Appendix B Vegetation Monitoring and Invasive Species Control Plan

HYDE POND DAM REMOVAL PROJECT
AQUATIC CONNECTIVITY AND STREAM RESTORATION
VEGETATION MONITORING AND INVASIVE SPECIES CONTROL PLAN

August 2015

Introduction

Hyde Pond Dam is located on Whitford Brook, the primary inflowing tributary of the Mystic River, in the towns of Groton, Ledyard, and Stonington in New London County, Connecticut. The existing, privately-owned dam is an earthen embankment with a concrete-capped masonry spillway and dry-laid fieldstone retaining wall with a total length of 200 linear feet; the spillway is 4.8 feet high. Built in the early nineteenth century and originally used to power a mill, it has not been operational in several decades. The dam impounds an approximately 12 acre area of open water and wetlands.

The United States Fish and Wildlife Service (Service), as lead federal agency, and its project partners, Connecticut Fund for the Environment Inc./Save the Sound (CFE/Save the Sound), the CT DEEP Inland Fisheries Division, and private landowners, are proposing to restore fish passage, stream habitat, water quality, and mitigate future flood impacts through removal of the Hyde Pond Dam.

Removal of the dam will lower water elevations approximately 5 feet at the dam, with decreasing change to water elevations upstream of the dam. As a result of this change, which is an expected outcome of in-stream barrier removal and stream restoration, aquatic and wetland habitat types will transition to other types over time.

Plans for the stream restoration include excavation of sediments to restore a more natural stream channel through the existing impoundment. Sediments from this excavation will be placed adjacent to a commercial building, stabilized and planted to provide 1) protection to the building foundation from a meandering stream channel, 2) protection from flooding, and 3) sequestration of sediments with slightly elevated contaminants.

One major goal of the dam removal is to restore stream connectivity for improved fish passage. The CT DEEP Inland Fisheries Division staff will use its visual assessment protocol that it has employed at this location for over 10 years. Field staff documents and quantifies the presence of diadromous fish in the stream. In this case, the protocol will be modified and expanded since there will no longer be a fishway to monitor, operate, or maintain. Field staff will visit the site weekly during the spring fish runs (April 1 – June 30) and walk the stream from below the current site of the dam to the upstream limit of the construction project or extent of channel formation, whichever is further upstream. Observations on the presence, identity, abundance, and behavior of fish will be recorded. The ability to safely and effectively pass through the affected area in a timely manner will be evaluated. The stability and suitability of the fish habitat will be assessed and determinations will be made if the addition of 'fish rocks' or other habitat features is needed to expedite fish passage. In addition, the Inland Fisheries Division will electrofish the stream in the area that was previous occupied by the pond once a year in the summer to document the fish community and compare it to the fish community prior to dam removal. Annual reports will be submitted to Save the Sound. The Service and project partners will complete the NOAA barrier removal monitoring worksheet, which is based on the Gulf of Maine Monitoring Guide: (http://www.habitat.noaa.gov/toolkits/restoration_center_toolkits/forms_and_guidance_documents/ori_monitoring_sheet_w_guidance.pdf) This plan outlines a 4-year monitoring plan for vegetation

transitions in the impoundment waters and wetlands and the sediment placement /riparian enhancement area following the proposed removal of the Hyde Pond Dam. The goals of the monitoring are to 1) document riparian vegetation changes following lowering of water elevations, and to 2) ensure that riparian areas, both former impoundment open water areas and the sediment placement area become vegetated with indigenous plants and not invasive plant species.

Monitoring questions

1. How are the vegetative communities changing in response to the dam removal and restored pre-disturbance hydrology?
2. Are the sediment/riparian buffer area and the former impoundment shallow water areas supporting a minimum of 80% cover of native vegetation?
3. Have any invasive plants seeded into the sediment/riparian buffer area and the former impoundment shallow water areas?

Planting Plan

A planting plan for the sediment/riparian buffer area and a section of the former impoundment shallow water areas is attached.

Impoundment

Once the dam removal has been completed, water elevations lowered and sediments drained, the existing seed bank contained within the impoundment sediments is expected to germinate and establish a community of native flora. This natural restoration of flora has occurred at other successful dam removal and river restoration sites, including the former Rutan Dam on Anguilla Brook, also located in Stonington, Connecticut. A scrub-shrub habitat in the former shallow water areas of the impoundment are predicted to become established based on modeling of post dam removal hydrology.

Sediment placement/ riparian buffer area

Immediately post construction, in September or October 2015, the sediment placement/riparian buffer area will be seeded with an herbaceous cover crop (Virginia rye and other graminoid species that will germinate in the fall) to stabilize sediments as they consolidate. Live stakes will also be planted in the fall of 2015 (see attached planting plan). In the spring of 2016, the placement areas will be seeded with a mix of seeds, collected in 2015, of native trees, shrubs and herbs from local sources. A proposed list of plant species for live stakes and seed mix is in the attached planting plan. The New England Wildflower Society (NEWFS) has funding to collect seeds for Hurricane Sandy restoration projects such as this one. Bill Brumback and Michael Piantedosi of NEWFS will be coordinating the native seed collection for this project.

Monitoring Plan coordination

The U.S. Fish and Wildlife Service will be the party responsible for coordinating the post-construction monitoring as described in this monitoring plan. Activities will be performed by the Service, project partners, volunteers, and/or contractors as the Service deems appropriate.

Photo documentation

Changes in vegetation cover and general landscape morphology can be assessed qualitatively using fixed stations where photographs will be taken each year. Figure 1 shows 8 photo stations: six at the upland edge of the three transects, and two from the remnant dam embankment, river left, with one facing upstream and the other downstream. Digital photographs will be taken once yearly at or around the same time that the vegetation monitoring and assessments take place in the summer.

Wetlands within the former impoundment
Changes in water levels will drive predictable transitions in wetland cover types. It is expected that some submerged lands will become exposed and will transition to scrub-shrub wetland. Existing emergent wetland may transition to scrub-shrub wetland or to floodplain forest and upland riparian border vegetation. All of these are ecologically valuable wetland types associated with riverine systems. The site currently has very low density of invasive plants, and is dominated by indigenous wetland species. These native species are expected to provide the propagules (e.g., seeds, rhizomes) for colonization and re-vegetation of the newly exposed pond sediments.

