IEc

ECONOMIC EVALUATION OF THE COSTS AND BENEFITS OF THE FORGE POND DAM FISH PASSAGE IMPROVEMENT ALTERNATIVES

Final Report | October 11, 2013

prepared for:

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SECTION 1 | INTRODUCTION AND SUMMARY RESULTS

The purpose of this report is to evaluate costs and benefits associated with integrating fish passage improvements at Forge Pond Dam on Silver Lake in Kingston, Massachusetts. The analysis focuses in particular on evaluating the potential financial impacts of fish passage alternatives on the City of Brockton, which relies on Silver Lake as a drinking water source. This report also considers the potential economic benefits of ecological improvements generated by the fish passage improvements. This report serves as a companion document to the Massachusetts Division of Marine Fisheries (*MarineFisheries*) feasibility study ("Feasibility Report").[1] Industrial Economics, Inc. (IEc) prepared this report under contract to the Jones River Watershed Association (JRWA).

1.1 BACKGROUND

Silver Lake is an approximately 634-acre glacial lake hydrologically connected to Cape Cod Bay by the 7.5 miles-long Jones River. The Forge Pond Dam is the final remaining obstruction blocking passage of anadromous river herring (*Alosa pseudoharengis* and *Alosa aestivalis*) and catadromous American eel (*Anguilla rostrata*) from Cape Cod Bay to Silver Lake. Of the two other dams along the Jones River, the Elm Street Dam integrated an upgraded fish ladder in 2001 and the JRWA removed the Wapping Road Dam in 2011.

The natural resources of the Jones River and Silver Lake make fish passage at Forge Pond Dam one of the highest ranking priorities of the *MarineFisheries* for river herring restoration in Massachusetts. Accordingly, the objective of the *MarineFisheries* Feasibility Report is to evaluate the feasibility of restoring river herring and American eel populations to Silver Lake according to four fish passage alternatives at Forge Pond Dam:

Alternative 1. Construction of a fish ladder;

Alternative 2. Construction of a bypass channel;

Alternative 3. Partial dam removal; and

Alternative 4. Full dam removal.

In addition to the technical aspects, the alternatives vary with respect to the volume of water the City of Brockton could feasibly continue to withdraw from Silver Lake and the timing of those withdrawals.[2]

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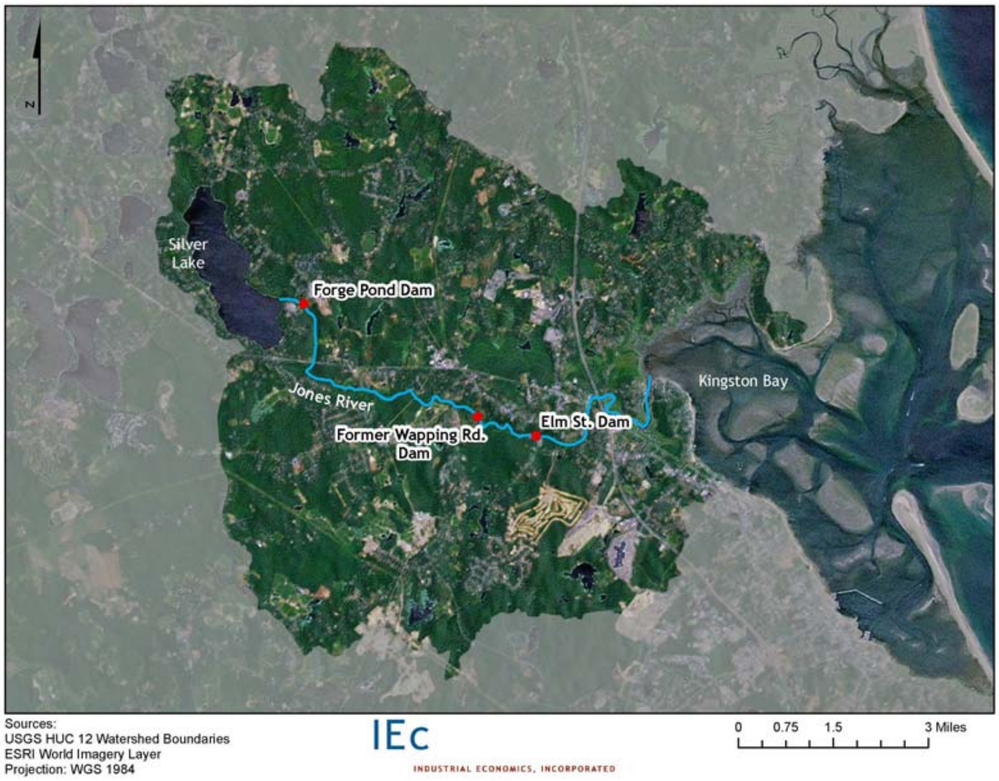
[1] Gomez and Sullivan Engineers, P.C. July 2013. Forge Pond Dam Fish Passage Improvement Feasibility Study and Preliminary Design: Final Feasibility Report. Prepared for: Massachusetts Division of Marine Fisheries.

[2] Ibid.

This economic analysis serves as a companion document to the Feasibility Report, drawing on its findings to evaluate the potential financial and economic implications of implementing the fish passage alternatives. Section 2 of this analysis evaluates the impacts to the City of Brockton in the case that the fish passage alternatives require the City to rely on substitute drinking water sources, in particular from the Taunton River via the Aquaria desalination plant. Section 3 of this analysis describes the economic significance of restoring herring and eel populations, and describes additional ecosystem service benefits associated with the fish passage improvements.

EXHIBIT 1-1. MAP OF JONES RIVER WATERSHED



1.2 KEY DATA SOURCES

This analysis relies on and builds upon the data provided in the *MarineFisheries* Feasibility Report. We also collected and reviewed the following documentation for the financial analysis:

- City of Brockton Basic Financial Statements for fiscal years ended June 30, 2009, 2010, 2011, and 2012;
- City of Brockton Budgets for fiscal years ended June 30, 2013 and 2014;
- Sustainable Water Management Initiative Report, prepared by Princeton Hydro, LLC for Town of Halifax, MA and MA Department of Environmental Protection (July 2013, Final);
- Water Purchase Agreement between the City of Brockton and INIMA, Servicios Europeos de Medio Ambiente, S.A., jointly with Bluestone Energy Services, Inc., dated May 22, 2002 (the Aquaria contract);

- City of Brockton, MA Draft Comprehensive Water Management Plan (CWMP), dated November 2009;
- Water Rate Evaluation, City of Brockton, Preliminary Results, prepared by CDM for the City of Brockton, January 15, 2008 (a presentation, provided by JRWA);
- Summary of Brockton's current water rates (available on Brockton's web site at http://www.brockton.ma.us/docs/documents/2011_Water_and_Sewer_rates.pdf?sfvrsn=0);
- Socio-economic and demographic data for the City of Brockton from the Bureau of Labor Statistics, American Community Survey, and other sources;
- Other financial, economic, and demographic data.

We also conducted phone interviews with Mr. Brian Creedon of the Brockton Water Commission and Mr. Jeff Hanson, the Aquaria plant's developer and consultant.

To develop the discussion of potential benefits, we relied on literature reviews focused on the value of herring and related fisheries, and Federal and State fisheries reports and management plans. We also interviewed relevant stakeholders at the *MarineFisheries*, Massachusetts Division of Ecological Restoration (MA DER), and Town of Halifax.

1.3 SUMMARY RESULTS

We find that the service that the Brockton Water Enterprise Fund provides to its residential customers is relatively inexpensive, both as compared to water rates in the nearby communities in the Commonwealth and water rates of similarly sized communities in the nation. At less than one percent of Median Household Income (MHI), Brockton's cost per household (CPH) as a percent of MHI is also considerably lower than the affordability thresholds of two and 2.5 percent of MHI that the U.S. Environmental Protection Agency (USEPA) uses in its evaluations of water utilities.

Our evaluation of incremental costs associated with the proposed fish passage alternatives indicates that on a CPH basis, all of the scenarios result in only minor increases in the CPH (between $11 and $80 on an annual basis or $0.95 to $6.65 on a monthly basis). Four out of five scenarios result in CPH as a percent of MHI that is below one percent of MHI, with incremental increases relative to the baseline of seven percentage points or less. Overall, from the CPH perspective, all fish passage scenarios appear affordable. Complicating factors, however, include the City's current socio-economic conditions, the utility's need to resume its maintenance and capital replacement activities, and the current lack of political support to institute rate increases.

Exhibit 1-2 summarizes the findings of our scenario analysis, based on the alternatives and flow data presented in the *MarineFisheries* Feasibility Report and described in the Background section above.[3]

[3] Gomez and Sullivan Engineers, P.C., 2013. Pg. 90, 91, and 111.

EXHIBIT 1-2. COST PER HOUSEHOLD AS A PERCENT OF MEDIAN HOUSEHOLD INCOME, FISH PASSAGE ALTERNATIVES AND ASSOCIATED FLOW SCENARIOS (FISCAL YEAR ENDED JUNE 30, 2012; NUMBER OF RESIDENTIAL CONNECTIONS)[4]

METRICS	BASELINE	ALT. 1&2 FISH LADDER OR BYPASS	ALT. 1&2 FISH LADDER OR BYPASS	ALT. 1&2 FISH LADDER OR BYPASS	ALT. 3&4 PARTIAL/FULL DAM REMOVAL	ALT. 3&4 PARTIAL/FULL DAM REMOVAL
	No Substitution	Substitute 2 MGD of Silver Lake Withdrawal with Aquaria April-June and September-November (6 mo. a year)	Substitute 2 MGD of Silver Lake Withdrawal with Aquaria April-November (8 mo. a year)	Substitute 4.5 MGD of Silver Lake Withdrawal with Aquaria April-November (8 mo. a year)	Substitute 4.5 MGD of Silver Lake Withdrawal with Aquaria July-October (4 mo. a year)	Substitute 7 MGD of Silver Lake Withdrawal with Aquaria July-October (4 mo. a year)
	N/A	**[A]**	**[B]**	**[C]**	**[D]**	**[E]**
CPH (annual)	$403	$414	$418	$433	$418	$483
CPH as a % of MHI	0.90%	0.92%	0.93%	0.97%	0.93%	1.08%

Our analysis identified a number of uncertainties, which we discuss in more detail in Section 2. Specifically, we recommend:

- Obtaining a copy of the Veolia contract to identify the current cost of the contract to the City and evaluate the City's ability to renegotiate the contract should its water demand decrease below the contractual level;
- Confirming the values for the residential flow and the number of households in the service area, including households (and their flow) in the wholesale communities to refine the CPH analysis; and
- Determining whether the City prepared a rate study to support its 2008 water rate increase, and if so, obtaining a copy of that document to identify the specific costs that the rate increase was designed to cover.

