Royal River, Yarmouth, Maine
Section 206, Aquatic Ecosystem Restoration

Appendix A: Environmental, Cultural Resources and Pertinent Correspondence

October 2024

US Army Corps of Engineers®
New England District

YARMOUTH
MAINE

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1.0 ENVIRONMENTAL CONSIDERATIONS

1.1 INTRODUCTION

This Monitoring and Adaptive Management Plan has been developed for the Tentatively Selected Plan (TSP) of the Royal River, Yarmouth, Maine Section 206 Aquatic Environmental Restoration Detailed Project Report/Environmental Assessment in Yarmouth and North Yarmouth, Maine. Section 2039 of the Water Resource Development Act (WRDA) 2007 (as amended by Section 1161 of WRDA 2016) directs the Secretary of the Army to ensure that when conducting a feasibility study for a project (or component of a project) under the U.S. Army Corps of Engineers (USACE) ecosystem restoration mission, the decision document must include a monitoring and adaptive management plan.

There are two elements that make up a Monitoring and Adaptive Management Plan, as the name implies – future monitoring and adaptive management. Both pieces work together to ensure the success of the project. Monitoring activities described in the Monitoring and Adaptive Management Plan measure the success of the aquatic ecosystem restoration project by evaluating if the goals and objectives established during the feasibility phase are successfully achieved. The actions described in this monitoring plan will be performed by or under the guidance of the USACE, New England District. The monitoring is intended to be flexible to allow readjustment as new information and conditions develop.

The second part of the plan involves adaptive management. Section 1161 of WRDA 2016 also directs USACE to develop a plan for adaptive management for all ecosystem restoration projects. Adaptive management is an approach taken during project monitoring to allow for the quick identification and management of unforeseen problems that keep a project from achieving its intended purpose. It can also be defined as an iterative approach to managing ecosystems, where the methods of achieving the desired objectives are unknown or uncertain. In essence, adaptive management provides a formalized process for the management of an ecosystem restoration project. The information generated by monitoring will be used by the New England District, in consultation with the federal and state resources agencies and the USACE North Atlantic Division (NAD), to guide decisions on operational or structural changes that may be needed to ensure that the ecosystem restoration project meets the success criteria. Adaptive management must be appropriately scoped to the scale of the project.

1.1.1 Project Goal

The goal of the feasibility study is to recommend a plan that will restore degraded significant ecosystem structure, function, and dynamic processes to a less degraded, more natural condition, with a specific focus on reestablishing fish passage in the Royal River. The alternative plans developed and assessed during the feasibility phase focused on the restoration of passage for alewife (*Alosa pseudoherringus*) and other diadromous, fish that migrate between salt and freshwater, species such as Blueback herring (*Alosa* *aestivalis*) and American eel (*Anguilla rostrata*), to reproductive habitat located upstream of the existing in-stream structures which impede migration.

1.1.2 Project Objectives

The primary objective of this project is to restore the aquatic ecosystem of the Royal River and return it to a healthy, self-sustaining river system. This result would aid the native species that rely on riverine habitats for their existence and reproduction. Other objectives include:

- Improve aquatic passage for all species within the Royal River Watershed over the study period of analysis,
- Restore habitat and reconnect disjointed biomes within the Royal River Watershed over the study period of analysis,
- Reduce the significant risk costs of O&M, repair, and replacement of the dams, and
- Improve public safety within Yarmouth over the study period of analysis.

1.2 PROJECT AREA DESCRIPTION

The Royal River watershed is located in southeastern Maine (**Figure 1**). The watershed includes the Royal River, Chandler Brook and their tributaries and is approximately 141 square miles. The headwaters of the Royal River originate in Sabbathday Lake, New Gloucester and flows downstream for about 39 miles; ultimately emptying into Casco Bay, Yarmouth, Maine. The Royal River is a freshwater environment and is the second largest contributor of freshwater to the Casco Bay. The river transitions into an estuarine, tidally influenced aquatic environment in Yarmouth. The head of tide is located approximately at the East Main St /Route 88 Bridge in Yarmouth.

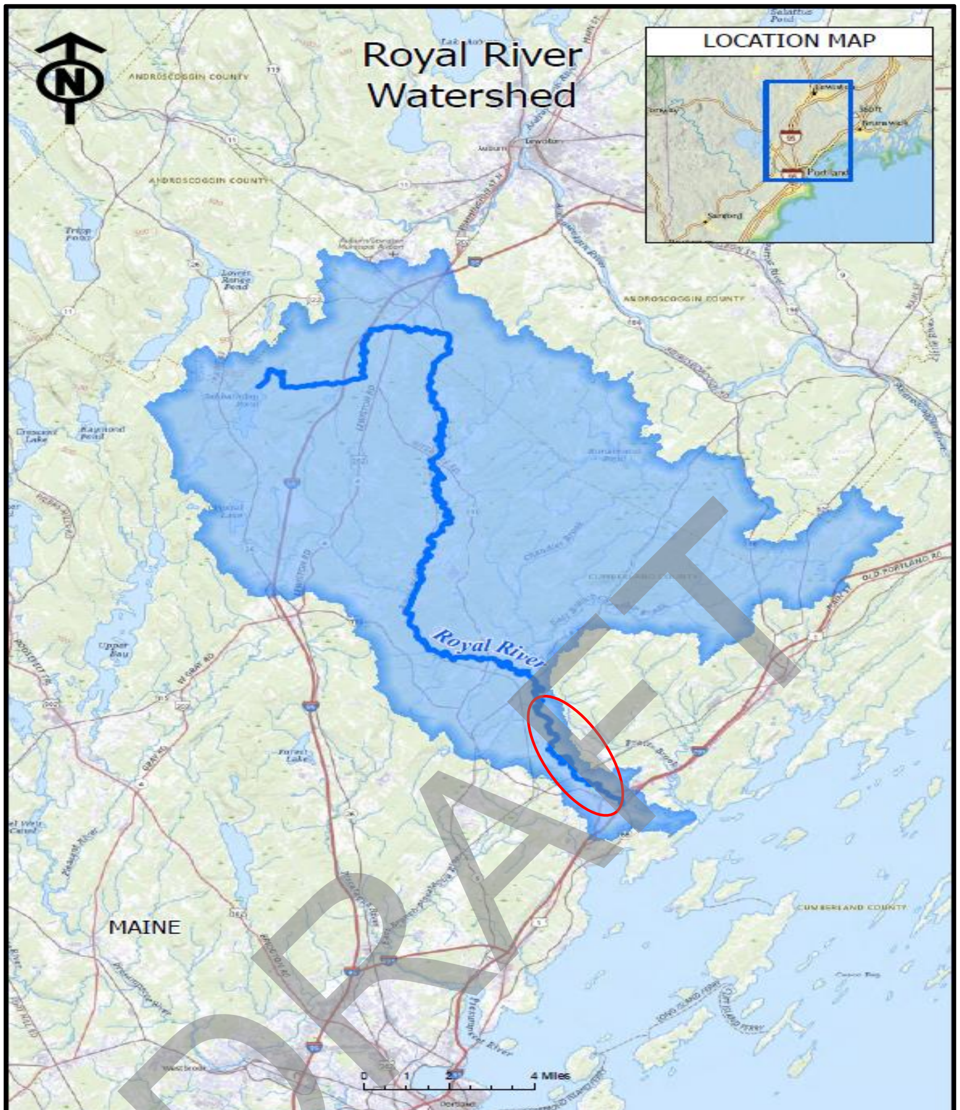

Figure 1. The Royal River Watershed
(*The study area is circled in red)*

The study area is located in the towns of Yarmouth and North Yarmouth and is approximately 12 miles north of the state's largest city, Portland (**Figure 2**). The study area runs from the head of tide (also known as First Falls) to a site 750 feet upstream of Baston Park (**Figure 2**), which includes approximately 7.0 miles of the Royal River. The northern most limit of the East Elm Street Dam impoundment extends between 5,000 to 12,000 ft (0.95 to 2.27 miles) upstream depending on the height of the river.

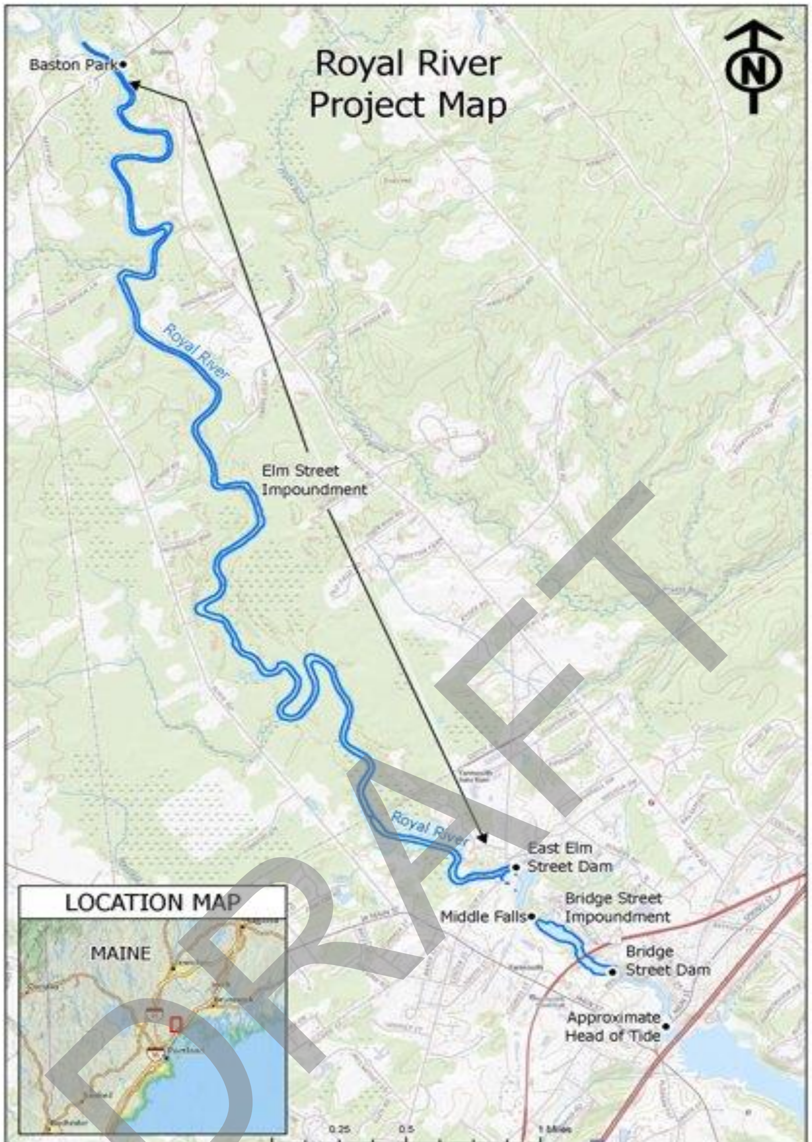

Figure 2. The Study Area

The industrialization of the Royal River watershed in the 1800s resulted in the construction of several dams along its course to power textile, paper, flour and sawmills. The historic dams obstruct upstream migration to historic spawning habitat for alewife and fish passage for other diadromous species. The result is the loss of reproductive potential for alewife and other species.

Currently, there are three impediments to fish passage found within the study area. Two are man-made, the East Elm Street Dam and the Bridge Street Dam. The third impediment is an area which include a natural cascade and a modified side channel, commonly referred to as Middle Falls. The impediments block the passage of alewife and other migratory fish species from traveling upstream to suitable spawning habitat.

1.3 RESTORATION OF FISH PASSAGE ON THE ROYAL RIVER

Diadromous fish passage is a critical component to aquatic ecosystem restoration in river systems. The obvious benefit of allowing the reproductive cycle of these species to occur uninterrupted is critical to the recruitment and long-term sustainability of the populations. Fish species have become extirpated from the Royal River. This means that the species has become locally extinct, where they cease to exist in a particular area, but continue to exist elsewhere. The reintroduction of species extirpated, or near extirpated from the river represent a massive influx of nutrients to the river. If we view these species as concentrations of nutrients, such as fats and proteins rather than animals, anadromous fish (fish that migrate up rivers from the ocean to spawn) represent an otherwise non-existent return of nutrients from the ocean (Mattocks et al., 2017). The river flows from upland out to the sea, carrying with it nitrogen, phosphorus, iron, and all the nutrients critical to support life. Under normal conditions, this exchange is one way from upland to sea, with the river as the vector of transport. Anadromous fish spend their adult lives in the ocean where they grow and concentrate the abundant resources of the ocean into their own biomass. The spawning run upstream then brings these nutrients back upstream, fueling the growth of both predatory and decomposing organisms. The pressure placed on resident species by competition for available food is outweighed by the nutritional boon the spawning run poses to the larger river ecosystem.

In an attempt to restore diadromous fish passage to Royal River, two concrete Denil-type fish ladders were constructed to bridge the obstructions caused by the Bridge Street and East Elm Street dams in 1974 and 1979 respectively. The structures were monitored by Maine Department of Marine Resources (DMR) from 1975 to 1985. Between 1981 and 1989 Maine DMR recorded a maximum of 11% of the alewives recorded crossing the Bridge Street Dam structure also ascending the East Elm Street Fish ladder (Whipplehauser, 2011). This failure of passage implies the existence of an additional barrier to fish passage between the two structures. The barrier was later identified as the cascade adjacent to Factory Island known as Middle Falls or Factory Falls. The effectiveness of the structures are dependent on many conditions including water flow, regular maintenance, and debris removal. For many years, the fish passage structure was inoperable due to damage and lack of maintenance. In recent years, a local group of volunteers have repaired the fish ladder. Their efforts have shown some success, as they have filmed fish moving through the fish ladder in 2024, though individual fish passage is measured in tens of fish.