To assess such successional transitions over time, riparian habitats will be characterized by walking defined transects, as shown if figure 1. These lines across the impoundment are proposed transect to be used for monitoring purposes, correspond roughly to transects 4A, 5, and 5A as shown on the design plans by Princeton Hydro. GPS coordinates will be recorded for the start and end points of the transects. Riparian habitats will be measured by linear meters. Riparian habitats will be described according to guidelines in the Stream Barrier Removal Monitoring Guide (Gulf of Maine Council on the Marine Environment 2007), as modified in *Hyde Pond Dam Inspection and Dam Removal Monitoring Plan* (Guy et al. 2014).

List of Riparian Habitat Types:
- Submerged Aquatic Wetland (A)
- Herbaceous Communities (H)
- Sapling/Shrub (S)
- Forested/Tree (T)
- Barren Ground (B)

Vegetation sampling plots
For each vegetation cover type along each transect, a random vegetation sampling plot will be established for more detailed assessment of plant species present. In Forested/Tree areas, a 9-meter radius plot will be sampled and, for sapling/shrub areas, a 5-meter radius plot will be sampled. Within each sampling station, species will be identified and percent coverage will be recorded. Within the tree layer, both canopy coverage and diameter at breast height will be recorded. In herbaceous and submerged aquatic wetland, a 1-square meter plot will be sampled. If invasive species are identified within sampling stations, the species and number of stems will be recorded prior to removal. The center location coordinates of these vegetation sampling plots will be recorded with GPS, marked with a flagged stake, and re-located and re-sampled in year four. Vegetation changes are not expected to be very pronounced from year to year, and therefore, sampling is proposed three years apart, in years one and four.

Invasive species
Invasive species will be identified and removed according to the guidelines below in Invasive Species Management. Staff persons from the Service and CFE/Save the Sound have sufficient experience with identification of invasive plants to be able to identify invasive plants in the field, and also to train a small number of volunteers to also identify such species. Identification and training tools that will be used for these purposes include but are not limited to: *Connecticut's Invasive Aquatic and Wetland Plants Identification Guide* (Bugbee and Balfour 2010), *Invasive Plants in Your Backyard! A Guide to Their Identification and Control*. Connecticut River Coastal Conservation District, Inc., 2009. 16 pp. (Available as a PDF online), and *Invasive Terrestrial Plants of Vermont: A Guide to Identification, Prevention and*

Management. 2011, published by The Nature Conservancy. Additionally, the Connecticut Invasive Plant Working Group website has a list of invasive plants in the state and links to photos and descriptions for each species (http://cipwg.uconn.edu/invasive_plant_list/). Staff and volunteers will review these materials prior to conducting monitoring each year.

As depicted on the attached planting and invasive species monitoring plan, any newly exposed areas of pond unconsolidated bottomlands at the southeast end of the impoundment, closest to the former dam site, will be searched thoroughly each year for invasive species. These areas will re-vegetate naturally, and identifying and preventing the establishment of invasive plants is a priority of the proposed monitoring.

Monitoring schedule

The sediment placement /riparian buffer area and former open water areas, shown in white box in Fig. 1, will be searched thoroughly for invasive species for four years post-construction. The invasive species will be identified and removed according to the guidelines below in "Invasive species management".
Photo stations: Years 1, 2, 3, and 4
Riparian Habitat survey along three transects: Years 1,2, 3, and 4
Vegetation plots: Years 1 and 4
As discussed in the Planting Plan, if the goal of 80-85% cover of native plant species is not met by spring of year 2 following construction (2017), additional measures will be taken to improve the restoration success to meet this goal.

Invasive species management

Non-native, invasive species can outcompete native plants for nutrients, light, water and space, and can form monocultures to the exclusion of native species. To prevent the establishment of non-native, invasive plants in the restored impoundment, including in the sediment deposition areas, two years of post-construction monitoring will be conducted. The best control approach for this project will be hand-pulling of young plants.

Commonly occurring non-native, invasive plant species that may be found include: common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), Asiatic bittersweet (*Celastrus orbiculatus*), and multiflora rose (*Rosa multiflora*). Control measures for these species are discussed below. Control measures for other invasive species encountered will follow guidelines of the Connecticut Invasive Plant Working Group control guide (http://cipwg.uconn.edu/invasive-plants-in-control-guide/), or other references, as needed.

Purple Loosestrife (*Lythrum salicaria*)

An herbaceous species, purple loosestrife is a wetland indicator species often found in natural and man-made wetlands. This species can be effectively controlled by several methods. Typical control measures include hand pulling, herbicide treatment or biological control (*Galerucella* spp. beetles).

Young plants will be pulled up by hand or dug up using a hand trowel if the plant is not easily pulled and the infestation not too widespread. Invasive plants such as purple loosestrife are not expected to establish large populations as they will be removed by hand at an early colonization stage and small plant sizes. Vegetation that is pulled up by hand will be handled to minimize seed dispersal and re-rooting. Removed plants will be placed in sealed black plastic bags and left in the sun for several weeks to ensure that plants are killed before disposal.

Once the plants get larger than 18 inches in height, or the density of plants is excessive, herbicide treatment with Glyphosate (Rodeo®) is more effective to control loosestrife. Herbicide can be sprayed or applied by wick application. Any herbicide application would be conducted by a Connecticut licensed herbicide applicator. We do not expect that colonies will become large enough to warrant use of biological control agents.

Common Reed (*Phragmites australis*)
Hand pulling or digging may be effective on small or very young plants. If a stand becomes established, the extensive root system will make hand pulling or digging very difficult and potentially ineffective.

The most effective means of control of common reed has been application of herbicides such as glyphosate. Herbicide can be sprayed or applied by a wicking device. Control of dense stands of common reed would likely require multiple applications over several years. Any herbicide application would have to be conducted by a Connecticut licensed herbicide applicator. However, with the proposed early monitoring plan following dam removal, Phragmites is unlikely to become well-established before it is pulled. An existing small stand of Phragmites located on the northeastern shore of the impoundment will be treated with glyphosate by the Connecticut Department of Energy and Environmental Protection. Their Wetland Restoration Unit has extensive experience with treating Phragmites in wetlands, and the head of this unit, Paul Capotosto, has given a verbal commitment to complete this treatment as part of the construction phase of the project. In the past, no formal agreement was signed for treating small areas on wetland and stream restoration projects.