Our discussion of the benefits of the fish passage alternatives provides context regarding the potential gains to the Commonwealth and its citizens for comparison with the costs described above. Populations of both river herring and American eels have experienced steep declines in recent decades, resulting in moratoria on commercial and recreational catch of river herring. While data do not exist to support a quantitative assessment of the potential benefits of the fish passage alternatives, it is reasonable to expect that the alternatives will benefit river herring and American eel populations. First, *MarineFisheries* and JRWA have determined that Silver Lake maintains suitable conditions to serve as spawning habitat for herring.[5] In addition, Forge Pond Dam is the sole remaining obstruction preventing these species from reaching Silver Lake. However, data describing the relative expected population level effects of the alternatives on herring and eel populations are not available. Absent this information, we provide a qualitative

[4] Note: Scenario E results in a CPH considerably higher than those of other scenarios due to the Aquaria expanded firm commitment fee associated with Scenario E.

[5] Chase, B.C. et al., 2013.

characterization regarding the regional economic importance of these species, in particular with respect to recreational and commercial fisheries.

The fish passage alternatives may also benefit local water quality conditions both in Silver Lake and at Monponsett Pond in the Town of Halifax. In particular, Monponsett Pond is hyper-eutrophic (i.e., excessive nutrient levels result in proliferation of algae and depleted levels of dissolved oxygen) and has experienced toxic algal blooms. While the eutrophic conditions of Monponsett Pond are primarily a result of nutrient loading from surrounding development, application of trophic models determined that changing water management policies such that Monponsett was allowed to flow naturally instead of being held for diversion to Silver Lake would measurably reduce nutrient levels in the Pond.[6] Under such circumstances, the Town of Halifax may benefit from reduced water quality management expenses and citizens of Halifax and adjacent towns would benefit from reduced frequency of beach closures at the Pond and improved quality of recreational activities.

[6] Princeton Hydro, LLC., 2013.

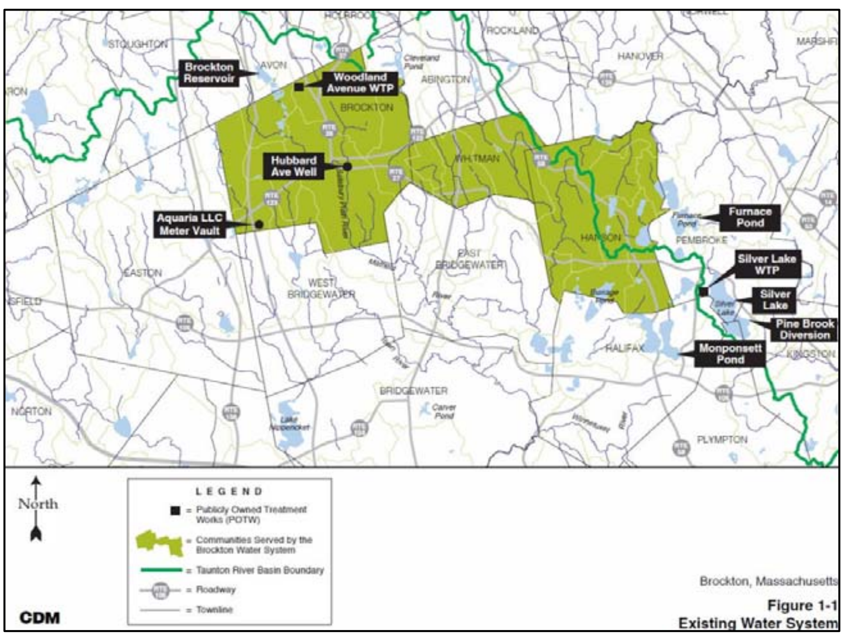
SECTION 2 | FINANCIAL REVIEW AND ANALYSIS

This section presents the results of our review of the financial and economic condition of the City of Brockton and its water utility and our research into the City's water rates relative to the rates of other communities in the nation and the Commonwealth. This section also presents our analysis of Brockton's current cost per household as a percent of MHI and the potential incremental impact on a cost per household basis associated with the various fish passage alternatives.

2.1 CITY AND UTILITY OVERVIEW

The City of Brockton, through its Department of Public Works and its Water Enterprise Fund, provides drinking water services to customers in Brockton as well as in the neighboring towns of Whitman, Hanson, and small parts of Pembroke and Avon, MA.[7] According to Brockton's 2011 Annual Statistical Report, of 3,017 million gallons (mg) finished water available for distribution, Whitman received 338 mg, Hanson received six mg, and Pembroke received less than one mg.[8] Halifax, West Bridgewater, East Bridgewater, and Stoughton, MA also have emergency connections to the system.[9] Exhibit 2-1 below provides a map of the City's service area.

EXHIBIT 2-1. MAP OF THE CITY OF BROCKTON SERVICE AREA[10]



[7] City of Brockton, MA. Draft Comprehensive Water Management Plan (CWMP). 2009. Pg. 1-6.

[8] Brockton Water Commission. 2012. 2011 Public Water Supply Annual Statistical Report. Massachusetts Department of Environmental Protection. Pgs. 38 and 43.

[9] 2009 CWMP, pg. 1-6.

[10] 2009 CWMP, pg. 1-2. Note, Brockton does not have a permit to take water from Pine Brook and the source is physically disconnected.

Brockton maintains roughly 300 miles of water distribution mains within its city limits.[11] The City's water comes from four surface water reservoirs: Silver Lake, Furnace Pond, Monponsett Pond, and Brockton Reservoir. According to the 2009 Draft Comprehensive Water Management Plan (CWMP), the City has a registration to withdraw 11.11 million gallons per day (mgd) from Silver Lake, Monponsett Pond, and Furnace Pond (commingled supply with a single withdrawal point at Silver Lake) and 0.83 mgd from Brockton Reservoir.[12] Brockton's average annual Silver Lake withdrawal during the period from 1996 to 2012 was 9.6 mgd.[13] The City owns and operates via its contractor Veolia two water treatment plants: the Silver Lake plant with a capacity of 24 mgd and the Woodland Avenue plant with a capacity of 0.9 mgd.[14] The City has an additional water supply source in the Aquaria desalination plant on the Taunton River.

According to the 2011 American Community Survey (2011 ACS), Brockton's population is 94,312. The city has 37,938 housing units, 11 percent of which are vacant (i.e., the City has 33,720 occupied housing units, or households). Approximately 47.5 percent of all structures in the City contain a single unit (attached or detached). The remainder of the housing units are in structures with two or more units. The City's Median Household Income (MHI) is $44,786, approximately 11 percent lower than the 2011 national MHI ($50,502) and nearly 30 percent below the 2011 Commonwealth of Massachusetts MHI ($62,859). The Brockton-area 2012 unemployment rate was 7.6 percent, half a percentage point below the national unemployment (8.1 percent) but nearly a percentage point higher than the unemployment rate in the Commonwealth (6.7 percent).[15] The City's 2013 foreclosure rate (0.10 percent of all homes in the city) is at the national level, but considerably above the Commonwealth rate (0.04 percent).[16] In February 2013, the Massachusetts Housing Partnership found Brockton to have the most distressed properties per capita.[17] Overall, on a number of indicators, Brockton performs similarly to the national averages, but considerably worse than the Commonwealth averages.

2.2 BROCKTON WATER SOURCES

As described above, Brockton sources its potable water from four surface reservoirs, including Silver Lake. Brockton contracts with Veolia to treat the water drawn from these sources and distributes it to its customers. The Aquaria desalination plant is the City's additional drinking water source. Presently, Brockton relies on Silver Lake for its primary supply and uses Aquaria for emergency supply only. We discuss the Veolia and Aquaria arrangements in more detail below.

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[11] 2009 CWMP, pg. 1-6.

[12] 2009 CWMP, pgs. 1-4 and 1-5.

[13] Silver Lake withdrawal during the period ranged from 8.95 to 10.37 mgd. From Gomez and Sullivan Engineers, P.C., 2013. Pg. ES-9.

[14] 2009 CWMP, pg. 1-6.

[15] BLS. Brockton-Bridgewater-Easton 2012 unemployment rate and 2012 national unemployment rate.

[16] RealtyTrac.com. 2013. Brockton Foreclosure Trends. Accessed on September 18th, 2013 at http://www.realtytrac.com/statsandtrends/foreclosuretrends/ma/plymouth-county/brockton.

[17] Patriot Ledger. 2013. Massachusetts Foreclosures Down Sharply in First Quarter. Accessed on September 18th, 2013 at http://www.patriotledger.com/topstories/x1039441638/Massachusetts-foreclosures-fell-sharply-in-first-quarter#ixzz2fAiEjmIY.

2.2.1 BROCKTON CONTRACT WITH VEOLIA FOR WATER TREATMENT

Brockton has contracted out the operation and maintenance of the City's water treatment plants to Veolia and its predecessors since 1986.[18] Brockton's contract with Veolia is a fixed price contract for producing an average annual treated flow of 10.8 to 13.2 mgd. According to the 2009 Draft CWMP, the contract also provides a variable rate that raises or lowers the fixed annual fee for flows above or below the 10.8 to 13.2 mgd fixed price range.[19] However, Mr. Creedon of the Brockton Water Commission explains that the variable fee only applies to situations where Brockton exceeds its contracted volume, but not when the City's consumption is below the contracted volume.[20] As noted above, the City's average demand (9.6 mgd) is less than the low end of the contracted range.[21]

We could not obtain the Veolia contract for review and have relied on characterizations of the contract in other documents. Without reviewing the contract, we cannot confirm information that is important to evaluating the economic impact of changes in the volume of water treated by Veolia, including the values for the fixed and variable fees, the contract expiration date, and the City's ability to renegotiate the contract should its water demand change.[22]

We found that the City's financial statements do not contain sufficient detail to identify the value of Veolia's fixed fee, nor were we able to obtain this cost through communication with the Brockton Water Commission. Based on our rough calculations relying on the historical and projected financial and water demand data, the Veolia fixed fee is likely within the range of $900,000 to $1.7 million annually.[23] For example, according to the 2009 Draft CWMP, based on the 2009 average demand of 10.04 mgd, Veolia-treated water cost Brockton approximately $325 per million gallons, which would make the fixed fee that year about $1.2 million.[24] At the same time, the 2008 Water Rate Evaluation prepared by CDM lists a Veolia line item expense at between $2.8 and $3.0 million; however, these values appear high in comparison to the values we inferred from Brockton's recent financial statements.[25] The reason for this discrepancy in estimates is unclear.

Finally, we could not determine the specific expenses the Veolia fixed fee includes. From our discussion with Mr. Hanson, we understand that Brockton may be paying directly for electricity use at the Veolia plant; however, we do not have documentation to confirm that nor do we have documentation to identify the party responsible for the treatment costs (for example, chemicals) at the Veolia plant.

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[18] We do not know when Veolia began operating Brockton's treatment plants.

[19] 2009 CWMP, Appendix A, pg. 2.

[20] Personal communication with Mr. Creedon.

[21] Gomez and Sullivan Engineers, P.C., 2013. Pg. ES-9.

[22] Personal communication with Mr. Jeff Hanson indicates that Brockton may have some flexibility in renegotiating the Veolia contract should its water demand change.

[23] WC Budget 2013 Water – level funded.1.xlsx (a spreadsheet provided by JRWA that contains Brockton's budgets for fiscal years 2011-2013).

[24] 2009 CWMP, Appendix A, pg. 2.

[25] CDM. 2008. Water Rate Evaluation, Preliminary Results. Prepared for City of Brockton. Slide not numbered.

