CITY OF NORTHAMPTON

MASSACHUSETTS

In City Council, August 19, 2010

Upon recommendation of Councilor Marianne L. LaBarge, Councilor Paul D. Spector and Councilor Eugene A. Tacy

A RESOLUTION OF THE CITY COUNCIL ON THE PRESERVATION OF THE UPPER ROBERTS MEADOW DAM

Whereas, One of the Guiding Principles of the Sustainable Northampton Comprehensive Plan is to, "encourage conservation and use of alternative and renewable energy sources throughout the community," and

Whereas, The Upper Roberts Meadow Dam has been identified as a potential hydro-power facility that could produce 114 – 130 megawatt hours annually, enough to power 25 to 30 homes, from a generator that will produce 26 kilowatts on average per hour, and

Whereas, The new Alternative Energy Portfolio Standard reflects the Green Communities Act goal of meeting 20% of Massachusetts' electricity consumption from new renewable and alternative energy generation by 2020, and

Whereas the Sustainable Northampton Comprehensive Plan targets 25% of its municipal energy to be supplied by renewable sources by 2017, and

Whereas, Goal 3 of the Energy, Environment and Climate Protection section of the Sustainable Northampton Comprehensive Plan is, "Protect valuable and sensitive ecological resources... including to Protect rare and endangered plants and animals and important wildlife corridors," and

Whereas, the Upper Roberts Meadow Dam has formed such an ecological resource by providing a habitat noted by the Massachusetts Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program as a "Core Habitat" that is home to Species of Special Concern including Four-toed Salamander, Jefferson Salamander, Spotted Turtle, Spring Salamander, Wood Turtle, Elderberry Long-Horned Beetle and Spatterdock Darner, and

Whereas, Goal 1 of the Heritage Resources section of the Sustainable Northampton Comprehensive Plan is, "Protect and preserve the City's heritage resources," including objectives to "educate and inform decision makers about heritage resources," and "protect heritage resources from degradation or destruction by public or private actions or inactions," and

Whereas, The Upper Roberts Meadow Dam is such a city heritage resource in that the dam is an historic granite block gravity-arched structure which was built to create a drinking water reservoir, and the Roberts Meadow district was purged of homes, farms, and businesses, similar to the Quabbin, to protect the quality of the drinking water and to create a watershed, and

Whereas, The Upper Roberts Meadow dam is being considered by the Massachusetts Historic Commission for placement on the state Registry of Historic Places, and its consulting engineer, Clemens Herschel, became an engineer of international renown still honored today for inventing the *Venturi* meter that measures water flow, and

Whereas, the micro-hydro dam could generate up to $20,000 annual revenue via net metering that could be used for future dam maintenance and repairs, and

Whereas, the remaining balance of the revenue raised by the micro-hydro dam could be added to the City's general fund, thereby meeting Goal 1 of the Municipal Governance and Financial Stability section of the Sustainable Northampton Comprehensive Plan, which calls for the City to "Diversify revenue streams to support municipal operations."

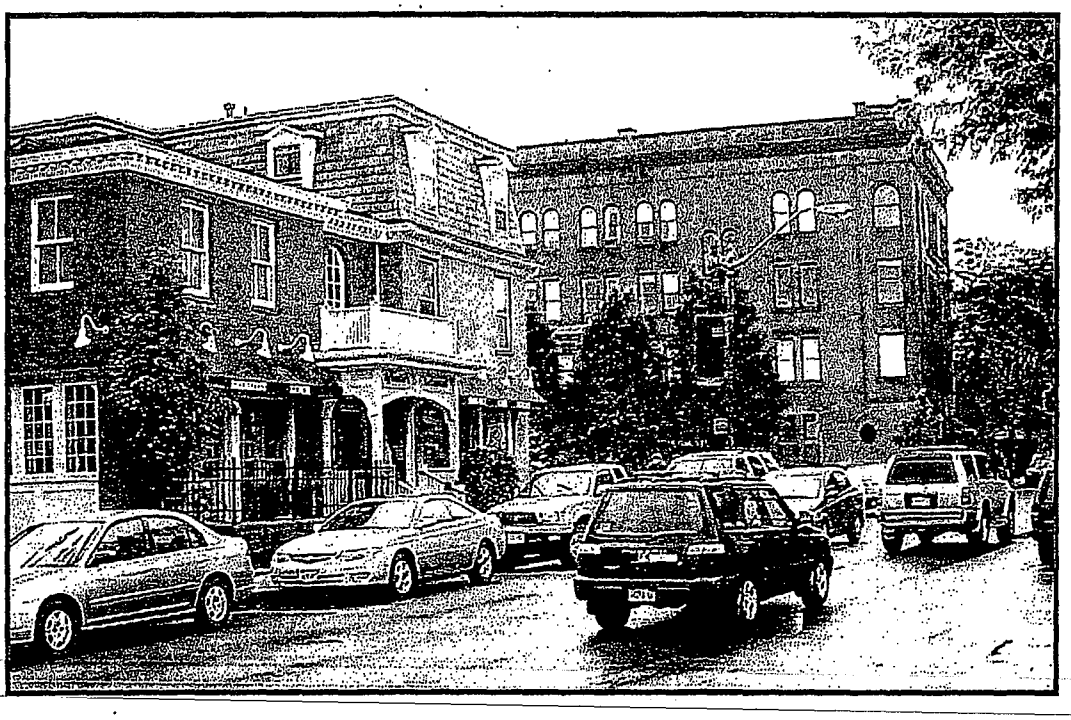
NOW THEREFORE BE IT RESOLVED

The City Council advises the Board of Public Works to seek a change in the current "high hazard" classification of the dam;

And furthermore, if there is a clear understanding that the project will be revenue neutral and does not burden the City with additional costs, the City Council endorses the preservation and restoration of the Upper Roberts Meadow Dam and Reservoir;

And also advises the Board of Public Works to consider that the dam and reservoir are, collectively, more valuable to the City economically, ecologically, historically, and aesthetically intact than if they were removed, and if so determined, the Board of Public Works will cease its' planning for the demolition of the dam and the draining of the reservoir.

- **Support a diverse and integrated community** where all residents have the opportunity to excel on a social, economic, and academic level and to lead healthy, independent and successful lives;
- **Act as a part of a broader region** through the resources connecting us beyond our municipal borders, such as watersheds, rivers, roads, economy, culture, or common goals;
- **Significantly improve energy efficiency** in city buildings and programs, reduce greenhouse gas emissions, and encourage conservation and use of alternative and renewable energy sources throughout the community;
- **Support a wide variety of housing types** that increase rental and homeownership units to create and preserve a range of affordability and choice in housing options;
- **Support artists and the arts,** local culture, history, and education at all levels as vital to a successful, well-balanced community;
- **Connect municipal capital improvements directly to the goals** of *Sustainable Northampton*;
- **Adopt land use patterns** that maintain a mix of urban and rural areas; concentrate development in neighborhood, village, and commercial centers supported by adequate infrastructure, including public transit; promote energy efficiency; and protect environmental, open space, and agricultural resources.
- **Recognize and foster the unique history, character and function** of each residential, commercial, mixed use, and open space neighborhood.
- **Recognize that a diverse and vibrant economy is integral** to a successful community and support business and job development that contribute to the community and the city's long-term sustainability;
- **Make the city increasingly more walkable, bikeable, and transit-oriented;**
- **Improve citizens' lives** through continuous, high quality education; and,
- **Operate the city as a democratic enterprise** that is responsive and responsible to the fiscal, economic, social, and environmental interests of its citizens.



THE ESSEX PARTNERSHIP
65 Main St, Suite 22
Ivoryton, CT 06442

April 7, 2010

Ms. Dee Boyle-Clapp
Friends of the Upper Roberts Meadow Reservoir
Post Office Box 561
Leeds, MA 01053

Re: Upper Roberts Meadow Dam Preliminary Hydro Assessment

Dear Ms. Boyle-Clapp:

This interim report summarizes our findings of the hydropower potential at the Upper Roberts Meadow Dam in Northampton Massachusetts.

INTRODUCTION

The objective of this preliminary evaluation was to utilize readily available information to assess the potential capacity and energy generation of a hydroelectric development at the existing dam. Information on the dam, gross head and drainage area were obtained from GZA's March 2008 *PHASE II ENGINEERING EVALUATION & ALTERNATIVES ANALYSISI* ("GZA Report") and are tabulated below.

Height of Dam	30.1 feet
Hydraulic Height (Gross Head)	25.4 feet
Drainage Area	8.8 sq. mi.

METHODOLGY

Since the Roberts' Meadow Brook is ungaged, flow data were obtained from USGS gauges on the Mill River (gauge #01171500) and Bassett Brook (#01171800). The West Branch of the Westfield River is also in the area but the drainage area is significantly greater (94 square miles at USGS gauge #01181000vs. 8.8 sq. mi. at Roberts Meadow Dam) and was not used in the analysis.

Although the Roberts Meadow Brook is a tributary of the Mill River, the drainage area at the USGS gage is much greater than the Upper Roberts Meadow Dam (52.6 square miles vs. 8.8 sq.mi.). The drainage area for the Bassett Brook is 5.56 square miles - which is much closer in scale to that of Roberts Meadow Brook. The USGS gage at Bassett Brook, however, has only ten years of flow data (1964-1973), compared to over 71 years of data at the Mill River gauge. For this analysis we prorated the Mill River gage flows based on drainage area (52.6sq. mi./8.8 sq. mi.) and then developed an algorithm for the two rivers based on recorded flows for the period 1964 through 1973. The algorithm was then applied to the Mill River gauge for the period January 1, 1939 through December 31,

2009 to estimate flows over a 71-year period of record at the Upper Roberts Meadow Dam. A plot of the annual flow duration curves for the West Branch of the Westfield River. Mill River and Roberts Meadow Brook is attached.

