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Attachments

1.0 Introduction and Purpose

The US Army Corps of Engineers, New England District (USACE/NAE) is conducting a multi-year feasibility study to identify watershed restoration opportunities in the Blackstone River Basin in Massachusetts. The goals of this study are to identify environmental restoration needs and opportunities in the basin, develop plans and cost estimates for restoration projects, assess benefits and costs of alternative restoration plans, select a recommended watershed restoration plan, and prepare appropriate NEPA documentation.

In 1999, Epsilon Associates, Inc. (Epsilon) was subcontracted by Battelle Memorial Institute (Battelle) to perform Tasks A and B for the Blackstone River Feasibility Study (USACE/NAE July 20, 1999). As defined by USACE/NAE, Task A included a comprehensive inventory of wetlands, riparian areas, streams, and ponds to identify and assess restoration opportunities within the Blackstone River Basin. The geographic range of the Task A work was restricted to the southern half of the Blackstone Watershed including the towns of Attleboro, Bellingham, Blackstone, Douglas, Franklin, Hopedale, Hopkinton, Mendon, Milford, Millville, North Attleboro, Northbridge, Oxford, Plainville, Upton, Uxbridge, Webster, and Wrentham. Task B included a comprehensive inventory of impoundments to assess existing habitat and recreational value of each identified impoundment. The geographic range of the Task B work was the entire area of the Blackstone Watershed, which in addition to the towns listed for Task A, included the towns of Auburn, Boylston, Grafton, Holden, Leicester, Millbury, Paxton, Shrewsbury, Sutton, Westborough, West Boylston, and Worcester. A final report on Tasks A and B was submitted to the USACE/NAE in 2003 (Battelle and Epsilon Associates, Inc. 2003).

Concurrent with the work completed on Task A and B, the MA Wetlands Restoration Program (MWRP) working with the University of Massachusetts, was completing an inventory of wetlands restoration opportunities in the Upper Blackstone Watershed. This work was completed and a report was submitted to the USACE/NAE in 2002.

In June 2003, the USACE/NAE requested that Battelle and Epsilon complete the inventory for habitats in the upper part of the Blackstone Watershed (Task C) that were not previously inventoried in Tasks A and B or by the MWRP. The habitats that had not been inventoried in the Upper Blackstone include riparian areas, streams, and ponds. This Task C report provides a comprehensive inventory and habitat assessment of these areas consistent with the methodology employed in the previous Tasks.

2.0 Study Area

The Task C study area includes 12 municipalities that make up the northern portion of the Blackstone River Basin located in Massachusetts. For the purpose of this evaluation, the Task C study area is assumed to include all or a portion of the following municipalities: Auburn, Boylston, Grafton, Holden, Leicester, Millbury, Paxton, Shrewsbury, Sutton, Westborough, West Boylston, and Worcester.

3.0 Site Selection Criteria

The Scope of Work (SOW) for Task C identifies four resource types that have been targeted for potential restoration opportunities in the Blackstone River Basin: riparian buffer, riparian habitat, stream, and pond. The definitions of the resource types are consistent with those used for Task A. Wetlands were excluded from Task C as they were inventoried by the MWRP in a separate report. The SOW has identified specific site selection criteria for each of these resources which are described below.

Riparian Buffers: Opportunities will be identified to restore wooded buffers greater than 50 feet wide along the Blackstone River, its perennial tributaries, and impoundments greater than 5 acres in size. Potential restoration sites will be defined as lengths of riparian area where a 50-foot wide buffer is lacking for a linear distance of more than 250 feet. Disturbed land in undeveloped to moderately developed areas of the watershed will be targeted for analysis (as discussed with USACE/NAE). Site visits will be conducted at all riparian areas where the potential exists to restore a vegetated buffer along an area greater than 1,000 feet in length.

Riparian Habitat: Opportunities will be identified to restore large (greater than 2 acre) continuous tracts of riparian habitat along the Blackstone River, its perennial tributaries, and impoundments greater than 5 acres in size (as discussed with USACE/NAE). Disturbed land in undeveloped or lightly developed areas of the watershed will be targeted for analysis. Likely restoration sites include agricultural land, junkyards, borrow pits, and unnecessary parking lots. Field visits will be conducted for all sites greater than 5 acres in size.