2.2.2 BROCKTON CONTRACT WITH AQUARIA FOR POTABLE WATER

Brockton contracted with Aquaria LLC on May 22, 2002 to build and operate a plant that can produce potable water through desalinization of brackish water drawn from the Taunton River. The plant went online in December 2008. As we understand, Brockton currently views Aquaria as an additional water supply only, and rarely, if ever, purchases water from it.

The Aquaria contractual arrangement is complex, including provisions to address a variety of potential situations:[26]

- *Firm Commitment Fixed Fee:* The City pays Aquaria an annual fixed fee, based on the firm commitment flow during that year, at $167,480 per 0.1 million gallons of the firm commitment. The City must pay this amount regardless of the volume of water it purchases from Aquaria (if any). The firm commitment increases from 1.9 mgd in Year 1 of the plant operation to 4.07 mgd in Years 11 through 12. Brockton's 2012 firm commitment was 3.5 mgd. Exhibit 2-2 summarizes the commitment and related fee.

EXHIBIT 2-2. AQUARIA FIRM COMMITMENT FLOWS AND CALCULATED FIXED FEE[27]

YEAR NUMBER	YEAR	FIRM COMMITMENT FLOW (MGD)	FIRM COMMITMENT FIXED PRICE ($167,480 per 0.1 MG)
1	2008	1.9	$3,182,120
2	2009	2.0	$3,349,600
3	2010	2.5	$4,187,000
4	2011	3.0	$5,024,400
5	2012	3.5	$5,861,800
6	2013	3.5	$5,861,800
7	2014	3.56	$5,962,288
8	2015	3.56	$5,962,288
9	2016	3.82	$6,397,736
10	2017	3.82	$6,397,736
11-20	2018-2027	4.07	$6,816,436

- *Volume-based Fixed Fee for Water Purchased within the Firm Commitment:* According to the contract, Brockton pays $1.23 per 1,000 gallons of desalinated water Aquaria delivers within the firm commitment amount. That is, in 2012, Brockton may purchase up to 3.5 mgd at a price of $1.23 per 1,000 gallons in addition to paying the annual firm commitment fixed fee of $5,861,800.

[26] All data are from the 2002 Aquaria contract (Water Purchase Agreement between the City of Brockton and INIMA, Servicios Europeos de Medio Ambiente, S.A. and Bluestone Energy Services, Inc. May 22, 2002). Note that the volume-based rates also change every year with the Producer Price Index (PPI); however, for simplicity, we did not include these inflationary adjustments in our discussion and calculations.

[27] Gomez and Sullivan Engineers, P.C., 2013. Pg. 42.

- *Volume-based Fixed Fee for Water Purchased over the Firm Commitment:* If Brockton requires more water than the year's firm commitment, it may purchase up to one mgd at an excess rate of $0.60 per 1,000 gallons. In other words, in 2012, Brockton had the option to purchase a total of 4.5 mgd; the first 3.5 mgd are at a rate of $1.23 per 1,000 gallons (described above); the last one mgd is at a rate of $0.60 per 1,000 gallons.
- *Firm Commitment Fixed Fee – Expanded Firm Commitment:* Finally, Brockton has an option to increase its fixed commitment by up to 2.5 mgd for a price of $85,775 per year per 0.1 million gallons of the expanded firm commitment. This fixed commitment is subject to the same variable rate arrangement as the original fixed commitment. For example, based on our reading of the contract, in 2012 Brockton could have withdrawn as much as seven mgd of desalinated water from Aquaria and pay:

    1. Original fixed commitment (3.5 mgd), $ per year:

        $167,480 / 0.1 mg x 3.5 mg = $5,861,800;

    2. Expanded firm commitment (2.5 mgd), $ per year:

        $85,775 / 0.1 mg x 2.5 mg = $2,144,375;

    3. Volume-based fee for water purchased within the firm commitment (6 mgd), $ per day:

        $1.23/1,000 gallons x (3.5 mg + 2.5 mg) x 10^6 = $7,380 (this assumes daily consumption of 6 mgd, the maximum allowable consumption within the firm commitment);

    4. Volume-based fee for water purchased above the firm commitment (1 mgd), $ per day:

        $0.60/1,000 gallons x 1 mg x 10^6 = $600 (this assumes daily excess consumption of 1 mgd, the maximum allowable excess consumption).

2.3 BROCKTON WATER ENTERPRISE FUND: REVIEW OF FINANCIAL DATA FY2009 - 2014

Brockton records its water utility activities within its proprietary Water Enterprise Fund, which is a part of the City's overall financial reporting.[28] We reviewed Brockton Water Fund's financial data for fiscal years (FY) 2009 – 2012 (years ended June 30 of each year) and Brockton's financial projections for FY2013 and 2014. Brockton's revenues (charges for services and fees) fluctuated widely during FY2009-2012: from a low of $13.8 million in FY2010 to a high of $15.8 million in FY2009. In FY2012, Brockton's revenues were $15.1 million. The cause of the revenues' fluctuations and decrease compared to 2009 is unclear. In our discussion, Mr. Creedon of the Brockton Water Commission stated that the 2012 low revenues were due to high rates of foreclosures and people moving out of the service area, causing a loss of about 1,000 customers.[29] Exhibit 2-3 below summarizes the financial data.

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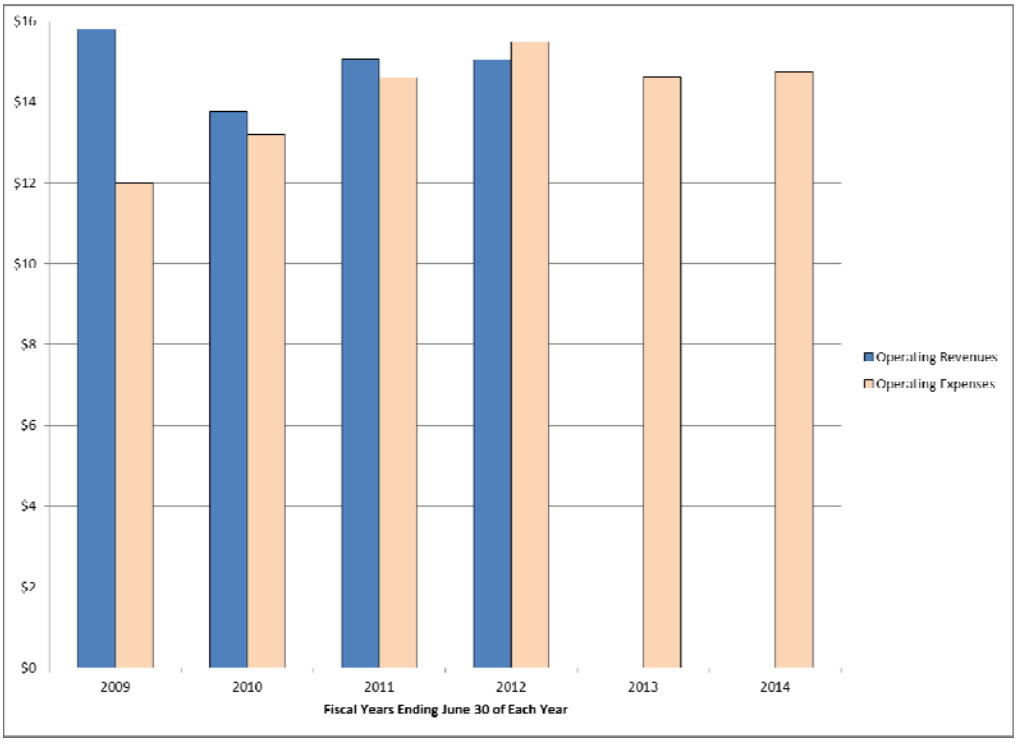
[28] Enterprise funds are budget and accounting units created for particular purposes, such as water and sewer or other self-sustaining operations, to separate the revenue and financial control of such operations from the municipality's General Fund.

[29] The available demographic data may support this assertion (though without a detailed break-down of the City's water revenue collections, we are unable to confirm the information provided by Mr. Creedon). According to the American Community Survey, in 2010, 6.8 percent of the City's 35,895 housing units were vacant. In 2011, the number of total housing units grew to 37,938 and the

EXHIBIT 2-3. SUMMARY OF BROCKTON WATER ENTERPRISE FUND'S OPERATING REVENUES AND EXPENSES (FY2009-2012 ACTUALS; FY2013-2014 BUDGET PROJECTIONS)[30]



During the same time period, Brockton's operating expenses increased steadily from $12.0 million in FY2009 to $15.5 million in FY2012. Though there has been some fluctuation in expense line items, including a $600,000 reduction in salaries and benefits, most of the operating expense increase is due to increases in "Contractual Services." We expect that this increase is due to increases in the Aquaria fixed commitment cost, but the financial statements do not provide sufficiently detailed data to confirm this.

As a result, Brockton Water Enterprise Fund's operating income fell from a positive income of $3.8 million in FY2009 to a loss of $424,000 in FY2012. After interest income, expenses, debt subsidies, and transfers in and out of the Fund, the change in the Fund's net assets (i.e., the amount of money it generated/lost on an income statement basis) decreased from a positive change in net assets of nearly $3.0 million in FY2009 to a negative change of nearly $1.2 million in FY2012. This situation is not sustainable in the long term, and the utility will have to implement rate increases and/or decrease its expenses in order to operate without a loss.

vacancy rate nearly doubled to 11.1 percent, potentially indicating that a) the developers were unable to sell/ensure occupancy of about 2,000 new housing units and b) the existing housing units that were unoccupied in 2010 largely remained unoccupied in 2011. In other words, though the number of available housing units increased significantly between 2010 and 2011, the number of occupied housing units showed a negligible increase: from 33,460 in 2010 to 33,720 in 2011. At the same time, the number of owner-occupied units decreased from 19,527 in 2010 to 18,446 in 2011; during the same time period the population increased slightly: from 93,973 in 2010 to 94,312 in 2011.

[30] City of Brockton. 2009-2012. Brockton financial statements, FY2009-2012; City of Brockton. 2013. Brockton Budgets, FY2013-2014.

We also obtained Brockton's budgets for FY2013 and 2014 which show expense detail for the Water Enterprise Fund activity. In FY2013 Brockton intends to reduce its expenses by nearly $1 million compared to FY2012, mostly through reductions in salaries and benefits. Mr. Creedon advised that due to labor shortages, Brockton has been unable to conduct its regular operations and maintenance activities (such as water main replacements), which is also not supportive of a sustainable operation in the medium or long term. Appendix 1 provides further detail on the available financial data.

2.4 WATER RATES

2.4.1 HISTORICAL RATE INCREASES

Since 1982, Brockton has implemented eight rate increases, ranging between six and 60 percent. The City passed and implemented the most recent rate increase, 60 percent, in 2008, presumably to cover the Aquaria costs (the plant came online in December 2008) and other expenses. Exhibit 2-4 provides the historical rate increases for residential customers receiving 1000 cubic feet per month.