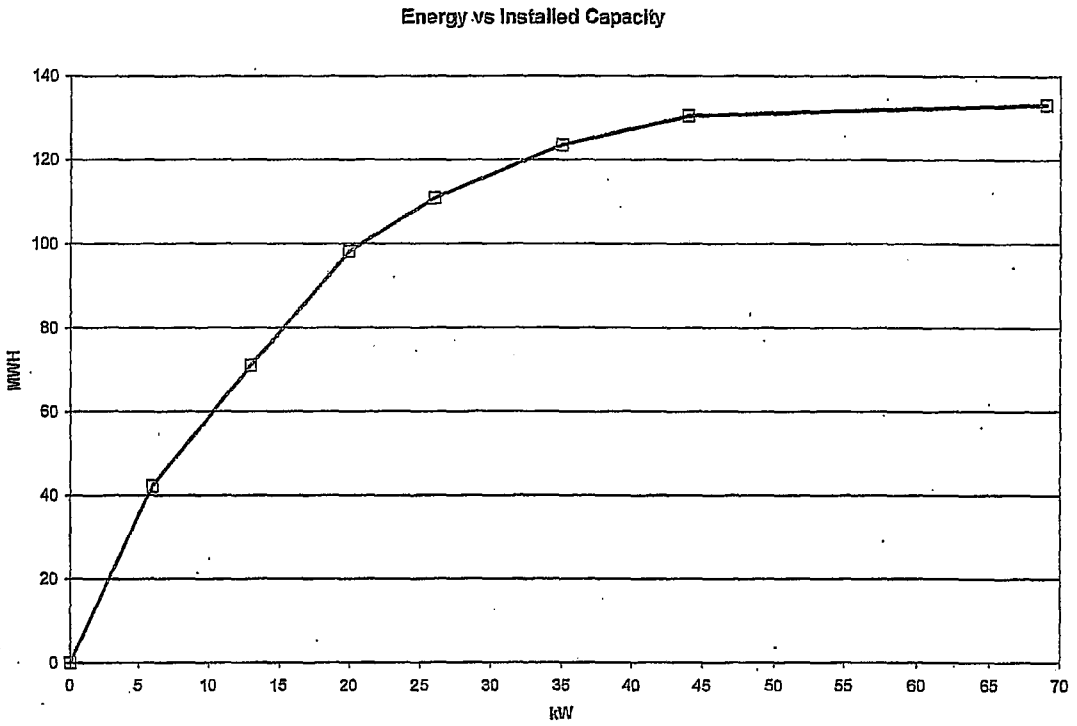
An energy model was developed using flow duration techniques. The time step was in 87.6 hour increments (each increment = 1% of the year X 100 increments). To account for the relationship between headwater and tailwater, gross head was assumed to decrease by two feet over the entire flow range. Head losses (intake and conduit) were assumed to range from 0 to 1.0 feet and vary as a function of the turbine flow squared. River flows were reduced by 1 CFS to account for potential minimum flow requirements.

RESULTS

Preliminary performance data for hydro turbines ranging in hydraulic capacities from 3 CFS to 40 CFS were developed using the proprietary turbine design software *TurbinePro*. Axial flow (propeller) turbines are best suited for this head range (approximately 20-ft. to 25-ft.). A total of thirteen turbine configurations were evaluated; three Kaplan (double regulated) and ten fixed blade (single regulated) units. Our preliminary findings are tabulated below.

		Turbine Flow (CFS)		Power	Net Energy	Capacity Factor
	Kaplan Units					
No	Case	Min	Max	kW	MWH	%
1	Large Kaplan	2.9	25.1	46	152	38%
2	Medium Kaplan	1.8	16.6	30	131	49%
3	Small Kaplan	1.5	12.5	23	114	56%
	Fixed Blade Units					
		Min	Max	kW	MWH	%
4	Large Fixed Blade x Two	8.6	40.0	70	133	22%
5	Medium Fixed Blade x Two	5.0	26.0	44	131	34%
6	Large Fixed Blade	8.6	19.8	35	101	33%
7	Small Fixed Blade X Two	4.2	20.0	35	124	40%
8	Smaller Fixed Blade x 2	3.1	15.0	26	111	48%
9	Medium Fixed Blade	5.0	12.9	24	95	45%
10	Smallest Fixed Blade x 3	1.5	11.2	20	98	56%
11	Small Fixed Blade	4.2	9.8	18	83	52%
12	Smaller Fixed Blade	3.1	6.7	13	69	61%
13	Smallest Fixed Blade	1.5	3.4	7	42	74%

To better understand the relationship between installed capacity and generation we prepared the following graph.



The energy generated in MWH is plotted for various installed capacities ranging from 5 kW to 70 kW. The slope of the curve is fairly steep for installed capacities up to 20 or 25 kW. This suggests that each increment of capacity that is installed results in a corresponding increase in energy production. Beyond 25 kW the slope starts to 'flatten out', indicating that energy production is not increasing as much with additional capacity. Between 45 kW and 70 kW, energy production only increases by 2 MWH.

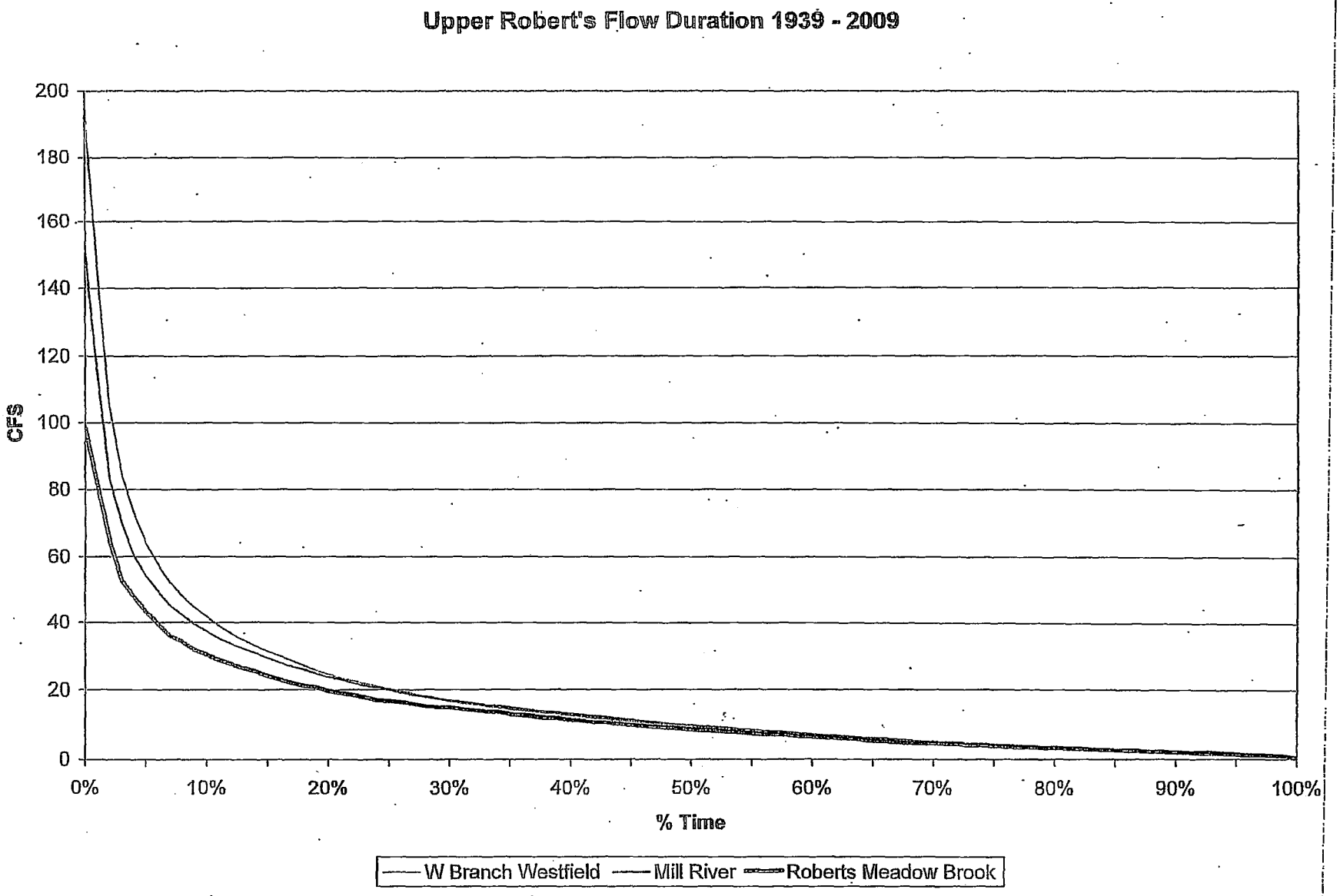
Based on the above preliminary hydraulic analysis the optimum installed capacity appears to be in the range of 20 kW to 25 kW. A small Kaplan unit would produce 23 kW of power and generate approximately 114 MWH of energy each year. Another option would be three small fixed blade units with a total installed capacity of 20 kW and generating approximately 98 MWH. Finalizing the installed capacity will also depend upon license conditions imposed on the project, equipment availability and costs.

We appreciate this opportunity to assist you. If you have any questions, please contact me at (860) 581-8111.

Regards,

Fred Szufnarowski

Fred Szufnarowski, P.E.
The Essex Partnership LLC


Upper Robert's Flow Duration 1939 - 2009
200
180
160
140
120
100
80
60
40
20
0
CFS
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
% Time
W Branch Westfield
Mill River
Roberts Meadow Brook

Improvements

Add standards in City's street tree and open space programs to help reduce fossil fuel use (e.g. provide summer shade to reduce use of air conditioning).