Streams: Perennial streams where the potential exists for instream habitat restoration and streambank stabilization/erosion control projects will be identified and documented. Restoration opportunities will typically include streams that have been channelized, have eroded banks, or exhibit excessive sedimentation of the substrate.

Ponds: Ponds greater than 1 acre in size (as discussed with USACE/NAE) within the study area that would benefit from habitat enhancement, invasive species control, and eutrophication reduction through the use of dredging will be identified and documented.

4.0 Methodology

In identifying potential restoration sites in the Blackstone River Basin, a three phased approach was used. The first phase involved the procurement of existing information from a variety of sources. The second phase involved analyzing this information to identify potential restoration sites as defined by the criteria outlined in Section 3.0. The third phase involved field visits to each site for the purpose of collecting additional information and evaluating sites as potential restoration opportunities. The methodology employed for Task C is consistent with that used previously for Tasks A and B. One significant difference is that much of the data, (e.g., aerial photographs, USGS maps, and other data) were available in digital formats through MassGIS (Massachusetts Geographic Information System Program). Use of the digital data enhanced the efficiency of identifying potential restoration opportunities, as opposed to manually reviewing and assessing sites on individual aerial photographs.

The activities included in these three work phases are described below.

4.1 Information Procurement

In this initial phase, existing information on the Blackstone River Basin that is applicable to this project was collected and catalogued. Government agencies, academic institutions and non-profit organizations were contacted to identify information sources for the project, such as resource maps, watershed studies, aerial photography and other ongoing studies and projects. Some of the information sources used on the project include the following:

- Massachusetts GIS Program
- Massachusetts Department of Environmental Protection (DEP) Bureau of Waste Site Cleanup
- Massachusetts DEP Wetlands and Waterways Program
- Massachusetts Division of Fish and Game (MDFG)
- Massachusetts Natural Heritage and Endangered Species Program (MNHESP)
- National Park Service (NPS) Blackstone National Heritage Corridor
- U.S. Army Corps of Engineers/ New England District (USACE/NAE)
- U.S. Environmental Protection Agency (USEPA)
- U.S. Fish and Wildlife Service (USFWS)
- University of Massachusetts Earth Science Information Office
- USDA Natural Resource Conservation Service (NRCS)
- U.S. Geological Survey (USGS)

Much of this information was already available in-house as a result of past work on earlier tasks. Staff at the MA Division of Fish and Game (MDFG) provided valuable information on stream restoration sites, including data scores using EPA's stream assessment methodology which MDFG had completed on impacted streams. These data were used to identify appropriate stream sites in the study area. The stream information is summarized in Attachment J. A data request was also made to the MA Natural Heritage and Endangered Species Program (MNHESP) to identify rare habitat. Refer to Attachment A for ay primary list of reference information used in identifying potential restoration sites for this project.

4.2 Information Interpretation and Analysis

The second phase of the project involved the interpretation of the data collected in the first phase (Section 4.1). The size of sites was calculated using GIS and a scaled acetate sheet to determine if sites met predetermined size requirements. Once potential sites were identified, their locations were placed on a base map compiled from USGS topographic quadrangles. This base map presented all potential restoration sites identified, including those to be visited in the field.

The final stage of data interpretation consisted of preparing the field packets for the site evaluation phase. Each field packet contained useful information that helped the field staff confirm habitat restoration sites. Each packet included enough information to allow the field staff to visit and evaluate sites over a 4 to 6-day time period. The field packet included: a USGS map with potential restoration sites plotted; an aerial photograph with sites identified, a blank field form; a copy of a road map locating all sites to be visited; and an assortment of natural resource information on the region including fisheries information, vegetation keys, and soil surveys. The purpose of the field packet was to provide the field team with the information needed to locate the site quickly and efficiently, review known information gathered during earlier phases, and conduct the field evaluation and site ranking.

