Town of Yarmouth. Signage at all bridges above the BSD and EESD impoundments will need to clearly indicate the danger of low water levels and prohibit jumping into the river to prevent injuries. Any suggested changes at MF either by the TSP or RRTF will not significantly change the existing risk of accessing the river at MF.

> **Note:** The Maine DEP permitting process re-evaluates safety, risk, and other considerations prior to construction.

7.5. Reliability of USACE's H&H Model for River Depth and Velocity:

We agree that the USACE's H&H model findings on river depth and velocity are reliable. USACE Hydrologic Engineering Center's (CEIWR-HEC) River Analysis System (HEC-RAS) v6.4.1 (2D version)

provided more precise hydraulic modeling capabilities than the 1D version used by Stantec in previous studies nearly 10 years ago (USACE draft report, p.21). The 2D version can simulate complex flow patterns and depth variations across two dimensions, making it better suited for complex river conditions, like those following dam removal. USACE used this software to determine water surface elevations, velocities, and flow patterns under various conditions including dam removal scenarios (USACE draft report, Appendix C1). HEC-RAS is the global industry standard and widely used for hydraulic modeling. One study team member has seen its use in numerous river restoration projects worldwide. Royal River daily average streamflow data were compiled using 59 years of USGS Royal River gauge records. The gauge is located upstream of First Falls in the Grist Mill Fields park. These data were used to create a baseline of current hydrologic and hydraulic conditions, needed to evaluate flows under various conditions, including during fish migration periods. The USACE's prediction of water level decrease is expected to be accurate, given the use of high-quality data, calibration, and the reliability of the updated HEC-RAS model. The sources of data were: DEM (digital elevation model software) generated contours; surveys from Interfluve (2016) and Titcomb Associates (2013); bathymetry from USACE, Stantec, and FEMA (uses sound waves); and LiDAR of in-channel boulders and ledge from USGS 3D Elevation Program Lidar ME SouthCoastal updated in 2020 (uses laser pulses of light) (USACE draft report, Appendix C1, p.30). As with any predictive model, minor discrepancies could occur, but the 2D HEC-RAS should provide a reliable approximation.

7.6. Infrastructure Considerations: Transportation Crossings & Property:

Nine bridges traverse the Royal River in the vicinity of the project. They range from Interstate 295 downstream of Lower (or First) Falls in the estuary up to Route 9 near Dunns Corner. Of the bridges available in the Maine Department of Transportation (DOT) database, all were constructed with foundations on bedrock, which will not be impacted by the removal of the dams. The Beth Condon Foot Bridge was not noted in the database, but it was constructed on existing abutments that likely also tie into bedrock. Of the nine crossings, there are two railroad bridges. One is owned by the St. Lawrence and Atlantic Railroad and appears abandoned. The other carries Amtrak and remains an active service rail line at high conventional speeds. The rail bridges are also presumed to penetrate to bedrock given the very small tolerances to settlement or vibration necessary for railroad structures. Since all bridges are situated on bedrock their foundations will not be altered by removal of the dams. Near the upstream limits of the EESD impoundment in North Yarmouth, the Route 9 bridge infrastructure includes a dry hydrant for rural fire fighting. The dry hydrant allows fire crews to draw water directly from Royal River, which could potentially be sensitive to changes in water levels (USACE draft report, p. 46) even if it only approaches a foot of change at normal low water.

Appendix A: References, Links, and Resources

1. Royal River, Yarmouth, Maine, Section 206, Aquatic Ecosystem Restoration, Draft Integrated Detailed Project Report & Environmental Assessment (11 Oct 2024), USACE.
2. Brown, G. The Fisheries and Fishery Industries of the United States. (1887). Washington, Govt. https://doi.org/10.5962/bhl.title.54844
3. Deinet, S., et al. The Living Planet Index for Migratory Freshwater Fish 2024 update – Technical Report. World Fish Migration Foundation, The Netherlands. (2024). https://worldfishmigrationfoundation.com/wp-content/uploads/2024/05/LPI_migratory-freshwater-fishes-2024_Technical-report.pdf