To address the impediments to fish passage, the Royal River TSP includes the following three elements:

- Removal of a 120 linear foot (LF) section of the East Elm Street Dam and the Denil-type fish passage structure located on the right descending bank of the Royal River.
- Removal of Bridge Street Dam across the entire width of the river, which includes the 275 LF structure and the Denil-type fish passage structure located on the right descending bank of the Royal River.
- Installation of diversion structure at the top of Middle Falls to divert

streamflow into the side channel. Flow in the side channel will be monitored for capacity to pass fish and additional interventions may be executed as part of an adaptive management plan.

1.4 MONITORING AND ADAPTIVE MANAGEMENT

Dam removal in the Royal River will be very beneficial to the historic alewife migration, but it will not be an immediately noticeable. It will likely take 5-10 years before the run becomes apparent as more fish successfully pass the current obstructions and find safe spawning and refuge habitat upstream of the East Elm Street dam. Recruitment will increase annually as more fish born in the Royal River grow to maturity and return to their natal habitat to spawn. The historic spawning habitat for the alewife in Royal River is in its headwaters at Sabbathday Lake in New Gloucester, Maine. It is important to note that passage to this spawning ground is still obstructed and the spawning ground it represents is not reflected in the habitat assessment. It is therefore important to monitor the project site and annual alewife migration to determine the success of the ecosystem restoration project.

The purpose of the monitoring and adaptive management plan is to evaluate the success of the TSP. Goals and objectives formulated during the early planning of the project are the basis for the establishment of monitoring criteria. Goals refer to the target characteristics to be restored, such as suitable fish passage for alewife and other diadromous fish species. Objectives are more precise, such as the specific characteristics of vegetation for nesting habitat. Performance indicators, such as the acreage of reproductive habitat, are developed and applied to a monitoring plan to quantitatively determine the success of a project in meeting its goals.

The adaptive management goal of this project is to increase reproductive habitat in Royal River to support increased numbers of alewife. This project seeks to minimize impacts to stream habitat in the achievement of the project goal and to minimize long-term impacts to associated fish and wildlife resources.

1.5 MONITORING PLAN

The U.S. Fish and Wildlife Service (USFWS) currently has a group of local volunteers that monitor the annual migration. Coordination with USFWS and this group can greatly decrease the cost and effort of monitoring over a 10-year period. In addition to coordination with USFWS, a USACE representative will travel to observe the migration at Bridge Street, East Elm Street, and Middle Falls (Factory Island) once annually at peak migration. The Factory Island side channel is an ideal point to observe this migration as it is much narrower than the other two locations and will naturally funnel migrating fish into a channel for observation.

Data from the annual monitoring will be recorded as a Memorandum for the Record (MFR) along with details of the monitoring effort. These will include geographic location of the observation, date, time of day, weather, number of fish witnessed, and the amount of time observed. The number of fish observed can be standardized between years by effort of observation as with Catch per Unit Effort (CPUE). This will allow a comparison of fish observed over each obstruction per year. Communication and coordination with USFWS and their volunteers will be used to note outliers in the normal trends due to unforeseen circumstances with the monitoring effort.

Monitoring alewife passage will produce an annual dataset of passage through the project. In early years this can inform of the success of the individual measures used in the project alternative (i.e. dam demolition, channel modification). Fish passage at one obstruction but not at another may suggest a potential failure point in the connectivity of the river. Maintaining the observations from all three obstructions will allow for a higher degree of accuracy in pinpointing potential failure points and applying mitigation measures to solve them. The Third Falls were identified as a potential failure point in connectivity due to a similar dataset monitoring the success of the previously installed Denil-style fish ladders. The monitoring can also be used to inform required maintenance efforts along the study area that may impact the migration like debris removal.

1.5.1 OBJECTIVE 1

Increase spawning potential for Alewife in the upstream area, approximately 311 acres, upstream of the Bridge Street dam to support increased numbers of alewife.

<u>Success Criteria</u>: Alewife and other migratory fish species are observed upstream of the Bridge Street and East Elm Street Dam and Middle Falls.

<u>Monitoring Procedure</u>: To determine presence and count of migratory fish species, an observer at the dam locations will record upstream and downstream fish movement counts for four hours, one day a month during the migration season, between March and May.

1.5.2 OBJECTIVE 2

Restore fish passage through the Middle Falls obstruction.

<u>Success Criteria</u>: Alewife and other migratory fish species will be observed swimming through the side channel at Middle Falls and successfully reach the pool above Middle Falls.

<u>Monitoring Procedure</u>: To determine presence and count of migratory fish species, an observer at the side channel of Middle Falls will record upstream and downstream fish movement counts for four hours, one day a month during the migration season, between March and May.

1.6 ADAPTIVE MANAGEMENT

1.6.1 OBJECTIVE

In the face of uncertainty, adaptive management strategies will be implemented to maintain passage of alewife and other diadromous fish to the upper reaches of the Royal

River. Additionally, management strategies will be used to deter invasive plant species from colonizing the exposed riverbanks of the East Elm Street Impoundment.

1.6.2 SUCCESS CRITERIA

Success criteria for the adaptive management plan are:

- Alewife and other migratory fish species are moving upstream past the two dam locations and Middle Falls and are spawning upstream of East Elm Street Dam.
- Native plant species are colonizing the riverbanks in the East Elm Street Dam Impoundment.

1.6.3 METHODS

The first adaptive management procedure relates to the disturbance of riverbank during construction and exposure of the riverbank in the East Elm Street Dam Impoundment once the dams have been removed and water levels drop. As discussed in the Environmental Assessment, USACE Hydrologic Engineering Center's (CEIWR-HEC) River Analysis System (HEC-RAS) model was utilized for this analysis, given the software capability for two-dimensional unsteady flow calculations. HEC-RAS version 6.1 was initially utilized for terrain and initial model development at the beginning of the study, with Version 6.4.1 utilized for model finalization, computations, and alternative evaluation.

This modeling effort showed an anticipated loss of 4 feet of depth in the Bridge Street and East Elm Street dam impoundments. **Figures 3** and **4** show the anticipated effects and provide some perspective on the lower water level and its impact on the riverbanks. The removal of the East Elm Street and Bridge Street dams and associated Factory Island channel modification are anticipated to have some minor impacts to the riparian and riverine wetlands due to the water level lowering. There may also be some disturbance in the construction areas from the presence and use of heavy machinery. As part of the implementation of the project, the USACE has include erosion control and revegetation measures on the riverbanks immediately adjacent to the two dam sites.

The effect of the lowered water level can be observed throughout the impoundment, but the effect becomes less pronounced the greater the distance from the dams. It is estimated that 5 acres of riverbank will become exposed. This area will be hydroseeded using the New England Wetmix seed blend from New England Wetland Plants, Inc (**Table 1**). Source material from the seller states 1 pound of the New England Wetmix will cover 2,500 square feet thus to cover the anticipated 5 acres of riverbank we will use 90 pounds of seed. Due to the difficulty of access to large sections of the affected areas the hydroseeding will take place from the water in a canoe or other small boat.

Figure 3. Side-by-side comparison of velocity and inundation before and after dam removal at Bridge Street dam.

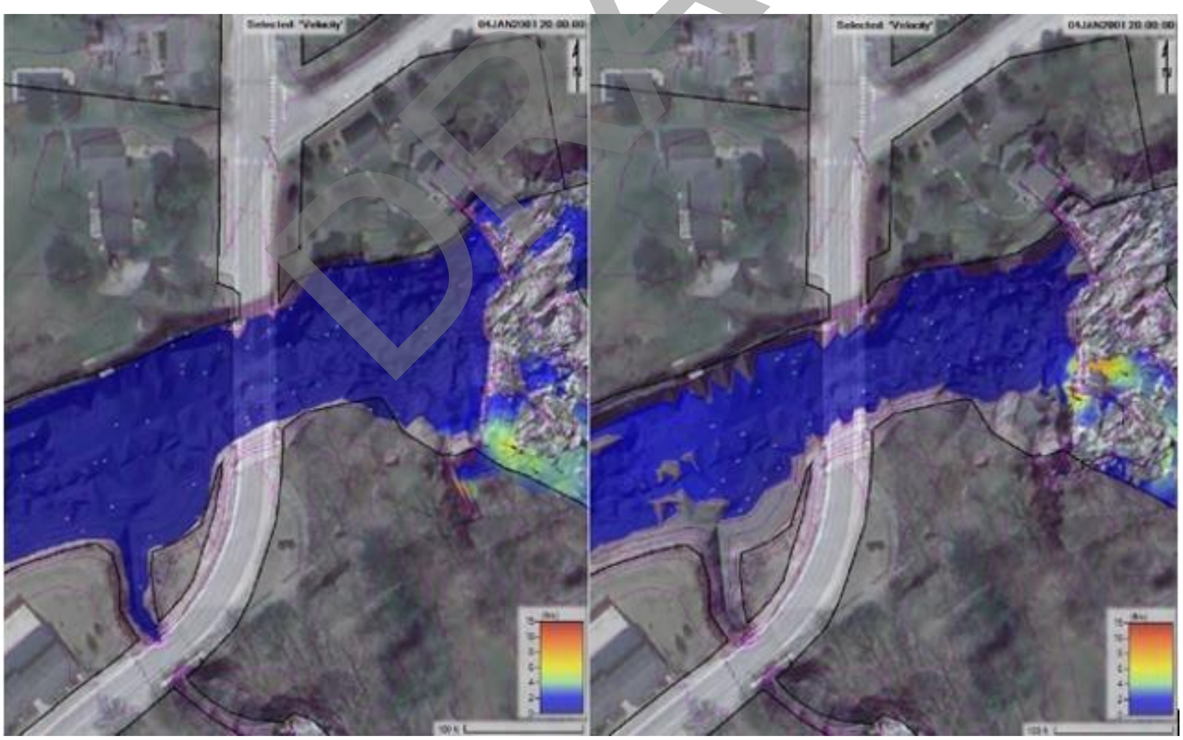

Figure 4. Side-by-side comparison of velocity and inundation before and after dam removal at East Elm Street dam.

Table 1. Composition of New England Wetmix from New England Wetland Plants, Inc.

NEW ENGLAND WETLAND PLANTS, INC
820 WEST STREET, AMHERST, MA 01002
PHONE: 413-548-8000 FAX 413-549-4000
EMAIL: INFO@NEWP.COM WEB ADDRESS: WWW.NEWP.COM

New England Wetmix (Wetland Seed Mix)

Botanical Name	Common Name	Indicator
Carex vulpinoidea	Fox Sedge	OBL
Carex scoparia	Blunt Broom Sedge	FACW
Carex lurida	Lurid Sedge	OBL
Carex lupulina	Hop Sedge	OBL
Poa palustris	Fowl Bluegrass	FACW
Bidens frondosa	Beggar Ticks	FACW
Scirpus atrovirens	Green Bulrush	OBL
Asclepias incarnata	Swamp Milkweed	OBL
Carex crinita	Fringed Sedge	OBL
Vernonia noveboracensis	New York Ironweed	FACW+
Juncus effusus	Soft Rush	FACW+
Aster lateriflorus (Symphyotrichum lateriflorum)	Starved/Calico Aster	FACW
Iris versicolor	Blue Flag	OBL
Glyceria grandis	American Mannagrass	OBL
Mimulus ringens	Square Stemmed Monkey Flower	OBL
Eupatorium maculatum (Eutrochium maculatum)	Spotted Joe Pye Weed	OBL

The second action included in the adaptive management plan is associated with Middle Falls. The TSP includes the installation of a diversion structure at the top of the main channel. The structure will divert water into the side channel, increasing flows to facilitate fish passage. Two high rock ledges, which could interfere with fish passage, are in the side channel. Once the diversion structure has been installed, water flow will be monitored to ensure successful fish migration. If the ledges continue to be a hinderance to fish passage, additional interventions, such as rock chipping, may be executed as part of an adaptive management plan.

1.7 MONITORING AND ADAPTIVE MANAGEMENT COSTS

Required efforts and man-hours were determined and costs developed of the monitoring for a five-year monitoring period at $50,000 fully funded. Preconstruction baseline monitoring will take place in the year before construction. Monitoring will be conducted for five years following construction for the durations included in each procedure listed in **Section 5.0**.

Adaptive management costs were calculated based on efforts and criteria described in **Section 6.0** and based on level 3 cost estimates prepared prior to final design and implementation.

1.8 Environmental Model

This model was designed to assess alternatives for alewife passage on the Royal River. The model assumes 3 obstructions in the river: Bridge Street dam, Middle Falls and East Elm Street dam. Three measures were assessed for each dam (Demolition, Fish ladder construction, No Action) and two measures were assessed for Middle Falls (Side Channel Modification, No Action). This resulted in 18 alternatives from all possible permutations of the measures.

Table 2 details the percentage of fish able to pass for each measure under consideration expressed as a decimal. Three measures were evaluated for each dam including demolition, fish ladder replacement, and the no action alternative. For Middle Falls, two measures were evaluated including side channel modification and the no action alternative. Fish ladder installation at middle falls was screened out at this location due to cost and spatial constraints.

Table 2. Assumptions of the percent of alewife able to pass each fish passage measure.

Assumptions:	Passability
Dam Demolition	1.0
Side Channel Modification	0.7
Fish Ladder	0.5
No Action	0.05

The habitat assessment for the project area (**Table 3**) was provided by USFWS as part of a response to a request for assessment of fish passage within the Royal River. Lakes like Sabbathday Lake were not accounted for in the assessment because they are not currently accessible (Harris, 2017). **Table 4** details the fish passage for all 18 alternatives generated from the array of measures.