Responsible Agencies: Tree Committee, Department of Public Works

Create a program to maximize the use of public forests for reducing carbon.

Responsible Agencies: Tree Committee, Department of Public Works

Present a report for public review that identifies where, as allowed by state law, the City land use ordinances could further address greenhouse gas emissions, and identify the local costs in implementation.

Responsible Agencies: Energy Resources Commission, Energy Officer, Office of Planning And Development

Incentives

Prepare an incentive program that will motivate residents and businesses to implement increased energy efficiency measures and use of renewable energy system in existing buildings and present for public review. An example of one such program exists in Cambridge, MA,

Responsible Agencies: Mayor, Energy Resources Commission, Capital Improvement Committee

Create an awards program for improvements in energy efficiency and the built environment for both City agencies and private sector development.

Responsible Agencies: Mayor, Energy Resources Commission, Energy Officer

Provide incentives [bonuses and waivers] in the land use regulations for new construction to achieve certification for high efficiency and green building standards.

Responsible Agencies: Planning Board, City Council, Office of Planning and Development

Measurements of Progress:

Total Energy Demand

Metric: Trend in total energy demand from City facilities

Reporting Agencies: City Treasurer, Energy Officer

Target: 2 to 3% reduction per year on payments for energy bills

Responsibility for Target: Central Services, Energy Resources Commission, School Department, Energy Officer

Renewable Energy Use

Metric: Percent of municipal energy supplied by renewable sources

Reporting Agency: City Treasurer

Target: Total of 25% energy demand supplied from renewable sources by 2017 based on payments on energy bills

Responsibility for Target: Mayor, City Council, Central Services, Energy Resources Commission, Energy Officer

Monitoring

Metric: Match comparative performance standards from ICLEI, The Climate Registry, and others

Reporting Agencies: Energy Officer, Office of Planning and Development

Target: Lead in local climate protection efforts

Responsibility for Target: All City Departments

Total Greenhouse Gas Reduction

Metric: Percent of FY2000 Equivalent CO2 Emissions from all City functions

Reporting Agency: Energy Officer

Target: 8% below 2000 levels by 2010, 25% below by 2017, and 30% below by 2020.

Responsibility for Target: All City Departments, Energy Resources Commission, School Department, Energy Officer

Potential Conflicts:

- There is widespread support for energy conservation, but little in the way of tangible plans to make it happen.
- The conflict between lifestyles/current habits of property owners and the emerg-

ing cost and uncertainty of energy supply will need to be explored.

Potential Response:

- The recognition of growing scarcity costs associated with uncertain energy supplies will encourage modification of energy utilization.
- New technologies are being rapidly developed that will help address these conflicts.

Goal EEC-3: Protect valuable and sensitive ecological resources (land, air, water, habitat, plants and animals)

Objectives:

1. Prioritize and preserve quality wetlands by encouraging development in densely populated areas and in clusters.
2. Protect and conserve water supplies (drinking, surface, groundwater, recharge areas, aquifers) and continue to enforce groundwater protection regulations.
3. Conserve wetlands with programs to ensure no net loss of total wetlands (existing area of approximately 3,000 acres).
4. Preserve floodplains for flood storage and, where appropriate, habitat values.
5. Preserve existing forests, floodplains, wetlands, and agricultural soils of high ecological value.
6. Protect rare and endangered plants and animals and important wildlife corridors.
7. Improve the quality and appearance of the public water supply.
8. Recognize that the protection of environmental resources will improve the quality of life and the value of property in the City.
9. Minimize the loss of tree canopy throughout the City and increase tree canopy in urbanized areas to maintain a higher quality environment in all areas.

See also: Land Use Goals

Strategies and Actions:

Continue implementation of water conservation plans.

Responsible Agency: Department of Public Works

Investigate the creation of a land banking system for wildlife habitat and wetlands protection.

Responsible Agency: Office of Planning and Development

Expand the street tree program by obtaining private funds and services as grants, mitigation, and exactions and using them to implement the public sector programs through design, construction, and maintenance.

Responsible Agencies: Tree Committee, Department of Public Works,

Create an awards program for protection of ecological resources for both City agencies and private sector development.

Responsible Agencies: Mayor, Energy Resources Commission, Energy Officer

Measurement of Progress:

Conservation

Metric: Acreage and numbers of sites of land and natural resource conservation

Reporting Agencies: Conservation Commission, Office of Planning and Development

Target: 2% increase in area or number per year.

Responsibility for Target: Conservation Commission, City Council, Planning Board

BioMap and Living Waters

Guiding Land Conservation for Biodiversity in Massachusetts

Core Habitats of Northampton

This report and associated map provide information about important sites for biodiversity conservation in your area.

This information is intended for conservation planning, and is not intended for use in state regulations.

Produced by:
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries and Wildlife
Executive Office of Environmental Affairs
Commonwealth of Massachusetts

Produced in 2004

BioMap: Species and Natural Communities

Northampton

Core Habitat BM734

Plants

Common Name	Scientific Name	Status
Bush's Sedge	*Carex bushii*	Endangered

Vertebrates

Common Name	Scientific Name	Status
Four-toed Salamander	*Hemidactylium scutatum*	Special Concern
Spotted Turtle	*Clemmys guttata*	Special Concern

Core Habitat BM737

Invertebrates

Common Name	Scientific Name	Status
Elderberry Long-Horned Beetle	*Desmocerus palliatus*	Special Concern
Spatterdock Darner	*Aeshna mutata*	Special Concern

Vertebrates

Common Name	Scientific Name	Status
American Bittern	*Botaurus lentiginosus*	Endangered
Four-toed Salamander	*Hemidactylium scutatum*	Special Concern
Jefferson Salamander	*Ambystoma jeffersonianum*	Special Concern
Spotted Turtle	*Clemmys guttata*	Special Concern
Spring Salamander	*Gyrinophilus porphyriticus*	Special Concern
Wood Turtle	*Clemmys insculpta*	Special Concern

Core Habitat BM740

Natural Communities

Common Name	Scientific Name	Status
Black Gum-Pin Oak-Swamp White Oak "Perched" Swamp		Imperiled
High-Terrace Floodplain Forest		Imperiled

BioMap: Core Habitat Summaries

Northampton

Core Habitat BM734

The wetlands, meadows, and forests in this Core Habitat support Four-toed Salamanders and Spotted Turtles, as well as the Endangered Bush's Sedge. The central part of this Core Habitat is protected as the Fitzgerald Lake Conservation Area, but the outer areas appear unprotected.

Plants

One of only four known Massachusetts occurrences of Bush's Sedge, an Endangered plant, is found in a wet meadow within this Core Habitat.

Vertebrates

This Core Habitat encompasses a roadless area of mixed forest, forested and scrub-shrub wetlands, and small meadows along four miles of the headwater tributaries of Broad Brook in Northampton. Collectively these habitats support a population of Spotted Turtles. Four-toed Salamanders occur here in small forested pools and seeps with abundant sphagnum moss.

Core Habitat BM737

This Core Habitat encompasses a variety of habitats along Roberts Meadow and Brewer Brooks that support rare invertebrates such as the Spatterdock Darner dragonfly, and several rare species of salamanders, reptiles, and birds. Small portions of this area are protected as conservation land.

Invertebrates

This Core Habitat includes Hanging Mountain Pond and nearby meadows and wetlands that provide habitat for both the Spatterdock Darner dragonfly and the Elderberry Longhorned Beetle. This Core Habitat is located close enough to Core Habitats in Williamsburg and Northampton, allowing occasional dispersal between these areas. While a portion of this Core Habitat is on municipal watershed land, the majority appears to be unprotected. Conservation of the remaining areas of unprotected land within this Core Habitat is desirable to increase the amount of contiguous protected habitat and to help ensure the long-term viability of rare species inhabiting the area.

Vertebrates

This Core Habitat comprises mixed forest, shrub swamps, and wet meadows along Roberts Meadow and Brewer Brooks. These connected riparian habitats support populations of Jefferson, Four-toed, and Spring Salamanders, as well as Spotted and Wood Turtles. Shallow freshwater marshes and wet meadows also provide habitat for the American Bittern, a rare species of marsh bird.

Goal HR-1: Protect and preserve the City's heritage resources

Objectives:

1. Identify, document and evaluate the heritage resources.
2. Educate and inform decision makers and the community about heritage resources.
3. Protect the heritage resources from degradation or destruction by public or private actions or inactions.
4. Adopt and act on preservation programs that:
   - Employ a sound basis in field survey and archival research,
   - Provide economic and technical assistance to the extent feasible,
   - Are coordinated with other community policies and ordinances, and
   - Operate with sound and explicit standards, guidelines, criteria, and administrative procedures.

Strategies and Actions:

Conduct field and archival surveys to locate, document, and evaluate unrecorded heritage resources, as well as to update information on resources identified in past studies or surveys.

Responsible Agencies: Northampton Historical Commission, Office of Planning and Development, Pioneer Valley Regional Planning Commission, Historic Northampton, Library System

Increase the level of public participation in heritage resource identification and preservation, including involvement with local schools and colleges.

Responsible Agencies: Northampton Historical Commission, Office of Planning and Development, Northampton School System, 5 Colleges Network, Historic Northampton

Inform the community about heritage resources with displays, markers, publications, and public presentations undertaken cooperatively with concerned community organizations and the media.

Responsible Agencies: Northampton Historical Commission, Historic Northampton, Office of Planning and Development, Greater Northampton Chamber of Commerce

Provide training opportunities for City officials, boards, and staff to increase awareness of heritage resources and preservation programs.