4.3 Site Evaluation

Site evaluations were conducted at each identified potential restoration site that met the selection criteria listed in Section 3.0. A field data form created for each resource restoration type was completed at each site. The information on each field data form required collection of data associated with each restoration goal, general site characteristics, and site location information.

The site evaluation, which was conducted primarily by one field person, entailed visiting sites identified during the information interpretation phase. Initial site visits were conducted by a two-person field team to establish field protocols and consistent data interpretation. The field staff was equipped with a field packet (maps, field forms, directions, etc.) prepared for the specific area to be visited in a given day. The field team also carried copies of a letter signed by the USACE/NAE describing the purpose of the project. A copy of the letter was provided to anyone who inquired about the field program.

Additional equipment used in the field included a global positioning system (GPS) receiver, field manuals, and a digital camera. The GPS equipment used on this project was a hand-held Garmin GPS 12XL unit to 10-meter accuracy. Once on site, the field data forms were completed and a GPS point was recorded. The GPS information was used to produce geographic information system (GIS) maps showing each restoration site in the Blackstone River Basin.

When it was not feasible for the field team to directly access a site to collect information (due to posted private property, structures, etc.), field data were recorded from the closest accessible location to the extent possible. The field team spent approximately 45 minutes to 1 hour at each site. Approximately 4 to 6 sites were visited per day. While conducting site evaluations of the previously identified restoration sites, other potential restoration sites not previously identified meeting selection criteria were discovered. These sites have been included in the inventory in Attachment B. Additional potential sites that did not meet size criteria were not evaluated in detail but were simply listed as a potential opportunity in Attachment E.

4.4 Site Ranking Methodology

A scoring and ranking methodology was developed using other wetland, wildlife, and water habitat assessment methodologies (see reference list in Attachment A). Rankings were developed for the following attributes: impairments, benefits, negative impacts, and costs. After further consideration, it was discovered that it would be more efficient and practical to have the field staff perform the scoring and ranking in the field as part of the Site Analysis section of the field form. This allowed field staff to gather site information and score and rank various characteristics of the potential restoration opportunity while at the site.

Impairment scores were recorded on the field form for a variety of impairment factors observed at each potential restoration site. Possible impairment factors varied among resource types, however, examples that were common among all resource types included percentage of adjacent area developed, erosion and sedimentation, illegal dumping, and coverage of exotic species. Each observed factor was ranked on a scale of 1 to 3 with 1 indicating a low impairment and 3 indicating a high degree of impairment. The impairment scores were then tallied and the total impairment score was used to rank impairments as low, medium or high based on the range of scores that might be recorded.

Potential benefits of the restoration project were evaluated and scores recorded on the field form for a variety of benefits that could be expected as a result of actual site restoration. Examples of potential benefit indicators included improvements to water quality, fisheries/wildlife habitat, flood control recreation, and groundwater recharge/discharge. The total number of indicators of potential benefits observed on the site were tallied and then ranked as low, medium or high based on the range of scores that might be recorded.

Indicators of potential negative impacts were evaluated and the scores were recorded on the field form for a variety of impacts that could be expected as a result of restoration. Examples of potential negative impact indicators included impact to fisheries or rare species habitat, loss of agricultural land, and negative impacts to commercial uses. The total number of possible negative impacts potentially resulting from restoration were ranked as low, medium or high based on the range of scores that might be recorded.

Potential indicators of cost to restore a potential restoration site were evaluated and the scores were recorded on the field form. Examples of potential indicators of cost included ownership, re-grading, fill removal, and revegetation. Because the cost of a restoration project is a factor of its size, the total number of indicators of cost was weighted by a size factor. The size factors ranged from 1 to 3 and were based on the anticipated range of sizes that could be encountered at the sites. Scores were tallied and then ranked as low, medium or high based on the range of scores that might be recorded.

