# Town of Leicester

# Moose Hill Water Commission

# Moose Hill Reservoir Feasibility Evaluation

## June 2, 2008

Prepared by:

S E A Consultants, Inc.
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2008002.01A

S E A would like to thank the following persons for their cooperation, assistance, and as sources of information:

**Mike Knox** - Supt. of Cherry Valley and Rochdale Water District

**Frank Lyon** - Supt. of Leicester Water District and Supt. of Hillcrest Water District

**Dave Terry** - Director of MA-DEP Drinking Water Program

**Kathy Baskin** - Executive Director, Massachusetts Water Resources Commission

**Elizabeth Marc-Aurele** – Town of Leicester, Conservation Commission Dept. Asst.

**Jonathan Yeo** - Director of MA-DCR Water Supply Protection

**Jason Benoit** - MA-DCR Dam Safety Program

**Larry Boutiette** – USDA-NRCS - Civil Engineer, Massachusetts Community Assistance Partnership

**Carl Gustafson** – USDA-NRCS - State Conservation Engineer, Water Resources Engineering and Planning

**Allen R. Orsi**, P.E., Project Engineer, Pare Corporation

**Site Description:**

The Moose Hill Reservoir Dam is located within Worcester County approximately 3.6 miles northwest of the Leicester Town Hall on the border with the Town of Spencer. The Dam impounds water along Shaw Brook. The structure and the impoundment are shown in the Worcester North USGS Quad. Map at coordinates 42°16'10" N / 71°57'29" W. The dam is approximately 2000 feet long with a structural height of 71 feet and a maximum storage capacity of approximately 2140 acre feet or 785 million gallons. The drainage area is approximately 4.7 square miles (3027 acres) and extends through predominantly rural to undeveloped areas of the northwest corner of the Town and an area in southwestern Paxton. Of this drainage area, approximately 257 tributary acres is reportedly controlled for water supply purposes at the Shaw Pond Dam.

The Moose Hill Reservoir Dam is owned by the Massachusetts Department of Conservation & Recreation (DCR) as the parent organization of the Massachusetts Water Resources Commission. The dam was constructed in the late 1960's early 1970's to provide flood control capacity, water supply, and low flow augmentation. In accordance with DCR Office of Dam Safety classification, under Commonwealth of Massachusetts dam safety rules and regulations as stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Moose Hill Reservoir Dam is considered a LARGE size structure with a Class 1 ( High) Hazard classification.

DCR also maintains the dam under an Operation and Maintenance Agreement executed on September19, 1978 with the Town of Leicester. The Town agreed to share in costs associated with the operation and maintenance as described in said agreement. The Town's portion of this annual cost was established as 33.2%.

The following executed documents identify these contractual arrangements between the State and the Town of Leicester and are attached at the end of this report:

A). Supplemental Watershed Work Plan Agreement No. 2 – April 1968

B). Operation and Maintenance Agreement – September 1978.

**Project Description:**

S E A was retained by the Town of Leicester to assist the Moose Hill Reservoir Commission with the following tasks:

1. Evaluate the feasibility of re-certifying the reservoir as a new source of public water supply.
2. Prepare a timeline for the process of permitting the Reservoir.
3. Conduct a cost-benefit analysis of the use of the Reservoir.
4. Evaluate the feasibility of obtaining the permits necessary to utilize the reservoir as a new source of public water supply, including those permits related to:
    a. Interbasin transfer Act
    b. Water Management Act
    c. Massachusetts Environmental Policy Act
    d. Wetlands Protection Act
    e. Army Corps of Engineers

**Conclusion:**

At this time, we identified no fatal flaws that would destine this project to failure. It would require a very cooperative and collaborative effort between the Town, the three Water Districts, and the Sewer Districts involved. The permitting matrix would be complex and lengthy, we estimate taking somewhere between 48 to 84 months.

Our summary and response to these tasks will follow in the same order as they are presented above.

**Summary:**

**Task 1. Evaluate the feasibility of re-certifying the reservoir as a new source of public water supply. Please refer to the following memo.**

On Tuesday, 11 December, the writer met with David Terry, Director, Drinking Water Program, MASS-DEP at Mr. Terry's office in Boston. The purpose of the meeting was to discuss with Mr. Terry the process and procedure within DEP for certifying Moose Hill Reservoir as a public water supply (PWS).

The writer reviewed with Mr. Terry the history of the joint acquisition of the land and financing of the construction between the Massachusetts Water Resources Commission, the Soil Conservation Service, and the Town of Leicester. This includes the Town of Leicester being the sponsoring local organization in order for the project to include capacity for the withdrawal of water for a PWS. The writer also shared a November 1987 letter S E A's research had uncovered from the then CERO-DEP Deputy Regional Director James Fuller to the Moose Hill Water Commission approving the Moose Hill Reservoir as a public water supply, (copy attached). Mr. Terry asked several questions regarding current use, condition and threats on the watershed, and the long term intent of the Town.

The discussion concluded with Mr. Terry expressing that MASS-DEP is receptive to the Town of Leicester initiating the steps for approval of the Moose Hill Reservoir as a PWS. Speaking on behalf of MASS-DEP, Mr. Terry did not see any reason that if the proper procedures and protocol were followed, that Moose Hill Reservoir could not be a classified as a Class A waters applicable to its use as a PWS. This process would be initiated by the submittal of a request for a New Source of Supply Approval by the Town to MASS-DEP and the scheduling of a site exam. Assuming that the water quality test results met the Clean Water Act requirements for Class A waters, DEP would assign that classification to the Moose Hill Reservoir.

Therefore, the next task would be to develop and submit a New Source Approval request for Moose Hill Reservoir ( BRP-WS 20).

**Task 2. Prepare a timeline for the process of permitting the Reservoir.** Please refer to the timeline on the next page. Because the "project" is really not defined, some of these permits may or may not be necessary. Those that are project dependent are noted as such.

| Moose Hill Reservoir Permitting Process (Does Not include WTP and Appurtenant Structure Designs or Reviews) | | | | | |
|---|---|---|---|---|---|
| | | BEST | | WORST | |
| | ESTIMATED DURATION | START | FINISH | START | FINISH |
| | | Month | Month | Month | Month |
| MEPA 301CMR11.03 (475) | | | | | |
| *ENF* | 5 Months | 1 | 5 | 1 | 8 |
| *EIR (if required, project dependent)* | 12 Months | 9 | 21 | 10 | 34 |
| | | | | | |
| Water Resource Commission | | | | | |
| *Demand Projections* | 6 Months | 3 | 9 | 3 | 15 |
| | | | | | |
| *Interbasin Transfer Act (project dependent)* | | | | | |
| MGL-C215-8B-8D & 313 CMR 4.0 | 12 Months | 9 | 21 | 10 | 34 |
| | | | | | |
| MA DEP | | | | | |
| *BRP - WS-20 New Source Approval* | 6 Months | 1 | 6 | 1 | 9 |
| *BRP - WS-21 To Conduct a Pilot Study* | 4 Months | 5 | 11 | 10 | 20 |
| *BRP - WS-22 Pilot Study Report* | 6 Months | 18 | 20 | 28 | 40 |
| *BRP - WS-23 or 24To Build a WTP( project dependent)* | 6 Months | 28 | 36 | 48 | 60 |
| | | | | | |
| *401 Water Quality Cert -314 CMR 9.00* | 6 Months | 36 | 42 | 48 | 60 |
| | | | | | |
| *Water Management Act Permit - 310 CMR 36.00* | | | | | |
| *BRP MW-03* | 6 Months | 3 | 9 | 3 | 34 |
| | | | | | |
| US ACOE (project dependent) | | | | | |
| *ACOE 404 Clean Water Act Permit* | 12 Months | 36 | 48 | 50 | 86 |
| *33CFR325 (ENG Form 4345)* | | | | | |
| | | | | | |
| Town of Leicester -Con. Commission MGL C 131 S 40 | | | | | |
| *Notice of Intent - @ 60% design* | 6 Months | | | | |
| | | | | | |
| Glossary: | | | | | |
| BRP: DEP's Bureau of Resource Protection | | | | | |
| WS: Water Supply | | | | | |
| WM: Water Management | | | | | |
| CMR: Code of Massachusetts Regulations | | | | | |
| CFR: Code of Federal Regulations | | | | | |
| MGL: Massachusetts General Laws | | | | | |
| ACOE - US Army Corps of Engineers | | | | | |
| MEPA - Massachusetts Environmental Policy Act | | | | | |