EXHIBIT 2-4. BROCKTON WATER UTILITY RATE INCREASES, 1981 - PRESENT[31]

DATE	MONTHLY BILL, 1000 CUBIC FEET PER MONTH	% RATE INCREASE
7/1/1981	$8.00	N/A
1/1/1982	$10.00	25%
1/1/1989	$13.50	35%
7/1/1989	$14.50	7%
1/1/1991	$17.00	17%
1/1/1994	$18.00	6%
7/1/2004	$17.00	-6%
7/1/2006	$18.70	10%
7/1/2008	$29.90	60%

Brockton's current rate is $25.42 assuming a consumption level of 8.5 hundred of cubic feet (ccf) per month and $29.90 assuming 10 ccf per month.[32]

Although the 2008 rate increase was substantial in percentage terms (60 percent), in absolute terms, the water bill of the City's residential customers with average consumption of 8.5 ccf per month increased by less than $10 a month.

It is not clear what the revenues from the 2008 rate increase were designed to cover. For example, the January 2008 CDM Water Rate Evaluation presentation for the City of Brockton (prepared six months before the 2008 rate increase) appears to propose a rate increase under an assumption that the "City takes desal volumes equal to its firm commitments in each year." However, the CDM

[31] Brockton Water Rate Table, 1981-2010. 2013. City of Brockton, MA. File provided by Mr. Creedon via e-mail. The 2004 rate decrease appears to be due to the City's introduction of different blocks for its block rate structure. The City first introduced a block rate structure around 1992.

[32] Brockton's average consumption in 2011 was 8.5 ccf (Brockton Water Commission. 2012. 2011 Public Water Supply Annual Statistical Report. Massachusetts Department of Environmental Protection. Pgs. 42-46). Ten ccf is a value often used in rate comparisons.

presentation only includes cost projections through 2011, advises that the "City can reduce FY2009 expenses by minimizing desal water use to those days/periods where City unable to meet requirements from City supply," and includes proposed rate increase alternatives that do not match the rate increase that was enacted in July 2008.[33] We were unable to obtain the 2008 Rate Study that we would expect was prepared to support the presentation; Mr. Creedon and Mr. Hanson both advised that they were unaware whether such a study exists. As a result, we cannot determine whether the City intended for the 2008 rate increase to cover all or part of the fixed Aquaria costs and/or the cost of using the desalinated water up to the fixed commitment. It is further unclear through what year the rate increase covered the Aquaria expenses.

Further, the Water Commission has proposed at least three rate increases since the 2008 rate increase, including, most recently, a six percent rate increase in January 2013. However, the City Council did not approve the proposed rate increases.[34,35]

Generally speaking, a good financial management practice is to implement rate increases on an annual basis at a level sufficient, at a minimum, to cover the annual inflation in costs. In addition, in Brockton's case, rate adjustments may be necessary to accommodate the annual increases in the Aquaria fixed commitment fee and/or the Aquaria volume-based fee. The result of no recent rate increases is apparent in the FY2012 financial results, with the Water Fund operating at a loss. The financial statements and Mr. Creedon also indicate that "capital spending has suffered" due to the City's inability or unwillingness to increase rates. All of these factors underscore issues that Brockton must address, most likely through increased water rates or another revenue source.

2.4.2 COMPARISON OF BROCKTON RATES TO RATES OF SIMILAR WATER UTILITIES IN THE NATION AND THE COMMONWEALTH

We also collected data to compare Brockton's water rates to the rates of water utilities in the nation and the Commonwealth of Massachusetts. First, we compare Brockton's average rate to rates of similarly sized water utilities in the nation for which data are readily available. As described in Exhibit 2-5, we find that Brockton's current rate is similar to the median and the average bill of residents served by other similarly sized utilities. Note that the comparisons use the same monthly flow (10 ccf) across all cities to calculate the monthly rates, which may not reflect the actual typical monthly billings for a particular area. For example, Brockton's average residential consumption in 2011 was 8.51 ccf per month, and so, its residents may be paying less than $29.90 a month on average.[36]

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[33] CDM. 2008. Water Rate Evaluation, Preliminary Results. Prepared for City of Brockton. Slides not numbered.

[34] City of Brockton. 2012. Basic Financial Statements for the year ended June 30, 2012, pg. 15; Personal communication with Mr. Creedon.

[35] As we understand from Mr. Creedon, the rate increase process is as follows: 1) the Water Commission makes a recommendation for a rate increase; 2) the Mayor or a member of the City Council proposes the rate increase to the City Council; 3) the City Council makes the final decision.

[36] Brockton Water Commission, 2012. Pg. 42-46.

EXHIBIT 2-5. BROCKTON'S AVERAGE MONTHLY RESIDENTIAL CUSTOMER BILL COMPARED TO BILLS OF SIMILARLY SIZED WATER UTILITIES IN THE NATION (ASSUMING CONSUMPTION OF 10 CCF PER MONTH)[37]

ENTITY	SERVICE POPULATION	DAILY GALLONS SOLD (MGD)	MONTHLY RATE, 2012
Douglasville, GA	130,000	8.93	$41.18
Spotsylvania County, VA	120,000	8.34	$40.68
Santa Clara, CA	118,000	17.41	$39.10
Daytona Beach, FL	101,000	10.89	$38.13
Sioux Falls, SD	156,000	18.95	$36.89
Brunswick County, NC	110,000	12.45	$33.89
Palmdale, CA	111,000	15.69	$31.67
Lawrence, KS	100,000	10.51	$31.42
Lancaster, PA	120,000	13.06	$31.37
Cambridge, MA	105,000	13.88	$30.20
Brockton, MA	120,000	9.4	$29.90
Yuma, AZ	103,000	22.75	$29.88
Johnson City, TN	100,000	9.14	$26.92
Lima, OH	75,000	12.41	$25.15
Carrollton, TX	120,000	21.25	$23.93
Ann Arbor, MI	138,000	13.27	$20.56
Kalamazoo, MI	150,000	16.19	$13.92
Rochester, MN	107,000	11.58	$12.87
Average (excluding Brockton)			**$29.87**
Median (excluding Brockton)			**$31.37**

We also compared Brockton's average monthly water rate to rates of other communities in relative proximity to Brockton in the Commonwealth of Massachusetts (the communities vary in size). Exhibit 2-6 presents the data on Brockton's neighboring communities. Across the Commonwealth, typical monthly water bills range from $9.42 to $129.67 assuming a monthly flow of 10 ccf. The 2012 Commonwealth-wide monthly average rate was $41.50 per household; the median was $39.67. Brockton's rate ($36.92 including a service charge) is below both the average and the median. With respect to the neighboring communities, we find that Brockton's rate is also below the average and the median.[38]

[37] Raftelis Financial Consultants, Inc. 2013. 2012 Water and Wastewater Rate Survey. Brockton rate is from the City of Brockton website: Current Water and Sewer Rates. 2013. City of Brockton, MA. Accessed on September 18th, 2013 at http://www.brockton.ma.us/docs/documents/2011_Water_and_Sewer_rates.pdf?sfvrsn=0.

[38] These data include a service charge for many entities, including Brockton. We include the service charge in Brockton's rate for consistency.

EXHIBIT 2-6. BROCKTON'S AVERAGE MONTHLY RESIDENTIAL CUSTOMER BILL COMPARED TO RESIDENTIAL WATER BILLS OF COMMUNITIES IN RELATIVE PROXIMITY TO BROCKTON WITHIN THE COMMONWEALTH (ASSUMING CONSUMPTION OF 10 CCF PER MONTH AND INCLUDING SERVICE FEES)[39]

ENTITY	SERVICE POPULATION	MONTHLY RATE, 2012
Holbrook	10,780	$51.67
Abington/Rockland Joint Water Works	35,000	$51.50
Weymouth	55,000	$50.75
Quincy	88,000	$50.67
East Bridgewater	14,100	$48.25
Boston Water and Sewer Commission	1,100,000	$43.91
Stoughton	27,000	$41.00
Brockton	120,000	$36.92
Braintree	60,000	$35.66
West Bridgewater	6,795	$35.00
Easton	22,904	$29.50
Average (excluding Brockton)		**$43.79**
Median (excluding Brockton)		**$46.08**

Though the above exhibits demonstrate that the service that Brockton is providing is relatively inexpensive (at or below Commonwealth- and nationwide averages and medians), leaving room for rates to grow, there are limits as to how much and how quickly the City can increase its rates annually. In scheduling rate increases, the utility must manage to take into account rate shock, which occurs when the increase in the water bill causes customers to reduce consumption, thus reducing the revenue yield of the rate increase.

2.5 CURRENT COST PER HOUSEHOLD AS A PERCENT OF MHI

Another way to evaluate the relative burden of Brockton's water costs on its residential users is in terms of the cost per household (CPH). The CPH analysis uses the following approach:

1. Calculate the utility's current annual costs (sum of operating expenses, excluding depreciation, and annual debt service (interest and principal));
2. Calculate the residential share of costs, i.e., the share of costs attributable to the residential users. This calculation uses the residential factor, which is the percent of total flow attributable to the residential users. Residential Share = Current Cost x Residential Factor %;
3. Calculate the CPH: divide the Residential Share of Costs by Number of Households in the service area;

[39] All data are from: Tighe & Bond. 2013. 2012 Massachusetts Water Rate Survey. With the exception of Boston Water and Sewer Commission, which is from: Raftelis Financial Consultants, Inc. 2013. 2012 Water and Wastewater Rate Survey.

4. Calculate the CPH as a percent of Median Household Income (MHI): CPH divided by MHI.

Exhibit 2-7 presents this information in a flow chart format.

EXHIBIT 2-7. FLOWCHART: COST PER HOUSEHOLD AS A PERCENT OF MEDIAN HOUSEHOLD INCOME

Total Annual Costs

x

Residential Factor (%)

=

Residential Share of Costs

÷

Number of Households

=

Cost per Household (CPH)

÷

Median Household Income (MHI)

=

CPH AS A PERCENT OF MHI

With these data, we can compare Brockton's baseline CPH as a percent of MHI to national affordability thresholds. For example, in 1998, USEPA established a water affordability threshold of 2.5 percent of MHI in its National Level Affordability Criteria. It represents the upper limit for the cost of water bills including costs for treatment, distribution, and operation. It applies to small community water systems serving a population of fewer than 10,000. USEPA has also used as a benchmark a combined four percent affordability threshold for water systems, i.e., two percent each for water and wastewater.[40]

To evaluate each proposed fish passage scenario, we use the CPH affordability methodology and compare the results to the baseline and the national affordability thresholds.

This analytical framework is a "snapshot," and assumes that all of the costs are incurred today, including the full operations and maintenance costs that will ultimately be required for a project (e.g., the fish passage alternative). The analysis is not calculated out over years, and thus does not take into account changes in the residential share of costs, existing debt service, or number of households that may occur over time. Because such prognostication is difficult, we generally perform the analysis based on information from the most recent year available. For Brockton, we

[40] Congressional Budget Office. 2002. Future Investment in Drinking Water and Wastewater Infrastructure. Pg.55

rely on the financial data for the fiscal year ended June 30, 2012, 2011 flow data, and the 2011 American Community Survey data.

Exhibit 2-8 presents the results of our baseline analysis of Brockton's CPH. We find that the service that Brockton presently provides is relatively inexpensive on a CPH basis, between 0.55 and 0.90 percent of MHI (depending on whether we use the number of households or the number of residential connections in the analysis).