Asiatic bittersweet (*Celastrus orbiculatus*)
The best control method is to prevent establishment by monitoring and pulling small plants.
Small plants will be easily pulled. Larger plants can be controlled by cutting the vines and immediately treating the stump with herbicide. Herbicides that could be used include triclopyr or glyphosate. Cutting without herbicide treatment will stimulate regrowth and will not be done. Any herbicide application would have to be conducted by a Connecticut licensed herbicide applicator.

Multiflora rose (*Rosa multiflora*)
Hand-pulling or grubbing with a hand-held tool are effective methods for removing younger, smaller plants of multiflora rose (CIPWG online guide). Larger plants will be cut and herbicide applied to cut stems. Any herbicide application would have to be conducted by a Connecticut licensed herbicide applicator.

Monitoring and Reporting Schedule
Project construction will take place between August and October 2015. Monitoring will begin during the growing season of 2016. Project area photographs from photo stations will be included with each report.

Year 1 Monitoring Activities and Report 1 :

- Begin monitoring following the first year after completion of construction.
- Conduct monitoring observations in early to mid-summer.
- Submit monitoring report and self-certification form to ACOE on or before December 15, 2016.

Year 2 Monitoring Activities and Report 2:

- Conduct monitoring observations in early to mid-summer.

- Submit monitoring report and self-certification form on or before December 15, 2017.

Year 3 Monitoring Activities and Report 3:

- Conduct monitoring observations in early to mid-summer.
- Submit monitoring report and self-certification form on or before December 15, 2018.
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Year 4 Monitoring Activities and Report 4:

- Conduct monitoring observations in early to mid-summer.
- Submit monitoring report and self-certification form on or before December 15, 2019.

Return site visits will be conducted as needed to control any invasives identified during monitoring.

References

Connecticut's Invasive Aquatic and Wetland Plants Identification Guide. Gregory Bugbee and Martha Balfour. Bulletin No. 1027. 2010. 37 pp. The Connecticut Agricultural Experiment Station, New Haven, CT. Available as a PDF online at www.ct.gov/caes/lib/caes/invasive_aquatic_plant_program/pdf_reports/b1027.pdf

Fuss and O'Neill, Inc. 2011. Rutan Pond Dam Removal Project Wetland Mitigation Plan. Avalonia Land Conservancy, Old Mystic, CT.

Guy, S., S. Ozment, and J. O'Connell. 2014. Hyde Pond Dam Inspection and Dam Removal Monitoring Plan. River Processes and Restoration, Final Project, Yale University.

Gulf of Maine Council on the Marine Environment. 2007. Stream Barrier Removal Monitoring Guide. Online at; http://www.habitat.noaa.gov/pdf/Stream-Barrier-Removal-Monitoring-Guide-12-19-07.pdf

Invasive Plants in Your Backyard! A Guide to Their Identification and Control. Connecticut River Coastal Conservation District, Inc., Middletown, CT. 2009. 16 pp. Available as a PDF online at www.conservect.org/ctrivercoastal/Resources/tabid/232/Default.aspx

Invasive Terrestrial Plants of Vermont: A Guide to Identification, Prevention and Management. 2011. The Nature Conservancy.

VEGETATION RESTORATION PLAN SCHEDULE:
HYDE POND DAM REMOVAL, GROTON, LEDYARD, AND STONINGTON, CT

PRE CONSTRUCTION	1	USFWS WILL COORDINATE WITH NEW ENGLAND WILDFLOWER SOCIETY AND OTHER PROJECT PARTNERS TO HARVEST SEEDS FROM NATIVE PLANTS ON SITE OR IN THE AREA AND INITIATE COLD-CYCLING PROCESS.
DURING CONSTRUCTION	2	CONTRACTOR WILL INSTALL LIVE STAKES IN SOIL WRAPS ON STABILIZED BANK. CONTRACTOR WILL SEED DISTURBED SOILS WITH NATIVE SEED MIX AND STRAW MULCH.
POST CONSTRUCTION	3	UPON COMPLETION OF FINAL GRADES, USFWS SHALL COORDINATE WITH NEW ENGLAND WILDFLOWER SOCIETY AND OTHER PROJECT PARTNERS TO DISTRIBUTE SITE-SPECIFIC SEEDS ON RIPARIAN BUFFER AND DISTURBED AREAS.
	4	CTDEEP SHALL TREAT EXISTING STAND OF PHRAGMITES AT NORTHEASTERN SIDE OF IMPOUNDMENT.
BEGINNING OF FIRST GROWING SEASON FOLLOWING CONSTRUCTION	5	CFE SHALL COORDINATE WITH VOLUNTEERS AND PROJECT PARTNERS TO PLANT SUPPLEMENTAL WETLAND PLANTINGS IN ACCESSIBLE AREA(S).
2ND GROWING SEASON	6	CFE AND USFWS SHALL MONITOR PLANTED AREAS TO ASSESS PROGRESS TOWARD GOAL OF 80% NATIVE PLANT COVER, AND <10% NONNATIVEPLANT COVER. 1 - INVASIVES IDENTIFIED IN THE FORMERLY OPEN WATER AND RIPARIAN BUFFER AREAS SHALL BE REMOVED. 2 - IF SEEDING OF RIPARIAN BUFFER FAILS TO SHOW PROGRESS TOWARD GOAL, IT SHALL BE SUPPLEMENTED WITH PLANTINGS (TREES, SHRUBS, AND/OR PLUGS). 3 - IF PLANTED WETLAND AREA FAILS TO SHOW PROGRESS TOWARD GOAL, IT SHALL BE SUPPLEMENTED WITH PLANTINGS.
3RD GROWING SEASON	7	CFE AND USFWS SHALL MONITOR PLANTED AREAS TO ASSESS PROGRESS TOWARD GOAL OF 80% NATIVE PLANT COVER, AND <10% NONNATIVE PLANT COVER. 1 - INVASIVES IDENTIFIED IN THE FORMERLY OPEN WATER AND RIPARIAN BUFFER AREAS SHALL BE REMOVED. 2 - IF RIPARIAN BUFFER FAILS TO SHOW PROGRESS TOWARD GOAL, IT SHALL BE SUPPLEMENTED WITH PLANTINGS (TREES, SHRUBS, AND/OR PLUGS). 3 - IF PLANTED WETLAND AREA FAILS TO SHOW PROGRESS TOWARD GOAL, IT SHALL BE SUPPLEMENTED WITH PLANTINGS.
4TH GROWING SEASON	8	CFE AND USFWS SHALL MONITOR PLANTED AREAS TO ASSESS GOAL OF 80% NATIVE PLANT COVER, AND <10% NONNATIVE PLANT COVER. 1 - INVASIVES IDENTIFIED IN THE FORMERLY OPEN WATER AND RIPARIAN BUFFER AREAS SHALL BE REMOVED. 2 - IF RIPARIAN BUFFER FAILS TO SHOW PROGRESS TOWARD GOAL, IT SHALL BE SUPPLEMENTED WITH PLANTINGS (TREES, SHRUBS, AND/OR PLUGS). 3 - IF PLANTED WETLAND AREA FAILS TO SHOW PROGRESS TOWARD GOAL, IT SHALL BE SUPPLEMENTED WITH PLANTINGS.