4. Foster, N. and Atkins, C. Reports of the Commissioners of Fisheries of the State of Maine. Owen and Nash, Printers to the State, Augusta, (1869). https://lldc.mainelegislature.org/Open/Rpts/PubDocs/PubDocs1868-69/PD1868-69_12.pdf
5. Hall, C., Jordaan, A., and Frisk, M. Centuries of Anadromous Forage Fish Loss: Consequences for Ecosystem Connectivity and Productivity. BioScience 62: 723 (2012). https://academic.oup.com/bioscience/article/62/8/723/244248
6. Mattocks, S., Hall, C., and Jordaan, A. Damming, Lost Connectivity, and the Historical Role of Anadromous Fish in Freshwater Ecosystem Dynamics. BioScience 67: 715 (2017). https://drive.google.com/file/d/1TnedBFViE4QRmC48UfKCzKAXwPY97SVa/view?usp=sharing
7. Lichter, John, and Ted Ames. "Reaching into the Past for Future Resilience: Recovery Efforts in Maine Rivers and Coastal Waters." Maine Policy Review 21.1: 96 -102, 2012. https://digitalcommons.library.umaine.edu/mpr/vol21/iss1/14.
8. Prosek, J. If you unbuild it, they will come—the fish, that is. National Geographic (2020). https://www.nationalgeographic.com/animals/article/dam-removal-restores-alewife-run?loggedin=true&rnd=1731271071001
9. Stantec, Fisheries & Aquatic Habitat Restoration Feasibility Study, 2010. https://drive.google.com/file/d/1keLgUO_u5YxWIrPGzAFD129O9Mbf2prD/view?usp=sharing
10. United States Army Corps of Engineers New England District. Federal Interest Determination Royal River, Yarmouth, Maine §206 Aquatic Ecosystem Restoration. Concord, MA (2022). https://drive.google.com/file/d/1AOXbYs1t-tsLUt49mswdIgsWb-Pi7Ijm/view
11. US Fish and Wildlife Service, Assessment of the Royal River, 12 October 2017. https://drive.google.com/file/d/1uW-OAwVYKe4JCOj60cgl38VWc9zU_Syc/view
12. Wilcox,C et al, Royal River Dissolved Oxygen Report, Royal River Alliance, 2022. https://drive.google.com/file/d/1KIvPyqe9JdiD90U8PZclbcaQenohFKJR/view
13. Abbott, K et al, Investigating impacts of small dams and dam removal on dissolved oxygen in streams, 2022, https://drive.google.com/file/d/1TUjtPzXKHq5Q0OEIP3dlwYItwC7LJfa4/view
14. Eastern Brook Trout Joint Venture surveys, 19 Nov 2024 https://easternbrooktrout.org/about
15. Garland, W. Maine Department of Environmental Protection. "Certified data showing low dissolved oxygen in the Royal River". Memo, 10 March 2023. https://drive.google.com/file/d/1W0dxqI0f6z4hW_CF5iBRgrgvbUfOymoa/view?usp=drive_link
16. Stantec: Royal River Restoration Project: Phase II Analysis and Reporting, 2013. https://drive.google.com/file/d/1fcWKasVOK2N9FPJ_LTDv0FTPKiyiuS6C/view?usp=sharing
17. Stantec: Sediment Analysis Bridge Street Dam Impoundment, Royal River Yarmouth, ME, 2016. https://drive.google.com/file/d/1VI4hm8a6Eu_Un6G0n91zcN6IqJ3zq4DD/view?usp=sharing
18. Heinz, S. Estimate of Shad and River Herring Potential for the Royal River Watershed. Trout Unlimited, 2020. https://drive.google.com/file/d/16k2nYDkFwtdQpcPcsysCUSHUIExk4wHM/view?usp=sharing

LINKS:

Detailed Project Report/Environmental Assessment

- **Appendix A: Environmental, Cultural Resources and Pertinent Correspondence**
- **Appendix B: Sediment Investigations**
- **Appendix C (Part 1): Hydrology & Hydraulics Appendix**
- **Appendix C (Part 2): Hydrology & Hydraulics Appendix**
- **Appendix C (Part 3): Hydrology & Hydraulics Appendix**
- **Appendix D: Draft Real Estate Plan**
- **Appendix E: Cost Engineering**
- **Appendix F: ECB 2018-14 Analysis of Royal River Potential Climate Vulnerability**
- **Appendix G: Engineering**