A final score quantifying the quality of the restoration opportunity was tallied based on the calculated ranks for potential benefits, potential negative impacts, potential costs, and size of the restoration site. The calculated ranks were scored based on a scale of 1 to 3. The scores were then added together to produce a total score for the quality of the restoration opportunity. The total score was used to rank the site as low, medium or high based on the range of possible scores that might be recorded.

5.0 Results and Discussion

Field work for Task C was initiated in October and completed in December of 2003. Pond sites were visited first in order to view the late stages of aquatic plant growth. Other sites were visited based on geographic location and convenience.

5.1 Results

As part of the completed field work, a total of 50 restoration opportunities were visited and documented. Of this total, 18 were riparian buffer, 19 riparian habitat, 6 stream, and 7 pond restoration opportunities. Information collected for the 50 sites is summarized in the final site list provided in Attachment B. Locations of these sites are identified on the orthophoto base GIS maps provided in Attachment C. (Note: No sites were located in areas outside the map sheet coverage area.) Photographs of each site are included in Attachment D. In addition to the 50 sites that were field documented, 27 other potential restoration sites were identified, but were not documented either because they did not meet the size criteria or could not be accessed in the field. These sites are identified on a secondary sites list provided in Attachment E and are located on a USGS base provided in Attachment F.

The Final Site List including site attributes and scores and ranks are provided in Attachment B. To assess a site's viability for restoration, it was determined that two ranks should be considered: the impairment rank, and the final rank. For Riparian Buffer, two sites scored "high" for impairments and two different sites scored "high" for final rank. For Riparian Habitat, four sites scored "high" for impairment and one different site scored "high" for final rank. For streams, one site scored "high" for impairments, and two sites including the highly impaired site scored "high" for final rank. For Ponds, one site scored "high" for impairments and one different site scored "high" for final rank. Sites that did not score "high" scored "low", "low+", "medium", or "medium+". These scoring categories were created and modified as described below. Details of the modified scoring/ranking system used for each resource type are provided in Attachment G. Blank field forms are provided as Attachment H. The completed field forms are included as Attachment I.

5.2 Discussion

Upon completion of all field work and site ranking, it was necessary to modify the ranking system. Because the ranking methodology was originally based on potentially observed scores and not on actual observed scores (or raw scores), a disproportionate number of sites ranked as medium on a low, medium and high scale. The primary reason for this is that the raw scores do not exhibit the range of potential scores and are more central to that range. To improve the usefulness of the scoring/ranking system, two modifications to that system were made. First, sites were ranked using a system based on raw scores rather than potential or hypothetical scores. Second, the scoring/ranking system was modified to provide for a better separation of sites by using a scoring scale of 1-5 rather than 1-3. The new ranking scale employed five levels of rank -- low, low+, medium, medium+, and high -- rather than a scale of low, medium and high.

To create the new ranking system, the highest and lowest raw score for each habitat type was identified to establish the range for that habitat type's ranking structure. Then the range was divided into five segments with raw scores matching each of the five ranking categories. Where the range of raw scores for a habitat type were not equally subdivided by five, the ranking system was structured such that scores on either side of the "middle" category (i.e., medium) were balanced with extras applied to middle categories to preserve a "bell curve" effect.

The following scenarios applied:

One extra raw score in the range – apply to "medium"

Two extra raw scores in the range – apply one each to “low+” and “medium+”

Three extra raw scores in the range – apply one each to “low+”, “medium”, and “medium+”

Four extra raw scores in the range – apply two to “medium”, and one each to “low+” and “medium+”

The impairment rank is a measure solely of a site’s indicators of impairment and reflects the degree of environmental degradation. Its focus is exclusively on environmental factors that are observable. In contrast, the final rank includes a broad range of factors often considered when assessing environmental restoration including perceived benefits of restoration, potential negative impacts, and cost. The final rank is intended to incorporate both environmental and practical considerations in assessing restoration projects.

While only one restoration site scored “high” for both impairment and final rank, other sites had scoring combinations of high-medium+ and high-medium. These sites would likely be considered strong restoration opportunities. Furthermore, all sites have merit as restoration opportunities and the data provided in this report supports future action while providing some measure for prioritization.

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