EXHIBIT 2-8. BROCKTON WATER ENTERPRISE FUND, CURRENT COST PER HOUSEHOLD AS A PERCENT OF MHI (FY ENDED 6/30/12)

Line #	Inputs	Current Situation FY Ended 6/30/12		Comment
		Census Households	Residential Connections	
		2011 Average Consumption 9.4 MGD (raw); Average Silver Lake Withdrawal 9.6 MGD (all years)		
	Operating Expenses:			
1	Salaries and Benefits	4,553,216	4,553,216	Brockton Financial Statements for the year ended June 30, 2012, pg.25. Annual operating expenses, excluding depreciation.
2	Utilities	891,726	891,726	
3	Repairs and Maintenance	711,193	711,193	Aquaria fixed charge calculated using fixed charge data in calendar years 2011 and 2012; Aquaria's firm commitment volume at the end of 2012 was 3.5 MGD. Veolia fixed charge calculated as the difference between the total Contractual Services cost and the Aquaria cost. It is possible that there are other providers of contractual services to Brockton which this value includes; however, detailed information on Veolia fixed charge and other providers of contractual services is not available at this time.
4	Contractual Services	7,135,645	7,135,645	
5	*Aquaria (calculated)*	*5,443,100*	*5,443,100*	
6	*Veolia and Other (calculated)*	*1,692,545*	*1,692,545*	
7	Other Supplies and Expenses	613,391	613,391	
8	Annual Debt Service	1,865,999	1,865,999	Brockton Financial Statements for the year ended June 30, 2012, pg.26 and Brockton Financial Statements for the year ended June 30, 2011, pg. 49. This value combines the Water Fund's principal and interest paid on debt in 2012. The interest paid is from Brockton's 2012 Water Fund's Statement of Cash Flows. The principal paid is from the notes to Brockton's 2011 Financial Statements, principal to be paid by the Water Fund in 2012. (The 2012 Statements did not include a separate value for the principal paid).
9	**Total:**	**15,771,170**	**15,771,170**	Calculated as the sum of the above.
10	Residential Factor (% of Flow)	52.8%	52.8%	2011 residential usage as a percent of total average day demand. Draft Final Feasibilty Report, July 2013, pg. 68 (data from Brockton's 2011 Annual Statistical Report). Note, this value does not include flows of residential users in Hanson and Whitman and may be lower than the actual. In addition, the City's commercial accounts may serve residential users (for example, those residing in multi-unit buildings). This calculation does not include flows to such users; inclusion of such users' flow will result in a higher residential factor.
11	Residential Share of Costs	8,322,617	8,322,617	Calculated (line 9 times line 10).
12	Number of Households/Residential Connections in the Service Area	33,720	20,662	Number of households in Brockton is from the 2011 American Community Survey. Assumes the service area covers the City in its entirety (confirmed in discussions with JRWA). According to Brockton's 2011 Annual Statistical Report, the City has 20,662 residential connections - a value lower than the number of households in Brockton. This may indicate that Brockton serves some residential households under commercial accounts. We conduct the analysis using both values.
13	**Cost per Household (CPH)**	**247**	**403**	Calculated (line 11 divided by line 12).
14	Service Area MHI	44,786	44,786	Brockton Median Household Income, 2011 American Community Survey.
15	**CPH as a % of MHI**	**0.55%**	**0.90%**	Calculated (line 13 divided by line 14).

The two main uncertainties in our analysis are the residential factor and the number of households/residential connections in the service area.

- **Residential Factor:** The Residential Factor is the percent of water volume provided to the residential users of the system. Our residential factor value (53 percent) relies on usage by residential customers as defined by Brockton (users with residential connections). It does not include the usage of households in wholesale communities (whose flow is listed separately) and likely excludes at least some households in multi-unit structures (such structures often have a single commercial connection and are billed as commercial users). Ideally, the Residential Factor value should include flows to households in all types of structures (including multi-unit buildings) as well as to residential users in wholesale communities such as Hanson and Whitman. At this time, detailed data necessary to conduct such analysis are not available.
- **Number of Households vs. Number of Residential Connections:** We conduct the analysis using both the number of households and the number of residential connections in Brockton. Because our cost, residential flow, and residential factor data are for Brockton alone, we focus on the core City in our analysis. Our service area households include Brockton households only and do not include the households in wholesale communities. Similarly, we assume that all residential connections are located within Brockton. We find that the number of households in Brockton is significantly higher than the number of residential connections, which may indicate that Brockton serves some residential households under commercial accounts.

Overall, our analysis concludes that Brockton's current cost of service is relatively low, less than one percent of MHI regardless of the assumption regarding the number of households. The CPH that relies on the number of connections, however, is nearly double the CPH that uses the number of households. To be consistent with our residential flow data that rely on residential connections, we use the number of residential connections in our analyses of fish passage alternatives.

We also compare the estimated cost per household to the annual average residential bill (approximately $305 annually, assuming average monthly residential consumption of 8.51 ccf and a rate of $2.99 per ccf). This is close to a mid-point between the households-based CPH of $247 and the connections-based CPH of $403. Because our CPH analysis contains several uncertainties, an average residential bill between the two CPH values we calculate is generally in line with our expectations.

2.6 FISH PASSAGE ALTERNATIVES EVALUATION

Finally, we conduct a CPH analysis of the proposed fish passage alternatives. All scenarios evaluate the changes in Brockton's CPH associated with substituting Silver Lake withdrawals with desalinated water from Aquaria. The amounts and timing of the substitutions differ in each scenario. We evaluate the following scenarios:[41]

A. Alternatives 1 and 2, Fish Ladder or Bypass: substitute 2 mgd of Silver Lake withdrawal with water from Aquaria between April and June and between September and November (6 months a year);

B. Alternatives 1 and 2, Fish Ladder or Bypass: substitute 2 mgd of Silver Lake withdrawal with water from Aquaria between April and November (8 months a year);

C. Alternatives 1 and 2, Fish Ladder or Bypass: substitute maximum allowable volume of Silver Lake withdrawal with water from Aquaria between April and November (8 months a year). For purposes of this analysis and to ensure that all data are consistent in terms of the year they were generated, we use Aquaria's 2012 fixed commitment volume of 3.5 mgd. With an additional authorized excess withdrawal of 1 mgd, the maximum allowable Aquaria volume in this scenario is 4.5 mgd;

D. Alternatives 3 and 4, Partial or Full Dam Removal: substitute maximum allowable volume of Silver Lake withdrawal with water from Aquaria between July and October (4 months a year). Similar to the Scenario C above, we use a maximum allowable volume of 4.5 mgd;

E. Alternatives 3 and 4, Partial or Full Dam Removal: substitute 7 mgd of Silver Lake withdrawal with water from Aquaria. For purposes of this analysis, we assume that Brockton will utilize the contractual option to increase its firm commitment volume by 2.5 mgd, to a total of 6 mgd. With an additional authorized excess withdrawal of 1 mgd, the total Aquaria volume in this scenario is 7 mgd.[42]

We assume that the majority of inputs will not change compared to the baseline CPH calculation, including: Veolia and Aquaria baseline costs, annual debt service, residential factor, number of residential connections, or service area MHI. The analysis varies inputs for Aquaria fixed fee (associated with the expanded firm commitment), the flow-based rate, and the excess rate. The inputs that vary are highlighted in orange in Exhibit 2-9.

To calculate the incremental Aquaria fees and charges, we rely on the flow information, the number of days when Brockton requires the Aquaria water, and the fee and rate data summarized in the Aquaria section above.[43]

[41] Gomez and Sullivan Engineers, P.C., 2013. Pg. 90, 91, and 111.

[42] Our analysis does not contemplate the option of the Aquaria plant's purchase by Brockton. The Aquaria contract does contain a purchase clause; however, no other information is available on the subject.

[43] For example, the calculation of the Aquaria Variable Rate (line 10) under Scenario A (substitute 2 mgd 6 months a year) is as follows: \$1.23/1,000 gallons x 2 mgd x 10^6 x (30+31+30+30+31+30) = \$447,720.

We find that the fish passage scenarios do not result in a significant incremental increase in CPH or CPH as a percent of MHI. In all but one scenario the CPH remains less than one percent of MHI (0.92 to 0.97 percent of MHI). One scenario (Scenario E, which assumes a significant increase in Aquaria fixed commitment) results in a CPH that is slightly above one percent of MHI at 1.08 percent of MHI, but is still considerably below the USEPA thresholds of 2 or 2.5 percent of MHI used for water utilities. On a dollar basis, the CPH increases by between $11 and $80 per year, compared to the baseline CPH. Exhibit 2-9 summarizes the analysis.

EXHIBIT 2-9. BROCKTON WATER ENTERPRISE FUND. COST PER HOUSEHOLD AS A PERCENT OF MHI, FISH PASSAGE ALTERNATIVES AND SCENARIOS

Line #	All Actuals Are for FY Ended 6/30/12; All Scenarios Rely on Number of Residential Connections	**Alt. 1&2 Fish Ladder or Bypass**	**Alt. 1&2 Fish Ladder or Bypass**	**Alt. 1&2 Fish Ladder or Bypass**	**Alt. 3&4 Partial/Full Dam Removal**	**Alt. 3&4 Partial/Full Dam Removal**
		Substitute 2 MGD of Silver Lake Withdrawal with Aquaria April-June and September-November (6 mo. a year)	Substitute 2 MGD of Silver Lake Withdrawal with Aquaria April-November (8 mo. a year)	Substitute 4.5 MGD of Silver Lake Withdrawal with Aquaria (Max Allowable: 3.5+1) April-November (8 mo. a year)	Substitute 4.5 MGD of Silver Lake Withdrawal with Aquaria (Max Allowable: 3.5+1) July-October (4 mo. a year)	Substitute 7 MGD of Silver Lake Withdrawal with Aquaria (Increase Firm Commitment: 3.5+2.5+1) July-October (4 mo. a year)
		[A]	[B]	[C]	[D]	[E]
	Operating Expenses:					
1	Salaries and Benefits	4,553,216	4,553,216	4,553,216	4,553,216	4,553,216
2	Utilities	891,726	891,726	891,726	891,726	891,726
3	Repairs and Maintenance	711,193	711,193	711,193	711,193	711,193
4	Contractual Services	7,135,645	7,135,645	7,135,645	7,135,645	7,135,645
5	*Aquaria (calculated)*	*5,443,100*	*5,443,100*	*5,443,100*	*5,443,100*	*5,443,100*
6	*Veolia and Other (calculated)*	*1,692,545*	*1,692,545*	*1,692,545*	*1,692,545*	*1,692,545*
7	Other Supplies and Expenses	613,391	613,391	613,391	613,391	613,391
8	Annual Debt Service	1,865,999	1,865,999	1,865,999	1,865,999	1,865,999
	Scenario development:					
9	Aquaria Fixed Rate - Expanded Firm Commitment ($85,775 per year per 0.1 MGD)	0	0	0	0	2,144,375
10	Aquaria Variable Rate ($1.23 per 1,000 gallons) within the firm commitment	447,720	600,240	1,050,420	529,515	907,740
11	Aquaria Excess Rate ($0.60 per 1,000 gallons) above the firm commitment	0	0	146,400	73,800	73,800
12	**Total:**	**16,218,890**	**16,371,410**	**16,967,990**	**16,374,485**	**18,897,085**
13	Residential Factor (% of Flow)	52.8%	52.8%	52.8%	52.8%	52.8%
14	Residential Share of Costs	8,558,884	8,639,371	8,954,192	8,640,993	9,972,197
15	Number of Residential Connections	20,662	20,662	20,662	20,662	20,662
16	**Cost per Household (CPH)**	**414**	**418**	**433**	**418**	**483**
17	MHI (Brockton)	44,786	44,786	44,786	44,786	44,786
18	**CPH as a % of MHI**	**0.92%**	**0.93%**	**0.97%**	**0.93%**	**1.08%**

Overall, our analysis is likely conservative (i.e., more likely to overstate than understate the CPH) because we do not have sufficient data to account for the reduction in costs associated with the reduction in withdrawals and treatment of water from Silver Lake. Specifically:

- Utilities (line 2): As we understand from our discussions with Mr. Hanson, Brockton currently pays for electricity at the Veolia plant. If Veolia were to treat less water, the electricity cost may decrease. However, we do not have sufficient information to account for this reduction. We also do not have information to determine whether Brockton pays for any water treatment costs at Veolia in addition to the fixed fee.