Responsible Agencies: Massachusetts Historical Commission, Northampton Historical Commission, Office of Planning and Development, Historic Northampton, Pioneer Valley Regional Planning Commission

Recognize with an award program the research, publication, communication, restoration, or rehabilitation projects or activities that contribute to the awareness and preservation of heritage resources in the City.

Responsible Agencies: Northampton Historical Commission, Office of Planning and Development

Promote and encourage the protection and preservation of significant heritage resources by listing eligible properties on the National Register of Historic Places.

Responsible Agencies: Northampton Historical Commission, Pioneer Valley Regional Planning Commission, Office of Planning and Development, Historic Northampton

Encourage private landowners to establish historic preservation restrictions and open space/conservation easements by working with the city, local non-profit land trusts, or state/national entities authorized to hold easements for the purpose of heritage resource preservation.

Responsible Agencies: Community Preservation Committee, Northampton Historical Commission, Office of Planning and Development

Provide information to decision makers and the community on loans, grants, tax advantages, and other financial incentives that may be available from federal, state, non-profit, and private sources to property owners for the restoration or rehabilitation of heritage resources in private or public ownership.

A Brief History of
the Robert's Meadow Upper Reservoir Dam
& the Robert's Meadow District

The Dam

The Robert's Meadow Upper Reservoir Dam was built in 1883, nearly a decade after the Williamsburg earthen dam collapse which led to the disastrous *Mill River Flood of 1874*. This arch-design dam was built of large granite block from Becket quarries and was designed and overseen by skilled engineers. Newspaper accounts assured the public that engineers Davis and Clemens Herschel took great pains to excavate deeply to locate a solid foundation, despite incurring cost overruns. The foundation stones were laid on July 22, 1883. This was a state-of-the art dam at the time and cost a total of $12,000. One of its engineers, Clemens Herschel, would go on to become famous for his illustrious engineering career and his invention of the *Venturi* meter, to measure water flow.

Dam Site & Possible Artifacts

The grandson of Rev. Jonathan Edwards, established a 'tan-yard' at the site in 1790 which was later incorporated into the Hampshire Leather Mfg. Co. Col. Wm. Edwards' memoirs written in 1847 contain much detail. In addition to employing water power to grind bark for tannin, he developed processes for the tanning of hides and improvements to the quality of leather for which he was granted patents in 1812. Renowned for his scientifically based manufactures of superior quality and quantity, Edwards has been credited in print for making Northampton "a center of the industry" in leather production and exports. Benjamin B. Hoxie succeeded Edwards at the tan-yard, bark-mill. His son's 1917 manuscript confirms that the current dam "was built on the site of a former bark-grinding mill" and that "*the stone used for grinding [bark] is now to be seen at the foot of the present dam owned by the city.*"

Early Nearby Dams

The first recorded dam on the brook was one built for a sawmill by an early ancestor of Nathaniel Edwards, owner of the Edwards Inn. Hoxie recalled that the "foundation timbers were seen in the winter of 1854 and were still in a sound condition. The "old sawmill yard" was sold to Col. Wm. Edwards, who later built the bark grinding mill for the extraction of tannin for the Hampshire Leather Mfg. Co., also located along the brook.

Another early dam was located about 40 rods below the present reservoir dam This was a woolen cloth mill or 'fulling' mill, owned by Chilson, Wild, L Knapp, and others and later operated by Eli Goodale. According to D.E. Hoxie "the wheel was under the rear of the house later owned by Horace Wright. The dam was about five or six feet high and a part of it was in place as recently a 1856."

The District

Robert's Meadow was named for young Robert Lyman, of Northampton, who loved to roam, hunt and fish in the locale. The area was a plentiful source o game, timber and firewood for early Northampton settlers. Early town map show Robert's Meadow as being a portion of Northampton's heavily woode and sparsely settled "Long Division" district. By 1778, the western portion o the district was settled and had incorporated into a new town, Westhampton Robert's Meadow, however, remained Northampton land and continued to b designated as 'Robert's Meadow' on future maps.

An Extinct Neighborhood

Today, only a handful of families remain in the once bustling district of Robert Meadow, now commonly referred to as "Leeds." The remainder of Robert Meadow is now watershed land, owned by the City of Northampton. Tall pine now grow in and around the foundations of the homes, taverns and mills th spanned three centuries of life in this Northampton district.

D.E. Hoxie provides a first-hand account of this Northampton village, onc populated with homes, farms and manufacturing, similar to Florence or Ba State. As with the 'lost towns of Quabbin,' the Robert's Meadow village w

erased because of the need to create a reservoir to provide drinking water. Mr. Hoxie's manuscript, however, recalls the people and places now long removed from living memory. Tall pines of the watershed, planted as a CCC project in the 1930s, currently line Chesterfield, Sylvester and Reservoir Roads where, once, stood the Robert's Meadow school, the Edwards and the Moody taverns, E.A. Sylvester's tobacco barn and another Edwards' 300 merino sheep, a tannery, a bark manufacturing plant, a sawmill, a carriage shop, Clapp's blacksmith shop, a fulling mill, and the homes of Mr. Hoxie's relatives, friends and neighbors. He recalls the location of the turnpike toll gate at the Edwards Inn, and the family of Luther A. Martin, a member of the early *Community* at Florence.

Lafayette's Visit in 1825 ...

It was through this very scene that General Lafayette, himself, passed in 1825, during his famous farewell tour of each of America's 24 states, coming by stage from Pittsfield over the present Berkshire trail on his way to Northampton, Lafayette was met at the Edwards tavern at Robert's Meadow by Northampton's sheriff and a committee of citizens and a military escort.

"Do my young friends here realize that the great **Lafayette** came again to this country in 1825 to visit the scene of the war, and that his suite traveled from Albany to Boston and passed by my old Bridgman home on the Chesterfield road and was warmly greeted and saluted by those present. There were six coaches drawn by four horses each, and they started down the hills from Chesterfield, stopping at Moody's tavern for a banquet, after which he reviewed a large number of veteran soldiers. After a brief rest, he continued over Roberts Hill to Northampton." ~ Edward Clark Bridgman at Westhampton

The Martin property, along with the property of widow Angeline Clapp, the Rhood's, the Sylvester's and others are now part of the existing watershed. D.E. Hoxie's own farm was purchased by the city's Water Department. For years, and in the department's records, the dam was referred to as 'Hoxie's Dam.'

Moody's Tavern at Roberts Meadow

~ Bibliography ~

Various Hampshire Gazette a.k.a Daily Hampshire Gazette Newspapers

Hoxie, D.E., "Early-Birds" Rambles in Rusty Records, Where, When How They Lived and Died. Local Landmarks in a Life of 70 Years, dated 1917

Robert's Meadow School District Account Book 1839-1860

Various early maps of Northampton

Springfield Republican newspaper articles of 8-27-1883 and 10-09-1883

Vol. 10, The Americana: a universal reference library comprising the arts and sciences, literature, history, biography, geography, commerce, etc. of the world

MHC Reconnaissance Survey Town Report on Northampton dated 1982

Memoirs of William Edwards, 1750-185, printed in Washington D.C. in 1897 (Property of the Cabot Science Library of the Harvard College Library)

Prepared by Barbara Pelissier, President, Westhampton Historical Society, 2010

MEMOIRS OF DECEASED MEMBERS

CLEMENS HERSCHEL, Past-President and Hon. M. Am. Soc. C. E.[1]

DIED MARCH 1, 1930

Clemens Herschel was born on March 23, 1842. He passed his boyhood in Davenport, Iowa, and, after studying with a tutor, he entered the Lawrence Scientific School of Harvard University at the early age of 16. Graduating in 1860 with distinction (*summa cum laude*), he took an advanced course in chemistry for one term, and then went to Europe to study French and prepare to enter the Ecole des Ponts et Chaussées, in Paris. As the number of foreigners was limited, and the quota was complete, he was unable to obtain admission, and went, as a consequence, to the Technical School at Karlsruhe, Germany, to complete his education. Long afterward, in 1925, the Karlsruhe Technical School bestowed upon him the honorary title of Doctor of Engineering.

In 1864, Mr. Herschel returned to the United States and opened an office as Consulting Engineer, in Boston, Mass., doing such work as came to hand. He was Engineer of the Albany Street Bridge, built by the City of Boston in 1867, and at one time was connected with the Boston Sewer Department. The variety of his work is indicated by a letter-head of 1871 which reads, "Civil Engineering in all its branches, Iron and other Bridges and Roofs, Hydraulic Engineering, Roads, River and Harbor Improvements, etc., etc." In 1872, he was appointed Superintendent of Streets of West Roxbury, Mass. (now part of Boston), and from 1881 to 1883 he was one of the three Railroad Commissioners of Massachusetts.

Mr. Herschel was Engineer of the Quinnipiac Drawbridge, New Haven, Conn., erected 1874-1878, and this led to the publication, in 1875, of his book on "Continuous Revolving Drawbridges." A bridge of minor importance, but which is of interest because it is still standing and readily accessible, is that across the Public Garden Pond in Boston. The design, prepared in cooperation with an architect named William G. Preston, was accepted as the result of a prize competition.

To one of Mr. Herschel's independence of thought, it was disappointing to note that "bridges and roofs" did not offer any future for a Consulting Engineer since their design was falling entirely into the hands of large bridge companies, where a designer became, as he expressed it, merely a "cog in a wheel". He had at one time worked under the late James B. Francis, Past-President and Hon. M. Am. Soc. C. E., a hydraulic engineer whom he greatly admired, and this, as well as the lack of a future in bridge work, naturally turned his attention especially to hydraulics.