WETLAND PLANTING
SCRUB-SHRUB 0.25 ACRES

CFE TO COORDINATE WITH PROJECT PARTNERS AND VOLUNTEERS FOR A ONE-DAY PLANTING EVENT FOCUSED ON THE WETLAND AREA ON THE SOUTH SIDE OF POND (RIVER LEFT) THAT WAS FORMERLY OPEN WATER.

QTY	BOTANICAL NAME:	SPECIES NAME:	PLANTING TYPE:
T.B.D.	EUPATORIUM MACULATUM / PURPUREUM	JOE-PYE WEED	PLUG
T.B.D.	EUPATORIUM PERFOLIATUM	BONESET	PLUG
T.B.D.	ALNUS RUGOSA	SPECKLED ALDER	1-GAL / LIVE STAKE
T.B.D.	CEPHALANTUS OCCIDENTALIS	BUTTONBUSH	1-GAL / LIVE STAKE
T.B.D.	VIBURNUM LENTAGO	NANNYBERRY	1-GAL / LIVE STAKE
T.B.D.	CORNUS AMOMUM	SILKY DOGWOOD	1-GAL / LIVE STAKE
T.B.D.	CORNUS SERICEA	ROD OSIER DOGWOOD	1-GAL / LIVE STAKE

EMERGENT MARSH / WET MEADOW PLANTS

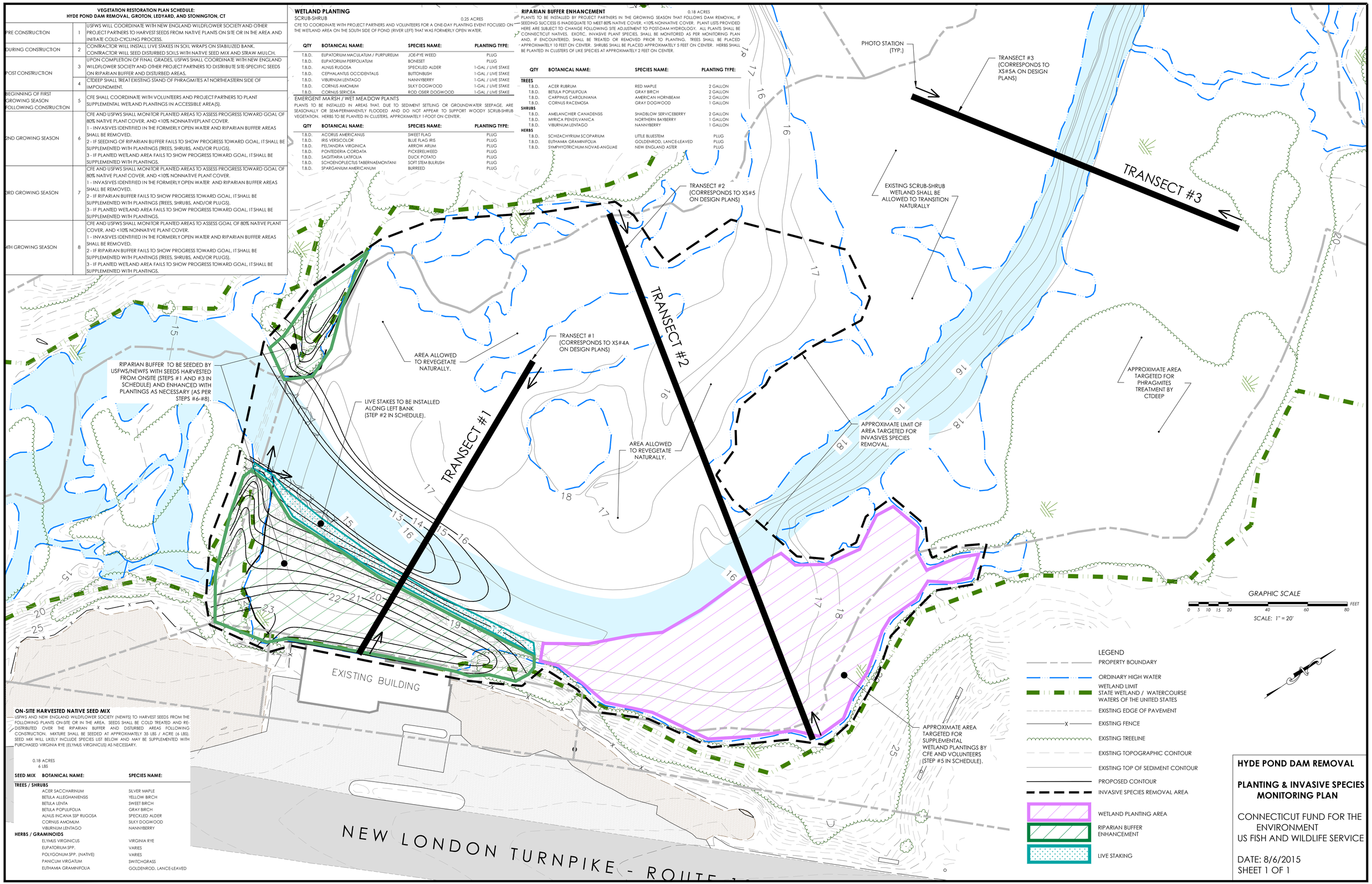
PLANTS TO BE INSTALLED IN AREAS THAT, DUE TO SEDIMENT SETTLING OR GROUNDWATER SEEPAGE, ARE SEASONALLY OR SEMI-PERMANENTLY FLOODED AND DO NOT APPEAR TO SUPPORT WOODY SCRUB-SHRUB VEGETATION. HERBS TO BE PLANTED IN CLUSTERS, APPROXIMATELY 1-FOOT ON CENTER.