## Task 3. Conduct a cost-benefit analysis of the use of the Reservoir.

### Introduction

This section of the report summarizes the results of a financial analysis that was conducted to identify updated capital and operation and maintenance (O&M) costs of infrastructure improvements associated with establishing the Moose Hill Reservoir as a public water supply. If approved as a public water supply, the Moose Hill Reservoir would have the potential to serve as a supply to several local water supply districts, including the Leicester Water Supply District (LWSD), Cherry Valley – Rochdale District, and the Hillcrest Water District. Furthermore, the reservoir could serve as either a primary or secondary source of water for communities bordering Leicester, provided that sufficient treatment and distribution capacity is constructed.

The Moose Hill Reservoir has a designated average daily yield of approximately 1.5 million gallons. To utilize the reservoir as a source of supply for the water districts named above, construction of new infrastructure would be required, including:

- Water Treatment Plant – A new water treatment plant would be built on land near the reservoir to remove impurities from the raw water and provide disinfection prior to delivering the water to customers.

- Transmission Main – A new transmission main would be installed along Moose Hill Road, Watson Street and Route 9 to convey treated water from the new plant at the reservoir to the terminus of the existing distribution system for the LWSD. From there, water would be conveyed through the LWSD water system and to the Cherry Valley – Rochdale and Hillcrest Water Districts through existing interconnections with LWSD.

- Water Storage Tank – The new treatment plant would pump treated finish water to a new water storage tank located off Route 9, which would provide consistent and reliable water pressure and fire protection for customers.

Sizing of new treatment, distribution and storage facilities and their related costs are explored further in the following section.

## Infrastructure Sizing and Cost Considerations

Infrastructure sizing and cost considerations are provided below for a new water treatment plant, distribution piping, and water storage tank that are required to bring the Moose Hill Reservoir on-line as a public water supply source.

*New Water Treatment Plant:*

The 1986 preliminary design report prepared by S E A recommended the use of prefabricated treatment units utilizing a technology that is referred to as contact coagulation-filtration, or upflow clarification. In these units, chemical mixing, coagulation and flocculation occurs within a vessel within the interior of the circular unit under downward flow conditions, followed by upflow through a 'sludge blanket' in an outer vessel that facilitates clarification and sludge removal. The preliminary design report also recommended gravity filtration and the use of granular activated carbon to address potential THM formation, followed by chlorination for disinfection. In 1986, the Engineer's Opinion of Probable Construction Cost for a water treatment plant utilizing this technology was approximately $3.14 Million (0.5 MGD capacity) and $3.61 Million (1.0 MGD capacity), respectively. Annual O&M costs were estimated at $215,000 for the 0.5 MGD treatment plant and $280,000 for the 1.0 MGD treatment plant.

In the 22 years that have elapsed since issuance of the preliminary design report, there have been significant changes in the area of water treatment technology. And while the use of contact coagulation-filtration was considered a competitive alternative to treat raw water from the Moose Hill Reservoir then, its use now is less favorable compared to other technologies that are currently available, such as the use of membrane filtration or modern prefabricated treatment units that utilize adsorption clarification/filtration technology.

To evaluate potential sizing of the new water treatment plant, information was collected on the current and projected average day and maximum day demands for the three water districts, which are shown in Table 1. Based on the combined water demand from the three water districts shown in Table 1, opinions of cost were developed for a new water treatment plant ranging in capacity from a minimum of 0.5 MGD to a maximum of 1.5 MGD, with the upper limit of the range representing the reported design yield of the reservoir.

**Table 1**
**Current and Projected Water Demands (gallons per day)**

| | Current Avg Day Demand | Current Max Day Demand | Future Avg Day Demand | Future Max Day Demand |
|---|---|---|---|---|
| Leicester Water Supply District | 250,000 | 395,000 | 625,000[1] | 987,500[4] |
| Cherry Valley – Rochdale District | 256,000[2] | 533,500 | 398,000[3] | 829,400[4] |
| Hillcrest Water District | 65,000 | 167,500 | 65,000 | 167,500 |
| **Total** | 571,000 | 1,096,000 | 1,088,000 | 1,984,400 |

1 LWSD future avg day demand based on projected potential growth in residential, commercial and industrial wastewater flows to 2025.

2 Cherry Valley - Rochdale District current avg day demand based on average pumping production from 2003 to 2007.

3 Cherry Valley –Rochdale District future avg day demand includes demands for the approved Chapel Hill Estates and Grand View Estates developments, and the proposed Pulte Homes and Twelve Oaks developments.

4 Future max day demands assume same avg day to max day peaking factor as current demands.

In order to develop an updated opinion of cost for a new water treatment plant at the Moose Hill Reservoir, S E A reviewed costs from several recent water treatment plant projects utilizing modern treatment technologies. S E A also contacted manufacturers to obtain price quotes for the major treatment units that would comprise such a facility. Water quality data from the 1986 preliminary design report was utilized to provide insight into the feasibility of certain treatment technologies and their ability to produce high quality potable water that meets state and federal drinking water quality standards, now and into the foreseeable future. Based on a review of recent treatment plant projects and price information provided by manufacturers, opinions of cost for a new water treatment plant are shown in Table 2. As shown in Table 2, capital and O&M costs related to the water treatment plant are provided over a range of capacities, from 0.5 MGD to 1.5 MGD.

**Table 2**
**Opinion of Probable Construction Costs and O&M Costs**
**Water Treatment Plant**

| Size of Plant (MGD) | Capital Cost ($) | Cost per Gallon of Treatment Capacity ($) | O& M Costs[2] |
|---|---|---|---|
| 0.5 | $2,500,000 | $5.00 | $255,000 |
| 1.0 | $3,750,000 | $3.75 | $330,000 |
| 1.5 | $4,500,000 | $3.00 | $405,000 |

1 All costs based on ENR CCI Index = 8184.94

2 O&M Costs assume 2 new full-time employees required to operate plant + benefits ($180,000) and a unit rate cost of $150,000/MGD for power and chemical costs, etc.

*New Transmission Main:*

LWSD recently installed approximately 15,000 feet of new water transmission main along the Route 9 corridor to attract commercial development in this area of Town. New 16-inch ductile iron water main was installed in Route 9 (Main Street) from Pleasant Street in the downtown area to Old Route 9 (Main Street), and in Old Route 9 (Main Street) to Watson Street. New 12-inch water main was installed in the section of Old Route 9 located west of Watson Street and the remaining section of Route 9 to complete the loop. New 16-inch water main was also installed in Blueberry Lane to the proposed location of a future water storage tank, which is described in more detail below.

If the water treatment plant is built on land along the southern shore of the reservoir with access to the site off Moose Hill Road, which was originally proposed in the 1986 Preliminary Design Report, then approximately 5,500 feet, or slightly more than one mile of new 16-inch water main would be required in order to extend from the new water treatment plant location to the terminus of the existing 16-inch D.I. water main located near the intersection of Old Route 9 and Watson Street. The Opinion of Probable Construction Cost for this improvement is approximately $1,375,000, as shown in Table 1.