- Veolia Contractual Services (line 6): As discussed above, we do not have the Veolia contract or detailed information about the fixed fee that Brockton pays to Veolia. However, as we understand, in the short-term, the City has little flexibility with respect to this fixed fee, even if it withdraws and treats less water than specified in the contract.[44] In the medium or long term, Brockton may be able to renegotiate the Veolia contract if its Silver Lake water withdrawals remain consistently below the contractual range of 10.8 to 13.2 mgd. However, absent detailed information, we do not account for this potential reduction in our analysis.

[44] There is conflicting information regarding whether Veolia may be contractually obligated to reimburse Brockton in case Brockton withdraws and treats volumes of water that are lower than those in the contract. See the Veolia discussion above for further information.

SECTION 3 | DISCUSSION OF POTENTIAL BENEFITS

The primary intended benefit of the fish passage alternatives at Forge Pond Dam is to restore river herring and American eel populations at Silver Lake, which is historic habitat for both species. Lakes and rivers, and the fish and wildlife species within these water bodies, are public trust resources. These resources can benefit the public, for example, through recreational opportunities or simply the knowledge that they will be available for future generations. The lack of fish passage at Forge Pond Dam, and the current management of Silver Lake as a drinking water source for the City of Brockton, compromise the quality and availability of these resources. The remainder of this section discusses how implementing the fish passage alternatives described in Section 1 may benefit the public.

3.1 CATEGORIES OF POTENTIAL ECOSYSTEM SERVICE BENEFITS

Healthy, well-functioning ecosystems provide an array of goods and services of value to people. We refer to these goods and services collectively as "ecosystem services." That is, ecosystem services reflect, "…the direct or indirect contributions that ecosystems make to the well-being of human populations."[45] The primary environmental improvements related to the proposed fish passage alternatives include more robust local populations of herring and eel, and reduced eutrophication levels of Silver Lake and Monponsett Pond. These improvements have the potential to increase the value of regional commercial fisheries, enhance the quality of regional recreational opportunities, and increase property values adjacent to improved water bodies.

Ecosystem Service Benefits of Improved Herring and Eel Populations

Increased fish and eel populations may improve the quality of regional recreational activities, such as fishing, boating, and wildlife-watching. As herring serve as an important prey species for other wildlife (including fish, birds, mammals and turtles), this benefit is not only directly associated with increased numbers of herring but also healthier populations of other fish and wildlife species within the food web.

River herring also historically provided a valuable commercial fishery in Massachusetts. To the extent that herring populations increase to levels sufficient to lift the existing moratorium on recreational and commercial fishing, the species could once again serve as an economic resource, increasing regional income and providing employment opportunities. Furthermore, striped bass and cod (key commercial fisheries in the Commonwealth) rely on herring as a prey species. Accordingly, increased herring populations may also contribute to the maintenance or improvement of these related fisheries.

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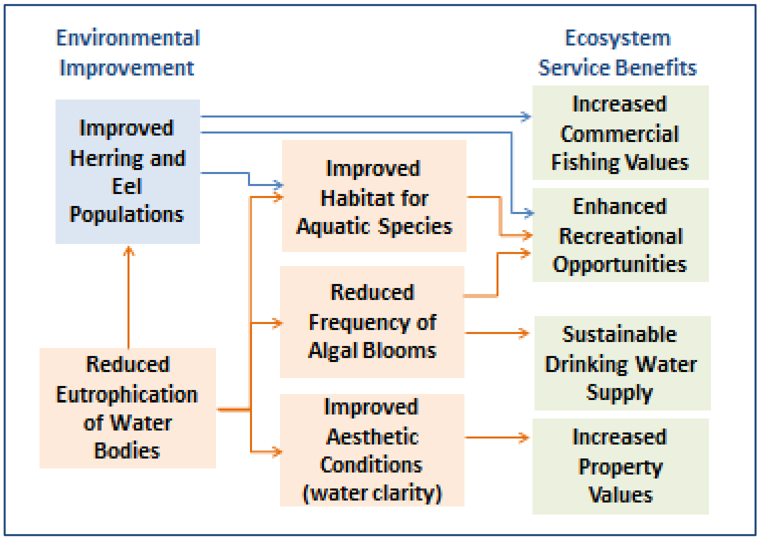
[45] U.S. Environmental Protection Agency Science Advisory Board, Committee on Valuing the Protection of Ecological Systems and Services. May 2009. Valuing the Protection of Ecological Systems and Services: A Report of the EPA Science Advisory Board. EPA-SAB-09-012.

Ecosystem Service Benefits of Reduced Eutrophication

Excess nutrients (i.e., nitrogen and phosphorus) in water can lead to eutrophication, which involves the production of algal blooms that deplete dissolved oxygen levels in the water and block sunlight. These algal blooms can adversely affect fish populations, plant species, and other aquatic life. Recent water quality monitoring data for Silver Lake and Monponsett Pond indicate that Silver Lake is currently slightly eutrophic, whereas the East Basin of Monponsett Pond is eutrophic and the West Basin of Monponsett Pond is hyper-eutrophic and subject to severe nuisance algae growth.[46,47] The algal blooms have caused beach closures at Monponsett Pond.[48]



The City of Brockton currently diverts water from Monponsett Pond to Silver Lake in order to maintain lake levels sufficient for withdrawing water for treatment and potable use. The City also occasionally diverts the water to avoid flooding at the Monponsett Pond site. The fish passage alternatives will reduce the need for the City of Brockton to divert water from Monponsett and Furnace Ponds to Silver Lake. A recent analysis developed by Princeton Hydro, LLC modeled the expected effect on water quality at both sites of ending diversions from Monponsett Pond to Silver Lake. This analysis identified an expected reduction in phosphorus levels at both sites.[49] While ending the diversions from Monponsett to Silver Lake would improve water quality at both sites to some extent, eutrophication will most likely remain an issue in Monponsett. However, the expected reduction in nutrient levels may alleviate the production of algal blooms, improving habitat conditions for aquatic life and potentially reducing the frequency of beach closures. In addition, reducing the eutrophic conditions at these sites may decrease the cost of water treatment, thereby improving the efficiency and sustainability of Silver Lake as a drinking water supply. Furthermore, reducing algae proliferation will increase water clarity. The economics literature demonstrates that people have a positive preference for clearer water. This value may be reflected in an increased willingness to pay for residential properties adjacent to clearer water, all else equal. Sections 3.2 and 3.3 of this analysis discuss these benefits in more detail.

[46] Princeton Hydro, LLC. 2013.

[47] The Princeton Hydro report further noted that Furnace Pond in Pembroke, MA, from which Brockton also diverts water to Silver Lake, is eutrophic. However, the fish passage alternatives are not expected to reduce the level of eutrophication in Furnace Pond. Accordingly, we do not focus on Furnace Pond in this discussion of potential benefits.

[48] Personal communication with Peggy Selter, Administrative Assistant, Halifax Board of Health, on September 10, 2013.

[49] Princeton Hydro, LLC, 2013.

3.2 POTENTIAL EFFECTS ON COMMERCIAL AND RECREATIONAL FISHING

The fish passage alternatives would improve to varying extents the ability of river herring and American eel to access habitat in 634-acre Silver Lake. Full and partial dam removal provide the greatest fish passage benefits, particularly with stable channel construction, followed by the fish ladder and bypass channel alternatives. Full and partial dam removal would fully restore the connectivity of the upper Jones River, while construction of the proposed Alaska steep-pass fish ladder or nature-like fishway channel would allow river herring and American eels to bypass the dam structure. All alternatives are therefore expected to benefit herring and eel populations, although data are not available to quantify the specific extent to which the passage options will increase population levels.

Status of Regional River Herring and American Eel Populations

Fish counts have documented both species within the 7.5-mile-long Jones River; the river herring run size has ranged from approximately 500 to approximately 4,500 since 2005 based on estimates derived from volunteer fish counts, while a young-of-the-year eel station on the river monitored by the Massachusetts Division of Marine Fisheries has monitored population levels of American eels in the river since 2001.[50] Sampling efforts have also determined that Silver Lake has water quality conditions sufficient to support river herring spawning and nursery habitat requirements.[51]

The Forge Pond Dam is the final obstruction preventing these species from reaching Silver Lake (river herring cannot currently reach Silver Lake, and while eels have been found in the lake, passage for the species is impaired). The Elm Street Dam (the first obstruction encountered on the Jones River) was fitted with an efficient Alaskan steep-pass fish ladder in 2001, while the Wapping Road Dam (the second obstruction) was removed in 2011.

The populations of both river herring and American eels have experienced steep declines in recent decades, resulting in recent petitions to list these species under the Federal Endangered Species Act (ESA).[52] The Commonwealth of Massachusetts implemented a moratorium on the harvest of river herring in 2005, and the Atlantic States Marine Fisheries Commission implemented a recreational and commercial fishing moratorium in 2011. The National Marine Fisheries Service (NMFS) identified river herring as a "Species of Concern" in 2006, and though the agency recently decided not to list the species under the ESA, NMFS is planning to implement a coordinated coast-wide river herring conservation effort in collaboration with the Atlantic States Marine Fisheries Commission, to include both monitoring and restoration activities.[53]

American eel is also a priority species for the Atlantic States Marine Fisheries Commission, which recently developed an Addendum III to its management plan for American eel to reduce mortality and increase conservation of the species. The species is also currently under review by the U.S. Fish and Wildlife to determine whether the listing of the species as "threatened" is

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[50] Chase, 2011.

[51] Chase et al., 2013.

[52] Natural Resources Defense Council, 2011.

[53] National Oceanic and Atmospheric Administration, 2013.

warranted under the Endangered Species Act.[54] Providing fish passage to Silver Lake for these species would thus support the goals of the Commonwealth of Massachusetts, NMFS, and the Atlantic States Marine Fisheries Commission.