In 1879, Mr. Herschel was appointed Hydraulic Engineer of the Holyoke (Mass.) Water Power Company. It should be remembered that power at

[1] Memoir prepared by J. Waldo Smith, Hon. M. Am. Soc. C. E., and William H. Burr, M. Am. Soc. C. E.

yoke was developed before the days of electrical transmission, and the er Company not only controlled the dam, but had also to operate the als which supplied water for power to the various mills. During the ten rs that Mr. Herschel held this position he built and operated the Holyoke ting Flume, then one of the few places in the country for measuring the iency of hydraulic turbines. All the turbines in use in the Holyoke ls were tested, and the discharge was determined for different gate-nings. Thus, every turbine became its own water meter, and by reading gate-openings twice a day, an accurate record of the use of water power purposes was obtained. This system was of great help in securing equitable distribution of water among the different mills, supplied from canals of the Holyoke Water Power Company, and in preventing waste.

This was not enough. The many paper mills used large quantities of wash ter that did not pass through the turbines and was not measured. Mr. erschel gazed on those wash-water pipes and pondered. He wondered how ey could be made to tell how much water was passing through them. The nturi meter was the answer, but it came too late to be used for measuring ash water. As he was wont to remark, the Venturi meter has been used for great variety of purposes, but never for the purpose for which it was vented.

It had been observed by Venturi in 1791, that, if a liquid flows first through converging and then through a diverging cone, the pressure at the narrow ction where the two cones join is less than the initial pressure. To Ven-ri, the philosopher, this was merely an interesting phenomenon of Nature; Herschel, it was a suggestion of a practical and much needed device, and, 1887, he conducted a series of tests to determine whether the rate of flow ould be calculated from this difference in pressure. Here, again, his training nder Mr. Francis was of great assistance, as the latter had determined n tests on diverging cones, the small taper necessary for the down-stream cone f the meter, if the permanent or over-all loss of head should be a minimum.

The Holyoke tests were so satisfactory that the device was patented and vas named the Venturi meter. Thus, Clemens Herschel became "the man who nade Venturi famous". He was presented with the Rowland Prize by the Society for his paper describing his tests,[2] and was awarded the Elliott Cresson Gold Medal by the Franklin Institute for his invention.[3]

Another piece of important work at Holyoke was in practically re-building the wooden dam across the Connecticut River. This had become unsafe and threatened to give way, but when repaired and filled with gravel, it lasted as long as necessary, that is, until it was replaced after Mr. Herschel left Holyoke, by a stone dam built below it. In connection with the work on the dam Mr. Herschel added to the diversity of his accomplishments by going down in a diving suit, because he did not believe what the divers told him and he wanted to see for himself.

In 1889, Mr. Herschel was made Chief Engineer and Superintendent of the East Jersey Water Company, and gave up his position with the Holyoke

[2] *Transactions*, Am. Soc. C. E., Vol. XVII (July–December, 1887), p. 228.
[3] *Proceedings*, Franklin Inst., February, 1899.

Water Power Company. The East Jersey Water Company was organized to build works to provide a large additional water supply to Newark and other New Jersey communities. These works included dams and reservoirs on the Pequannock River, and a riveted, steel pipe line which was one of the first of that type to be built in the East. A contract was made on September 24, 1889, with the City of Newark, to build works to supply 50 000 000 gal. of water per day to that city, the works to be finished by May 1, 1892. Eventually, two pipe lines were laid and the capacity was increased to 80 000 000 gal.

It was on the works of the East Jersey Water Company that the Venturi meter had its first practical application. About thirteen meters were used and a daily record was kept of all water entering the pipes and of water delivered. From this beginning, the use of the Venturi meter has spread over the entire world, not only for water, but also for measuring gas and steam and other fluids. Noteworthy on account of their great size are the meters of the Catskill Aqueduct which measure the water consumption of New York City.

It was during Mr. Herschel's service with the East Jersey Water Company that he published, in 1897, "115 Hydraulic Experiments", on the flow of water in pipes and conduits. He left that Company in 1900, after the works for the City of Newark had been finished and turned over to the city.

Since 1884 Mr. Herschel had been Consulting Engineer of the largest power developments at Niagara Falls, including the work of the Cataract Construction Company and the Niagara Falls Power Company. In earlier developments at Niagara Falls, the head was subdivided or part wasted, and power was distributed by shafting. The ready-made turbines available at that time in the United States could not be used for the high heads and the large volumes of water available at Niagara Falls, and electrical transmission of power seemed desirable. To consider these questions, an International Commission of five members was appointed, Mr. Herschel being the only American member.

This work brought him into contact with European and especially with Swiss builders of hydraulic turbines, and the decision was reached to obtain from Europe, turbines built to order for the head and discharge available, and with a speed suitable for driving electric generators.

Turbines were first imported from Switzerland about 1904, but later the building of large power hydraulic turbines designed for predetermined conditions, was established in the United States, largely as a result of the experience of the Niagara Falls Power Company with Swiss turbines. Mr. Herschel was the first Manager of the Hydraulic Engineering Department of the Allis-Chalmers Company, but resigned when the Company's office was moved from New York to Milwaukee, Wis. With his intense love for Boston, he considered even New York as "too far West", and Milwaukee was unthinkable.

Mr. Herschel devised an application of the Venturi meter, which he called a "fall increaser", to increase the power of hydraulic turbines when low head was experienced in times of flood. This, however, was never put into practice, and conical draft-tubes, and other features of more recent turbine design, have rendered it unnecessary.

Mr. Herschel continued to act as Consulting Engineer with his office at Wall Street, New York. He was one of a Commission of three engineers hc examined the plans for the New York City Aqueduct in 1910 before ıey were approved by the Board of Estimate and Apportionment. In 1920, e read a paper before the American Society of Mechanical Engineers on An Improved Form of Weir for Gaging in Open Channels", in which he escribed a method of reading pressures in a perforated pipe placed at the rest of the weir, and of calculating the flow from these readings.

He was a frequent contributor to the technical journals, and was always eady to champion the Venturi meter with vigor. Although he had written A Farewell Word on the Venturi Meter", in April, 1929, at the age of 87, re find him back again on the firing line with a letter[4] to the Editor of *Engineering News-Record* written when confined to his home, and dated, Glen Ridge, N. J., August 28, 1929.

Among the obviously professional parts of Mr. Herschel's engineering career here is none more prominent than his contributions to what may be called Engineering Science. It was fundamental with him in seeking the solution of any important engineering problem to make a searching general analysis of all its features leading to results constituting a marked advance in engineering practice. His professional work from its beginning to its end exhibited such marked advances, as in his papers on drawbridges and other continuous masses and on the Venturi meter, and in other cases of similar character. The same desire to give intellectual quality and finish to his professional work is gracefully shown in his translation of Frontinus on the water supply of Ancient Rome.

These characteristics of his practice as a civil engineer just at the time when Civil Engineering was taking its place as a profession in the United States made him one of its marked pioneers, especially in Hydraulic Engineering. His excellent educational equipment combined with a trained analytic mind was well timed to act upon the opportunities offered by the profession of Civil Engineering then coming into being. In fact, it is due to him and a few others associated with him that Hydraulic Engineering has been developed to its present status in this country.

His most remarkable literary achievement, and the culmination of years of study, was the publication, in 1899, of a translation from the Latin into English, of the "Two Books on the Water Supply of the City of Rome", by Sextus Julius Frontinus. Like many another, Mr. Herschel had forgotten the Latin learned in his youth, but, nothing daunted, he undertook the task with the help of a French and a German translation, and produced the first translation to appear in English.

Mr. Herschel enjoyed unusually good health until the last year of his life, and commuted daily from Glen Ridge, N. J., to his office in New York.

He was married, in 1869, to Grace D. Hobart, of Boston, who died in 1898; he was married a second time in 1910 to Jeanette B. Hunter, of Thompsonville, Conn. His children, all of whom survive, are Arthur H., Winslow H., and Clementine (Mrs. Hobart Rawson), by his first wife, and one son, Clemens, by his second wife.

[4] *Engineering News-Record*, September 12, 1929.

Mr. Herschel was Treasurer of the Boston Society of Civil Engineers from 1874 to 1880, and was President of that Society in 1890–1891. At the time of his death he was Past-President and Honorary Member both of the American and of the Boston Society of Civil Engineers. He always loved Boston and the Boston Society, and directed in his will that his engineering books should be given to the Boston Society and to the Boston Public Library. His correspondence of many years has been given to the Engineering School of Harvard University.

In addition to the memberships mentioned, Mr. Herschel was a member of the Union Club of Boston, the Century and Engineers' Clubs, of New York City, and a Life Member of the Institution of Civil Engineers of London, England.

Mr. Herschel was elected a Member of the American Society of Civil Engineers on April 21, 1869, and an Honorary Member on June 19, 1922. He served as Director of the Society in 1891; as Vice-President in 1915 and 1916; and as President in 1916.

Municipal Governance and Financial Stability

Goal MG-1: Diversify revenue streams to support municipal operations

Objectives:

1. Match land use changes and improvements with diversified revenue potential.
2. Lead regional and statewide effort to increase authority for municipalities to develop and implement non-property tax local revenue sources.
3. Develop revenue streams in an equitable and consistent manner for all populations in the City.
4. Encourage Payment in Lieu of Taxes (PILOT) from tax-exempt uses.

Strategies and Actions:

Identify properties and blocks that are appropriate for redevelopment to improve the tax base.

Responsible Agencies: Economic Development, Planning Board, City Council, Office of Planning and Development

Ask all city departments for suggestions to increase revenues.

Responsible Agencies: Mayor, Finance Director, All City Departments

Measurement of Progress:

Metric: New revenue sources added

Reporting Agencies: Mayor, City Council

Target: Three percent increase per year in non-property tax revenues

Responsibility for Target: Mayor, City Council

Goal MG-2: Minimize the adverse municipal fiscal impacts of development

Objectives:

1. Include considerations for the overall environmental impact of the project in determining whether it is "paying its fair share towards public infrastructure."
2. Recognize and provide incentives for the benefits of development projects that support social and economic goals.