*New Transmission Main:*

In 2007, S E A completed the design of a new 500,000 elevated composite water storage tank located on Blueberry Lane. The tank was designed to provide equalization storage and fire reserve storage for the LWSD only – equalization storage for the Cherry Valley – Rochdale District and Hillcrest District were not provided. The Engineer's Opinion of Probable Construction Cost developed during design was approximately $1,530,000, which includes site work. If a 0.75 MG elevated composite water storage tank is constructed – for example to accommodate future equalization storage for customers outside the LWSD – then the construction cost estimate would increase to $1,925,000.

## Cost-Benefit Analysis

This section includes a cost-benefit analysis that compares total capital and additional O&M costs to increasing levels of treatment plant capacity. The analysis includes a summary of total capital and additional O&M costs for alternatives involving different levels of capacity at a new treatment plant (i.e. 0.5 MGD option, 1.0 MGD option, and a 1.5 MGD option). In this analysis, capital costs for a new transmission main in Moose Hill Road and Watson Street and a new water storage tank in Blueberry Lane are assumed fixed. Table 3 provides a summary of the opinions of capital and annual O&M costs for varying levels of water treatment plant capacity.

**Table 3**
**Summary of Opinions of Cost**

| Infrastructure Improvement | 0.5 MGD Water Treatment Plant | | 1.0 MGD Water Treatment Plant | | 1.5 MGD Water Treatment Plant | |
|---|---|---|---|---|---|---|
| | Capital Costs | O&M Costs | Capital Costs | O&M Costs | Capital Costs | O&M Costs |
| Water Treatment Plant | $2,500,000 | $255,000 | $3,750,000 | $330,000 | $4,500,000 | $405,000 |
| Transmission Main | $1,375,000 | - | $1,375,000 | - | $1,375,000 | - |
| Water Storage Tank | $1,530,000 | - | $1,530,000 | - | $1,530,000 | - |
| **SubTotal** | $5,405,000 | $255,000 | $6,655,000 | $330,000 | $7,405,000 | $405,000 |
| **Engineering** | $1,081,000 | - | $1,331,000 | - | $1,481,000 | - |
| **Total** | $6,486,000 | $255,000 | $7,986,000 | $330,000 | $8,886,000 | $405,000 |

1 Engineering assumes design, bid phase and construction engineering at 20% of capital costs.

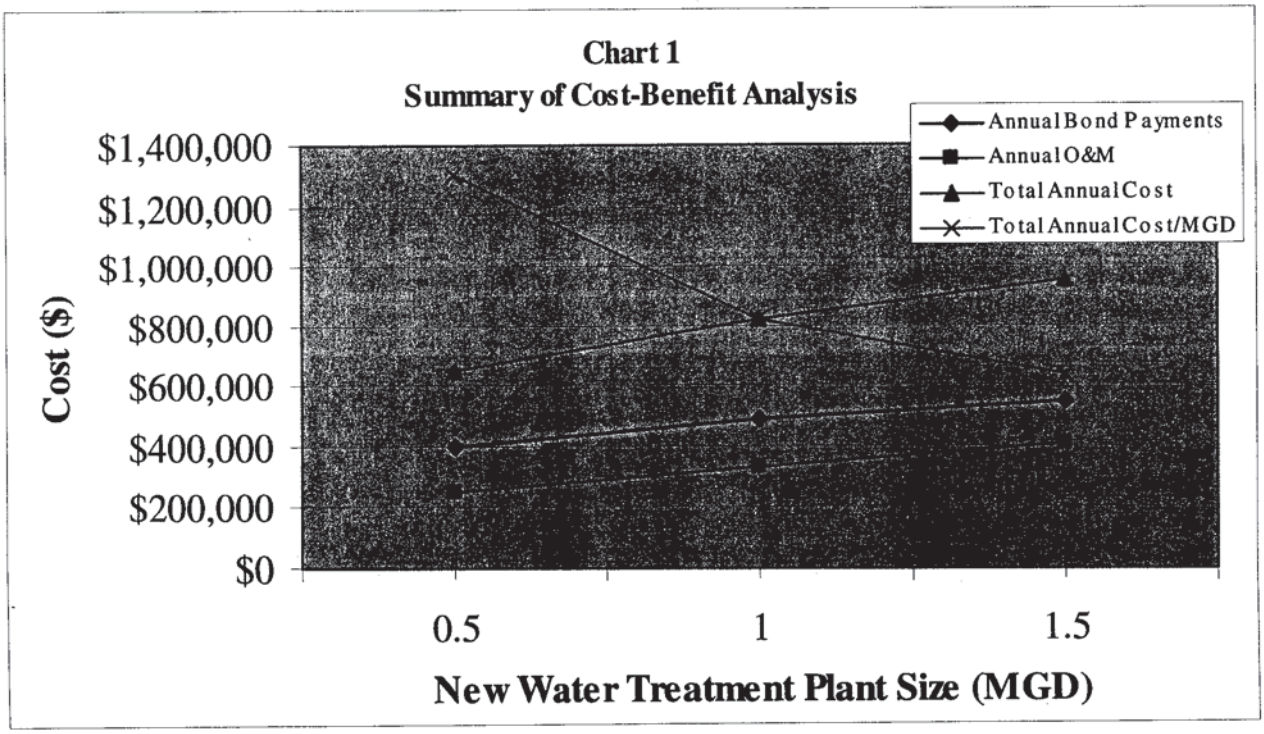
2 New water storage tank costs based on 0.5 MG storage volume.

Table 4 provides a summary of the cost-benefit analysis, which is also shown graphically in Chart 1. Table 4 and Chart 1 include annual bond payments on the capital improvements, annual O&M costs related to the improvements, and annual total costs associated with the improvements for varying levels of water treatment plant capacity.

**Table 4**
**Summary of Cost-Benefit Analysis**

| Treatment Plant Size (MGD) | Capital Cost ($) | Annual Bond Payments ($) | Annual O&M Costs ($) | Total Annual Cost ($) | Total Annual Project Cost per MGD |
|---|---|---|---|---|---|
| 0.5 | $6,486,000 | $396,662 | $255,000 | $651,662 | $1,303,325 |
| 1 | $7,986,000 | $488,398 | $330,000 | $818,398 | $818,398 |
| 1.5 | $8,886,000 | $543,439 | $405,000 | $948,439 | $632,292 |

1 All costs based on ENR CCI Index = 8184.94
2 'Annual Bond Payments' assume 2% SRF interest rate over 20 years.



**Task 4. Evaluate the feasibility of obtaining the permits necessary to utilize the reservoir as a new source of public water supply, including those permits related to:**

**a. Interbasin transfer Act**

**b. Water Management Act**

**c. Massachusetts Environmental Policy Act**

**d. Wetlands Protection Act**

**e. Army Corps of Engineers**

**a. Interbasin Transfer Act (IBTA):**

The Interbasin Transfer Act (MGL C 21 S 8B-8D) and appurtenant regulations (313 CMR 4.05) are administered by the Massachusetts Water Resources Commission. These regulations involve the transfer of drinking water or wastewater between river basins and Towns. Although there are exemptions, an interbasin transfer can typically be considered to occur when either drinking water or resulting wastewater is transferred over both a basin and a Town boundary. For the Town of Leicester, there are three separate Water Districts and three separate Sewer Districts.

The service areas and sources for the three Water Districts in the Town of Leicester are as follows:

- The Cherry Valley and Rochdale Water District (CV&RWD) serves customers located in the Town of Leicester in both the Blackstone and the French River basins from sources located in the French Basin in Leicester. The Cherry Valley section is in the Blackstone River Basin and the Rochdale section is in the French River Basin.
- The Leicester Water District (LWSD) serves customers in Leicester with sources in the French Basin in Leicester and in the Blackstone Basin in Paxton

- The Hillcrest Water District (HWD) serves customers in the French River Basin from their source in the same basin and they also purchase water from the Leicester Water District with sources in the Blackstone and the French Basins.