Table 3. Habitat assessment of the project area and upstream of East Elm Street dam (USFWS 2017).

Reach Name	Acres of Habitat	Alewives (117/acre)
Bridge Street Dam to 3rd Falls	6	702
3rd Falls to East Elm Street Dam	9	1053
Above East Elm Street Dam	296	34,632
Total	311	36387

Table 4. Analysis of potential alternatives.

Alternative	Habitat Units
Alt 1: Bridge St No Action, Factory Island No Action, East Elm St No Action	
k*5%(Bridge St No Action)	1819.35
k*5%(Bridge St No Action)*5% (Factory Island No Action)	90.9675
k*5%(Bridge St No Action)*5% (Factory Island No Action)*5%(East Elm No Action)	4.548375
Alt 2: Bridge St Dam Demolition, Factory Island Side Channel Modification, East Elm St Dam Demolition	
k*100%(Bridge Street Demolition)	36387
k*100%(Bridge Street Demolition)*70% Side Channel Modification Factory Island)	25470.9
k*100%(Bridge Street Demolition)*70% (Side Channel Modification Factory Island)*100%(East Elm St Dam Demolition)	25470.9
Alt 3: Bridge St Dam Demolition, Factory Island No Action, East Elm St Dam Demolition	
k*100%(Bridge Street Demolition)	36387
k*100%(Bridge Street Demolition)*5% (No action Factory Island)	1819.35
k*100%(Bridge Street Demolition)*5% (No action Factory Island)*100%(East Elm Demolition)	1819.35
Alt 4: Bridge St Fish Ladder, Factory Island Side Channel Modification, East Elm St Fish Ladder	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*70% (Factory Island Side Channel Modification)	12735.45
k*50%(Bridge Street Fish Ladder)*70% (Factory Island Side Channel Modification)*50%(East Elm St Fish Ladder)	6367.725
Alt 5: Bridge St Fish Ladder, No Action Factory Island, East Elm St Fish Ladder	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*5% (Factory Island No Action)	909.675
k*50%(Bridge Street Fish Ladder)*5% (Factory Island No Action)*50%(East Elm Fish Ladder)	454.8375
Alt 6: Bridge St Dam Demolition, Factory Island Side Channel Modification, East Elm St Fish Ladder	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*70% (Factory Island Side Channel Modification)	12735.45
k*50%(Bridge Street Fish Ladder)*70% (Factory Island Side Channel Modification)*50%(East Elm Fish Ladder)	12735.45
Alt 7: Bridge Street Dam Demolition, Factory Island No Action, East Elm St Fish Ladder	
k*100%(Bridge Street Dam Demolition)	36387
k*100%(Bridge Street Dam Demolition)*5%(Factory Island No Action)	1819.35
k*100%(Bridge Street Dam Demolition)*5%(Factory Island No Action)*50%(East Elm St Fish Ladder)	909.675
Alt 8: Bridge Street Fish Ladder, Factory Island Side Channel Modification, East Elm St Dam Demolition	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*70% (Factory Island Side Channel Modification)	12735.45
k*50%(Bridge Street Fish Ladder)*70% (Factory Island Side Channel Modification)*100%(East Elm St Dam Demolition)	12735.45

Alternative	Habitat Units
Alt 9: Bridge Street Fish Ladder, Factory Island No Action, East Elm St Dam Demolition	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*5% (No action Factory Island)	909.675
k*50%(Bridge Street Fish Ladder)*5% (No action Factory Island)*100%(East Elm St Dam Demolition)	909.675
Alt 10: Bridge Street Dam Demolition, Factory Island Side Channel Modification, East Elm St No Action	
k*100%(Bridge Street Dam Demolition)	36387
k*100%(Bridge Street Dam Demolition)*70%(Factory Island Side Channel Modification)	25470.9
k*100%(Bridge Street Dam Demolition)*70%(Factory Island Side Channel Modification)*5%(East Elm St No Action)	1273.545
Alt 11: Bridge Street Dam Demolition, Factory Island No Action, East Elm St No Action	
k*100%(Bridge Street Dam Demolition)	36387
k*100%(Bridge Street Dam Demolition)*5%(Factory Island No Action)	1819.35
k*100%(Bridge Street Dam Demolition)*5%(Factory Island No Action)*5%(East Elm St No Action)	90.9675
Alt 12: Bridge Street Fish Ladder, Factory Island Side Channel Modification, East Elm St No Action	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*70%(Factory Island Side Channel Modification)	12735.45
k*50%(Bridge Street Fish Ladder)*70%(Factory Island Side Channel Modification)*50%(East Elm St No Action)	636.7725
Alt 13: Bridge Street Fish Ladder, Factory Island No Action, East Elm St No Action	
k*50%(Bridge Street Fish Ladder)	18193.5
k*50%(Bridge Street Fish Ladder)*5%(Factory Island No Action)	909.675
k*50%(Bridge Street Fish Ladder)*5%(Factory Island No Action)*5%(East Elm St No Action)	45.48375
Alt 14: Bridge Street No Action, Factory Island No Action, East Elm St Dam Demolition	
k*5%(Bridge St No Action)	1819.35
k*5%(Bridge St No Action)*70% (Factory Island Side Channel Modification)	1273.545
k*5%(Bridge St No Action)*70% (Factory Island Side Channel Modification)*100%(East Elm St Demolition)	1273.545
Alt 15: Bridge St No Action, Factory Island No Action, East Elm St Dam Demolition	
k*5%(Bridge St No Action)	1819.35
k*5%(Bridge St No Action)*5% (Factory Island No Action)	909.675
k*5%(Bridge St No Action)*5% (Factory Island No Action)*100%(East Elm St Demolition)	909.675
Alt 16: Bridge Street No Action, Factory Island Side Channel Modification, East Elm St Fish Ladder	
k*5%(Bridge St No Action)	1819.35
k*5%(Bridge St No Action)*70% (Factory Island Side Channel Modification)	1273.545
k*5%(Bridge St No Action)*70% (Factory Island Side Channel Modification)*50%(East Elm St Fish Ladder)	636.7725
Alt 17: Bridge St No Action, Factory Island No Action, East Elm St Fish Ladder	
k*5%(Bridge St No Action)	1819.35
k*5%(Bridge St No Action)*5% (Factory Island No Action)	90.9675

Alternative	Habitat Units
k*5%(Bridge St No Action)*5% (Fish Ladder No Action)*50%(East Elm St Fish Ladder)	45.48375
Alt 18: Bridge St No Action, Factory Island Side Channel Modification, East Elm St No Action	
k*5%(Bridge St No Action)	1819.35
k*5%(Bridge St No Action)*70% (Factory Island Side Channel Modification)	1273.545
k*5%(Bridge St No Action)*70% (Factory Island Side Channel Modification)*5%(East Elm St No Action)	63.67725

Table 5 summarizes the information generated in this analysis. Alternative A, the No Action Alternative, would result in no additional passing alewife, beyond the existing conditions, for alewife over time. However, Alternative B, would pass alewife upstream, above Middle Falls to historic reproductive habitat, resulting in a maximum potential of 25,880 alewife. Alternative B is the recommended plan.

Table 5. Summary of results sorted by habitat units.

Results	Habitat Units
Alt 2 Bridge St Dam Demolition, Factory Island Side Channel Modification, East Elm St Dam Demolition	25880
Alt 4 Bridge Street Fish Ladder, Factory Island Side Channel Modification, Elm St Removal	12940
Alt 6 Bridge St Dam Demolition, Factory Island Side Channel Modification, East Elm St Fish Ladder	12940
Alt 8 Bridge St Fish Ladder, Factory Island Side Channel Modification, East Elm St Fish Ladder	6470
Alt 3 Bridge St Dam Demolition, Factory Island No Action, East Elm St Dam Demolition	1849
Alt 14 Bridge Street No Action, Factory Island Side Channel Modification, East Elm St Dam Demolition	1294
Alt 10 Bridge Street Dam Demolition, Factory Island Side Channel Modification, East Elm St No Action	1294
Alt 9 Bridge Street Fish Ladder, Factory Island No Action, East Elm St Dam Demolition	924
Alt 15 Bridge St No Action, Factory Island No Action, East Elm St Dam Demolition	924
Alt 7 Bridge Street Dam Demolition, Factory Island No Action, East Elm St Fish Ladder	924
Alt 16 Bridge Street No Action, Factory Island Side Channel Modification, East Elm St Fish Ladder	647
Alt 12 Bridge Street Fish Ladder, Factory Island Side Channel Modification, East Elm St No Action	647
Alt 5 Bridge St Fish Ladder, No Action Factory Island, East Elm St Fish Ladder	462
Alt 11 Bridge Street Dam Demolition, Factory Island No Action, East Elm St No Action	92
Alt 18 Bridge St No Action, Factory Island Side Channel Modification, East Elm St No Action	65
Alt 17 Bridge St No Action, Factory Island No Action, East Elm St Fish Ladder	46
Alt 13 Bridge Street Fish Ladder, Factory Island No Action, East Elm St No Action	46
Alt 1 Bridge St No Action, Factory Island No Action, East Elm St No Action	5

1.9 Greenhouse Gas Emissions

According to the Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) Guidance on Consideration of Greenhouse Gas (GHG) Emissions and Climate Change (Federal Register, Vol. 88, No. 5, January 9, 2023), climate change is a defining national and global environmental challenge of this time, threatening broad and potentially catastrophic impacts to the human environment. Global atmospheric GHG concentrations are substantially affecting the Earth's climate, and the dramatic observed increases in GHG concentrations since 1750 are unequivocally caused by human activities including fossil fuel combustion (IPCC, 2021). Rising GHG levels are causing corresponding increases in average global temperatures and in the frequency and severity of natural disasters including storms, flooding, and wildfires (NASA, 2021). CEQ directs agencies to quantify GHG emissions of proposed actions, place GHG emissions in appropriate context, disclose relevant GHG emissions and relevant climate impacts, and identify alternatives and mitigation measures to avoid or reduce GHG emissions in NEPA reviews.

GHG emissions resulting from the construction of this project are calculated in **Table 6**. Calculations are based on SCAB Fleet Average Emission Factors 2025 and are calculated using the equation:

$$CO2eq = X*CO2 + Y*N2O + Z*CH4$$

Where X = 100 Year Global Warming Potential for Carbon Dioxide = 1
Where Y = 100 Year Global Warming Potential for Nitrous Oxide = 298
Where Z = 100 Year Global Warming Potential for Methane = 25
*CFR Title 40 Chapter I Subchapter C Part 98: Table A-1 Global Warming Potentials

The Royal River Aquatic Ecosystem Restoration will produce 419.54 million tons of carbon dioxide equivalent (CO2eq). The state of Maine produced 16.19 million metric tons of CO2eq in 2021 (State of Maine Priority Climate Action Plan, 2024). The project will produce the equivalent of 0.0026% the annual CO2eq for the state of Maine. Maintenance of the project is expected to have similarly insignificant CO2eq production.

Table 6. Greenhouse Gas Emissions Calculations

Equipment	Hours running	NOX	CO2	CH4	NOX hr	CO2 hr	CH4 hr	CO2eq
AIR COMPRESSOR, 265 CFM (7.5 CMM), 205 PSI (1413 KPA), TRAILER MTD (ADD HOSE)	56.4333	0.2187	88.483	0.0038	12.34	4993.4	0.216065	8,676.11
CONCRETE SAW, 18" MAX DEPTH, HANDHELD, CHAIN SAW, MINIMAL CORNER OVERCUT (ADD COST FOR SAWBLADE WEAR & WATER)	52.6667	0.1256	16.478	0.0018	6.6158	867.83	0.094463	2,841.69
CONCRETE SAW, 18" MAX DEPTH, HANDHELD, CHAIN SAW, MINIMAL CORNER OVERCUT (ADD COST FOR SAWBLADE WEAR & WATER)	56.4333	0.1256	16.478	0.0018	7.0889	929.89	0.101219	3,044.92
CRANE, HYDRAULIC, SELF-PROPELLED, YARD, 10.5 TON (9.5 MT), 32' (9.8 M) BOOM, 4X4	2	0.2298	50.148	0.0034	0.4597	100.3	0.00679	237.44
CRANES, HYDRAULIC, SELF-PROPELLED, ROUGH TERRAIN, 50T (45.4 MT), 110' (33.5 M) BOOM, 4X4	80	0.2705	112.16	0.0049	21.642	8972.7	0.392828	15,431.74

CRANES, HYDRAULIC, TRUCK MTD, ALL TERRAIN, 110T (99.8MT), 168' (51.2M) BOOM, 8X6	16	0.23	80.345	0.0042	3.6805	1285.5	0.066745	2,383.98
DUMP TRUCK, HIGHWAY, 32 KGVW (14.5 MT), 2 AXLE, 4X2 WITH REAR 10 - 13 CY (7.6 - 10.0 M3) DUMP BODY	40	0.0581	7.6244	0.0008	2.3249	304.98	0.033197	998.64
DUMP TRUCK, HIGHWAY, 32 KGVW (14.5 MT), 2 AXLE, 4X2 WITH REAR 10 - 13 CY (7.6 - 10.0 M3) DUMP BODY	48	0.0581	7.6244	0.0008	2.7899	365.97	0.039836	1,198.37
FORK LIFT, ROUGH TERRAIN, 8,000 LB (3629 KG), @ 22' (6.7M) HIGH STRAIGHT MAST, 4X4	80	0.0997	31.225	0.0015	7.9735	2498	0.121506	4,877.12
FORK LIFT, ROUGH TERRAIN, 8,000 LBS @ 22' HIGH STRAIGHT MAST, 4X4	20.5	0.0997	31.225	0.0015	2.0432	640.11	0.031136	1,249.76
GENERATOR SET, TRAILER MTD, 120 KW, 1P - 120/240V, 3P 120/208V, 3P 120/240V, 3P 277/480V	52.6667	0.3885	212.5	0.005	20.459	11192	0.265143	17,295.33
GENERATOR SET, TRAILER MTD, 120 KW, 1P - 120/240V, 3P 120/208V, 3P 120/240V, 3P 277/480V	56.4333	0.3885	212.5	0.005	21.922	11992	0.284106	18,532.25
GRADER, MOTOR, ARTICULATED, 138 HP (103 KW), 12' (3.6 M) BLADE WIDTH	1.2	0.3117	123.92	0.0059	0.374	148.71	0.007056	260.34