QTY	BOTANICAL NAME:	SPECIES NAME:	PLANTING TYPE:
T.B.D.	ACORUS AMERICANUS	SWEET FLAG	PLUG
T.B.D.	IRIS VERSICOLOR	BLUE FLAG IRIS	PLUG
T.B.D.	PELTANDRA VIRGINICA	ARROW ARUM	PLUG
T.B.D.	PONTEDERIA CORDATA	PICKERELWEED	PLUG
T.B.D.	SAGITTARIA LATIFOLIA	DUCK POTATO	PLUG
T.B.D.	SCHOENOPLECTUS TABERNAEMONTANI	SOFT STEM BULRUSH	PLUG
T.B.D.	SPARGANIUM AMERICANUM	BURREED	PLUG

RIPARIAN BUFFER ENHANCEMENT 0.18 ACRES

PLANTS TO BE INSTALLED BY PROJECT PARTNERS IN THE GROWING SEASON THAT FOLLOWS DAM REMOVAL. IF SEEDING SUCCESS IS INADEQUATE TO MEET 80% NATIVE COVER, <10% NONNATIVE COVER. PLANT LISTS PROVIDED HERE ARE SUBJECT TO CHANGE FOLLOWING SITE ADJUSTMENT TO POST-DAM HYDROLOGY. ALL PLANTS SHALL BE CONNECTICUT NATIVES. EXOTIC, INVASIVE PLANT SPECIES, SHALL BE MONITORED AS PER MONITORING PLAN AND, IF ENCOUNTERED, SHALL BE TREATED OR REMOVED PRIOR TO PLANTING. TREES SHALL BE PLACED APPROXIMATELY 10 FEET ON CENTER. SHRUBS SHALL BE PLACED APPROXIMATELY 5 FEET ON CENTER. HERBS SHALL BE PLANTED IN CLUSTERS OF LIKE SPECIES AT APPROXIMATELY 2 FEET ON CENTER.

QTY	BOTANICAL NAME:	SPECIES NAME:	PLANTING TYPE:
TREES			
T.B.D.	ACER RUBRUM	RED MAPLE	2 GALLON
T.B.D.	BETULA POPULIFOLIA	GRAY BIRCH	2 GALLON
T.B.D.	CARPINUS CAROLINIANA	AMERICAN HORNBEAM	2 GALLON
T.B.D.	CORNUS RACEMOSA	GRAY DOGWOOD	1 GALLON
SHRUBS			
T.B.D.	AMELANCHIER CANADENSIS	SHADBLOW SERVICEBERRY	2 GALLON
T.B.D.	MYRICA PENSYLVANICA	NORTHERN BAYBERRY	1 GALLON
T.B.D.	VIBURNUM LENTAGO	NANNYBERRY	1 GALLON
HERBS			
T.B.D.	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	PLUG
T.B.D.	EUTHAMIA GRAMINIFOLIA	GOLDENROD, LANCE-LEAVED	PLUG
T.B.D.	SYMPHYOTRICHUM NOVAE-ANGLIAE	NEW ENGLAND ASTER	PLUG



ON-SITE HARVESTED NATIVE SEED MIX

USFWS AND NEW ENGLAND WILDFLOWER SOCIETY (NEWFS) TO HARVEST SEEDS FROM THE FOLLOWING PLANTS ON-SITE OR IN THE AREA. SEEDS SHALL BE COLD TREATED AND RE-DISTRIBUTED OVER THE RIPARIAN BUFFER AND DISTURBED AREAS FOLLOWING CONSTRUCTION. MIXTURE SHALL BE SEEDED AT APPROXIMATELY 35 LBS / ACRE (6 LBS). SEED MIX WILL LIKELY INCLUDE SPECIES LIST BELOW AND MAY BE SUPPLEMENTED WITH PURCHASED VIRGINIA RYE (ELYMUS VIRGINICUS) AS NECESSARY.

0.18 ACRES
6 LBS

SEED MIX	BOTANICAL NAME:	SPECIES NAME:
TREES / SHRUBS		
	ACER SACCHARINUM	SILVER MAPLE
	BETULA ALLEGHANIENSIS	YELLOW BIRCH
	BETULA LENTA	SWEET BIRCH
	BETULA POPULIFOLIA	GRAY BIRCH
	ALNUS INCANA SSP RUGOSA	SPECKLED ALDER
	CORNUS AMOMUM	SILKY DOGWOOD
	VIBURNUM LENTAGO	NANNYBERRY
HERBS / GRAMINOIDS		
	ELYMUS VIRGINICUS	VIRGINIA RYE
	EUPATORIUM SPP.	VARIES
	POLYGONUM SPP. (NATIVE)	VARIES
	PANICUM VIRGATUM	SWITCHGRASS
	EUTHAMIA GRAMINIFOLIA	GOLDENROD, LANCE-LEAVED

HYDE POND DAM REMOVAL

PLANTING & INVASIVE SPECIES MONITORING PLAN

CONNECTICUT FUND FOR THE ENVIRONMENT
US FISH AND WILDLIFE SERVICE

DATE: 8/6/2015
SHEET 1 OF 1

Appendix C Wetland Functions and Values Assessment

Table 3. Wetland Functions and Values* Impacts Assessment for Hyde Pond Dam Removal, Whitford Brook, Old Mystic, CT