The service areas and discharge locations for the three Sewer Districts that serve the Town of Leicester are as follows:

- The Oxford–Rochdale Sewer District Facility has a WWTP discharge in the French River Basin in the Town of Oxford at the town line with Leicester.

  This wastewater facility serves:

  - a portion of the HWD, which receives water from its own well in the French and the LWSD with sources in the French and in the Blackstone basins from sources in the towns of Leicester and Paxton, and
  - the Rochdale section of the CV&RWD, with sources in the French Basin in the town of Leicester,

- The Upper Blackstone Water Pollution Abatement District Facility (Upper Blackstone) serves the Cherry Valley portion of the CV&RWD with sources in the French Basin, with a WWTP discharge in the Blackstone Basin on the boundary line of the Town of Millbury and the City of Worcester.

- The Leicester Water Supply District's Sewer Facility with a WWTP discharge in the French River Basin serves the Leicester Water Supply District customers and a portion of the HWD with sources in the French Basin in Leicester and the Blackstone Basin in Paxton.

In addition, there are lots within each Water or Sewer District that are served by on-site Title 5 systems.

<u>Findings:</u>

Withdrawals from Moose Hill Reservoir that would be exempt from the IBTA under the Act's intra-town exception are:

- The **sale of water** from Moose Hill Reservoir by any of the Water Districts to customers within the Town of Leicester **would not trigger an IBTA submittal.**
- Any **increase in the wastewater** that would be discharged by the three water districts' customers to a Title 5 system, in-town privately owned treatment works, or to the Leicester Water District's Sewer Facility **would be exempt from the Act.**

Conversely, **any proposed flow increases or changes in the physical capability to increase discharges** from the Town of Leicester as a result of a withdrawal from Moose Hill Reservoir to sewer systems served by the Oxford-Rochdale Sewer District Plant or the Blackstone Water Pollution Abatement District Facility would require an IBTA submittal by the respective sewer district or sponsoring entity.

It is our experience that the greatest permitting efficiencies are gained when the IBTA submittal is coordinated as a joint submittal as one document with the Environmental Impact Report through MEPA.

**b. Massachusetts Water Management Act**

The organization supporting and owning the proposed withdrawal from the Moose Hill Reservoir will need to file a Water Management Act Permit ( WMAct ) application with DEP under 310 CMR 36.00. This application could be developed and submitted early in the process but a response from DEP would not be forthcoming until the Massachusetts Environmental Protection Act (MEPA) certificate was issued by the Secretary indicating that the MEPA process was completed successfully.

In order to receive a WMAct permit, amongst other things the applicant would need to show a need for the demand as the DEP will not permit speculation. This need would be supported by demand projections for the service area as determined by DCR. The current DCR schedule does not have projections for the French Basin being developed until 2014. This is the last basin projections to be developed for the Town of Leicester service area. Therefore, any estimates desired prior to that date would need to be specially requested.

**c. Massachusetts Environmental Protection Act (MEPA)**

The purpose of the Massachusetts Environmental Policy Act (301 CMR 11.03, 4&5)

*"is to provide meaningful opportunities for public review of the potential environmental impacts of Projects for which Agency Action is required, and to assist each Agency in using (in addition to applying any other applicable statutory and regulatory standards and requirements) all feasible means to avoid Damage to the Environment or, to the extent Damage to the Environment cannot be avoided, to minimize and mitigate Damage to the Environment to the maximum extent practicable."*

The regulation has mandatory thresholds for specific activities that require levels of environmental review. Applicable to this project, Section 4 of the MEPA Thresholds in the Act requires the submittal of an initial Environmental Notification Form (ENF) and then based on the Executive Office of Energy and Environmental Affairs Secretary's scope, an Environmental Impact Report (EIR) for the following:

*301 CMR 11.03.4.2 – "New Interbasin transfer of water of 1,000,000 or more gpd (gallons per day) or any amount determined to be significant by the Water Resources Commission."*

Since the portion of the Moose Hill Reservoir built for public water supply is 1.5MGD (million gallons per day), to ensure that this volume would be available at a later date, it would be recommended that the ENF and subsequent EIR be prepared with this capacity consideration. Therefore, an EIR would be scoped by the Secretary from the ENF submittal.

**d. Wetland Protection Act**

A Notice of Intent would need to be filed with the Leicester Conservation Commission under MGL C 131 S 40. This filing would need to be accompanied with about a level of design that would show the WTP footprint, pipe corridors, stormwater mitigation, wetland limits and additional information as required by the Commission. Therefore, this application could not be made proactively prior to the initiation of design but during that process.

**e. Army Corps of Engineers (ACOE)**

This project would require the proponent to conduct pre-filing meeting(s) with the ACOE on the appropriateness and level of information required under Section 404 of the Clean Water Act. Based on those findings, a certain level of design would need to be completed to respond to the issues and concerns that the ACOE would have expressed. The level of effort and the length of time to receive this permit would be related to the impacts that would need to be investigated by the ACOE and the ability of the proponent to provide a satisfactory answer. It is our experience that this permit has the capability of being the last one to be received by the proponent.

# Attachment A

(3)

Attachment A

SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 2

between the

Southern Worcester County Conservation District
Local Organization

Northwestern Worcester County Conservation District
Local Organization

Town of East Brookfield
Local Organization

Town of Leicester
Local Organization

Massachusetts Water Resources Commission
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)
Commonwealth of Massachusetts

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for the Upper Quaboag River Watershed, Commonwealth of Massachusetts, executed by the Sponsoring Local Organization named therein and the Service, became effective on the 28th day of September, 1962; and

Whereas, the Supplemental Watershed Work Plan Agreement No. 1 for the Upper Quaboag River Watershed, Commonwealth of Massachusetts, executed by the Sponsoring Local Organization named therein and the Service, became effective on the 29th day of June, 1963; and

Whereas, in order to carry out the watershed work plan for said watershed, it has become necessary to modify said Watershed Work Plan Agreement, as Supplemented; and

Whereas, it has been found necessary to modify the watershed work plan as it pertains to the Shaw site by including municipal water storage for the Town of Leicester within the reservoir, by revising the individual Sponsor's responsibilities, the cost allocation and cost sharing and by including the intent of the Town of Leicester to secure a loan from the Farmers Home Administration; and

(6)

Whereas, it has become desirable to increase the fish and wildlife storage at the Horsepond site by modifying the principal spillway; and

Whereas, it has been found necessary to increase the project installation period from seven to ten years; and

Whereas, a Supplemental Watershed Work Plan which modifies the watershed work plan dated February 1961 for said watershed has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service, which plan is annexed to and made a part of this agreement;

Now, therefore, the Sponsoring Local Organization and the Service hereby agree upon the following modifications of the terms, conditions, and stipulations of said Watershed Work Plan Agreement:

(1.) The Massachusetts Water Resources Commission hereby agrees to become one of the local organizations sponsoring said watershed project.

(2.) The Town of Leicester hereby agrees to become one of the local organizations sponsoring said watershed project and to assume, jointly with the Massachusetts Water Resources Commission, the responsibilities of the Sponsoring Local Organization as they relate to the Shaw site under Paragraphs Numbered 1, 2, 3 and 9 of the Work Plan Agreement, as supplemented, with respect to land acquisition, water rights, construction costs, and operation and maintenance. The Town of Leicester further agrees to assume the responsibility, as it relates to the Shaw site, of the Sponsoring Local Organization under Paragraph Numbered 4 of the Work Plan Agreement, as supplemented, with respect to engineering services.

(3.) It is agreed that the Town of Leicester's responsibility for carrying out this plan is limited to the Shaw site Reservoir. The Town of Leicester will have no further interest in any subsequent supplements to this plan.