There is limited research focused on quantifying the relationship between the amount of available habitat for fish life functions, such as spawning or foraging, and the size of fish populations. The productivity of river herring runs varies widely and thus any estimates of the potential size of the run that Silver Lake could support are uncertain. Fisheries management agencies, including the Massachusetts Division of Marine Fisheries (*MarineFisheries*), have referenced a few existing studies that estimate the herring productivity per unit of spawning habitat. Officials at *MarineFisheries* have cautioned, however, that these studies are site-specific and based on limited data. Regardless, they represent the best available information regarding potential benefits of opening additional habitat.[55]

In particular, two studies of alewife runs in lakes in Maine estimate the number of juvenile alewife produced per hectare of spawning habitat. The findings of the two studies vary by an order of magnitude. Specifically, based on estimates of approximately 165 juveniles per acre to 3,300 per acre, Silver Lake may contribute on the order of 100,000 to two million juvenile herring.[56] While these studies demonstrate that spawning habitat is important in restoring sustainable herring populations, the productivity estimates do not directly translate to population level effects for river herring. Generally a small proportion of these juvenile alewives would then survive long enough to return to spawn.

3.2.1 RIVER HERRING

River herring constitute one of the oldest fisheries in Massachusetts. These species supplied food and fertilizer to the early inhabitants of Massachusetts since the landing of the Pilgrims.[57] Although there are no quantitative data on the size of the historic runs of these species in the Jones River, available information dating back to the late 1800s suggests that the river herring run size has declined significantly over time. Historic studies describe the existence of dams as preventing passage of the species to Silver Lake.[58]

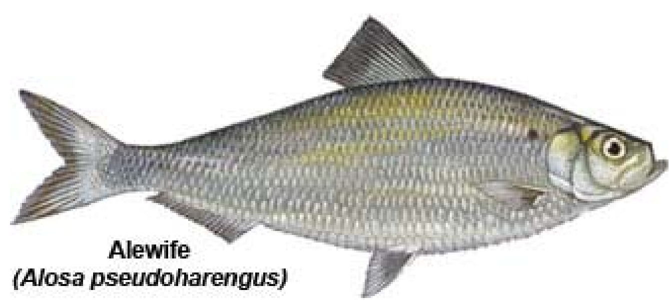


Image Credit: NOAA, Northeast Regional Office via www.nero.noaa.gov

[54] United States Fish and Wildlife Service, 2011.

[55] Personal communication with Brad Chase, Massachusetts Division of Marine Fisheries, on September 24, 2013.

[56] Estimate of 3,300 juveniles per acre from Walton, C.J., 1987; estimate of 165 juveniles per acre from Havey, K.A., 1973.

[57] Field, G.W., 1914.

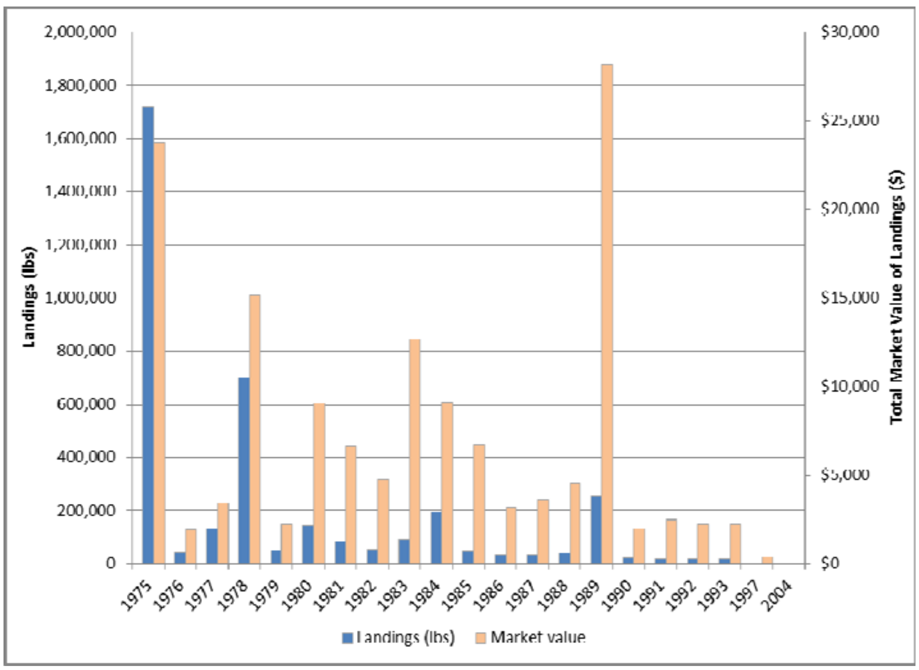
[58] Chase et al., 2013.

Both blueback herring and alewives were harvested commercially in Massachusetts up until the Commonwealth implemented a moratorium on harvest in 2005. Both species of river herring were also harvested recreationally, mainly for bait (i.e., for lobster and striped bass) and personal consumption.[59] While there are some data regarding the historic numbers of river herring harvested recreationally, the *MarineFisheries* caution that these data are not precise estimates.[60]

Exhibit 3-2 presents the quantity and value of annual commercial landings of river herring in Massachusetts between 1975 and 2004, which fell dramatically from a peak of about 1.7 million pounds harvested in 1975 to the 89 pounds harvested in 2004. This reduction in catch is due primarily to a coast-wide decline in population resulting from a number of factors including overexploitation, accidental catch while fishing for other species, water quality, and dams.[61]

River herring play an important ecological role, serving as key species in the dynamics of food chains in freshwater, estuarine, and marine ecosystems. For example, Yako et al. (2000) report that juvenile river herring were the most important fish prey consumed by largemouth bass (*Micropterus salmoides*) in two coastal Massachusetts lakes.[62] The presence of juvenile river herring as a forage base in freshwater water bodies in Massachusetts accordingly has the potential to improve freshwater recreational fishing opportunities in the Commonwealth.

EXHIBIT 3-2. ANNUAL COMMERCIAL RIVER HERRING LANDINGS IN MASSACHUSETTS



Source: NMFS. 2013. National Marine Fisheries Service Annual Commercial Landing Statistics.

[59] Atlantic States Marine Fisheries Commission, 2008.

[60] Nelson, G.A., P.D. Brady, J.J. Sheppard, and M.P. Armstrong. January 2011. "An Assessment of River Herring Stocks in Massachusetts." Massachusetts Division of Marine Fisheries Technical Report TR-46.

[61] Schmidt, R.E., et al., 2003; National Oceanic and Atmospheric Administration, 2013.

[62] Yako, L.A. et al., 2011.

River herring are also an important prey item for striped bass (*Morone saxatilis*), an important recreational and commercial fishery in Massachusetts.[63] In a report prepared for Stripers Forever, a non-profit, volunteer organization that supports river herring conservation, Southwick Associates, Inc. (2005) estimate that in 2003, about one million pounds of striped bass were harvested commercially in Massachusetts with a retail sale value of approximately $6 million. The report further finds that approximately five million pounds of striped bass were harvested recreationally in the Commonwealth with associated travel and equipment expenditures of approximately $650 million.[64] Improved river herring populations contribute to the maintenance or improvement of both the commercial fishery and the recreational fishery values.

Sufficient abundance of river herring is also important for the recovery of New England cod (*Gadus morhua*), another key commercial fishery in Massachusetts that has experienced declines in the past few decades.[65] Commercial landings of cod in Massachusetts were worth $27.6 million in 2011, approximately five percent of the total value of commercial fish landings in Massachusetts during that year.[66]

Providing fish passage at the Forge Pond Dam thus has the potential to help restore the Jones River's river herring population and the broader Jones River ecosystem, contribute to the recovery of Massachusetts' river herring fishery, and indirectly support important recreational and commercial fisheries in the Commonwealth, though the magnitude of these benefits is uncertain.

3.2.2 AMERICAN EEL

American eels, which forage in freshwater ponds and rivers but spawn in the Sargasso Sea, also support both recreational and commercial fisheries in the United States. Commercial landings peaked at 3.6 million pounds in 1979, while the value of U.S. commercial American eel landings peaked in 1997 at $6.4 million.[67] In 2009, approximately 728,000 pounds of eels were harvested commercially in the United States with a total value of $1.9 million and an average value per pound of $2.57 (NOAA 2009).[68]

Image Credit: Andy Martinez via http://stellwagen.noaa.gov

[63] Walter, J.F. et al., 2003.

[64] Southwick Associates, Inc., 2005.

[65] Natural Resources Defense Council, 2011; National Oceanic and Atmospheric Administration, 2013.

[66] National Marine Fisheries Service, 2013.

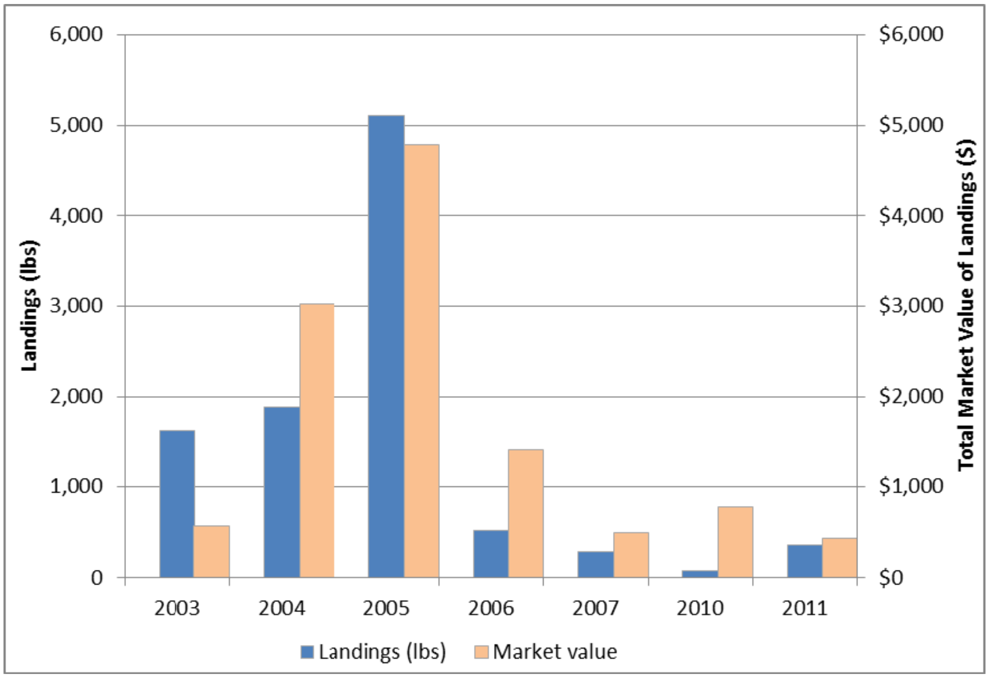
[67] Atlantic States Marine Fisheries Commission, 2013; United States Fish and Wildlife Service, 2011.

[68] National Oceanic and Atmospheric Administration, 2009.

Massachusetts currently supports both recreational and commercial eel fisheries, though the harvest of elvers (the juvenile life stage) is illegal. Massachusetts regulations allow the commercial harvest of eels greater than six inches using specific fishing gear, and the recreational harvest of 50 eels per person per day, though the use of mesh is restricted. Coastal towns also regulate eel fishing.[69]

In the 1970's, Massachusetts supported a growing eel fishery due to high prices paid to fishermen because of increasing European eel demand. However, landings decreased in the early 1980's due to a collapse of the export market.[70] More recently, Massachusetts has had relatively insignificant eel landings, with an average recent harvest between 2009 and 2011 of 621 pounds per year.[71] Exhibit 3-3 presents the weight and value of commercial landings of American eel in Massachusetts between 2003 and 2011.