Strategies and Actions:

Prepare a fiscal impact assessment to determine current costs and develop an impact assessment and fee program to address shortfalls if other goals social and economic goals are not met.

Responsible Agencies: Finance Director, All City departments collecting fees

Measurement of Progress:

Metric: Municipal services fiscal impacts

Reporting Agency: Finance Director

Target: Conformance with municipal services fiscal impact standards

Responsibility for Target: All City Departments

Goal MG-3: Maximize use and return on targeted tax incentives and other state programs to support the City's economic goals

Objectives:

1. Consider state programs for District Increment Financing (DIF), Tax Increment Financing (TIF), 40R/40S, and Expedited Permitting, as a means to encourage appropriate development through tax incentives and reimbursement programs.

Strategies and Actions:

Review and consider new or additional application of DIF, c. 40R/40S. TIF and similar

Upper Roberts Dam and Reservoir cost comparisons:

1. **Cost:** According to the figures handed out by the DPW to the Friends, Paul Spector, Mayor and BPW in November at the Mayor's office, the amount expected for dam repair vs. renovation is $625,000 broken out as follows:

Dam Repair Cost			**Dam Removal Cost**		**Difference**
	Dam Rehab	$950,000	Removal/Dredging	$925,000	$25,000
	Design/Permitting	$125,000	Design/Permitting	$125,000	0
	Repair Total	$1,075,000	Removal Total	$1,050,000	**$25,000**

Estimated 50 year Maintenance Costs

Dam Repair Maintenance	Dam Maintenance		Dam Removed costs		Difference
	Future Inspections	$125,000	Upkeep	-	$125,000
	Routine Maintenance	$75,000	Routine Maintenance	$50,000	$25,000
	2 Stone Repointing	$50,000	-		$50,000
(We contest the dredging. It hasn't been dredged in over 70 years and may not be done for another 70!) Other engineers say it does not need it at all.	1 future dredging of Upper Reservoir	$500,000	Partial Dredge of Middle Reservoir (*we contest this low cost– without the Upper Res. ALL sediment will enter the middle, costing far more. Invasive species removal could far exceed this cost as well.)	$100,000*	*$400,000
Totals /Difference in Dam Repair/50 yr maintenance	Total Maintenance, repaired dam	$750,000	Total Maintenance without the dam	$150,000+	**$600,000**
Full dam Repair/50 yr maintenance	Repair $1,075,000 + Upkeep $750,000 + $1,825,000	$1,825,000	Removal. $1,050,000 Upkeep + $150,000+ $ 1,200,000	$1,200,000	**Total Difference $625,000**

Dam Safety Inspection Requirements: The Office of Dam Safety has made available documents that can be downloaded here to serve as a **template and guidelines for conducting compliant dam safety field inspections and filing compliant Dam Safety Phase I Inspection Reports** with the Office of Dam Safety. Owners of dams are required by 302 CMR 10.07 to hire a qualified engineer to inspect and report results every 2 years for High Hazard Potential dams, every 5 years for Significant Hazard Potential dams and every 10 years for Low Hazard Potential dams.

Hazard Potential Classification

High Hazard Potential dam refers to dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard Potential dam refers to dams located where failure may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.

Low Hazard Potential dam refers to dams located where failure may cause minimal property damage to others. Loss of life is not expected.

dcr

Massachusetts

APPLICATION TO CHANGE HAZARD CLASSIFICATION OF DAM

In accordance with 302 CMR 10.06 (6) Hazard Reconsideration. An owner may at any time request the Commissioner to reconsider the hazard determination. The owner's request must be filed by a registered professional civil engineer, specifying the findings and analyses with which the owner disagrees. The Commissioner will issue a written decision to the owner and the registered professional civil engineer within 30 days of receipt of a request for hazard reconsideration, and such decision shall be final and binding upon the parties.

(This form and supporting information must be attached to a letter from the dam owner's registered professional civil engineer on the engineering firm's letterhead.)

Dam Name:_____ **Date:** _____

National Inventory of Dams ID Number: _____

Dam Location (City or Town):_____

Owner(s) Name and Address:_____

Fill in Part A or Part B

PART A: Application to Raise Hazard Classification (e.g., from Significant to High)

Current Hazard Classification: _____
(as listed in DCR Office of Dam Safety Database)

Proposed Hazard Classification: _____

Reason for Change:

_____

Attach any applicable supporting information.

PART B: Application to Reduce Hazard Classification (e.g., from High to Significant, High to Low or Significant to Low.)

Current Hazard Classification: _____
(as listed in DCR Office of Dam Safety Database)

Proposed Hazard Classification: _____

Applicant must submit engineering studies to justify the change in Hazard Class. Indicate the studies that accompany this application:

- ☐ Hydrologic / Hydraulic Analyses
- ☐ Dam Breach / Inundation Analyses
- ☐ Incremental Damage Assessment
- ☐ Other_____

Reason for Change:_____

_____

_____

_____

_____

UPPER LEEDS RESERVOIR & DAM (a.k.a. Hoxie Reservoir)
History from Water Department Records

Background:

1882: E.C. Davis surveyed and estimated cost and capacity of a new reservoir at 2 locations. Plans and specifications were prepared for construction of the Hoxie Reservoir.

1883: Stonework was awarded to Jerre Brown & William Kyle – amount of stone work used in the dam was increased due to not finding bedrock and work and excavations were continued until a solid foundation was reached.

- D.W. Axtell of Huntington was employed to inspect and constantly superintend the work.
- E.C. Davis made frequent examinations as work progressed:
- The plans and specifications were filed and approved by the County Commissioners;
- Due to the height of the dam and the potential loss in the event of its destruction, Clemens Herschel, C.E. of Holyoke Water Power Co. was employed as a consulting engineer.
    - His findings stated that: "the foundation was laid on either ledge or on rock immediately overlaying the ledge all the way across.
    - He: "recommended the earth embankment built in extension of the dam have its elevation at 105 not 104."
    - He: "observed that all stumps, roots and vegetable mold was removed from the bed of the reservoir."

Original Dam Specifications required:

- Reservoir to be constructed to hold 16,500,000 gallons and to have and additional 2,000,000 gallons of storage with the use of flashboards.

Work on this facility consisted of:

1887: 24th of July, the flash planks were put on the dam. High water overflowed the embankment on the north side of the stream and the planks were removed;

- Wall and embankment were repaired (cost $152.31).

1888: A very rainy season;

1892: Due to increased consumption, it was recommended to raise the dams and the embankments of the upper reservoir (this one) to increase storage by 8 – 10 million gallons to supply the town with water for the next 10 +/- years at a cost of $9,000.00.

1893: Severe drought – the upper bed of the reservoir was cleaned. Approximately 4500 loads of leaves and accumulations were removed.

1944: Reservoir was treated with copper sulphate.

1946: Brooks were inspected and cleaned in the spring.

1947: Brooks were inspected and cleaned in the spring.

1948: Brooks were inspected and cleaned in the spring.

1950-51: Wooden fence posts repaired

1953: Brooks were inspected and cleaned in the summer using temporary help

1954: Brooks were inspected and cleaned in the summer using temporary help

FEDERAL ENERGY REGULATORY COMMISSION

NEWS

April 15, 2010
Docket No. AD09-9-000

NEWS MEDIA CONTACT
Celeste M. Miller - 202.502.8680

FERC Looks to Ease Development of Small Hydropower Projects

The Federal Energy Regulatory Commission (FERC) took a step toward making its small hydropower licensing program more user-friendly today by announcing a series of Web-based tools that will help developers understand the FERC licensing process, help improve coordination with other agencies, and help license applicants complete the process more quickly and efficiently.

"Efforts to reduce carbon emissions and meet the growing number of state renewable energy standards are drawing increased attention to small hydropower project development," FERC Chairman Jon Wellinghoff said. "These new tools will help provide additional resources to applicants considering developing hydropower."

"Small and micro hydropower has enormous potential, but these projects often cannot be developed under traditional licensing methods," Commissioner Philip Moeller said. "By our action today, the Commission is working to ease the regulatory burden of harnessing this clean and renewable form of energy."

The new resources, to be available at www.ferc.gov in August 2010, came out of discussions at FERC's December 2009 technical conference on small, non-federal hydropower projects. The resources will provide a roadmap that walks applicants through the process of selecting a project site, determining if a project is jurisdictional, selecting a FERC licensing process, consulting with stakeholders, and preparing a license or exemption application. New tools, such as fill-in-the-blank license and exemption application templates and tips on how to expedite the application process, are intended to make it easier for a potential applicant to apply for a license or exemption.

Staff also intends to update existing agreements, or Memoranda of Understanding (MOUs), with other agencies to improve coordination, and will employ a new outreach program to educate potential small hydro developers. Staff also will continue to provide a small hydro hotline and email address to answer applicants' questions.

At the December 2009 technical conference, participants noted the increasing interest in small hydropower in recent years. Last year, FERC staff received almost twice as many inquiries on small hydro issues than in 2008. And the Commission has received more preliminary permit, license and exemption applications for these types of projects.

(30)

R-10-24

FEDERAL ENERGY REGULATORY COMMISSION

STATEMENT

April 15, 2010
Item No. A-5

Chairman Jon Wellinghoff

Statement of
Chairman Jon Wellinghoff on
Small/Low-Impact Hydro Development

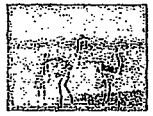
"This has been an extremely important endeavor and one that I have been particularly interested in. To address the U.S.'s energy challenges, we must ensure that we are both making the most efficient use of our existing hydropower resources and promoting smart investment in new hydropower resources and innovative technologies. There are great potential benefits from smart investment in small hydropower projects, and I am pleased that there has been an increased interest in small hydropower projects. The development of such distributed resources would not only provide new capacity, but also enhance reliability.