4. Paragraph Numbered 1 is modified to read as follows:

> The Massachusetts Water Resources Commission will acquire without cost to the Federal Government such lands, easements, or rights-of-way as will be needed in connection with the works of improvement except for the concrete dike. The Town of East Brookfield will acquire such lands, easements, or rights-of-way as will be needed for the concrete dike. (Estimated cost $365,709.)

5. Paragraph Numbered 3 is modified with respect to the Horsepond site Reservoir and the Shaw site Reservoir, to read as follows:

(7)

The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

| Works of Improvement | Sponsoring Local Organization (percent) | Service (percent) | Estimated Construction Cost (dollars) |
|---|---|---|---|
| Shaw Multipurpose Structure | | | |
| Joint Cost: | 35.7 | 64.3 | 199,700 |
| Specific Cost: (water supply) | 100.0 | 0 | 54,000 |
| Horsepond Multiple-purpose Floodwater Retarding and Fish and Wildlife Structure 1/ | | | |
| Joint Costs: | 0.63 | 99.37 | 170,447 |
| Specific Costs: - (Modification of Principal Spillway) | 50.0 | 50.0 | 250 |

1/ Construction Completed in 1965.

6. Paragraph Numbered 4 is modified with respect to the Shaw site Reservoir to read as follows:

The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

| Works of Improvement | Sponsoring Local Organization (percent) | Service (percent) | Estimated Engineering Cost (dollars) |
|---|---|---|---|
| Shaw Multipurpose structure, A & E contract | 35.7 | 64.3 | 25,000 |

7. Paragraph Numbered 5 is modified to read as follows:

The Massachusetts Water Resources Commission will bear the costs of administering contracts (Estimated cost $15,069.)

8. Paragraph Numbered 9 is modified to read as follows:

The Town of Leicester will provide 33.2 percent and the Massachusetts Water Resources Commission will provide 66.8 percent of the costs for the operation and maintenance of the Shaw site Reservoir. The Massachusetts Water Resources Commission will be responsible for the operation and maintenance of all structural measures by actually performing the work or arranging for such work in accordance with an agreement to be entered into prior to issuing invitations to bid for construction work.

9. Paragraph Numbered 11 is modified to read as follows:

This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose. Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Massachusetts Water Resources Commission prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

10. Paragraph Numbered 14 is added to read as follows:

The program conducted will be in compliance with all requirements respecting non-discrimination as contained in the Civil Rights Act of 1964 and regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.13), which provides that no person in the United States shall, on grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

11. Of the tables referred to in the Watershed Work Plan, Tables 4, 5 and 8A are eliminated and Tables 1, 2, 3, 6, 7, 8 and 9 are replaced by Tables 1, 2, 2A, 3, 4, 5 and 6 (Revised) in the Supplemental Work Plan.

The Sponsoring Local Organizations and the Service further agree to all other terms, conditions, and stipulations of said Watershed Work Plan Agreement as supplemented, not modified herein.

(9)

Attachment B

SUPPLEMENTAL WATERSHED WORK PLAN NO. 2

for the

UPPER QUABOAG RIVER WATERSHED

Worcester, Hampden and Hampshire Counties, Massachusetts

April 1968

## SUMMARY OF SUPPLEMENTAL PLAN

This Supplemental Plan provides for more fully developing the water resources potential of the Upper Quaboag River Watershed by adding municipal water and low flow release storage to the Shaw site Reservoir and increasing the volume of fish and wildlife storage in the Horsepond site Reservoir. The installation period will be increased by three years to allow sufficient time to implement the proposed changes in the work plan. There will be no revision of the land treatment measures from the work plan. Only those features of the work plan which have been modified are presented herein.

The installation costs for the structural measures have been revised based upon actual costs for the completed structures (Horsepond, Kittredge, Lamberton, Sucker sites and Floodwall) and 1967 prices for all other structures. Annual flood prevention and changed land use benefits have been updated to 1967 price levels to reflect the increase in value of those facilities producing the primary benefits. Annual costs were amortized over a 100-year period at 3 1/4 per cent interest.

1 CFS = .646 MGD
1/4 CFS = .162 MGD

The municipal water storage in the Shaw site Reservoir will supply the Town of Leicester with 1,500,000 gallons of water daily. The Town's Consulting Engineers estimate that this storage will provide sufficient water for the Town until the year 2000. The low flow release storage in the Shaw site Reservoir will allow a continuous flow of 0.25 cubic feet per second to be released through the dam into Shaw Brook. This flow is approximately equal to the minimum flow recorded immediately below the Shaw site and will assure that this minimum flow will be maintained after the Shaw site Reservoir is installed.

The total installation costs of all structural measures are now estimated to be $2,440,231, of which P.L. 566 funds will provide $1,914,278 and other funds $525,953. Annual benefits from structural measures are $122,178 with annual costs of $90,815. The overall benefit cost ratio for the project is 1.3 to 1.0. Secondary benefits of $8,207 annually are included in the benefits above. The Shaw site Reservoir will have water supply benefits of $8,718 annually compared to $6,762 annual costs. Benefits for the low flow release and fish and wildlife resource improvements were considered equal to costs.

(10)

The other funds necessary for the installation of the structural measures except for the Shaw site will be provided by the Commonwealth of Massachusetts through special legislation filed in the General Court. The Town of Leicester, through a loan from the Farmers Home Administration, and the Massachusetts Water Resources Commission, through the special legislation, will provide the other funds for the installation of the Shaw site Reservoir.

The Massachusetts Water Resources Commission will be responsible for and will provide 66.8% of the annual cost for the operation and maintenance of the Shaw site Reservoir. The Town of Leicester will provide the remaining annual cost. The Massachusetts Water Resources Commission will also be responsible for the operation and maintenance of all other structural measures included in the plan.

## WATERSHED PROBLEMS

The Town of Leicester, realizing its growing need for an additional water supply, made a study of potential sources and reservoir sites. The Town presently receives its water supply primarily from deep wells. This supply is distributed through the services of three water districts to certain areas of the Town. The other areas rely on individual wells of uncertain quality and quantity.

In June 1965, the Town obtained a planning loan from the Housing and Home Finance Agency, under the provisions of Public Law 83-560, to finance an engineering study and report relative to the feasibility of providing domestic water supply storage at the Shaw site Reservoir. This study and report was completed in February 1966 and recommended that Leicester participate in the Shaw site Reservoir as this was the only feasible manner of obtaining water both in quantity and dependability. The firm of Sanitary Engineering Associates, Inc., Consulting Engineers, Boston, Massachusetts, made the study for the Town of Leicester. Their report describes the study and recommendations in detail.

The average minimum flow recorded at Moose Hill Road during 1961, 1962, 1965 and 1966 by the U. S. Geological Syrvey was 0.18 cubic feet per second, with a minimum low flow of 0.01 cfs on 9-13-66.

The Horsepond multiple purpose floodwater retarding and fish and wilflife structure was constructed in 1965. The Massachusetts Division of Fisheries and Game, as part of its management program, made an evaluation study of the completed site. This study found that the present fish and wildlife pool would be greatly enhanced if the depth of the poolwere increased approximately three feet.

The sediment pool was impounded and a gate added to the principal spillway to permit seasonal manipulation of water levels to enhance waterfowl habitat conditions for food production, nesting areas and hunting areas. The fish and wildlife pool was not designed or constructed to be managed for fish production.

(11)

## BASIS FOR PROJECT FORMULATION

The primary objective of the sponsors for this project is to make maximum practical use of available water resources within the watershed. The changes included in this supplement will be consistent with their objectives.

The Consulting Engineers for the Town of Leicester determined that the Shaw site Reservoir was the only feasible way to obtain water in quantity and dependability. Their study included feasibility investigations of other possible structure sites and the additional use of deep wells for ground water supply. The Shaw site Reservoir is the most feasible, both economically and physically, and will meet the Town's water supply needs until the year 2000.