Function/Value	Assessment
GROUNDWATER RECHARGE/DISCHARGE This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. Recharge should relate to the potential for the wetland to contribute water to an aquifer. Discharge should relate to the potential for the wetland to serve as an area where groundwater can be discharged to the surface.	The site has two mapped inflowing tributaries (Whitford Brook, Lampheres Brook) and one outflow (Whitford Brook) - most flow passes through the site; groundwater exchange is likely minimal. The existing dam elevates water surface which may promote recharge and slow discharge. However, the site is not associated with a mapped Aquifer Protection Area, Public Water Supply Well, nor mapped groundwater quality (CT ECO). With dam removal, hydrology of the site will return to conditions more similar to pre-dam and rates of recharge may decline, while groundwater discharge may increase. No net change anticipated.
FLOODFLOW ALTERATION (Storage & Desynchronization) This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.	The existing dam was created to provide hydro-mechanical power for a historic mill; the dam was not designed to provide flood storage and therefore has little influence on downstream water surface elevations. With dam removal, portions of the impoundment that are currently inundated will revert to adjacent floodplain and thereby result in a net increase of floodplain area. Hydraulic modeling indicates that flows in the impoundment are primarily influenced by downstream structures. No net change anticipated.
FISH AND SHELLFISH HABITAT This function considers the effectiveness of seasonal or permanent waterbodies associated with the wetland in question for fish and shellfish habitat.	The existing dam serves as a barrier to the movement of resident fish, migration of anadromous fish species, and recolonization of shellfish species, which rely on host fish to move through a river system. A fish-way has been installed onsite but is considered to be ineffective. The existing dam also provides pondfish habitat; however, open water area has substantially filled in over the last two decades, and open water area will likely be non-existent in several years under existing conditions. With dam removal, full passage to all fish (including Alewife, Blueback Herring, American Eel, American Shad, and Sea-Run Brook Trout) would be restored and stream habitat will be restored that is beneficial to stream finfish and still compatible with pond fish. Restoring fish passage and free-flowing stream, a driving goal for this project, results in a net increase.
SEDIMENT/TOXICANT/PATHOGEN RETENTION This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens.	The existing dam retains in-stream sediments and particulate-bound contaminants. The interuption of sediment transport, of both bedload gravels, cobbles as well as finer grain sizes, creates geomorphic imbalance (aka "sediment deprivation") in downstream reaches that can accelerate bed and bank erosion and induce channel instability. Accumulated contaminants may exert an impact on the aquatic community on-site, both benthic organisms and pond fish (as stated above). Uncontrolled dam failure presents potential for uncontrolled release of sediment and contaminants. Furthermore, the existing dam increases water temperatures and decreases dissolved oxygen levels in the impoundment and likely, downstream reaches. With dam removal, the thermal and oxygen impacts will be removed, sediment transport will be restored, and the adjacent floodplain/wetland will serve to retain sediments/contaminants from out-of-bank flows. The proposed design entails excavation of a portion of potentially mobile fine sediment and on-site sequestration of sediments with elevated contaminants. A net increase is anticipated in water quality.
NUTRIENT REMOVAL/RETENTION/TRANSFORMATION This function relates to the effectiveness of the wetland to prevent adverse effects of excess nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers, or estuaries.	The existing dam and impoundment likely retains, from upstream reaches of Whitford Brook and Lampheres Brook, a large proportion of nutrient inputs, including excess nutrients that originated from polluted runoff (e.g. phosphorus and nitrogen in various forms), as well as organic carbon inputs such as coarse organics and large wood, which form the base of the aquatic food system. The trapping efficiency is actively diminishing as the impoundment continues to fill-in. During normal flows after dam removal, a greater portion of nutrients delivered by the two inflowing tributaries will pass through the site, similar to pre-dam conditions. During out-of-bank flood flows after dam removal, nutrients delivered to the floodplain will still have the opportunity for retention and transformation on the floodplain wetland. However, the natural free-flowing stream is anticipated to result in a net decrease in nutrient retention.
PRODUCTION EXPORT (Nutrient) This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms.	The existing dam and impoundment supports a broad array, and high density, of plant and animal biota, including wildlife food sources, as documented in the natural resources inventory. The site is not used to yield products for direct human consumption. With dam removal, the rapid drawdown will likely cause an initial decline in productivity before the plant community reverts to the post-dam hydrology. Wetland productivity is also partially limited by the barrier to fish movement presented by the dam. With dam removal, restored fish passage and the restoration of cyclical flooding and drying is anticipated to result in a net increase in productivity of the site and the greater river system.
SEDIMENT/SHORELINE STABILIZATION This function relates to the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.	The existing impoundment contains stream banks and accumulated sediment delta that are stabilized by established herbaceous and scrub-shrub vegetation. However the dam, and associated sediment transport interuption, may exacerbate bank erosion in downstream reaches. With dam removal, restored sediment transport would reduce a cause of instability in downstream reaches. The majority of impounded sediments will remain stabilized by established vegetation, even as the community shifts to adjust to the post dam hydrology. Further, the proposed design entails excavation of a substantial volume of potentially mobile sediment and storage in overbank areas, stabilization of banks, and planting of the wetland floodplain in the lower portion of the impoundment. Channel re-formation through the upper portion of the impoundment after full removal may result in additional erosion that, despite the offsets of the improved conditions, may result in a net decrease of sediment stabilization in the near-term before geomorphic stability is re-established.

Table 3. (Continued) Wetland Functions and Values* Impacts Assessment for Hyde Pond Dam Removal, Whitford Brook, Old Mystic, CT