We should encourage small hydro by processing these projects expeditiously, while ensuring that we consider any environmental issues and the needs of the other stakeholders that may have interests. While I believe that small hydropower projects have an important role to play in this country's energy future, it is important to recognize that a project's small size may not mean that it has few environmental impacts.

Staff has done excellent work in engaging all interested stakeholders on issues related to licensing small non-federal hydropower projects in the United States, and we have received significant interest in this issue. I am pleased to support the action plan on small hydro. It appropriately balances the need to reduce the burden on developers of small hydropower projects with the need to protect the environment. Our staff has already been providing information to small hydropower developers, and is properly continuing programs such as the small hydro hotline and email address to assist applicants. In addition, I am pleased that staff will reach out and provide education to small hydro developers. Commission staff's experience will be invaluable in helping these developers prepare their applications. I also believe that by adding tools to the website, potential developers will better understand the licensing process and be able to choose the most effective and appropriate course to getting their small hydro project built, while ensuring environmental issues are appropriately considered. The action plan will help break down regulatory barriers facing small hydropower projects and ensure that we are developing hydropower resources in an efficient manner."

Developing Small/Low-Impact Hydropower Projects

The Federal Energy Regulatory Commission (FERC) is experiencing increased interest from those seeking to develop small/low-impact hydropower projects. This brochure explains how best to obtain Commission authorization to construct and operate these small/low-impact projects while assuring adequate protection of environmental resources. Benefits of developing these projects include:

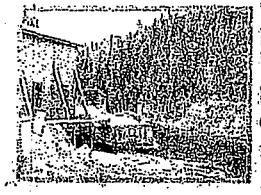


- Emission-free renewable source of energy
- Low impacts to environmental resources
- Financial incentives to developers under state Renewable Portfolio Standards

FERC's Role

Under the Federal Power Act, FERC is charged with the authorization and regulation of the nation's non-federal hydropower resources. FERC issues three types of authorizations:

- **License** – Issued for 30- to 50-year terms. Must be renewed. Gives the licensee the power of "eminent domain" to obtain lands or other rights needed to construct, operate, and maintain the hydroelectric project.
- **5-Megawatt (MW) Exemption** – Issued in perpetuity. Must be located at the site of an existing dam or use a natural water feature. Must propose increased capacity. The exemptee must own all lands and facilities other than federal lands to be eligible.
- **Conduit Exemption** – Issued in perpetuity. Must use the potential of a conduit constructed primarily for non-hydropower purpose. The exemptee must own the proposed powerhouse and the lands upon which the powerhouse will be located. A conduit exemption may not use federal lands.



General Process for License and Exemption Applications

Getting started

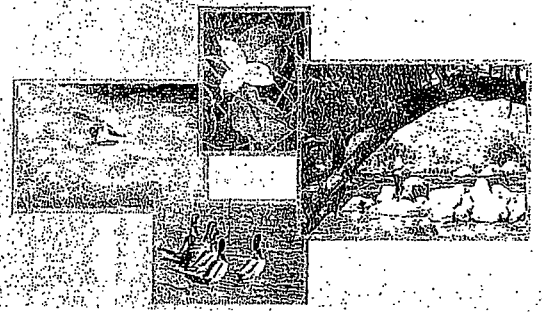
- Contact FERC staff to get advice on the best way to obtain authorization for your project (1-866-914-2849 or smallhydro@ferc.gov)

Pre-filing consultation and initial project review

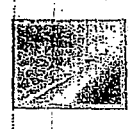
- Gather needed information to identify project-related effects
- Send package describing your proposal and environmental effects to Commission staff, all relevant government and tribal agencies, and non-government and public entities
- Meet with all affected agencies and entities to explain your proposal and to request input
- Determine whether and to what degree affected agencies and entities are willing to expedite the consultation process or forego a consultation stage
- Apply for and obtain a state Water Quality Certification or waiver
- Prepare and file a license or exemption application

Application processing

- Commission staff requests comments on application from all interested agencies and entities
- Commission staff conducts comprehensive project review, including issuing environmental document (not usually required for conduit exemption)
- Commission acts on application



How FERC May Expedite the Process



- With resource agency cooperation, waive some pre-filing consultation requirements
- Combine scoping of issues with pre-filing consultation
- Combine public noticing requirements
- Shorten comment periods
- Use a single environmental document in lieu of draft and final documents

Factors that Reduce Time and Cost

- Project at existing dam
- Little change to water flow and use
- Unlikely to: affect threatened and endangered species; or need fish passage
- Applicant owns all lands needed for project construction and operation
- Information on existing environmental resources and project effects readily available
- A complete application that addresses all issues

Examples of Successfully Expedited Projects

- Lower Turnbull Drop Project No. 12597 (5.0 MW), Upper Turnbull Drop Project No. 12598 (4.1 MW), Mill Coulee Drops Project No. 12599 (1.05 MW)- licenses issued (07/28/06) 8 months from filing

- Corriveau Project No. 12629 (350 kW)- exemption issued (10/24/06) 10 months from filing

Quick Facts

- Hydropower is a renewable, efficient, and reliable source of energy that does not directly emit greenhouse gases or other air pollutants and that can be scheduled to produce power as needed.
- There are about 78,000 megawatts of hydropower generation capacity in the United States.
- Depending on water availability, hydroelectricity provides 5 to 10 percent of the electricity used in the United States and 70 percent of the electricity from all renewable sources.
- More than half of the total U.S. hydroelectric capacity for electricity generation is concentrated in three western states–Washington, California and Oregon–with approximately 27 percent in Washington alone. Canada is a major electricity supplier to New York, New England, the Upper Midwest, the Pacific Northwest, and California.
- Only about 3 percent of the roughly 79,000 dams in the United States have hydropower plants and can generate electricity.
- Existing hydropower is very inexpensive to operate (generation costs 2 to 4 cents per kilowatt-hour) and the levelized cost of electricity from new hydropower puts it among the least expensive forms of low-carbon electricity.
- The effects of climate change on water availability are expected to affect hydropower generation.

Background

Hydropower, or hydroelectricity, is electricity generated by the force of moving water in the penstock[1] of a hydropower unit. Turbines are used to capture the kinetic energy of water by converting it to electricity as the falling water spins the turbine. Hydropower plants may be located below reservoirs or built in rivers (run-of-the-river units) with no water storage capacity. Hydropower is considered a renewable source of energy, as it relies on water which is continuously renewed through the natural water cycle.

Hydroelectricity's low cost, near-zero emissions, and ability to be dispatched quickly to meet peak electricity demand have made it one of the most valuable renewable energy sources worldwide. Hydropower accounts for about 17 percent of the world's total electricity generation.[2]

Depending on water availability and annual precipitation, hydroelectricity has provided 6 to 9 percent of the electricity used in the United States in the last ten years and is the largest renewable source of electricity in the United States.[3,4] U.S. hydropower generation accounts for 10 and 1.5 percent of global hydropower and electricity generation, respectively.[5]

Description

The amount of electricity generated by a hydropower facility depends on three factors: 1) the turbine generating capacity; 2) the turbine discharge flow (the volume of water passing through the turbine in a given amount of time), and 3) the site head (the height of the water source or vertical distance between the highest point of water source and the turbine). The higher the head, the more gravitational energy the water has as it passes through the turbine. Most existing hydropower facilities in the United States can convert about 90 percent of the energy of falling water into electricity, which makes hydropower a technically efficient source of energy.

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TESTIMONY - In Support Of S. 1485 - An Act Encouraging Renewable Energy Generation

April 27, 2009

The Honorable Michael W. Morrissey, Senate Chair
The Honorable Barry Finegold, House Chair
Joint Committee on Telecommunications, Utilities and Energy
State House, Rooms 413-D and 473-B
Boston, MA 02133

Re: S. 1485 An Act Encouraging Renewable Energy Generation

Dear Chairman Morrissey and Chairman Finegold:

I write to register my support for S. 1485, *An Act Encouraging Renewable Energy Generation*, a bill I sponsored currently pending before your Committee. I ask that this proposal be granted a favorable report.

I filed S. 1485 on behalf of the Bay State Hydropower Association, who views the legislation as a technical correction ensuring that hydropower is able to participate in the Renewable Portfolio Standards (RPS) on an equal basis with other renewable technologies a defined by the Green Communities Act of 2008.

The successful operation of the RPS is key to the Bay State Hydropower Association membership as it provides revenues for the maintenance and improvement of smaller existing plants and the development of additional renewable electricity from new hydro facilitie or efficiency improvements at existing facilities. Ideally, the RPS statute and governing regulations will ensure that hydropower is a full partner the Commonwealth's plan to increase renewable energy, reduce greenhouse gases and diversify generation sources.

DOWNING
STATE SENATE

S. 1485 streamlines the process by which hydropower receives Renewable Energy Credits under the RPS for both Class I and Class II hydro resources, which sought and received regulatory approval after 1987 by eliminating redundant and costly DOER review of environmenta criteria for new or incremental hydro resources. The legislation also eliminates severe limitations based on constructing a new dam or diverting water. The current statute is restrictive and vague, and may act to trump many proposed hydro applications for RPS for little or no environmental gain, which acts against the Legislature's intent to make hydropower a partner in addressing the Commonwealth's renewable energy goals.

S. 1485 adds a provision to clarify that other renewable energie: can be built at a hydropower site or within a hydro facility without triggering the output cap limits or environmental criteria that exists only for hydro power. It also clarifies that only energy from new hydro facilities having a capacity of 25 megawatts or less or attributable to improvements that incrementally increase capacity or efficiency by no more than 25 megawatts at an existing hydroelectric facility, or any capacity, shall qualify for RECs. Lastly, the bill ensures the Massachusetts Technology Collaborative will provide not less than $3 million in grants annually to hydroelectric facilities for upgrades to increase efficiency or capacity and to reduce environmental impacts, allowing hydropower to enjoy the same supports from the Renewable Energy Trust that other technologies, such as solar and wind power, currently enjoy.