The Massachusetts Water Resources Commission determined that 60 acre-feet of low flow release storage would be required to maintain a continuous release of 0.25 cfs from the Shaw site Reservoir for a 120 day period each year.

The Massachusetts Division of Fisheries and Game determined that the Horsepond Fish and Wildlife pool would also provide a warm water fishery with the depth increased by approximately three feet. The additional area inundated would increase the area for wildlife habitat and would further enhance the site for waterfowl.

## WORKS OF IMPROVEMENT TO BE INSTALLED

### SHAW SITE

The Shaw site Reservoir is located on Shaw Brook at the Spencer-Leicester Town line. This site provides for flood prevention, municipal water supply and low flow release.

The Town's Consulting Engineers determined that 800 acre-feet of municipal water storage would provide the needed quantity for water supply. The Massachusetts Water Resources Commission determined that 60 acre-feet of storage would be required for the low flow release. The total reservoir capacity of 2,412 acre-feet will provide 800 acre-feet for water supply, 60 acre-feet for low flow release, 10 acre-feet for the expected 100-year sediment accumulation and 1,542 acre-feet for flood prevention.

The reservoir dam will be of compacted earth fill, 66 feet in height, with a top width of 20 feet and 3:1 side slopes. The upstream face of the dam will be protected by rock riprap. The remainder of the dam will be vegetated. The emergency spillway will be in earth. The principal spillway will be of reinforced concrete with the crest set at approximately Elev. 887 to provide for a total storage of 870 acre-feet. The principal spillway will be modified to allow for the continuous release of the 0.25 cfs. Because of municipal water supply and low flow release included in the structure, the permanent pool will be cleared and grubbed. The rock rip-rap will protect the

upstream slope of the dam between the maximum and minimum water elevations when the impounded water is withdrawn or released. There will be no other works of improvement for water supply included in this plan. The Town plans to install the necessary pumping plant for removal of the water supply upstream from the dam.

(12)

Creation of the reservoir will necessitate the relocation of approximately 0.3 miles of the Moose Hill Road, 450 feet of power lines and one house.

The total estimated installation cost for the Shaw site Reservoir is $363,136. Of this total, $144,971 will be provided from P.L. 566 funds, $52,561 will be provided by the Water Resources Commission, and $165,604 will be provided by the Town of Leicester.

HORSEPOND SITE

An analysis of the final design showed that the existing water level could be raised by 2.7 feet by merely eliminating the low stage inlet in the principal spillway. This modification will reduce the floodwater storage less than two percent and the structure will still furnish the same degree of flood protection as originally planned. Since the Massachusetts Water Resources Commission presently owns the land that would be inundated, no additional land rights would be required. There will be no additional clearing involved and the Massachusetts Division of Fisheries and Game will remove any dead timber.

There will now be 13 acre-feet of sediment storage, 26 acre-feet of fish and wildlife storage, and 1370 acre-feet of floodwater storage in the Horsepond site. The total estimated cost for modifying the existing principal spillway is $250, to be borne equally by the Service and the Massachusetts Water Resources Commission.

EXPLANATION OF INSTALLATION COSTS

The installation costs shown in Tables 1 and 2 include either the actual costs for those structures completed or the estimated costs for those structures remaining to be installed. The costs for the construction of the Shaw site Reservoir and the modification of the Horsepond principal spillway represent an estimate of the cost of each contract for installing each measure. Construction costs were increased by about 12% for contingencies.

Engineering services costs include:

(1) additional engineering field surveys for final design
(2) geological investigation of sites and borrow areas
(3) soil mechanics laboratory tests, and
(4) preparation of final designs, drawings, plans and specifications.

The estimated engineering services cost for installation of the Shaw site Reservoir include the required consultant engineering and architectural services.

Land rights costs consist of the value of land, easements or rights-of-way, cost of relocating facilities and legal, survey and other costs associated with their acquisition. The estimated value of land rights costs for the Shaw site was provided by the Town's Consulting Engineer. (13)

Project administration costs include other administrative costs associated with the installation of the structural measures. These costs include the costs of contract administration, review of engineering plans prepared by consultant engineers and architects, services of a Government Representative on each contract and the necessary layout and inspection service during construction to insure that the structural measures are installed in accordance with the plans and specifications.

The Use-of-Facilities method was used to allocate the installation cost for the Shaw site Reservoir. The cost for the modifications of the Horsepond principal spillway will be borne equally by the Service and the Massachusetts Water Resources Commission.

Sharing of project costs between P.L. 566 funds and other funds is in accordance with the provisions of Public Law 566, 83d Congress, 68 Stat. 666, as amended, and the Policy Statement of the Secretary of Agriculture. The total project costs are estimated to be $3,310,861. 59.8 percent or $1,978,514 will be provided from P.L. 566 funds. Other funds will provide $1,332,347 or 40.2 percent.

The percentages of installation costs allocated to each purpose for the Shaw site Reservoir are as follows:

| Percentages of Cost Allocated by Purpose | | | | |
|---|---|---|---|---|
| Item | Flood Prevention | Water Supply | Low Flow Release | Total |
| Shaw site | 64.3 | 33.2 | 2.5 | 100.0 |

The following costs for the Shaw site Reservoir and the modifications of the Horsepond site Reservoir will be provided as follows:

A. From P.L. 566 funds:

1. Federal share of the construction cost as follows:

   a. 64.3% of the joint construction cost for the Shaw site Reservoir

   b. 50% of the construction cost for the modifications of the principal spillway for the Horsepond site Reservoir.

2. 64.3% of the cost for engineering services for consultant, architectural and engineering service for the construction of the Shaw site Reservoir.

3. The cost for project administration, except for contract administration involved in reviewing engineering plans prepared by consultant engineers and architects, services of Government Representatives for each contract and the necessary layout and inspection services during construction.

(14)

B. The Town of Leicester will provide for the Shaw site Reservoir:

1. 33.2% of the joint construction cost.

2. 100% of the specific construction cost for the clearing of the permenent pool and rip-rap.

3. 47.4% of the cost for about 95 acres of required land to be purhhased for the pool area.

4. 47.4% of the cost for relocation or removal of road, powerline and house.

5. 47.4% of survey and legal costs incurred in acquisition of land for the pool areas.

6. 35.7% of the engineering services cost for consultant architectural and engineering services.

C. The Water Resources Commission will provide:

1. 2.5% of the joint construction cost for the Shaw site Reservoir.

2. 52.6% of the cost for about 95 acres of required land to be purchased for the pool area and 100% of the cost for about 15 acres of required land for the dam and emergency spillway for the Shaw site Reservoir.

3. 52.6% of the cost for relocation or removal of road, powerline and house at the Shaw site Reservoir.

4. 52.6% of survey and legal cost incurred in acquisition of land for the pool area and 100% of survey and legal cost incurred in acquisition of land for the dam and emergency spillway for the the Shaw site Reservoir.