Function/Value	Assessment
WILDLIFE HABITAT This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and/ or migrating species must be considered. Species lists of observed and potential animals should be included in the wetland assessment report.	The existing impoundment serves as productive and diverse wildlife habitat with a variety of wetland classes, vegetation strata, and abundant cover. Open-water habitat, while highly valued, is limited, and rapidly disappearing due to on-going accumulation of in-stream sediment and organics -- open water area will likely be non-existent in several years under existing conditions. With dam removal, palustrine open-water and emergent wetlands will diminish and palustrine forested wetlands will expand. Herpetiles (i.e. amphibians and reptiles) that utilize the open-water may lose habitat, but will still be supported by the wooded wetland that is likely to return to the site. Also with dam removal, the return of free-flowing conditions and coarser sediments will create new habitat for benthic macroinvertebrates. Beavers that are active in the site and adjacent reaches, may also return to dam-building activities and maintain broader open-water habitat. Finally, with dam removal, the siteand upstream reaches will re-gain important wildlife habitat function with the return of migratory fish including Alewife, Blueback Herring, American Eel, American Shad, and Sea-Run Brook Trout, which results in a substantial net increase in wildlife habitat value.
RECREATION (Consumptive and Non-Consumptive) This value considers the effectiveness of the wetland and associated watercourses to provide recreational opportunities such as canoeing, boating, fishing, hunting, and other active or passive recreational activities. Consumptive activities consume or diminish the plants, animals, or other resources that are intrinsic to the wetland, whereas non-consumptive activities do not.	Recreational opportunities are limited by private land ownership, limited access points, ever decreasing open water, and small and overgrown distributaries. Much of the site is too close to residential areas to allow for hunting. Under existing conditions the site cannot be easily navigated by boat or on foot. Under proposed conditions, the stream will be boatable through the site, and more of the surrounding wetland floodplain will likely be walkable. The dam removal will amount to a net increase in recreational value.
EDUCATIONAL/SCIENTIFIC VALUE This value considers the effectiveness of the wetland as a site for an "outdoor classroom" or as a location for scientific study or research.	Bot the dam and impoundment, and the restored stream hold value for scientific study; however, public access limits its use for educational use. No net change anticipated.
UNIQUENESS/HERITAGE This value relates to the effectiveness of the wetland or its associated waterbodies to produce certain special values. Special values may include such things as archaeological sites, unusual aesthetic quality, historical events, or unique plants, animals, or geologic features.	The dam holds value as a historical industrial structure. Currently inundated lands may hold archeaological significance for Native American heritage. With the dam removal, an archaeologist to complete an archeaological investigation and documentation during the deconstruction of the dam. Also the proposed design includes leaving a portion of the earthen embankment onsite and re-using the larger stones in the restored stream. No net change anticipated.
VISUAL QUALITY/AESTHETICS This value relates to the visual and aesthetic qualities of the wetland.	The impoundment holds aesthetic value, primarily associated with the open-water areas that are gradually diminishing. The proposed stream and associated floodplain wetland will also hold aesthetic value, albeit of a different perception. No net change anticipated.
THREATENED or ENDANGERED SPECIES HABITAT This value relates to the effectiveness of the wetland or associated waterbodies to support threatened or endangered species.	The impoundment also supports the state-listed Banded Sunfish; CTDEEP Inland Fisheries Division supports the project, will participate in fish harvest during draw-down, and notes that the proposed restored channel is also compatible with Banded Sunfish. With dam removal, restoration of fish passage will allow for the return of state-listed species of concern, Blueback Herring, as well as other regionally depleted species: Alewife, American Eel, American Shad, and Sea-Run Brook Trout. Restoring populations of these species is a driving goal for this project. Substantial net increase anticipated.

***USACE New England District Highway Methodology Workbook Supplement (1999). Note:** Hyde Pond is an artificial impoundment created by a man-made dam that is obsolete, beyond its functional lifespan, and actively deterioriating. All functions and values provided by this impoundment are inherently unsustainable and subject to decline with the failure of the dam.

Appendix D Intra-Service Section 7 Biological Evaluation prepared by U.S. Fish and Wildlife Service

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Lori Benoit, Rhode Island Field Office, Charlestown, RI.

Telephone Number: 401-364-9124 ext. 41

Date: July 20, 2015

I. Service Program and Proposed Activity: Ecological Services, Coastal Program proposes to support the Connecticut Fund for the Environment- Save the Sound (CFE-STS) in a Hurricane-Sandy funded stream connectivity restoration project for fish passage and flood mitigation. Approximately ten trees will be removed to allow for construction vehicles to access the Hyde Pond Dam. The work is expected to begin in early August, 2015, pending regulatory approval, and to continue for several weeks.

II. Pertinent Species Within the Area: None known to occur in the area, although habitat may be suitable for the federally threatened northern long-eared bat (*Myotis septentrionals*; NLEB). The proposed project is located within the range of the NLEB. An IPaC Trust Resource Report generated on July 20, 2015 identified that the threatened NLEB may be present in the project area due to the presence of suitable habitat, but no critical habitats were identified.

III. Station Name and Action: Southern New England – NY Bight Coastal Program working with CFE-STS. Funding of the Hyde Pond Dam Removal Project through the Disaster Relief Appropriations Act of 2013 and Technical Assistance provided by the Service's Coastal Program.

IV. Location: Hyde Pond Dam river left, Westerly, RI, Lat- 41° 23' 47.68"N, Long – 71° 57' 33.84"W. Property owned by John Chiangi.

V. Determination of Effects

A. Explanation of effects of action on species and critical habitats listed in II

Construction activities will include the removal of approximately ten trees and underbrush to allow access to the dam and its spillway. There have been no bat surveys at this site and no known occurrences of the NLEB. The project site is located adjacent to an auto shop business in a generally rural area with limited suburban development, in the towns of Groton and Stonington (Village of Mystic). Upstream of the dam is an approximately 12 acre impoundment consisting of some shallow open water and larger areas of wetlands. In a larger context, the site is located at the southern edge of the heavily forested southeastern Connecticut region.

The proposed area to be cut is very small, involving only ten trees that are of a size suitable to support roosting or nesting bats. A Service biologist examined the trees to be cut and determined that none possessed any features such as cracks or holes that could serve as suitable nesting sites. One tree, an American sycamore, showed the patchy look of bark that had exfoliated, but did not appear to have any large pieces of bark coming off that could serve as a roosting site. Another tree located just outside of the area of disturbance, an ash (*Fraxinus* spp.) with an estimated 14-16" dbh, did have two large crevices that could be suitable nesting or roosting habitat. This tree

will be marked on the plans and flagged in the field to ensure that it will not be disturbed. Therefore, this work is not expected to have any adverse effects to the reproductive success or survival of northern long-eared bats.

B. Explanations of actions to be implemented to reduce adverse effects.

The total area to be disturbed is less than one quarter acre and so this small of an area at the southern fringe of a much larger contiguous forest is not likely to impact the reproduction or survival of the NLEB. No trees with suitable habitat for roosting or nesting were identified during a visual survey of the proposed area to be cleared. The original design included a second access path through woods north of the dam, but this was changed to providing construction access at only the dam site, thus limiting impacts to the forest.

VI. Effect Determination and Response Requested

A. Listed Species Determination: No effect

A. Response Requested: Request concurrence

VII. Reviewing Ecological Services Office Evaluation

A. Concurrence: N/A

B. Formal Consultation Required: No

C. Conference Required: No

D. Nonconcurrence : N/A

Remarks: This consultation was reviewed by Susi von Oettingen, Endangered Species Specialist, of the New England Field Office.