My district hosts more hydropower plants than any other, in the nine communities of Conway, Florida, Heath, Lee, Monroe, Rowe, Stockbridge, Washington and Williamstown. I have seen firsthand that hydropower produces clean, renewable and reasonably priced electric power. I believe hydro to be an essential part of the renewable energy generation goals we have set for the Commonwealth, as such, I urge you to act favorably on S. 1485.

Thank you in advance for your consideration of this matter. Please do not hesitate to contact me if I can provide you with additional information or assistance.
Sincerely,
BENJAMIN B. DOWNING, State Senator
Berkshire, Hampshire and Franklin District

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Berkshire Co-Act Community Organizing for Action

Local Low Impact Hydroelectric:
Proposed Addition to the Draft Climate Implementation Plan

Massachusetts has made impressive strides in greenhouse gas (GHG) reductions. The scope of considerations is broad in the implementation plan but does not include the fruitful option Co-Act has been working on for the past year, utilizing existing Massachusetts dams. Our proposal for one watershed in Central and Southern Berkshire County can generate over one hundred million dollars of revenue to local municipalities over the life of the project. Our proposal includes two additional watersheds in Western Massachusetts.

Harnessed water power supplied energy to most of Massachusetts industry well into the early 1900's and is the reason why most Massachusetts towns are located along rivers. A romantic notion during this time of unprecedented oil pollution is to refurbish our region's "initial power grid". It is a timely program which will yield cost effective reductions in GHG.

Co-Act is proposing a unique process of collaboration and system development that can once again make small, low impact hydroelectric a feasible, attractive, and reliable source of renewable energy. This process results in channeling the generated proceeds back into the municipalities in which the dams are located. Revitalizing appropriate, established hydroelectric facilities will provide a positive cash flow for communities, and for those towns with larger dams, provide significant income for generations to come. This is a form of economic development for underserved communities while increasing our energy independence.

On November 6 of 2009, Co-Act facilitated the first hydroelectric symposium of its kind in the country focused on Central and Southern Berkshire County. This meeting of environmental, regulatory, engineering, and funding professionals, along with owners and managers of facilities, made for an informative exchange. By the conclusion of the panel discussion, we had identified a cost effective, efficient, watershed approach to put dams in our region back 'on line', generating hydroelectric power.

We first applied our strategy by conducting a preliminary assessment of 11 low impact hydro projects in the Housatonic Basin, located in Berkshire County. Since then, we are investigating another 8 dams in Pioneer Valley which can provide similar benefits to their municipalities. We propose these 19 dams,

capable of generating $1.6 million/ yearly in revenues, plus an additional 6 dams located in Western MA, be selected for a pilot program to demonstrate the effectiveness of our watershed approach.

The approach we have developed can be applied state wide. It involves all the stakeholders identifying criteria for dam selection and "smart development". For example, the criteria we gathered from our meetings for the Housatonic include: minimal water diversion, structural integrity, potential improvements to the fish and wildlife habitat, and recreational use development. Once the smart development dams are selected Co-Act will expedite the permitting process with our team from Essex Partnership, an engineering firm specializing in low impact hydro. Essex will also assist with the engineering analyses to provide a reference design for dams in the same watershed to help reduce construction costs. We will realize further cost savings by clustering data gathering, environmental studies and inspection of the facilities.

Revitalization of existing dams and tapping appropriate run of the river sites requires a unique collaboration and due diligence that our assembled team is well qualified to perform. Licensing and approval for small hydroelectric plants typically costs several hundred thousand dollars and take four years or more. Co-Act's new approach can cut the time required to less than two years and greatly reduce costs. Our goal is a 50% reduction in time and pre-installation costs, compared to existing standards. This makes small hydro power feasible throughout Massachusetts while opening up the model for a clean energy economy throughout the United States.

Another advantage of our approach is that it allows us access to dam "barriers" on a stretch of river to increase and improved portage, recreational use, and safety. It also provides the benefit of an improved power transmission from distributed generation which will support the power grid at many points.

Rising Dam

Citing one example from our preliminary assessment, the Rising Dam on the Housatonic can produce $500,000 per year. Generators are built to last for one hundred years, as compared to photovoltaic panels which lasts for only 20 years. Presently, this energy is being wasted, as it is for most of the dams in our region.

Co-Act is seeking partnership with the Commonwealth of Massachusetts to initiate the first of three phases to harness this energy. This first phase involves the screening and analysis of 25 dams in three regions in Western MA. We have already begun work on two regions and

propose to include a third high yield region. Our team will research and gather available data on each dam and conduct a site visit to confirm hydraulic data, take measurements, and develop more accurate energy calculations. We will initiate meetings with owners of the dams and the town officials for their initial approval. We will provide initial estimates for repair, refurbishing, site preparation, and design. Our team will assess the dam for "smart development" criteria. At the conclusion of the first phase, we will provide preliminary cost estimates for equipment purchase and installation as well as return on investment calculations for each of the 25 low impact hydro electric dams.

With identified hydroelectric assets, we will approach "The Renewable Energy Trust" to increase their portfolio of MA renewable energy generation. For the 25 dam pilot project we are seeking $150,000 for this phase of the work, or $6,000 per dam from the state.

The second phase would involve detailed structural and engineering analysis for each site, and permit application completion. The third phase involves the purchase and installation of equipment. These last two phases would involve funding from additional sources including the Renewable Energy Trust, local banks, and other institutions such as DEP. Cost estimates depend upon each site and are part of the first phase.

We will also need the state's support in streamlining the permitting process that will result in higher dam safety, system engineering analysis, retention of historic dams and important habitats, a healthier environment and improved recreational use. State officials are needed to support this watershed development for municipal power generation as it involves contiguous municipalities. State representatives can provide important insights and valuable networking to make this project a reality as Senator Ben Downing is currently doing with our team.

As a next step, Co-Act would like to make a more formal presentation and have a detailed discussion with the Executive Office of Energy and Environment Affairs, Mass DEP and optimally Governor Patrick. This is not only about clean energy; it's also about accessing our common wealth for the good of the community. It's progressive, green, and grassroots oriented.

I appreciate having the opportunity to share our research, approach, and vision. I look forward to hearing about having a more in-depth meeting.

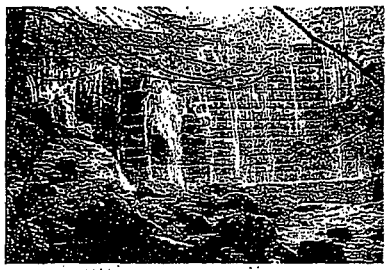
Sincerely;
Paul Deslauriers

Executive Director
Co-Act
413-232-7888
Paul@Co-Act.org

Regarding: Global Warming Solutions Act
To: Massachusetts Department of Environmental Protection
Attn: Lee Dillard Adams

Letter of support to include local, low impact hydroelectric in the "Draft Climate Implementation Plan"

I write on behalf of The Friends of the Upper Roberts Meadow Reservoir and Dam, which formed to protect the Upper Roberts Meadow Reservoir and is working to place low-impact micro-hydro power on the dams in Northampton. As potential partners with Co-Act for the attached project, we will be working to raise awareness that our community-owned assets are capable of many things, from creating clean, green, renewable energy to improving the safety of our dams to creating a new and much-needed revenue stream for the City of Northampton. With your help, we can begin the important work to install micro-hydro on our dams.


Upper Roberts Meadow Dam, Northampton

We fully support an important addition to the Massachusetts Climate Implementation Plan. There are many existing dams in Western MA, including the Upper Roberts and the City of Northampton's additional dams, which combined are capable of providing clean energy and a positive cash flow to the municipalities where they are located.

Everyone we speak with is excited about this and wants this green power. Unlike Cape Wind or placing wind turbines on Mt. Tom, micro-hydro does not change the landscape, but will do what we all want; tap the power that many feel is 'wasted' every minute of the day. Your support will do much to utilize this power source, and we ask for your help in conducting the necessary studies, in streamlining regulations and permitting processes, and installing micro-hydro. We need your help to enable Co-Act, The Friends and other groups to tap our dams so they can generate the power we need now and for decades into the future.

We strongly support the "smart development" approach proposed by Co-Act and Essex Partnership. (Essex Partnership is advising The Friends regarding only the Upper Roberts Meadow Dam.) Working together to share resources, information, and to provide a centralized base from which we can all learn together, makes sense. Having Co-Act and Essex work in tandem with The Friends and others brings expertise into communities where this is lacking. Our City leaders should not have to become engineers in order to tap their existing assets for power and income. This proposed investment will make a huge impact by providing our Western MA communities with experts who can navigate the system and make micro-hydro possible. This 'smart hydro' approach saves money, it improves our waterways by turning them into a valued resource, and

most importantly, this provides a way to access valuable clean energy that will benefit our community in a variety of important ways.

With the cities in dire straits and many communities facing removing dams because they no longer produce income and need maintenance we ask that you consider the attached proposal and make it possible to enable us to do the required research to make assets already waiting to be tapped a part of our Commonwealth's green energy solution.

Sincerely,
John Clapp
Friends of the Upper Roberts Meadow Reservoir and Dam
www.saveourdam.org

Regarding: Global Warming Solutions Act
To: Massachusetts Department of Environmental Protection
Attn: Lee Dillard Adams

Please add my voice to Mr. Clapp's. This is an initiative the state can be proud of.

Regards,

Adam Cohen
adam@winningwriters.com
Northampton, MA