5. Costs for administering contracts for installation of the structural measures remaining to be installed.

An estimate of the total Public Law 566 and other obligations during the revised installation period is listed in the table below:

| Year | PL 566 Funds | Other Funds | Total |
|---|---|---|---|
| First Five | | | |
| Land Treatment | 42,434 | 579,446 | 621,880 |
| Structural | 595,951 | 95,808 | 691,759 |
| Total | 638,385 | 675,254 | 1,313,639 |
| Sixth | | | |
| Land Treatment | 8,486 | 115,889 | 124,375 |
| Structural | 183,982 | 219,893 | 403,875 |
| Total | 192,468 | 335,782 | 528,250 |
| Seventh | | | |
| Land Treatment | 8,486 | 115,889 | 124,375 |
| Structural | 158,744 | 79,654 | 238,398 |
| Total | 167,230 | 195,543 | 362,773 |
| Eighth | | | |
| Structural | 93,702 | 23,876 | 117,578 |
| Ninth | | | |
| Structural | 451,960 | 75,163 | 527,123 |
| Tenth | | | |
| Structural | 434,769 | 26,729 | 461,498 |
| Grand Total | | | |
| Land Treatment | 59,406 | 811,224 | 870,630 |
| Structural | 1,919,108 | 521,123 | 2,440,231 |
| Total | 1,978,514 | 1,332,347 | 3,310,861 |

(15)

## EFFECTS OF WORKS OF IMPROVEMENT

The Shaw site Reservoir will provide a dependable water supply to furnish the Town of Leicester with the amount of 1,500,000 gallons per day, that will be required by the year 2000. This quantity was based on present population and rates of usage and the projected population within the area to be served by the year 2000. The Town's population growth was rated as over 35% from 1950 to 1960 and has continued for the period 1960-1965. This water supply will serve approximately 14,000 people within Leicester.

The continuous release of water through the Shaw site Reservoir will provide for maintaining the minimum flow of 0.25 cfs in Shaw Brook immediately below the structure. The 60 acre-feet of low flow

release storage will furnish a continuous flow of 0.25 cfs for 120 days each year. Any additional storage required to maintain this flow in extremely dry years will be provided from the water supply pool.

The increase in the depth and area of the Horsepond Fish and Wildlife pool will now provide a satisfactory warm water fishery which will be open to the public. The Division of Fisheries and Game will now also manage and maintain the pool for fishing as well as for wildlife habitat. (16)

In addition, the Shaw and Horsepond site Reservoirs will also contribute the same degree of flood protection as proposed in the original work plan.

## PROJECT BENEFITS

The direct annual monetary flood prevention benefits have been updated to 1967 values to reflect the increase in value of the facilities producing the primary flood benefits from 1961 when the damage surveys were made. These direct annual monetary flood prevention benefits are now estimated to be $98,487. Changed land use benefits presently derived from the project are now $2,929 to Urban-Residential and $6,011 to Industrial. Total annual indirect flood prevention benefits are $16,414. The total average annual primary flood prevention benefits are $107,427.

Secondary benefits were not considered pertinent to economic evaluation from a national viewpoint. The local secondary benefits stemming from this project are considered to be equal to ten per cent of the direct primary project benefits and amount to $8,207 annually.

The Consulting Engineers for Leicester have estimated that the water supply benefits accruing will be equal to or greater than the allocated cost for the water supply plus operation and maintenance costs. These water supply benefits are estimated to be $8,718 annually.

The low-flow release waters were included at the request of the Sponsoring Local Organization. The Massachusetts Water Resources Commission estimated that benefits were equal to the costs, and, therefore, are not included in the estimate of annual benefits. Benefits for fish and wildlife improvements were not evaluated and, therefore, neither the cost nor benefits for this purpose are included.

In addition to monetary benefits from flood prevention, recreation, fish and wildlife resource improvement, and water supply, the project will tend to improve public health, increase employment security, lessen hazards to life and property and provide a community sense of security.

The total annual benefits stemming from this project are estimated to be $124,793.

## COMPARISON OF BENEFITS AND COSTS

The overall benefit-cost ratio for this project is 1.4 to 1.0 with annual benefits of $124,793 and annual costs of $90,815. Without secondary benefits of $8,207, the benefit-cost ratio is 1.3 to 1.0. Flood prevention benefits are $107,427 annually as compared to an annual cost of $73,101. Water supply benefits are $8,718 annually compared to an annual cost of $6,762.

The annual benefits, annual costs and benefit-cost ratios are shown in Table 6. (17)

## PROJECT INSTALLATION

This plan will be completed as a joint undertaking of private, local, state and federal interests.

Five of the works of improvement from the original work plan have been completed. (These are: Horsepond, Kittredge, Sucker and Lamberton sites and the Floodwall). The remaining structural measures will be installed within the next five years. The installation period was extended by three years to allow sufficient time to complete this project. The Shaw site Reservoir will be constructed during the sixth year. During the seventh year, the Meadow site Reservoir will be constructed, followed by the Rice site during the eighth year. Turkey Hill site will be constructed during the ninth year, with stream channel improvement completing the structural measures during the tenth year. Land treatment measures are scheduled to be completed during the seventh year.

For the remaining structural measures to be installed, close cooperation and specific responsibilities are required of the sponsors and local, state and federal agencies assisting in this project.

## FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement will be provided from funds appropriated under the authority of Public Law 566, 83d Congress, 68 Stat. 666, as amended. The financial and other assistance to be furnished by the Soil Conservation Service is contingent upon the appropriation of funds for this purpose.

The Town of Leicester will provide its share of the non-federal funds to install the Shaw site Reservoir through a loan from the Farmers Home Administration.

The Water Resources Commission will provide the non-federal funds as set forth herein through special acts of legislation in the Massachusetts General Court.

# Attachment B

# OPERATION AND MAINTENANCE AGREEMENT

THIS AGREEMENT made on September 22, 1978, is between the Soil Conservation Service, United States Department of Agriculture, hereinafter referred to as the Service, and the following organizations, hereinafter referred to as the Sponsor(s):

MASSACHUSETTS WATER RESOURCES COMMISSION

TOWN OF LEICESTER

The Sponsor(s) and the Service agree to carry out the terms of this agreement for the operation and maintenance of the project measures in the State of Massachusetts. The project measures covered by this agreement are identified as follows:

I. OPERATIONS

A. The Sponsor(s) will be responsible for operating the measure without cost to the Service as follows:

1. In compliance with applicable Federal, State and local laws;

2. In compliance with the conditions set out in the instruments by which rights were acquired to install, operate and maintain the measure(s);

3. In a manner that will protect the environment and permit the measure(s) to serve the purpose for which installed as set forth in the program agreement;

4. In keeping with the requirements to provide inspection, operation and maintenance reports within the time frame provided in the attached plan;

B. Admission or users fees shall be charged only as necessary to produce revenues required by the Sponsor(s) to amortize its share of installation costs for that portion of the measures pertaining to recreation or fish and wildlife and to provide adequate inspection, operation, maintenance and replacement of the same.

C. In a recreation or fish and wildlife measure the Sponsor(s) may dispense such services and commodities, or arrange with private concessionaires for the dispensing of such services and commodities, which will contribute to the full use and enjoyment of the measure by the public at prices which are reasonable and compatible with prices for similar services and commodities within the area served by the measure.

D. The Service will, upon request of the Sponsor(s) and to the extent that its resources permit, provide consultative assistance in the operation of the structural measures.

II. MAINTENANCE

A. The Sponsor(s) will:

1. Be responsible for and promptly perform or have performed without cost to the Service all maintenance of the measures determined by either the Sponsor(s) or the Service to be needed.

2. Obtain prior Service approval of all plans, designs and specifications for maintenance work.

B. The Service will upon request of the Sponsor(s) and to the extent that its resources will permit, provide consultative assistance in the maintenance of the measure(s).

III. REPLACEMENT

A. The Sponsor(s) will be responsible for the replacement of parts or portions of the measure(s) which has a physical life of less duration than the evaluated life of the measure(s).

B. The Service will, upon request of the Sponsor(s), provide consultive assistance in the replacement of measure parts or portions.

IV. PLAN OF OPERATION AND MAINTENANCE

The Service and the Sponsor(s) will prepare a detailed plan of operation and maintenance for each measure covered by this agreement. More than one measure may be included in a single plan provided that the measures are sufficiently similar to warrant such action. Each such plan shall be attached to and become a part of this agreement.

V. INSPECTIONS AND REPORTS

A. The Sponsor(s) will inspect the measures at least annually and after each major storm or occurrence of any unusual condition that might adversely affect the measure(s).