GRADER, MOTOR, ARTICULATED, 138 HP (103 KW), 12' (3.6 M) BLADE WIDTH	2.57	0.3117	123.92	0.0059	0.801	318.48	0.015111	557.56
HAMMERS, HYDRAULIC, 5,500 FT-LBS, IMPACT FREQUENCY 430 BPM (ADD 56,000-86,000 LB EXCAVATOR)(ADD COST FOR POINT WEAR)	26.3333	0.1982	112.22	0.0047	5.2204	2955.2	0.123049	4,513.91
HAMMERS, HYDRAULIC, 5,500 FT-LBS, IMPACT FREQUENCY 430 BPM (ADD 56,000-86,000 LB EXCAVATOR)(ADD COST FOR POINT WEAR)	28.2167	0.1982	112.22	0.0047	5.5937	3166.5	0.131849	4,836.75
HAMMERS, HYDRAULIC, 5,500 FT-LBS, IMPACT FREQUENCY 430 BPM (ADD 56,000-86,000 LB EXCAVATOR)(ADD COST FOR POINT WEAR)	80	0.1982	112.22	0.0047	15.859	8977.7	0.37382	13,713.15
HAMMERS, HYDRAULIC, 5,500 FT-LBS, IMPACT FREQUENCY 430 BPM (ADD 56,000-86,000 LB EXCAVATOR)(ADD COST FOR POINT WEAR)	60	0.1982	112.22	0.0047	11.895	6733.3	0.280365	10,284.87

HAMMERS, HYDRAULIC, 5,500 FT-LBS, IMPACT FREQUENCY 430 BPM (ADD 56,000-86,000 LB EXCAVATOR)(ADD COST FOR POINT WEAR)	60	0.1982	112.22	0.0047	11.895	6733.3	0.280365	10,284.87
HYDRAULIC EXCAVATOR, ATTACHMENT, CONCRETE PULVERIZER, CRUSHER, 33.0" JAW OPENING (ADD 40,000 LB MIN HYDRAULIC EXCAVATOR)	26.3333	0.1982	112.22	0.0047	5.2204	2955.2	0.123049	4,513.91
HYDRAULIC EXCAVATOR, ATTACHMENT, CONCRETE PULVERIZER, CRUSHER, 33.0" JAW OPENING (ADD 40,000 LB MIN HYDRAULIC EXCAVATOR)	28.2167	0.1982	112.22	0.0047	5.5937	3166.5	0.131849	4,836.75
HYDRAULIC EXCAVATOR, ATTACHMENT, CONCRETE PULVERIZER, CRUSHER, 33.0" JAW OPENING (ADD 40,000 LB MIN HYDRAULIC EXCAVATOR)	80	0.1982	112.22	0.0047	15.859	8977.7	0.37382	13,713.15

HYDRAULIC EXCAVATOR, ATTACHMENT, CONCRETE PULVERIZER, CRUSHER, 33.0" JAW OPENING (ADD 40,000 LB MIN HYDRAULIC EXCAVATOR)	60	0.1982	112.22	0.0047	11.895	6733.3	0.280365	10,284.87
HYDRAULIC EXCAVATOR, ATTACHMENT, CONCRETE PULVERIZER, CRUSHER, 33.0" JAW OPENING (ADD 40,000 LB MIN HYDRAULIC EXCAVATOR)	60	0.1982	112.22	0.0047	11.895	6733.3	0.280365	10,284.87
HYDRAULIC EXCAVATOR, ATTACHMENT, MATERIAL HANDLING, GRAPPLE, 2-TINE/3-TINE (ADD 45,000-65,000 LB HYDRAULIC EXCAVATOR)	52.6667	0.1982	112.22	0.0047	10.441	5910.3	0.246098	9,027.83
HYDRAULIC EXCAVATOR, ATTACHMENT, MATERIAL HANDLING, GRAPPLE, 2-TINE/3-TINE (ADD 45,000-65,000 LB HYDRAULIC EXCAVATOR)	56.4333	0.1982	112.22	0.0047	11.187	6333	0.263698	9,673.48

HYDRAULIC EXCAVATOR, ATTACHMENT, MATERIAL HANDLING, GRAPPLE, 2-TINE/3-TINE (ADD 45,000-65,000 LB HYDRAULIC EXCAVATOR)	160	0.1982	112.22	0.0047	31.719	17955	0.747639	27,426.31
HYDRAULIC EXCAVATOR, ATTACHMENT, MATERIAL HANDLING, GRAPPLE, 2-TINE/3-TINE (ADD 45,000-65,000 LB HYDRAULIC EXCAVATOR)	120	0.1982	112.22	0.0047	23.789	13467	0.560729	20,569.73
HYDRAULIC EXCAVATOR, ATTACHMENT, MATERIAL HANDLING, GRAPPLE, 2-TINE/3-TINE (ADD 45,000-65,000 LB HYDRAULIC EXCAVATOR)	120	0.1982	112.22	0.0047	23.789	13467	0.560729	20,569.73
HYDRAULIC EXCAVATOR, CRAWLER, 115,700 LBS (52.5 MT), 4.05 CY (3.1 M3) BUCKET, 28' 10" (8.79M) MAX DIGGING DEPTH	79.35	0.1982	112.22	0.0047	15.73	8904.8	0.370782	13,601.73
HYDRAULIC EXCAVATOR, CRAWLER, 30,000 LB (13,608 KG), 0.75 CY (0.6 M3) BUCKET,	2.4	0.1982	112.22	0.0047	0.4758	269.33	0.011215	411.39

19.6' (5.9 M) MAX DIGGING DEPTH								
HYDRAULIC EXCAVATOR, CRAWLER, 30,000 LB (13,608 KG), 0.75 CY (0.6 M3) BUCKET, 19.6' (5.9 M) MAX DIGGING DEPTH	3.8	0.1982	112.22	0.0047	0.7533	426.44	0.017756	651.37
HYDRAULIC EXCAVATOR, CRAWLER, 52,650 LBS, 1.48 CY BUCKET, 21.5' MAX DIGGING DEPTH	1.9531	0.1982	112.22	0.0047	0.3872	219.18	0.009126	334.79
HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	52.6667	0.1982	112.22	0.0047	10.441	5910.3	0.246098	9,027.83
HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	56.4333	0.1982	112.22	0.0047	11.187	6333	0.263698	9,673.48
HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	160	0.1982	112.22	0.0047	31.719	17955	0.747639	27,426.31
HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	120	0.1982	112.22	0.0047	23.789	13467	0.560729	20,569.73

HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	120	0.1982	112.22	0.0047	23.789	13467	0.560729	20,569.73
HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	40	0.1982	112.22	0.0047	7.9297	4488.9	0.18691	6,856.58
HYDRAULIC EXCAVATOR, CRAWLER, 53,800 LBS, 0.69 CY BUCKET, 38.3' MAX DIGGING DEPTH	48	0.1982	112.22	0.0047	9.5156	5386.6	0.224292	8,227.89
HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	16.0256	0.1982	112.22	0.0047	3.1769	1798.4	0.074884	2,747.02
HYDRAULIC EXCAVATOR, CRAWLER, 55,000 LB (24,948 KG), 1.50 CY (1.2 M3) BUCKET, 23.3' (7.1 M) MAX DIGGING DEPTH	16.0256	0.1982	112.22	0.0047	3.1769	1798.4	0.074884	2,747.02
HYDRAULIC EXCAVATOR, CRAWLER, 57,200 LBS, 1.56 CY BUCKET, 22' MAX DIGGING DEPTH	52.6667	0.1982	112.22	0.0047	10.441	5910.3	0.246098	9,027.83

HYDRAULIC EXCAVATOR, CRAWLER, 57,200 LBS, 1.56 CY BUCKET, 22' MAX DIGGING DEPTH	56.4333	0.1982	112.22	0.0047	11.187	6333	0.263698	9,673.48
HYDRAULIC EXCAVATOR, CRAWLER, 57,200 LBS, 1.56 CY BUCKET, 22' MAX DIGGING DEPTH	160	0.1982	112.22	0.0047	31.719	17955	0.747639	27,426.31
HYDRAULIC EXCAVATOR, CRAWLER, 57,200 LBS, 1.56 CY BUCKET, 22' MAX DIGGING DEPTH	120	0.1982	112.22	0.0047	23.789	13467	0.560729	20,569.73
HYDRAULIC EXCAVATOR, CRAWLER, 57,200 LBS, 1.56 CY BUCKET, 22' MAX DIGGING DEPTH	120	0.1982	112.22	0.0047	23.789	13467	0.560729	20,569.73
LOADER / BACKHOE, WHEEL, 1.0 CY (0.76 M3) FRONT END BUCKET, 24" (61 CM) DIP, 6.2 CF (0.18 M3), 14.5' (4.4 M) DIGGING DEPTH, 4X2	1.2	0.2476	58.914	0.0036	0.2972	70.696	0.004301	159.36
LOADER / BACKHOE, WHEEL, 1.0 CY (0.76 M3) FRONT END BUCKET, 24" (61 CM) DIP, 6.2 CF (0.18 M3), 14.5' (4.4 M) DIGGING DEPTH, 4X2	20.5	0.2476	58.914	0.0036	5.0765	1207.7	0.073468	2,722.36

LOADER, FRONT END, CRAWLER, 2.3 CY (1.7 M3) BUCKET	1.2	0.2476	58.914	0.0036	0.2972	70.696	0.004301	159.36
LOADER, FRONT END, CRAWLER, 2.3 CY (1.7 M3) BUCKET	1.6957	0.2476	58.914	0.0036	0.4199	99.9	0.006077	225.19
LOADER, FRONT END, CRAWLER, 3CY-4CY (2.3M3-3.1M3) BUCKET	32	0.2476	58.914	0.0036	7.9243	1885.2	0.114682	4,249.54
LOADER, FRONT END, CRAWLER, 3CY-4CY (2.3M3-3.1M3) BUCKET	2	0.2476	58.914	0.0036	0.4953	117.83	0.007168	265.60
LOADER, FRONT END, CRAWLER, 3CY-4CY (2.3M3-3.1M3) BUCKET	32	0.2476	58.914	0.0036	7.9243	1885.2	0.114682	4,249.54
LOADER, FRONT END, TRACKED, 0.63 CY, 84" WIDE BUCKET	5.48	0.2476	58.914	0.0036	1.357	322.85	0.019639	727.73
LOADER, FRONT END, TRACKED, 0.63 CY, 84" WIDE BUCKET	16	0.2476	58.914	0.0036	3.9622	942.62	0.057341	2,124.77
LOADER, FRONT END, TRACKED, 0.63 CY, 84" WIDE BUCKET	3.44	0.2476	58.914	0.0036	0.8519	202.66	0.012328	456.83
LOADER, FRONT END, TRACKED, 0.63 CY, 84" WIDE BUCKET	8	0.2476	58.914	0.0036	1.9811	471.31	0.02867	1,062.39
LOADER, FRONT END, WHEEL, 2.0 CY (1.5 M3) BUCKET, ARTICULATED, 4X4	1.2	0.2476	58.914	0.0036	0.2972	70.696	0.004301	159.36
LOADER, FRONT END, WHEEL, 2.0 CY (1.5 M3) BUCKET, ARTICULATED, 4X4	1.9	0.2476	58.914	0.0036	0.4705	111.94	0.006809	252.32
LOADER, FRONT END, WHEEL, 2.0 CY	12.025	0.2476	58.914	0.0036	2.9778	708.43	0.043095	1,596.90

(1.5 M3) BUCKET, ARTICULATED, 4X4								
LOADER, FRONT END, WHEEL, 2.0 CY (1.5 M3) BUCKET, ARTICULATED, 4X4	2.0825	0.2476	58.914	0.0036	0.5157	122.69	0.007463	276.55
LOADER, FRONT END, WHEEL, 3.80 CY (2.9 M3) BUCKET, ARTICULATED, 4X4	0.2763	0.2476	58.914	0.0036	0.0684	16.278	0.00099	36.69
LOADER, FRONT END, WHEEL, SKID-STEER, 10.5 CF (0.3 M3), 62" (1.6 M) BUCKET	3.4	0.1446	25.519	0.0017	0.4915	86.765	0.005944	233.38
LOADER, FRONT END, WHEEL, SKID-STEER, 10.5 CF (0.3 M3), 62" (1.6 M) BUCKET	10.5	0.1446	25.519	0.0017	1.5179	267.95	0.018356	720.75
LOADER, FRONT END, WHEEL, SKID-STEER, 10.5 CF (0.3 M3), 62" (1.6 M) BUCKET	2.2	0.1446	25.519	0.0017	0.318	56.142	0.003846	151.01
LOADER, FRONT END, WHEEL, SKID-STEER, 10.5 CF (0.3 M3), 62" (1.6 M) BUCKET	6.5	0.1446	25.519	0.0017	0.9397	165.87	0.011363	446.18
LOADER, FRONT END, WHEEL, SKID-STEER, 9-11 CF (0.2-0.3 M3), 60" (1.5 M) BUCKET {BOBCAT}, 13 CWT (590 KG)	8.5313	0.1446	25.519	0.0017	1.2333	217.71	0.014914	585.61
LOADER, FRONT END, WHEEL, SKID-STEER, 9-11 CF (0.2-0.3 M3), 60" (1.5 M)	10.72	0.1446	25.519	0.0017	1.5497	273.57	0.018741	735.85