12/4/2024

Addendum

Analysis Summary of USACE TSP & Recommendations to Town Council

The Royal River Task Force (RRTF) received new information since issuing our report on Nov 21, 2024. First, Yarmouth's Town Engineer, Steve Johnson, provided an updated opinion of the probable cost of a nature-like fishway (1). Second, we received a copy of the US Fish & Wildlife Service (USFWS) agency's technical response to the USACE's draft report (2). These new documents informed our thinking and allowed us to refine our analysis. Based on this additional information, RRTF hereby updates its recommendations as follows:

Site Location	RRTF Recommendation Summary
Bridge Street Dam	Full removal of the Bridge Street dam (BSD) and fishway.
Middle Falls	Surveying and monitoring fish movement to assess effective fish passage and employing incremental adaptive management strategies, beginning with less expensive options, to ensure effective fish passage.
East Elm Street Dam	Partially remove the E. Elm St dam (EESD) and fishway. In addition, design components should be included to ensure flow around Gooch Island.

Basis for Updating Recommendation at East Elm Street Dam

In our report dated November 21, 2024, the RRTF advised the Town Council that it found that partial dam removal at EESD was "the most cost-effective for meeting the USACE's ecological restoration goals" (3). However, RRTF noted that the Town should consider two community concerns that were not fully discussed in the USACE draft report: maintaining flow around Gooch Island, and the rationale for excluding a nature-like fishway option which some participants needed to understand better. The RRTF report suggested evaluating a nature-like fishway using a decision-support matrix and noted that information about short-term and long-term costs was not available. With the Town Engineer's memorandum (1), based on Inter-Fluve's 2018 (9) and Stantec's 2010 (10) reports, RRTF took steps to evaluate and compare the relative costs and benefits of dam removal versus a nature-like fishway. In doing so, RRTF considered key factors including project costs, environmental, recreational, and cultural impacts, and the risks associated with each alternative. We also considered USFWS's advice to USACE to use a more conservative estimate for fish passage in a nature-like fishway (4). In addition, the fishway option is much more costly in terms of both short-term and

long-term costs for construction, operations, adaptation, maintenance, and future major overhauls, while still not meeting fish passage and ecological goals, nor mitigating existing current risks. In conclusion, the RRTF unanimously agreed that dam removal was decisively the best choice, resolving the concerns we listed in our report.

Full vs. Partial Dam Removal

The RRTF supports a partial removal of the EESD and its associated fishway as described in the TSP. However, for the reasons set forth below, the RRTF also endorses pursuing full removal of EESD ("TSP-plus") which "would allow a continuous flow of water through the back channel of Gooch Island and would eliminate future O&M costs to maintain the remaining section of dam"(5, p.124).

While the USFWS letter did not specifically address maintenance of flow around Gooch Island, they did make a general statement of support for full dam removal: "Full dam removal offers the most effective solution for restoring aquatic connectivity, as it eliminates barriers to fish passage entirely, allowing for unimpeded movement of all species. This approach also removes the need for future operations and maintenance costs associated with maintaining dam infrastructure. From a public safety perspective, dam removal eliminates risks related to potential structural failure, making it the safest long-term option for the Royal River community"(2).

With regard to the TSP's partial removal of EESD, USFWS notes, "The proposal to retain the left portion of the East Elm Street Dam (attached to a building foundation) should be carefully reviewed during the design phase. Assessing its structural integrity and long-term implications for fish passage and maintenance costs is crucial." Notably, in the draft report, USACE wrote that full removal of the EESD (TSP plus removal of the left section) would not impact the effectiveness of fish passage under the TSP (5, p.124).