B. The Service or Federal land administering agency may inspect the measures at any reasonable time during the period covered by this agreement. At the discretion of the State Conservationist, Service personnel may assist the Sponsor(s) in their inspections.

C. A written report will be made of each inspection. A copy of each report will be provided by the inspecting party to the other party within ten days of the date on which the inspection was made. The report will describe the conditions found and list any corrective action needed with a time frame to complete each action.

VI. TIME OF RESPONSIBILITY

The Sponsor(s)' responsibility for operation and maintenance begins when a part of or all of the work of installing a measure is completed and accepted or is determined complete by the Service. This responsibility shall continue until the expiration of the evaluated life of all the installed project measures. This does not relieve the Sponsor(s)' liability which continues throughout the life of the measure or until the measure is modified to remove potential loss of life or property.

VII. RECORDS

The Sponsor will maintain in a centralized location a record of all inspections and significant actions taken, cost of performance and completion date with respect to operation, maintenance and replacement. The Service may inspect these records at any reasonable time during the term of the agreement.

VIII. GENERAL

A. The Sponsor(s) will:

1. Prohibit the installation of any structure or facilities that will interfere with the operation or maintenance of the project measures.

2. Obtain prior Service approval of the plans and specifications for any alteration or improvement to the structural measures.

3. Obtain prior Service approval of any agreement to be entered into with other parties for the operation or maintenance of all or any part of the project measures, and provide the Service with a copy of the agreement after it has been signed by the Sponsor(s) and the other party.

B. Service personnel will be provided the right of free access to the project measures at any reasonable time for the purpose of carrying out the terms of this agreement.

C. The responsibilities of the Sponsor(s) under this agreement are effective simultaneously with the acceptance of the project measures in whole or in part.

D. Comply with the attached PROPERTY MANAGEMENT STANDARDS.

Name of Sponsor: Town of Leicester, Mass.

By: Anthony M. Maggone Sr. Title: Vice Chairman

This action was authorized at an official meeting of the Sponsor named immediately above on Sept 19, 1978 at Leic Selectmen Meeting

Attest: Mary K Clyburn Title: Acting Clerk Bd of Selectmen

Name of Sponsor: Massachusetts Water Resources Commission

By: Allen Martin Lyle Title: Acting Director

This action was authorized at an official meeting of the Sponsor named immediately above on July 11, 1977 at Boston

Attest: Fred A. St. Germain Title: Secretary

Soil Conservation Service, United States Department of Agriculture

By: [signature] Title: State Conservationist

# PLAN OF OPERATION AND MAINTENANCE

## MOOSE HILL RESERVOIR

I. The following items for operation and maintenance will be performed:

A. Clean debris from 30' culvert at station 50+00 on relocated Moose Hill.

B. Clean debris from Donnelly Cross Road bridge.

C. Inspect the relief wells and observation tubes to insure that they are in operation.

D. Check cold water release pipe.

E. Vegetation and Plantings.

1. Reestablishment and/or maintenance of grass-legume stands.

a. Reseed, and fertilize poor stands of grasses or legumes or resod and fertilize areas destroyed due to erosion. If necessary, regrade, fill or smooth eroded areas before reseeding.

b. To maintain site visual quality, cut and remove or spray with approved herbicides and remove any shrubs and trees which become established within seeded areas.

c. Lime and fertilize vegetation as required to maintain a vigorous stand. Soil tests should be made and pH readings obtained to determine exact needs.

(Soil tests will permit a closer evaluation of lime and fertilizer requirements, thereby permitting a more accurate amount of lime and fertilizer quantities needed, and; possibly resulting in some cost savings.)

d. All areas seeded to grasses and legumes are to be limed as necessary to maintain a soil pH between 6.0 and 7.0--or in lieu of a soil test, 4,000 pounds of ground limestone per acre are to be applied once every three years.

e. All areas planted to fescue, redtop, and birdsfoot trefoil mixtures are to be topdressed once a year in April or May with 400 pounds of 8-16-16 commercial fertilizer (or equivalent) per acre. At least 40 percent of the nitrogen shall have been derived from an organic source.

f. All areas planted to redtop, fescues, and crownvetch are to be topdressed once a year in April or May with 400 pounds of a 0-20-20 fertilizer (or equivalent) per acre and with 20 pounds of borax per acre if crownvetch is strongly dominant; if grasses are dominant or about in equal amount with crownvetch, an 8-16-16 (or equivalent) fertilizer is to be used with at least 40 percent of the nitrogen derived from an organic source.

g. Insects, fungus, disease, or other pests which would seriously damage seedings or cluster plantings will be controlled by using approved pesticides or other effective means. Observe local and state ordinances regarding spraying.

h. Areas shall be mowed only as necessary to prevent the encroachment of weeds and brush. It is preferred not to mow the crownvetch--grass mixture plantings; however, if mowed, plantings shall not be mowed more frequently than once a year and this mowing shall be performed during the month of August.

i. Clippings or mowings that are too dense or too tall, thereby endangering the residual grasses and legume stands by smothering, are to be removed.

2. Tree and Shrub Plantings

a. Trees and/or shrubs that become diseased, are dying, or die following the establishment period are to be uprooted, removed from the site, and disposed of in a manner that will minimize or prevent the spread of insects or disease.

b. Trees and/or shrubs removed are to be replaced by the same species or by plants having similar height and growth features.

c. Trees and/or shrub replacements and the soil area that will receive them are to be treated in a like manner as that done during the original planting; e.g. proper soil preparation, soil additives, proper planting, necessary anchoring, mulching, and other treatment required.

d. Remove anchoring collars in three to five years from planting date or at any other time when collars around tree branches or trunk constrict growth.

e. Injured, diseased, or dead branches of trees in cluster plantings will be removed and a commercially available wound dressing applied to the limb or stub.

F. The sponsor shall exercise control of maintenance vehicles and any other vehicles to prevent damage to the seedings and plantings and shall be responsible for reestablishing grass-legume stands and plantings on any areas that are damaged by the lack of such control.

II. The average annual costs of Operation and Maintenance are estimated to be $8,000.00. These financial resources will be provided in the budgets of the Sponsors.

III. Inspection of the works of improvement will be made annually, and after every major storm or occurrence of any unusual condition that might adversely effect the project measure, by the Sponsors, Southern Worcester County Conservation District, and the Soil Conservation Service. Inspection reports will be furnished to the Soil Conservation Service following each inspection. Upon request, the Southern Worcester County Conservation District will provide technical assistance for needed maintenance work. Further information relative to Operation and Maintenance is contained in the current issue of the Operations and Maintenance Handbook as developed by the U.S. Department of Agriculture, Soil Conservation Service.

IV. Critical items to be examined are listed on the Operation and Maintenance Record attached check list.

V. All work performed during Operation and Maintenance will comply with the appropriate state and local laws and regulations.

VI. Annual Operation and Maintenance inspections will be conducted during the month of August with corrective action completed within one year. Corrective action of an emergency nature will be completed within 90 days.

VII. The Operation and Maintenance Inspection Record (MA-AS-9) and the Operation and Maintenance Record (MA-AS-10) may be used to record and document Operation and Maintenance activities.

VIII. The works of improvement will provide water for the municipal water supply in the town of Leicester and flood prevention in the downstream watershed.

IX. Regulations for the safe and healthful use of this measure will be provided by the Massachusetts Water Resources Commission and the town of Leicester.

X. The expiration date of this agreement is 100 years from the date of acceptance of this project measure from the contractor. This is based on the evaluated life of these works of improvement.

XI. The necessary funds to perform Operation and Maintenance will be provided in the annual budgets of the Sponsors. The town of Leicester will provide 33.2 percent and the Massachusetts Water Resources Commission providing the remaining 66.8 percent. The Sponsors will also provide contingency funds in the same ratio to provide for unusual and unforeseen Operation and Maintenance needs.