BUCKET {BOBCAT}, 13 CWT (590 KG)								
LOADER, FRONT END, WHEEL, SKID-STEER, 9-11 CF (0.2-0.3 M3), 60" (1.5 M) BUCKET {BOBCAT}, 13 CWT (590 KG)	5.4063	0.1446	25.519	0.0017	0.7815	137.96	0.009451	371.10
LOADER, FRONT END, WHEEL, SKID-STEER, 9-11 CF (0.2-0.3 M3), 60" (1.5 M) BUCKET {BOBCAT}, 13 CWT (590 KG)	6.76	0.1446	25.519	0.0017	0.9772	172.51	0.011818	464.02
ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 22 TON (20.0 MT), 84" (1.2 M) WIDE, SOIL COMPACTOR	1.2	0.2501	67.031	0.0037	0.3001	80.437	0.004435	169.97
ROLLER, VIBRATORY, SELF-PROPELLED, SINGLE DRUM, SMOOTH, 22 TON (20.0 MT), 84" (1.2 M) WIDE, SOIL COMPACTOR	2.57	0.2501	67.031	0.0037	0.6427	172.27	0.009498	364.03
ROLLER, VIBRATORY, TOWED, SINGLE DRUM, SHEEPSFOOT, 25.5 TON (23.1 MT), 72" (1.8 M) WIDE, SHEEPSFOOT (ADD 180HP (135KW) TOWING UNIT)	4.5333	0.2501	67.031	0.0037	1.1336	303.87	0.016754	642.11
ROLLER, VIBRATORY, TOWED, SINGLE	2.928	0.2501	67.031	0.0037	0.7322	196.27	0.010821	414.73

DRUM, SHEEPSFOOT, 25.5 TON (23.1 MT), 72" (1.8 M) WIDE, SHEEPSFOOT (ADD 180HP (135KW) TOWING UNIT)								
TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	14.95	0.2157	171.74	0.0057	3.2249	2567.5	0.085437	3,530.61
TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	6.4002	0.2157	171.74	0.0057	1.3806	1099.2	0.036576	1,511.48
TRACTOR, CRAWLER (DOZER), 181-250 HP (135-186 KW), POWERSHIFT, LGP, W/UNIVERSAL BLADE	100	0.2157	171.74	0.0057	21.571	17174	0.571487	23,616.13
TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	1.2	0.2157	171.74	0.0057	0.2589	206.08	0.006858	283.39
TRACTOR, CRAWLER (DOZER), 300-340 HP (224-254 KW), POWERSHIFT, W/UNIVERSAL BLADE	2.57	0.2157	171.74	0.0057	0.5544	441.36	0.014687	606.93
TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	1.6	0.2157	171.74	0.0057	0.3451	274.78	0.009144	377.86
TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW),	2.5333	0.2157	171.74	0.0057	0.5465	435.06	0.014477	598.27

POWERSHIFT, W/UNIVERSAL BLADE								
TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	16.0333	0.2157	171.74	0.0057	3.4585	2753.5	0.091628	3,786.44
TRACTOR, CRAWLER (DOZER), 76-100 HP (57-75 KW), POWERSHIFT, W/UNIVERSAL BLADE	2.8	0.2157	171.74	0.0057	0.604	480.86	0.016002	661.25
TRACTOR, CRAWLER (DOZER), OVER 600 HP (447 KW), POWERSHIFT, W/UNIVERSAL BLADE	1.2	0.2157	171.74	0.0057	0.2589	206.08	0.006858	283.39
TRACTOR, CRAWLER (DOZER), OVER 600 HP (447 KW), POWERSHIFT, W/UNIVERSAL BLADE	2.7782	0.2157	171.74	0.0057	0.5993	477.12	0.015877	656.10
TRUCK OPTIONS, DUMP BODY, REAR, 10CY (7.6M3), AIR GATE (W/HOIST) (ADD 35KGVW (15.9MT) TRUCK)	1.9531	0.2679	135.58	0.0055	0.5232	264.81	0.010715	420.98
TRUCK OPTIONS, DUMP BODY, REAR, 16 CY (12.2 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	16.0256	0.2679	135.58	0.0055	4.2927	2172.8	0.087917	3,454.23
TRUCK OPTIONS, DUMP BODY, REAR, 16 CY (12.2 M3), AIR GATE (W/HOIST)	16.0256	0.2679	135.58	0.0055	4.2927	2172.8	0.087917	3,454.23

(ADD 50KGVW (22.7 MT) TRUCK)								
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	5	0.2679	135.58	0.0055	1.3393	677.92	0.02743	1,077.72
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	1	0.2679	135.58	0.0055	0.2679	135.58	0.005486	215.54
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	5	0.2679	135.58	0.0055	1.3393	677.92	0.02743	1,077.72
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	31.25	0.2679	135.58	0.0055	8.3708	4237	0.171439	6,735.77
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	3	0.2679	135.58	0.0055	0.8036	406.75	0.016458	646.63
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	10.4165	0.2679	135.58	0.0055	2.7902	1412.3	0.057146	2,245.22

TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	4.75	0.2679	135.58	0.0055	1.2724	644.02	0.026059	1,023.84
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	95.2	0.2679	135.58	0.0055	25.501	12908	0.522273	20,519.84
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	20	0.2679	135.58	0.0055	5.3573	2711.7	0.109721	4,310.89
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	21.2	0.2679	135.58	0.0055	5.6787	2874.4	0.116304	4,569.54
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	160	0.2679	135.58	0.0055	42.858	21693	0.877769	34,487.13
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	120	0.2679	135.58	0.0055	32.144	16270	0.658327	25,865.34
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST)	120	0.2679	135.58	0.0055	32.144	16270	0.658327	25,865.34

(ADD 50KGVW (22.7 MT) TRUCK)								
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	40	0.2679	135.58	0.0055	10.715	5423.4	0.219442	8,621.78
TRUCK OPTIONS, DUMP BODY, REAR, 20.0 CY (15.3 M3), AIR GATE (W/HOIST) (ADD 50KGVW (22.7 MT) TRUCK)	48	0.2679	135.58	0.0055	12.857	6508	0.263331	10,346.14
TRUCK OPTIONS, FLATBED, W/40" (1M) SIDE RACKS, 8' X 20' (2.4M X 6.1M)	2.5	0.2021	122.51	0.004	0.5054	306.26	0.009975	457.11
TRUCK OPTIONS, FLATBED, W/40" SIDE RACKS, 8' X 24'	20.5	0.2021	122.51	0.004	4.1439	2511.4	0.081798	3,748.29
TRUCK, HIGHWAY, 20KGVW (9000KG), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	0.0339	0.2376	125.09	0.0056	0.0081	4.2405	0.00019	6.65
TRUCK, HIGHWAY, 20KGVW (9000KG), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	0.1313	0.2376	125.09	0.0056	0.0312	16.424	0.000736	25.74
TRUCK, HIGHWAY, 20KGVW (9000KG), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	1.04	0.2376	125.09	0.0056	0.2471	130.09	0.005832	203.89
TRUCK, HIGHWAY, 20KGVW (9000KG), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	0.18	0.2376	125.09	0.0056	0.0428	22.516	0.001009	35.29
TRUCK, HIGHWAY, 20KGVW (9000KG), 2	9.8769	0.2376	125.09	0.0056	2.3472	1235.5	0.055389	1,936.32

AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)								
TRUCK, HIGHWAY, 26 KGVW (11.8 MT), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	11.9983	0.2376	125.09	0.0056	2.8513	1500.8	0.067285	2,352.21
TRUCK, HIGHWAY, 26 KGVW (11.8 MT), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	11.9983	0.2376	125.09	0.0056	2.8513	1500.8	0.067285	2,352.21
TRUCK, HIGHWAY, 26 KGVW (11.8 MT), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	2.5	0.2376	125.09	0.0056	0.5941	312.72	0.01402	490.11
TRUCK, HIGHWAY, 37 KGVW (16.8 MT), 2 AXLE, 4X2 (CHASSIS ONLY-ADD OPTIONS)	1.9531	0.2521	166.55	0.0066	0.4925	325.28	0.012859	472.36
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	16	0.2521	166.55	0.0066	4.0344	2664.7	0.105343	3,869.61
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	16	0.2521	166.55	0.0066	4.0344	2664.7	0.105343	3,869.61
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	37.0513	0.2521	166.55	0.0066	9.3424	6170.7	0.243943	8,960.87
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	1	0.2521	166.55	0.0066	0.2521	166.55	0.006584	241.85
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	37.0513	0.2521	166.55	0.0066	9.3424	6170.7	0.243943	8,960.87
TRUCK, HIGHWAY, 45,000 LB (20,412 KG)	31.25	0.2521	166.55	0.0066	7.8797	5204.5	0.205748	7,557.82

GVW, 4X2, 2 AXLE (ADD ACCESSORIES)								
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	3	0.2521	166.55	0.0066	0.7564	499.64	0.019752	725.55
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	10.4165	0.2521	166.55	0.0066	2.6265	1734.8	0.068582	2,519.23
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	4.75	0.2521	166.55	0.0066	1.1977	791.09	0.031274	1,148.79
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	95.2	0.2521	166.55	0.0066	24.005	15855	0.62679	23,024.15
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	20	0.2521	166.55	0.0066	5.043	3330.9	0.131679	4,837.01
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	21.2	0.2521	166.55	0.0066	5.3456	3530.8	0.139579	5,127.23
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	160	0.2521	166.55	0.0066	40.344	26647	1.053429	38,696.06
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	120	0.2521	166.55	0.0066	30.258	19985	0.790072	29,022.04
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	120	0.2521	166.55	0.0066	30.258	19985	0.790072	29,022.04
TRUCK, HIGHWAY, 45,000 LB (20,412 KG)	40	0.2521	166.55	0.0066	10.086	6661.8	0.263357	9,674.01

GVW, 4X2, 2 AXLE (ADD ACCESSORIES)								
TRUCK, HIGHWAY, 45,000 LB (20,412 KG) GVW, 4X2, 2 AXLE (ADD ACCESSORIES)	48	0.2521	166.55	0.0066	12.103	7994.2	0.316029	11,608.82
TRUCK, HIGHWAY, 50,000 LB (22,680 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	48	0.2521	166.55	0.0066	12.103	7994.2	0.316029	11,608.82
TRUCK, HIGHWAY, 50,000 LB (22,680 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	16	0.2521	166.55	0.0066	4.0344	2664.7	0.105343	3,869.61
TRUCK, HIGHWAY, 50,000 LB (22,680 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	32	0.2521	166.55	0.0066	8.0688	5329.5	0.210686	7,739.21
TRUCK, HIGHWAY, 50,000 LB (22,680 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	1.2	0.2521	166.55	0.0066	0.3026	199.85	0.007901	290.22
TRUCK, HIGHWAY, 50,000 LB (22,680 KG) GVW, 6X4, 3 AXLE (ADD ACCESSORIES)	2.57	0.2521	166.55	0.0066	0.648	428.02	0.016921	621.56
TRUCK, HIGHWAY, 52,000 LBS GVW, 3 AXLE, 6X4 (CHASSIS ONLY-ADD OPTIONS)	20.5	0.2521	166.55	0.0066	5.1691	3414.2	0.134971	4,957.93
TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X2	11.9983	0.2376	125.09	0.0056	2.8513	2.8513	0.067285	854.22
TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X2	11.9983	0.2376	125.09	0.0056	2.8513	2.8513	0.067285	854.22
TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X2	16	0.2376	125.09	0.0056	3.8023	3.8023	0.089726	1,139.12

TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X4	52	0.2376	125.09	0.0056	12.357	12.357	0.29161	3,702.13
TRUCK, HIGHWAY, CONVENTIONAL, 3/4 TON PICKUP, 4X4	16	0.2376	125.09	0.0056	3.8023	2001.4	0.089726	3,136.72

Total lbs.	924,920.88
Total MT	419.53671
Maine Total MT	16,118,550
Percentage	0.0026028

NOX - Nitrogen oxide
CO2 – Carbon dioxide
CH4 – Methane

1.10 REFERENCES

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1.11 ACRONYMS AND ABBREVIATIONS

CEQ	Council on Environmental Quality
CO2eq	Carbon Dioxide Equivalent
CPUE	Catch per Unit Effort
DMR	Department of Marine Resources
GHGs	Greenhouse Gases
HEC-RAS	Hydrologic Engineering Center's River Analysis System (USACE)
MFR	Memorandum for Record
NAD	North Atlantic Division
NEPA	National Environmental Policy Act
TSP	Tentatively Selected Plan
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WRDA	Water Resources Development Act

SECTION 2.0 CULTURAL RESOURCES

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD, MA 01742-2751

June 3, 2024

Planning Division
Environmental Branch

Mr. Kirk Mohney, Director and State Historic Preservation Officer Maine Historic Preservation Commission
55 Capitol Street, 65 State House Station Augusta, Maine, 04333-0065

Dear Mr. Mohney:

The U.S. Army Corps of Engineers (USACE), New England District, is preparing an integrated Detailed Project Report and Environmental Assessment (DPR/EA) for a proposed Section 206 Aquatic Ecosystem Restoration study of the Royal River from the Bridge Street Dam upstream to Baston Park including the East Elm Street Dam in Yarmouth and North Yarmouth, Maine. We would like your formal comments on the following undertaking in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended. See enclosed figures.