EXHIBIT 3-3. ANNUAL COMMERCIAL EEL LANDINGS IN MASSACHUSETTS



Source: NMFS. 2013. National Marine Fisheries Service Annual Commercial Landing Statistics.

Though Massachusetts has a relatively small eel harvest, the eel fishery is more economically significant at the regional level. In total, the average annual harvest of yellow eels between 2009 and 2011 in coastal states from Maine to Connecticut was approximately 11,000 pounds. In 2012, 20,764 pounds of elvers were harvested in Maine with a total value of about $39 million and an

[69] Atlantic States Marine Fisheries Commission, 2013; United States Fish and Wildlife Service, 2011.

[70] Facey and Avyle, 1987.

[71] Atlantic States Marine Fisheries Commission, 2013; United States Fish and Wildlife Service, 2011.

average price of $1,867 per pound, approximately nine percent of the value of Maine's entire commercial fisheries landings in 2012.[72] The difference is due to restrictions in Massachusetts on the harvest of valuable juvenile American eels. Such restrictions do not exist in Maine.

In conclusion, this discussion of recreational and commercial fishing values indicates that both river herring and American eel are valuable recreational and commercial fishing resources, both directly and indirectly, to the Commonwealth. Though the magnitude by which the fish passage alternatives may increase recreational or commercial fishing values is uncertain, the fish passage alternatives would contribute to the maintenance or improvement of these economic activities.

3.3 POTENTIAL WATER QUALITY BENEFITS OF FISH PASSAGE ALTERNATIVES

The fish passage alternatives will reduce or preclude the City of Brockton's water diversions from Monponsett and Furnace Ponds to Silver Lake. The two basins of the 528-acre Monponsett Pond are heavily impacted water bodies that have been subject to algal blooms in the last decade though the western basin has been affected to a greater extent. As of 2010, the eastern basin of the pond was categorized by the Massachusetts Integrated List of Waters (303(3) list) as a 4c water body for the presence of exotic species, while the western basin was classified as a Category 5 water body for nutrients, noxious aquatic plants, turbidity, and exotic species.[73] High nutrient levels leading to elevated counts of E. coli, blue-green algae and toxin has led to the closures of beaches on Monponsett Pond during the summers of 2009 through 2013.[74] As a result of these issues the Town of Halifax has spent more than $251,000 on water testing, monitoring of invasive weeds, lake management and algae remediation since 2000.[75] Most recently, in June 2013, Lycott Environmental, Inc. treated West Monponsett Pond with aluminum to reduce levels of available phosphorus in the pond and mitigate the algae issue.

Though the nutrients causing these problems originate from sources within the Monponsett Pond watershed, such as septic systems, storm sewers, fertilizer use around the ponds, and runoff from cranberry bogs and other upstream sources, the City of Brockton's management of Monponsett Pond contributes to water quality problems in both basins. A report developed by Princeton Hydro, LLC estimates that, if the City of Brockton ceased all diversions of water from Monponsett Pond, total phosphorus concentrations would decline by 25 percent in the western basin and 17 percent in the eastern basin. The same report also found that ceasing diversions of water from Monponsett would reduce total phosphorus concentrations in Silver Lake by four to nine percent.[76] The analysis does not evaluate the potential improvement associated with reducing, but not entirely eliminating, the diversions. Under natural conditions, water flows from

[72] Maine Department of Marine Resources, 2013.

[73] Lycott Environmental, Inc., 2012.

[74] Personal communication with Peggy Selter, Administrative Assistant, Halifax Board of Health, on September 10, 2013.

[75] Personal communication with Charlie Seelig, Town Administrator, Town of Halifax, on September 9, 2013.

[76] Princeton Hydro, LLC., 2013.

East Monponsett Pond to West Monponsett Pond and then discharges to Stump Brook. However, when water is diverted from the pond to Silver Lake, water from West Monponsett Pond is drawn into East Monponsett Pond, worsening conditions in the eastern basin. Lastly, the City of Brockton also operates a dam on Stump Brook that alters the natural flow conditions of the stream. When closed, this dam creates a stagnant diversion area in the western portion of Monponsett Pond that may worsen the algae problem.[77]

Reducing the proliferation of algae increases the clarity of the water. While this potential effect of the fish passage alternatives is most likely modest at Silver Lake (with only a four to nine percent reduction in phosphorus), the increased clarity may be more perceptible at Monponsett Pond. The economics literature demonstrates that people prefer clearer water. These studies typically apply hedonic methods, which rely on property transaction and characteristic data to evaluate how a change in one attribute results in a change in property value, all else equal. The majority of the hedonic literature valuing water quality improvements considers how improvements in water clarity, as measured by secchi depth or turbidity,[78] affect waterfront property values near lakes.[79] These studies generally find that home-buyers are willing to pay more for houses adjacent to clearer water (holding other factors constant). This value may reflect the increased aesthetic appeal of clear water, or real or perceived reductions in human or ecological health risks. As the extent to which the fish passage alternatives may increase water clarity at Monponsett Pond is uncertain, we are unable to rely on the existing economics literature to estimate the incremental property value benefit that may result.

A reduction of the amount of water diverted from the Monponsett Ponds would most likely improve water quality and benefit the adjacent Towns of Halifax and Hanson and their residents. First, Monponsett Pond is heavily used for recreation, and fewer or no closures of the pond's public beaches and boat ramps due to impaired water quality would be beneficial. Second, reduced eutrophication in the pond may reduce the cost of water quality treatments to the Town of Halifax. Finally, to the extent that the reductions are sufficient to perceptibly improve water clarity, the aesthetic benefits may be realized as a premium on nearby property values.

3.4 REGIONAL ECONOMIC BENEFITS OF ECOLOGICAL RESTORATION PROJECTS

In addition to the ecosystem service benefits associated with restoring fish populations and improving water quality, investing in ecological restoration projects generates regional economic activity during the planning and implementation phases of the projects. An analysis conducted by Industrial Economics Inc. (IEc) for the Massachusetts Division of Ecological Restoration (MA

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[77] Personal communication with Paul Collis, President, Monponsett Watershed Association, on September 11, 2013.

[78] Secchi depth measures water clarity based on the depth at which a small disc is visible from the surface.

[79] For example: Walsh, P. et al. "The Spatial Extent of Water Quality Benefits in Urban Housing Markets." National Center for Environmental Economics. Working Paper # 10-02. 2010.; Ara, S. et al. "Measuring the Effects of Lake Erie Water Quality in Spatial Hedonic Price Models." Selected Paper prepared for presentation at Environmental and Resource Economists, Third World Congress, Kyoto, Japan. 2006.; Kashian, R. et al. Lake Rehabilitation and the Value of Shoreline Real Estate: Evidence from Delavan, Wisconsin. *The Review of Regional Studies*. Vol. 36(2) 2006: 221-238; Krysel, C. et al. "Lakeshore Property Values and Water Quality: Evidence from Property Sales in the Mississippi Headwaters Region." Mississippi Headwaters Board and Bemidji State University. 2003.; Gibbs et al. An Hedonic Analysis of the Effects of Lake Water Clarity on New Hampshire Lakefront Properties. *Agricultural and Resource Economics Review*. Vol. 31(1) 2002: 39-46.

DER) estimated the short-term regional economic benefits of a subset of ecological restoration projects in the Commonwealth, including wetland creation, dam removals and culvert replacements.

In particular, the analysis quantified the short-term benefits associated with the increased demand for employment, materials, and services (e.g., construction labor, material costs, engineering time, and permitting activities) during the construction phase of the ecological restoration projects. The study concluded that for each $1.0 million invested, these projects generated demand for ten to 13 jobs (in "worker-years") and approximately $1.4 million to $1.8 million in economic output (i.e., value of economic production in the region generated by the project) during the construction phase.[80]

[80] Massachusetts Department of Fish and Game, Division of Ecological Restoration. March 2012. "The Economic Impacts of Ecological Restoration in Massachusetts."

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APPENDIX A

EXHIBIT A-1. BROCKTON WATER UTILITY STATEMENT OF REVENUES, EXPENSES, AND CHANGES IN NET ASSETS, FY2009-2012

YEAR ENDED JUNE 30,	2009	2010	2011	2012
Operating Revenues				
Charges for services	15,509,696	13,406,566	14,726,496	14,588,841
Fees	298,314	364,312	333,814	463,759
Total Operating Revenues	**15,808,010**	**13,770,878**	**15,060,310**	**15,052,600**
Operating Expenses				
Salaries and Benefits	5,195,091	4,362,228	4,471,957	4,553,216
Utilities	994,349	1,129,227	872,612	891,726
Repairs and Maintenance	918,442	962,886	627,197	711,193
Contractual Services	3,504,133	5,063,942	6,276,912	7,135,645
Other Supplies and Expenses	409,331	384,449	778,747	613,391
Depreciation	974,480	1,284,982	1,576,638	1,571,773
Total Operating Expenses	**11,995,826**	**13,187,714**	**14,604,063**	**15,476,944**
Operating Income (Loss)	**3,812,184**	**583,164**	**456,247**	**(424,344)**
Non-operating Revenues (expense)				
Interest Income	140,844	262,137	285,986	304,297
Interest Expense	(660,668)	(625,935)	(596,103)	(562,587)
Debt Subsidies	46,555	45,433	44,405	43,348
Total Non-operating (Expenses) Revenue	**(473,269)**	**(318,365)**	**(265,712)**	**(214,942)**
Income (Loss) Before Transfers and Capital Grants	**3,338,915**	**264,799**	**190,535**	**(639,286)**
Transfers In	191,713	106,500	10,116	0
Transfers Out	(530,681)	(680,015)	(654,704)	(543,135)
Total Transfers In (Out)	(338,968)	(573,515)	(644,588)	(543,135)
Change In Net Assets	**2,999,947**	**(308,716)**	**(454,053)**	**(1,182,421)**
Total Net Assets, Beginning of Year	34,272,002	37,271,949	36,963,233	36,509,180
Total Net Assets, End of Year	37,271,949	36,963,233	36,509,180	35,326,759

EXHIBIT A-2. BROCKTON WATER UTILITY BUDGETED OPERATING EXPENSES, FY2013-2014

YEAR ENDED JUNE 30,	2013	2014
Personal Services - Other Than Overtime	2,518,620	2,551,913
Personal Services - Overtime	450,000	450,000
Ordinary Maintenance - Services	1,472,848	1,376,398
Ordinary Maintenance - Goods	423,086	508,223
Expense Reimbursement to General Fund	2,000,491	600,000
Other Contract Services	1,416,800	1,399,897
US Filter Plant Contract Repair/Replacement Fee	245,834	245,834
Variable Fee	235,500	170,200
Debt Service	0	1,220,387
Desalination Fixed Charges	5,861,800	6,050,977
Desalination Variable Charge	0	100,000
DEP/USEPA Mandate	0	70,000
Total	**14,624,979**	**14,743,829**