The RRTF requested information from the USACE to compare water levels resulting from partial versus full dam removal. In response (12), Tom Mihlbachler, USACE Civil Engineer and H&H Modeler, advised that he had run the H&H model for full dam removal at East Elm Street but archived the results as full dam removal had been screened out. He stated that this analysis could be recovered or regenerated at the Town's expense but anticipated the "results to be similar or less extreme than" an analysis he conducted assuming different bottom conditions and a lower damming surface. Based on that analysis (excerpts of which are included in draft report Appendix C), Tom noted: "the extent of change is unlikely to impact normal water levels

upstream of the bedrock outcropping located approximately 150 feet upstream of the East Elm Street bridge, as compared to [partial removal under] the TSP."

The RRTF did not agree on a recommendation regarding the Foundry Channel. We therefore submit the two recommendations (*italicized* text indicates where the language is different):

> Version A: The Town *may want to* evaluate options for preserving flow through the Foundry Channel to address consequences of de-wetting such as public safety and invasive species management. In considering these options, the Town should proceed with the understanding that the available water is finite and that the Town should *prioritize fish migration in the main stem.*
>
> Version B: In addition, the Town *should* evaluate options for preserving flow through the Foundry Channel to address consequences of de-wetting such as public safety and invasive species management. In considering these options, the Town should proceed with the understanding that the available water is finite and that any diversion of water into the Foundry channel *should not substantially compromise the flow requirements for* fish migration in the main stem.

Basis for Updating Recommendation at Middle Falls

USFWS evaluated fish passage at Middle Falls as part of an agreement with USACE, but did not submit their final report before the release of the USACE Draft Report (6). USACE advised the Study Coordination Team that "The USFWS's insight and recommendations will be factored into the USACE's cost-benefit analysis" (8), and that they hoped USFWS would provide "that report in time to incorporate USFWS's input into the draft Detailed Project Report/Environmental Assessment (DPR/EA)" (7). As of the Study Coordination Team meeting on November 18, 2024, the USFWS site visit report had not been received (K. Orenstein, Study Coordination Team member).

In the USFWS agency technical response to the USACE dated November 15, 2024, USFWS states that additional surveying and mapping of the back channel, along with evaluating fish movement through the channel, is essential for assessing the feasibility and effectiveness of the channel for fish passage (2).

The RRTF maintains its lack of support for the proposed 40 ft length x 12 ft width x 4 ft high diversion structure outlined in the TSP to divert water flow to the side channel. Instead, RRTF recommends the less costly and less invasive approach suggested by USFW in 2017, which was noted in the USACE draft report (p.57) (5). USFWS suggested that fish passage could be

significantly improved by making *"alterations to the ledge outcroppings and/or movement of large rocks… these enhancements would be relatively low cost and should be considered a viable alternative"*. The USACE project delivery team visited the site in the summer of 2024 and concluded that *"the less expensive and less intrusive measure proposed by the USFWS would improve fish passage through the side channel"* (5). In conclusion, RRTF recommends evaluating fish passage, supported by USFWS (2), through the Middle Falls site and implementing an adaptive management plan as needed.

References:

1. Johnson, S. Yarmouth Town Engineer. Nature-Like Fishway Cost Estimate Update. November 26, 2024.
2. Cross, A. US Fish and Wildlife Service. Yarmouth Royal River Restoration USFWS Project Code: 2024-0067056. November 15, 2024.
3. Royal River Task Force. Analysis Summary of USACE TSP & Recommendation to Town Council. November 21, 2024.
4. Hershey, H. Updating the consensus on fishway efficiency: A meta-analysis. Fish and Fisheries. 22:735–748, 2021.
5. Royal River Section 206, Draft USACE Integrated Detailed Project Report & Environmental Assessment. October 11, 2024.
6. USACE Section 206 Study Bi-Weekly Project Update Minutes. November 4, 2024.
7. USACE Section 206 Study Bi-Weekly Project Update Minutes. June 25, 2024.
8. USACE Section 206 Study Bi-Weekly Project Update Minutes. April 10, 2024.
9. InterFluve: Fishway Assessment and Cost Analysis Report. 2018.
10. Stantec, Fisheries & Aquatic Habitat Restoration Feasibility Study, 2010.
11. USACE Section 206 Study Bi-Weekly Project Update Minutes. March 26, 2024.
12. Mihlbachler, Thomas G, email response to water level question from Royal River Task Force, November 25, 2024.