The purpose of this study is to examine the feasibility of restoring riverine fish passage and aquatic habitat on the Royal River in Yarmouth and North Yarmouth. The project area encompasses two low head dams (Bridge Street and East Elm Street) and one natural falls (Middle Falls) on the river and 7.01 miles of the waterway from the head-of-tide to the upstream limit of the East Elm Street impoundment. The main impediment to fish passage in the Royal River is the presence of the two dams built in the 1800’s and the naturally occurring falls (Middle Falls) that are obstructions.

The DPR/EA documents an array of alternatives that the study team considered for fish passage restoration including a combination of dam removal, fish ladder removal or replacement at Bridge Street and East Elm

Street Dam, and/or in-stream modification of the side channel at Middle Falls. After evaluation of these alternatives, the team chose the demolition and removal of the Bridge Street and East Elm Street Dams and fish ladders with modification of the side channel at Middle Falls to allow fish passage as the Tentatively Selected Plan.

The Area of Potential Effect (APE) is composed of both direct and indirect effects, with direct effects consisting of the removal of the East Elm Street and Bridge Street dams and fish ladders at each impoundment, and at the Middle Falls area where an in-stream modifications are proposed requiring construction access, staging, and possible ledge removal of the adjacent bank. Removal of the Bridge Street Dam would constitute an adverse effect upon a contributing element of the National Register of Historic Places (NRHP) eligible Royal River Manufacturing Company historic district.

Dam removal would also have an indirect effect upon the district as a whole. Lastly, removal of the two dams will result in the drawdown of current river levels, which may expose previously inundated archaeological sites along the banks, from about Baston Park in North Yarmouth south to downstream of the Bridge Street Dam.

No NRHP listed properties are located within the APE. The Bridge Street Dam is eligible for listing on the NRHP, as part of the Royal River Manufacturing Company which dates from 1857-1917. In addition to the dam itself, the proposed district includes the Sparhawk Mill (circa 1857), a cotton textile mill at 81 Bridge Street; an office and associated barn (80 Bridge Street); a house and barn (100 Bridge Street) built by mill owner Phillip Kimball; and boarding houses for the mill workers (107 and 109 Bridge Street). The mill was redeveloped into office space in 1992 and is still in use today.

Royal River Park, the town-owned recreation area along the west bank of the river, was once the site of the Yarmouth Paper Company and later, the Forest Paper Company pulp mill which extended across both sides of the Royal River and where bridge abutments are still present. Although the park has been heavily modified during construction in the 1990's with walking trails and paths with interpretive panels of the former industrial activity, there is still the potential for archaeological deposits to be present in some areas. Several foundations of the former mill have been incorporated into the design of the park and are visible along the paths.

According to Dr. Arthur Spiess, Maine State Archaeologist, there are no recorded archaeological sites in the Maine Historic Preservation Commission's inventory from East Elm Street to below the Bridge Street dam to the head of tide falls. There is the potential for undiscovered pre-Contact archaeological sites; however, no evidence has been identified on the surface in exposed soils along riverside paths downstream of the East Elm Street dam. Woodland Period (from about 2,800 to 500 years ago) archaeological sites may be present on or near the banks of the river upstream of East Elm Street, with one known pre-Contact site (#14.159) recorded for this area in the information provided by Dr. Spiess.

Because we cannot fully determine how the project may affect historic properties prior to finalization of this feasibility study, we propose to enter into a Programmatic Agreement (PA) (36 CFR 800.14(b)(3)) which will outline the process to identify and evaluate historic properties and avoid, minimize, and, where possible, mitigate for any adverse effects in accordance with Section 106 of the NHPA and implementing regulations (36 CFR 800). The PA allows us to complete the necessary historic, architectural, and archaeological surveys during the follow-on Design and Implementation phases of the project, when the final project design is completed and the dams and fish ladders have been removed. The draft PA will be provided under separate cover for your review and comment and will also be provided to identified interested parties including Tribes and the Yarmouth Historical Society.

Therefore, pursuant to 36 CFR 800.4(b)(2) and 36 CFR 800.14(b)(1)(ii), we defer final identification and evaluation of historic properties until after project approval when additional funding becomes available during the design and construction phases, and through execution of an approved PA. We would appreciate your concurrence with this determination. We will also contact the Advisory Council on Historic Preservation regarding development of the PA.

If you have any questions, please contact Ms. Janet Cote, Project Manager at 978-318-8728 or by email at Janet.Cote@usace.army.mil or Mr. Marc Paiva, Archaeologist at 978-318-8796 or by email at Marcos.A.Paiva@usace.army.mil.

Sincerely,

Wendy C. Gendron

Digitally signed by GENDRON.WENDY.C.138282532 9
Date: 2024.06.04 09:26:22 -04'00'

Chief, Planning Branch

Enclosures

Copies furnished:
Yarmouth Town Manager
Mi'kmaq Nation THPO
Houlton Band of Maliseets THPO
Passamaquoddy Tribe THPO
Penobscot Tribe THPO
Yarmouth Historical Society
Yarmouth Community Alliance for Racial Equity
Royal River Conservation Trust

Figure 5. Bridge Street Dam Area

Figure 6. East Elm Street Dam Area

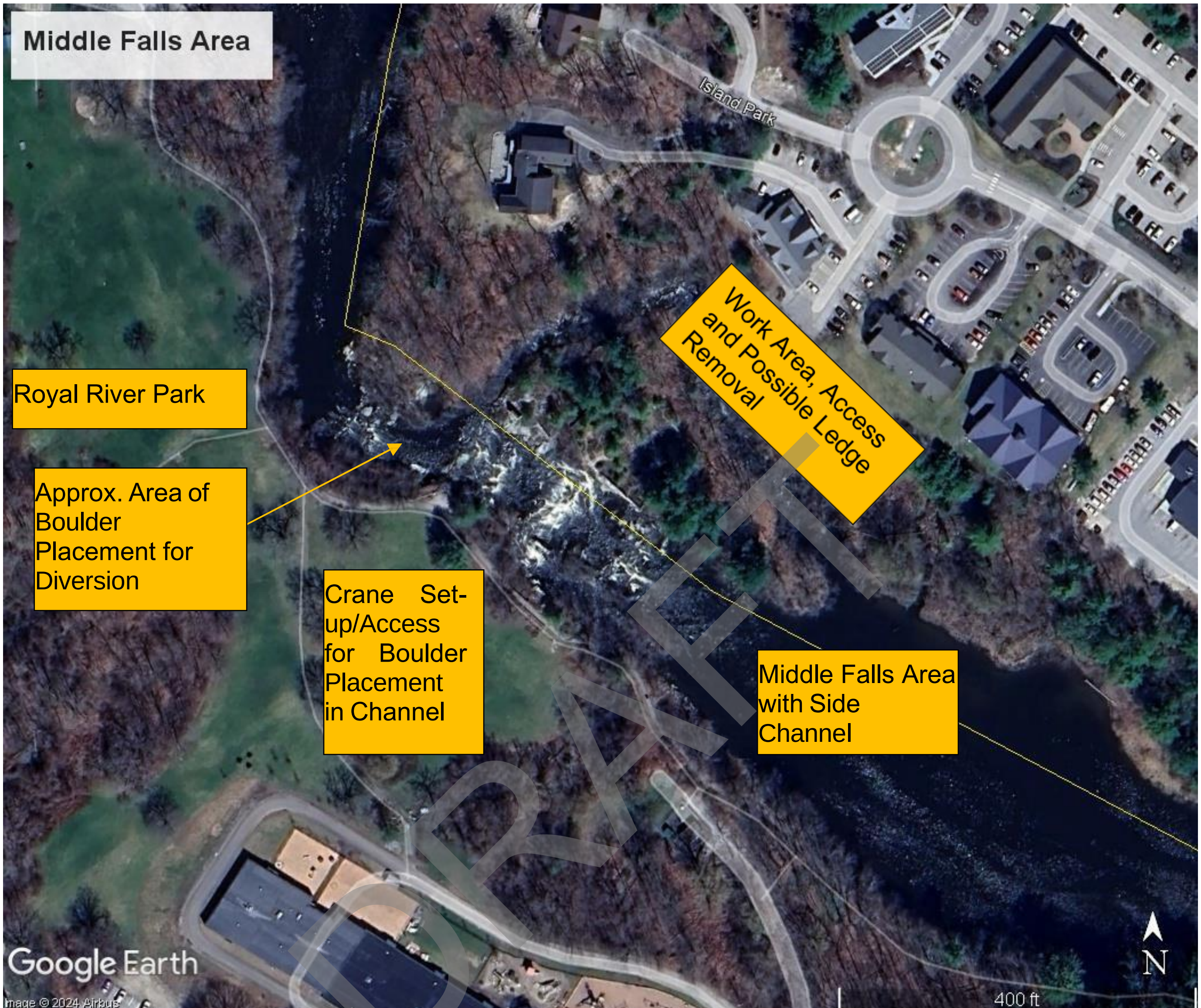

Figure 7. Middle Falls Area

SECTION 3.0 PUBLIC COMMENTS

Royal River Section 206 Aquatic Ecosystem Restoration Study
Public Comments Received to Date

COMMENT NO.	DATE OF LETTER	ORGANIZATION	COMMENT
1	2/5/2024	Private Citizen	1. Invasive Species overtaking areas exposed in the East Elm Street Dam impoundment if the dams are removed. 2. Invasive Species overtaking areas exposed in the Bridge Street Dam impoundment if the dams are removed. 3. Create a fish way using the back channel behind Gooch Island.
2	2/6/2024	Private Citizen	1. Repairing the existing fish ladders 2. Notes from the meeting with the marina owners. 3. Clean Water Act compliance if the dams remain in place.
3	2/7/2024	North Yarmouth	Concern about water level in the Royal River to support firefighting.
4	2/13/2024	Private Citizen	Dissolved oxygen levels in the Royal River.
5	2/15/2024	Private Citizen	Dissolved oxygen levels in the Royal River.
6	2/19/2024	Private Citizen	Concerns about partial removal of the dam and repair of the remaining dam
7	2/20/2024	Private Citizen	Provided pictures of his property and E. Elm Street dam
8	3/3/2024	Royal River Conservation Trust	Concerns about the H&H modeling not going upstream passed Rt 9.
9	4/26/2024	Private Citizen	Concern about impacts to private property
10	4/28/2024	Private Citizen	Sediment transport and disposition on private property.
11	5/8/2024	Private Citizen	Change of water flow near his property and Gooch Island. Repairs to the remaining East Elm Street dam.
12	5/11/2024	Private Citizen	Agreement between the town and the property owner regarding maintenance of the East Elm Street Dam.
13	5/13/2024	Private Citizen	Impacts on Gooch Island resulting from the TSP
14	5/14/2024	Private Citizen	Concerns about Gooch Island if there is a partial dam removal
15	5/14/2024	The Maine Monitor	Requested information about the study
16	5/15/2024	Yarmouth Boat Yard	1. Sediment contamination 2. Project costs 3. Water velocities due to implantation of the study 4. Dredging in the area of the marinas

17	5/20/2024	Private Citizen	Recreational activities after the removal of the dams.
18	5/22/2024	Private Citizen	Meeting with private property owners whose properties will be affected by the project
19	5/23/2024	Royal River Conservation Trust	1. Coordination with Yarmouth Wabanaki residents 2. Impacts to recreations activities (East Elm Street boat ramp)
20	5/31/2024	Private Citizen	Change in water levels at the Middle Falls
21	6/7/2024	Royal River Conservation Trust	Impacts to Gooch Island

SECTION 4.0 ESSENTIAL FISH HABITAT

NOAA Fisheries Greater Atlantic Regional Fisheries Office
Essential Fish Habitat (EFH) Assessment & Fish and Wildlife Coordination Act (FWCA) Consultation Worksheet
August 2021 rev.

Authorities

The Magnuson Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA Fisheries on any action or proposed action authorized, funded, or undertaken by such agency that may adversely affect essential fish habitat (EFH) identified under the MSA. This process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation of EFH assessments and generally outlines each agency's obligations in the consultation process.

The Fish and Wildlife Coordination Act (FWCA) requires that all federal agencies consult with NOAA Fisheries when proposed actions might result in modifications to a natural stream or body of water. The FWCA also requires that federal agencies consider the effects that these projects would have on fish and wildlife and must also provide for improvement of these resources. Under the FWCA, we work to protect, conserve and enhance species and habitats for a wide range of aquatic resources such as shellfish, diadromous species, and other commercially and recreationally important species that are not federally managed and do not have designated EFH.

It is important to note that these consultations take place between NOAA Fisheries and federal action agencies. **As a result, EFH assessments, including this worksheet, must be provided to us by the federal agency, not by permit applicants or consultants.**

Use of the Worksheet

This worksheet can serve as an EFH assessment for **Abbreviated EFH Consultations**, and as a means to provide information on potential effects to other NOAA trust resources considered under the FWCA. An abbreviated consultation allows us to determine quickly whether, and to what degree, a federal action may adversely affect EFH. Abbreviated consultation procedures can be used when federal actions do not have the potential to cause substantial adverse effects on EFH and when adverse effects could be alleviated through minor modifications.

The intent of the EFH worksheet is to provide a guide for determining the information needed to fully assess the effects of a proposed action on EFH. In addition, the worksheet may be used as a tool to assist you in developing a more comprehensive EFH assessment for larger projects that may have more substantial adverse effects to EFH. However, for large, complex projects that have the potential for significant adverse effects, an **Expanded EFH Consultation** may be warranted and the use of this worksheet alone is not appropriate as your EFH assessment.

An **adverse effect** is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Consultation under the MSA is not required if there is no adverse effect on EFH or if no EFH has been designated in the project area. However, because the definition of "adverse effect" is very broad, most in-water work will result in some level of adverse effect requiring consultation with us, even if the impact is temporary or the overall result of the project is habitat restoration or enhancement. It is important to remember that an adverse effect determination is a trigger to consult with us. It does not mean that a project cannot proceed as proposed, or that project modifications are necessary. An adverse effect determination under the EFH provisions of the MSA simply means that the effects of the proposed action on EFH must be evaluated to determine if there are ways to avoid, minimize, or offset adverse effects. Additional details on EFH consultations, tools, and resources, including frequently asked questions can be found on our website.

Instructions

This worksheet should be used as your EFH assessment for **Abbreviated EFH Consultations** or as a guide to develop your EFH assessment. It is not appropriate to use this worksheet as your EFH assessment for large, complex projects, or those requiring an Expanded EFH Consultation.

When completed fully and with sufficient information to clearly describe the activities proposed, habitats affected, and project impacts, as well as the measures taken to avoid, minimize or offset any unavoidable adverse effects, this worksheet provides us with required components of an EFH assessment including:

1. A description of the proposed action.
2. An analysis of the potential adverse effects on EFH and the federally managed species.
3. The federal agency's conclusions regarding the effects of the action on EFH.
4. Proposed mitigation, if applicable.

When completing this worksheet and submitting information to us, it is important to ensure that sufficient information is provided to clearly describe the proposed project and the activities proposed. At a minimum, this should include the public notice (if applicable) or project application and project plans showing:

- location map of the project site with area of impact.
- existing and proposed conditions.
- all in-water work and the location of all proposed structures and/or fill.
- all waters of the U.S. on the project site with mean low water (MLW), mean high water (MHW), high tide line (HTL), and water depths clearly marked.
- Habitat Areas of Particular Concern (HAPCs).
- sensitive habitats mapped, including special aquatic sites (submerged aquatic vegetation, saltmarsh, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges), hard bottom or natural rocky habitat areas, and shellfish beds.
- site photographs, if available.

Your analysis of effects **should focus on impacts that reduce the quality and/or quantity of the habitat or result in conversion to a different habitat type** for all life stages of species with designated EFH within the action area. Simply stating that fish will move away or that the project will only affect a small percentage of the overall population is not a sufficient analysis of the effects of an action on EFH. Also, since the intent of the EFH consultation is to evaluate the direct, indirect, individual and cumulative effects of a particular federal action on EFH and to identify options to avoid, minimize or offset the adverse effects of that action, is it not appropriate to conclude that an impact is minimal just because the area affected is a small percentage of the total area of EFH designated. The focus of the consultation is to reduce impacts resulting from the activities evaluated in the assessment. Similarly, a large area of distribution or range of the fish species is also not appropriate rationale for concluding the impacts of a particular project are minimal.

Use the information on the our EFH consultation website and NOAA's EFH Mapper to complete this worksheet. The mapper is a useful tool for viewing the spatial distribution of designated EFH and HAPCs. Because summer flounder HAPC (defined as: " all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH") does not have region-wide mapping, local sources and on-site surveys may be needed to identify submerged aquatic vegetation beds within the project area. The full designations for each species may be viewed as PDF links provided for each species within the Mapper, or via our website links to the New England Fishery Management Councils Omnibus Habitat Amendment 2 (Omnibus EFH Amendment), the Mid-Atlantic Fishery Management Councils FMPs (MAMFC - Fish Habitat), or the Highly Migratory Species website. Additional information on species specific life histories can be found in the EFH source documents accessible through the Habitat and Ecosystem Services Division website. This information can be useful in evaluating the effects of a proposed action. Habitat and Ecosystem Services Division (HESD) staff have also developed a technical memorandum *Impacts to Marine Fisheries Habitat from Non-fishing Activities in the Northeastern United States,* NOAA Technical Memorandum NMFS-NE-209 to assist in evaluating the effects of non-fishing activities on EFH. If you have questions, please contact the HESD staff member in your area to assist you.

Federal agencies or their non-federal designated lead agency should email the completed worksheet and necessary attachments to the HESD New England (ME, NH, MA, CT, RI) or Mid- Atlantic (NY, NJ, PA, DE, MD, VA) Branch Chief and the regional biologist listed on the Contact Regional Office Staff section on our EFH consultation website and listed below.

We will provide our EFH conservation recommendations under the MSA, and recommendations under the FWCA, as appropriate, within 30 days of receipt of a **complete** EFH assessment for an abbreviated consultation. Please ensure that the EFH worksheet is completed in full and includes detail to minimize delays in completing the consultation. If we are unable to assess potential impacts based on the information provided, we may request additional information necessary to assess the effects of the proposed action on our trust resources before we can begin a consultation. If the worksheet is not completely filled out, it may be returned to you for completion. **The EFH consultation and our response clock does not begin until we have sufficient information upon which to consult**.

If this worksheet is not used, you should include all the information required to complete this worksheet in your EFH assessment. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. You may need to prepare a more detailed EFH assessment for more substantial or complex projects to fully characterize the effects of the project and the avoidance and minimization of impacts to EFH. The format of the EFH worksheet may not be sufficient to incorporate the extent of detail required for large-scale projects, and a separate EFH assessment may be required.

Regardless of the format, you should include an analysis as outlined in this worksheet for an expanded EFH assessment, along with any additional necessary information including:

- the results of on-site inspections to evaluate habitat and site-specific effects.
- the views of recognized experts on habitat or the species that may be affected.
- a review of pertinent literature and related information.
- an analysis of alternatives that could avoid or minimize adverse effects on EFH.

For these larger scale projects, interagency coordination meetings should be scheduled to discuss the contents of the EFH consultation and the site-specific information that may be needed in order to initiate the consultation.

Please contact our Greater Atlantic Regional Fisheries Office, Protected Resources Division regarding potential impacts to marine mammals or threatened and endangered species and the appropriate consultation procedures.

HESD Contacts*

New England - ME, NH, MA, RI, CT

Chris Boelke, Branch Chief	christopher.boelke@noaa.gov
Mike Johnson - ME, NH	mike.r.johnson@noaa.gov
Kaitlyn Shaw - ME, NH, MA	kaitlyn.shaw@noaa.gov
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Mid-Atlantic - NY, NJ, PA, MD, VA

Karen Greene, Branch Chief	karen.greene@noaa.gov
Jessie Murray - NY, Northern NJ (Monmouth Co. and north)	jessie.murray@noaa.gov
Keith Hanson - NJ (Ocean Co. and south), DE and PA, Mid-Altantic wind	keith.hanson@noaa.gov
Maggie Sager - NJ (Ocean Co. and south), DE and PA	lauren.m.sager@noaa.gov
Jonathan Watson - MD, DC	jonathan.watson@noaa.gov
David O'Brien - VA	david.l.obrien@noaa.gov

Ecosystem Management (Wind/Aquaculture)

Peter Burns, Branch Chief	peter.burns@noaa.gov
Alison Verkade (NE Wind)	alison.verkade@noaa.gov
Susan Tuxbury (wind coordinator)	susan.tuxbury@noaa.gov

***Please check for the most current staffing list on our contact us page prior to submitting your assessment.**

EFH Assessment Worksheet rev. August 2021

Please read and follow all of the directions provided when filling out this form.

1. General Project Information

Date Submitted: 10/10/2024

Project/Application Number:

Project Name: Royal River Aquatic Ecosystem Restoration

Project Sponsor/Applicant: The Town of Yarmouth, ME

Federal Action Agency (or state agency if the federal agency has provided written notice delegating the authority[1]): United States Army Corps of Engineers

Fast-41: Yes ☐ No ☐

Action Agency Contact Name: Donnie Faughnan

Contact Phone: 978-318-8205 Contact Email: Donald.J.Faughnan@usace.army.mil

Address, City/Town, State:

696 Virginia Rd, Concord, Massachusetts

2. Project Description

[2]Latitude: 43.804904 Longitude: -70.188000

Body of Water (e.g., HUC 6 name): Lower Royal River (010600010206)

Project Purpose:

The purpose of the Royal River Aquatic Ecosystem Restoration Project is to restore habitat connectivity and aquatic ecosystem function and values to the Royal River. The Bridge Street and Elm Street Dams have fragmented the river system, impeded species movement limiting access to nursery and spawning areas, and have created upstream impoundments, altering habitat characteristics and reduced riverine aquatic habitat value. The impoundments are deeper and have weaker currents, with water moving slower than areas of the river not impeded by the dams. These adverse habitat and connectivity conditions reduce species abundance and richness (i.e., number of different species) of riverine specific species.

Project Description:

The project involves removal of a 120 linear foot (LF) section of the East Elm Street Dam and the Denil-type fish passage structure located on the right descending bank of the Royal River, removal of Bridge Street Dam across the entire width of the river, which includes 275 LF of structure and the Denil-type fish passage structure located on the right descending bank of the Royal River and installation of a diversion structure at the top of Middle Falls to divert streamflow into the side channel. Flow in the side channel will be monitored for capacity to pass fish and additional interventions may be executed as part of an adaptive management plan.

Anticipated Duration of In-Water Work including planned Start/End Dates and any seasonal restrictions proposed to be included in the schedule:

Bridge Street Dam work is anticipated to take 27 weeks time. Elm Street Dam is anticipated to take 19 weeks and for Middle Falls, 1 week of time. A time of year restriction was included to prevent work from 15 May to 15 June to avoid potential impacts to the existing upriver alewife migration.

[1] A federal agency may designate a non-Federal representative to conduct an EFH consultation by giving written notice of such designation to NMFS. If a non-federal representative is used, the Federal action agency remains ultimately responsible for compliance with sections 305(b)(2) and 305(b)(4)(B) of the Magnuson-Stevens Act. [2] Provide the decimal, or the degrees, minutes, seconds values for latitude and longitude using the World Geodetic System 1984 (WGS84) and negative degree values where applicable.

3. Site Description

EFH includes the biological, chemical, and physical components of the habitat. This includes the substrate and associated biological resources (e.g., benthic organisms, submerged aquatic vegetation, shellfish beds, salt marsh wetlands), the water column, and prey species.

	Yes	No
Is the project in designated EFH[3]?	☐	☑
Is the project in designated HAPC?	☐	☑
Does the project contain any Special Aquatic Sites[4]?	☑	☐
Is this coordination under FWCA only?	☐	☑

Total area of impact to EFH (indicate sq ft or acres): 0

Total area of impact to HAPC (indicate sq ft or acres): 0

Current range of water depths at MLW	Salinity range (PPT):	Water temperature range (°F):
1-12ft	0	

[3]Use the tables in Sections 5 and 6 to list species within designated EFH or the type of designated HAPC present. See the worksheet instructions to find out where EFH and HAPC designations can be found. [4] Special aquatic sites (SAS) are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. They include sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR Subpart E). If the project area contains SAS (i.e. sanctuaries and refuges, wetlands, mudflats, vegetated shallows/SAV, coral reefs, and/or riffle and pool complexes, describe the SAS, species or habitat present, and area of impact.

4. Habitat Types

In the table below, select the location and type(s) for each habitat your project overlaps. For each habitat type selected, indicate the total area of expected impacts, then what portion of the total is expected to be temporary (less than 12 months) and what portion is expected to be permanent (habitat conversion), and if the portion of temporary impacts will be actively restored to pre- construction conditions by the project proponent or not. A project may overlap with multiple habitat types.

Habitat Location	Habitat Type	Total impacts (lf/ft²/ft³)	Temporary impacts (lf/ft²/ft³)	Permanent impacts (lf/ft²/ft³)	Restored to pre-existing conditions?*
Freshwater	Substrate (silt/mud)	11,340 ft^3		11,340 ft^3	No
Freshwater	Wetland (scrub-shrub)*	7,222 ft^2		7,222 ft^2	Yes
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one

*Restored to pre-existing conditions means that as part of the project, the temporary impacts will be actively restored,such as restoring the project elevations to pre-existing conditions and replanting. It does not include natural restoration or compensatory mitigation.

Submerged Aquatic Vegetation (SAV) Present?:

Yes: ☑ No: ☐

If the project area contains SAV, or has historically contained SAV, list SAV species and provide survey results including plans showing its location, years present and densities if available. Refer to Section 12 below to determine if local SAV mapping resources are available for your project area.

In silted areas adjacent to the dam Valisinaria americana, and Potomogetion crispus can be observed.

Sediment Characteristics:

The level of detail required is dependent on your project – e.g., a grain size analysis may be necessary for dredging. In addition, if the project area contains rocky/hard bottom habitat [6](pebble, cobble, boulder, bedrock outcrop/ledge) identified as Rocky (coral/rock), Substrate (cobble/gravel), or Substrate (rock) above, describe the composition of the habitat using the following table.

Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage of Total Substrate on Site
Silt/Mud (<0.063mm)	Select one	
Sand (0.063-2mm)	Select one	
Rocky: Pebble/Gravel /Cobble(2-256mm)**	Select one	
Rocky: Boulder (256-4096mm)**	Select one	
Rocky: Coral	Select one	
Bedrock**	Select one	

[6]The type(s) of rocky habitat will help you determine if the area is cod HAPC.

* Grain sizes are based on Wentworth grain size classification scale for granules, pebbles, cobbles, and boulders.

** Sediment samples with a content of 10% or more of pebble-gravel-cobble and/or boulder in the top layer (6-12 inches) should be delineated and material with epifauna/macroalgae should be differentiated from bare pebble-gravel-cobble and boulder.

If no grain size analysis has been conducted, please provide a general description of the composition of the sediment. If available please attach images of the substrate.

The Royal River in the project area is primarily characterized by a bedrock bottom with interspersed deposits of silt/mud along the banks and behind the two dams or riffles formed by boulder and gravel deposition primarily at the bottom of the two dams and Middle Falls. The composition is highly variable along the 6 mile long impoundments. Please see the sediment sampling and testing in Appendix B for composition.

Diadromous Fish (migratory or spawning habitat- identify species under Section 10 below):

Yes: ☑ No: ☐

5. EFH and HAPC Designations

Within the Greater Atlantic Region, EFH has been designated by the New England, Mid-Atlantic, and South Atlantic Fisheries Management Councils and NOAA Fisheries. Use the EFH mapper to determine if EFH may be present in the project area and enter all species and life stages that have designated EFH. Optionally, you may review the EFH text descriptions linked to each species in the EFH mapper and use them to determine if the described habitat is present at your project site. If the habitat characteristics described in the text descriptions do not exist at your site, you may be able to exclude some species or life stages from additional consideration. For example, the water depths at your site are shallower that those described in the text description for a particular species or life stage. We recommend this for larger projects to help you determine what your impacts are.

Species Present	EFH is designated/mapped for:				What is the source of the EFH information included?
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/ spawning adults	
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One
Select One	☐	☐	☐	☐	Select One

6. Habitat Areas of Particular Concern (HAPCs)

HAPCs are subsets of EFH that are important for long-term productivity of federally managed species. HAPCs merit special consideration based their ecological function (current or historic), sensitivity to human-induced degradation, stresses from development, and/or rarity of the habitat.While many HAPC designations have geographic boundaries, there are also habitat specific HAPC designations for certain species, see note below. Use the EFH mapper to identify HAPCs within your project area. Select all that apply.

☐	Summer flounder: SAV[7]	☐	Alvin & Atlantis Canyons
☐	Sandbar shark	☐	Baltimore Canyon
☐	Sand Tiger Shark (Delaware Bay)	☐	Bear Seamount
☐	Sand Tiger Shark (Plymouth-Duxbury-Kingston Bay)	☐	Heezen Canyon
☐	Inshore 20m Juvenile Cod[8]	☐	Hudson Canyon
☐	Great South Channel Juvenile Cod	☐	Hydrographer Canyon
☐	Northern Edge Juvenile Cod	☐	Jeffreys & Stellwagen
☐	Lydonia Canyon	☐	Lydonia, Gilbert & Oceanographer Canyons
☐	Norfolk Canyon (Mid-Atlantic)	☐	Norfolk Canyon (New England)
☐	Oceanographer Canyon	☐	Retriever Seamount
☐	Veatch Canyon (Mid-Atlantic)	☐	Toms, Middle Toms & Hendrickson Canyons
☐	Veatch Canyon (New England)	☐	Washington Canyon
☐	Cashes Ledge	☐	Wilmington Canyon
☐	Atlantic Salmon		

[7] Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species have been eliminated from an area, then exotic species are included. Use local information to determine the locations of HAPC.

[8] The purpose of this HAPC is to recognize the importance of inshore areas to juvenile Atlantic cod. The coastal areas of the Gulf of Maine and Southern New England contain structurally complex rocky-bottom habitat that supports a wide variety of emergent epifauna and benthic invertebrates. Although this habitat type is not rare in the coastal Gulf of Maine, it provides two key ecological functions for juvenile cod: protection from predation, and readily available prey. See EFH mapper for links to text descriptions for HAPCs.

7. Activity Details

Select all that apply	Project Type/Category
☐	Agriculture
☐	Aquaculture - List species here:
☐	Bank/shoreline stabilization (e.g., living shoreline, groin, breakwater, bulkhead)
☐	Beach renourishment
☐	Dredging/excavation
☐	Energy development/use e.g., hydropower, oil and gas, pipeline, transmission line, tidal or wave power, wind
☐	Fill
☐	Forestry
☐	Infrastructure/transportation (e.g., culvert construction, bridge repair, highway, port, railroad)
☐	Intake/outfall
☐	Military (e.g., acoustic testing, training exercises)
☐	Mining (e.g., sand, gravel)
☐	Overboard dredged material placement
✔	Piers, ramps, floats, and other structures Diversion structure
✔	Restoration or fish/wildlife enhancement (e.g., fish passage, wetlands, mitigation bank/ILF creation)
☐	Survey (e.g., geotechnical, geophysical, habitat, fisheries)
☐	Water quality (e.g., storm water drainage, NPDES, TMDL, wastewater, sediment remediation)
☐	Other:

8. Effects Evaluation

Select all that apply	Potential Stressors Caused by the Activity
☑	Underwater noise
☑	Water quality/turbidity/ contaminant release
☐	Vessel traffic/barge grounding
☑	Impingement/entrainment
☐	Prevent fish passage/spawning
☐	Benthic community disturbance
☐	Impacts to prey species

Select all that apply and if temporary[9] or permanent		Habitat alterations caused by the activity
Temp	Perm	
☐	☑	Water depth change
☐	☐	Tidal flow change
☐	☑	Fill
☐	☐	Habitat type conversion
☐	☐	Other:
☐	☐	Other:

[9] Temporary in this instance means during construction. [10] Entrainment is the voluntary or involuntary movement of aquatic organisms from a water body into a surface diversion or through, under, or around screens and results in the loss of the organisms from the population. Impingement is the involuntary contact and entrapment of aquatic organisms on the surface of intake screens caused when the approach velocity exceeds the swimming capability of the organism.

Details - project impacts and mitigation

Briefly describe how the project would impact each of the habitat types selected above and the amount (i.e., acreage or sf) of each habitat impacted. Include temporary and permanent impact descriptions and direct and indirect impacts. For example, dredging has a direct impact on bottom sediments and associated benthic communities. The turbidity generated can result in a temporary impact to water quality which may have an indirect effect on some species and habitats such as winter flounder eggs, SAV or rocky habitats. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. Attach supplemental information if necessary.

There will be a direct impact to the silt/mud substrate that builds up against the dams when they are removed. Without the barrier to encourage deposition the sediment will continue downstream unobstructed, depositing on the banks, and in the estuary. There will be a temporary impact as the existing sediment is eroded and flushed downstream. This will begin during construction and will be mitigated by turbidity control measures associated with the dam removal. The wetland adjacent to the bridge street dam will be impacted by the reduction of the water level upon dam removal. newly exposed sediments will by hydro seeded to stabilize them and establish native wetland plant species while the existing seed bank migrates into the the new soil.

What specific measures will be used to avoid and minimize impacts, including project design, turbidity controls, acoustic controls, and time of year restrictions? If impacts cannot be avoided or minimized, why not?

Turbidity curtains will be used in the demolition and removal of the two dams to mitigate impacts to the fish community. There will also be a time of year restriction placed from May 15 to June 15 to preclude impacting the existing alewife migration in the river.

Is compensatory mitigation proposed? Yes ☐ No ☑

If compensatory mitigation is not proposed, why not? If yes, describe plans for compensatory mitigation (e.g. permittee responsible, mitigation bank, in-lieu fee) and how this will offset impacts to EFH and other aquatic resources. Include a proposed compensatory mitigation and monitoring plan as applicable.

Existing mitigation measures were deemed sufficient.

9. Effects of Climate Change

Effects of climate change should be included in the EFH assessment if the effects of climate change may amplify or exacerbate the adverse effects of the proposed action on EFH. Use the Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathways (RCP) 8.5/high greenhouse gas emission scenario (IPCC 2014), at a minimum, to evaluate the future effects of climate change on the proposed projections. For sea level rise effects, use the intermediate-high and extreme scenario projections as defined in Sweet et al. (2017). For more information on climate change effects to species and habitats relative to NMFS trust resources, see Guidance for Integrating Climate Change Information in Greater Atlantic Region Habitat Conservation Division Consultation Processes.

1. Could species or habitats be adversely affected by the proposed action due to projected changes in the climate?If yes, please describe how:

2. Is the expected lifespan of the action greater than 10 years? If yes, please describe project lifespan:

   The project will be a permanent alteration of the Royal River, restoring connectivity and fish passage.

3. Is climate change currently affecting vulnerable species or habitats, and would the effects of a proposed action be amplified by climate change? If yes, please describe how:

4. Do the results of the assessment indicate the effects of the action on habitats and species will be amplified by climate change? If yes, please describe how:

5. Can adaptive management strategies (AMS) be integrated into the action to avoid or minimize adverse effects of the proposed action as a result of climate? If yes, please describe how:

   Please see page of appended answers at the end of this document.

10. Federal Agency Determination

Federal Action Agency's EFH determination (select one)	
☑	There is no adverse effect[7] on EFH or EFH is not designated at the project site. EFH Consultation is not required. This is a FWCA only request.
☐	The adverse effect[7] on EFH is not substantial. This means that the adverse effects are no more than minimal, temporary, or can be alleviated with minor project modifications or conservation recommendations. This is a request for an abbreviated EFH consultation.
☐	The adverse effect[7] on EFH is substantial. This is a request for an expanded EFH consultation. We will provide more detailed information, including an alternatives analysis and NEPA documents, if applicable.

[7] An adverse effect is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

11. Fish and Wildlife Coordination Act

Under the FWCA, federal agencies are required to consult with us if actions that the authorize, fund, or undertake will result in modifications to a natural stream or body of water. Federal agencies are required to consider the effects these modifications may have on fish and wildlife resources, as well as provide for the improvement of those resources. Under this authority, we consider the effects of actions on NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats, that are not managed under a federal fisheries management plan. Some examples of other NOAA-trust resources are listed below. Some of these species, including diadromous fishes, serve as prey for a number of federally-managed species and are therefore considered a component of EFH pursuant to the MSA. We will be considering the effects of your project on these species and their habitats as part of the EFH/FWCA consultation process and may make recommendations to avoid, minimize or offset and adverse effects concurrently with our EFH conservation recommendations.

Please contact our Greater Atlantic Regional Fisheries Office, Protected Resources Division regarding potential impacts to marine mammals or species listed under the Endangered Species Act and the appropriate consultation procedures.

Fish and Wildlife Coordination Act Resources

Species known to occur at site (list others that may apply)	Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat). Please note, impacts to federally listed species of fish, sea turtles, and marine mammals must be coordinated with the GARFO Protected Resources Division.
alewife	Please see page of appended answers at the end of this document.
American eel	Please see page of appended answers at the end of this document.
American shad	
Atlantic menhaden	
blue crab	
blue mussel	
blueback herring	
Eastern oyster	
horseshoe crab	
quahog	
soft-shell clams	
striped bass	
other species:	
other species:	
other species:	

12. Useful Links

National Wetland Inventory Maps
EPA's National Estuary Program (NEP)
Northeast Regional Ocean Council (NROC) Data Portal
Mid-Atlantic Regional Council on the Ocean (MARCO) Data Portal

Resources by State

Maine

Maine Office of GIS Data Catalog
Town shellfish information including shellfish conservation area maps
State of Maine Shellfish Sanitation and Management
Eelgrass maps
Casco Bay Estuary Partnership
Maine GIS Stream Habitat Viewer

New Hampshire

NH Statewide GIS Clearinghouse, NH GRANIT
NH Coastal Viewer
State of NH Shellfish Program

Massachusetts

MA DMF Shellfish Sanitation and Management Program
MassGIS Data (Including Eelgrass Maps)
MA DMF Recommended TOY Restrictions Document Massachusetts
Bays National Estuary Program
Buzzards Bay National Estuary Program
Massachusetts Division of Marine Fisheries
Massachusetts Office of Coastal Zone Management

Rhode Island

RI Shellfish and Aquaculture
RI Shellfish Management Plan
RI Eelgrass Maps
Narragansett Bay Estuary Program
Rhode Island Division of Marine Fisheries
Rhode Island Coastal Resources Management Council

Connecticut

CT Bureau of Aquaculture

Natural Shellfish Beds in CT

Eelgrass Maps

Long Island Sound Study

CT GIS Resources

CT DEEP Office of Long Island Sound Programs and Fisheries

CT River Watershed Council

New York

Eelgrass Report

Peconic Estuary Program

NY/NJ Harbor Estuary Program

New York GIS Clearinghouse

New Jersey

Submerged Aquatic Vegetation Mapping

Barnegat Bay Partnership

NJ GeoWeb

NJ DEP Shellfish Maps

Pennsylvania

Delaware River Management Plan

PA DEP Coastal Resources Management Program

PA DEP GIS Mapping Tools

Delaware

Partnership for the Delaware Estuary

Center for Delaware Inland Bays

Delaware FirstMap

Maryland

Submerged Aquatic Vegetation Mapping

MERLIN (Maryland's Environmental Resources and Land Information Network)

Maryland Coastal Atlas

Maryland Coastal Bays Program

Virginia

VMRC Habitat Management Division

Submerged Aquatic Vegetation mapping

Section 9. Effects of Climate Change

5. Can adaptive management strategies (AMS) be integrated into the action to avoid or minimize adverse effects of the proposed action as a result of climate? If yes, please describe how:

Yes, in the adaptive management plan emphasis is placed on monitoring the diversion structure at Factory Island and allows for adjustment of the structure due to climate change impacting the normal flow of the river.

Section 11. Fish and Wildlife Coordination Act

Alewife: This project is specifically focused on restoring connectivity to the river to allow alewife migration upriver to historic spawning habitat. A time of year exclusion was included in the plans for May 15- June 15 to avoid potential impacts to the existing alewife migration in the river.

American Eel: Temporary impacts to the American eel migration may occur at the end of their downriver migration in late April to early May due to dam demolition and removal at the Bridge Street Dam. Demolition will be preformed by build a causeway along the existing dam to reach the furthest point, then gradually take up the dam removing it and the causeway as they recede. Potential impacts stem from noise disruption from the demolition effort during daytime hours, passage will not be occluded. Elm Street dam will use a different methodology including a flow diversion and will likely not impact the migration.