Lori Benoit, Fish and Wildlife Biologist
Originating Official

7/29/2015
Date

Appendix E Raber Associates report: Summary of Historical Background for Hyde Pond Dam

SUMMARY OF HISTORICAL BACKGROUND FOR HYDE POND DAM

Raber Associates
May 21, 2015

Hyde Pond Dam is located on Mystic River tributary Whitford Brook in Stonington and Groton, Connecticut, a short distance upstream of Old Mystic village. The dam is approximately 200 feet long, and includes two earthen embankments lined with large rubble or rubble masonry wall, and a 5-foot-high, 41-foot-long, 15-foot-wide, concrete-capped spillway with a rubble masonry downstream face retaining earthen fill. Prior to c1985, when a steel steeppass fish ladder was installed in the west embankment, there was a 10-foot-wide, 5-foot-deep channel in that embankment which served as an emergency spillway, and 12-foot-wide, stone-lined headgate channel in the east embankment which once controlled flow into an approximately 15-foot-wide, 750-foot-long earthen headrace discussed below. Comparing 1972 and 2005 conditions, fish ladder construction and subsequent repair was evidently associated with three modifications to the dam: installation of the fish ladder in the emergency spillway; addition of a concrete cap to the spillway; and installation of a 4-foot-diameter concrete-pipe low-level outlet in the east embankment. The pipe lies within a steel box with wooden wierboard controls at the upstream end.

Although the impoundment site is associated with a 17th-century gristmill, most or all of the present structure was likely built to serve early 19th-century cotton mills. Groton was part of the original town of New London, established in 1646 by John Winthrop, the Younger (1606-1676), who later served as governor of the Connecticut colony for most of the period 1657-76. Stonington was part of the Massachusetts Bay Colony until Connecticut's southeastern boundary was established at the Pawcatuck River in 1663, and became an independent town in 1664. Probably soon after the boundary adjustment, Winthrop received a grant of both sides of Whitford Brook from tidewater to Lantern Hill in present North Stonington. His son Fitz-John Winthrop (1638-1707) built a gristmill at the dam site c1674, which was immediately leased and expanded with a fulling mill. Rebuilt in 1699, this mill was evidently on the west side of the brook, in Groton which became an independent town in 1705. The mill was eventually purchased in 1780 by Stephen Avery, who operated it until 1813-1814.

Somewhat conflicting sources suggest the mill was purchased by John Hyde (1783-1861), and leased to the Mystic Manufacturing Company for cotton manufacture. The firm's charter indicates an intention to combine cotton production, gristmilling, and a machine shop in Avery's building, but in 1820 only cotton manufacture appears to have been in operation. In the 1820s, the company built two new cotton mills in Old Mystic just north of North Stonington Road, at the end of the long earthen headrace which ran from the east side of the present dam. It is likely that this larger scale of production, requiring more waterpower, included reconstruction of the dam along more or less current dimensions. The original gristmill was not operating by 1833, and was perhaps removed in the 1820s. Hyde purchased the company and the two mills in the 1820s, running them with steam as well as water power until his death. His sons continued the operation, under several names, until the business failed in 1873. The southern of the two mills burned down by the mid-1880s, but the northern mill stood until the 1920s and was leased for several operations including a laundry and a birch beer mill (Figures 1-3).

Aside from the dam, remains of the cotton-making development include sections of earthen headrace south of Route 184, and what appears to be the east wall of the northern mill located approximately 22 feet northwest of the present fire station on North Stonington Road (Figure 4). There is apparently no known evidence of the gristmill, but the limited extent of proposed dam removal work downstream of the west embankment make any possible impacts on the gristmill site unlikely. While the dam appears to be typical of many early 19th-century impoundments, undocumented foundations, probably reflecting vernacular engineering decisions, may also contribute to dam significance. Foundation components could include large flat rock slabs, timber or log matting, or timber cribwork.

DOCUMENTARY SOURCES

Beers, F.W., A.D. Ellis, and G.G. Soule
1868 *Atlas of New London County, Connecticut*. New York.

Blodget, William
1792 A New and Correct Map of Connecticut, One of the United States of America. Middletown, CT.

Downes, William
c1979 Old Mystic in days past. Mss, Mystic River Historical Society. On file, Indian and Colonial Research Center.

Fairchild Aerial Survey
1934 Aerial survey of the State of Connecticut. Record Group 89, Records of the Department of Transportation. Connecticut State Archives. Available on World Wide Web at http://www.cslib.org/aerials/

Fought, Leigh
2007 *A History of Mystic, Connecticut/From Pequot Village to Tourist Town.* Charleston, SC: The History Press.

Galgowski, Victor
1972 Hyde Pond Dam Inspection. Typescript with sketches. On file, Dam Safety Section, Inland Water Resources Division, Connecticut Department of Energy and Environmental Protection.

Greenhalgh, Kathleen
1999 *A History of Old Mystic 1600-1999.* Published by the author.

Hurd, D. Hamilton
1882 *History of New London County, Connecticut*....Philadelphia: J.W. Lewis & Co.

Indian and Colonial Research Center
n.d. Folder, Old Mystic Places/T/NB#11B.

Lester, William, Jr.
1833 Map of New London and Windham Counties in Connecticut.... New Haven: Daggett and Ely.

Pfrommer, J. Howard
2005 Memorandum to Clinton S. Brown II re: Whitford Pond/Hyde Pond Dam. On file, Dam Safety Section, Inland Water Resources Division, Connecticut Department of Energy and Environmental Protection.

U.S. Department of Commerce, Bureau of the Census
1820 Manuscript returns, Census of Manufactures.

1850 Manuscript returns, Census of Manufactures.

1860 Manuscript returns, Census of Manufactures.

1870 Manuscript returns, Census of Manufactures.

1880 Manuscript returns, Census of Manufactures.

Walling, Henry F.
1854 Map of New London County, Connecticut. Philadelphia: William E. Baker

Warren, Moses and George Gillet
1812 Connecticut, from Actual Survey, Made in 1811... East Windsor: Abner Reed.

Wheeler, Richard A.
1886 *Historical Sketch of Stonington & Westerly: A Sketch of Their Business Interest, Past and Present.* Westerly: Westerly Narragansett Weekly.

1900 *History of the Town of Stonington, County of New London, Connecticut, from its first settlement in 1649 to 1900…* New London: Press of the Day Publishing Company.

PERSONAL COMMUNICATION

Harry Yamalis, Environmental Analyst 2, Office of Long Island Sound Programs, Bureau of Water Protection and Land Reuse, Connecticut Department of Energy and Environmental Protection

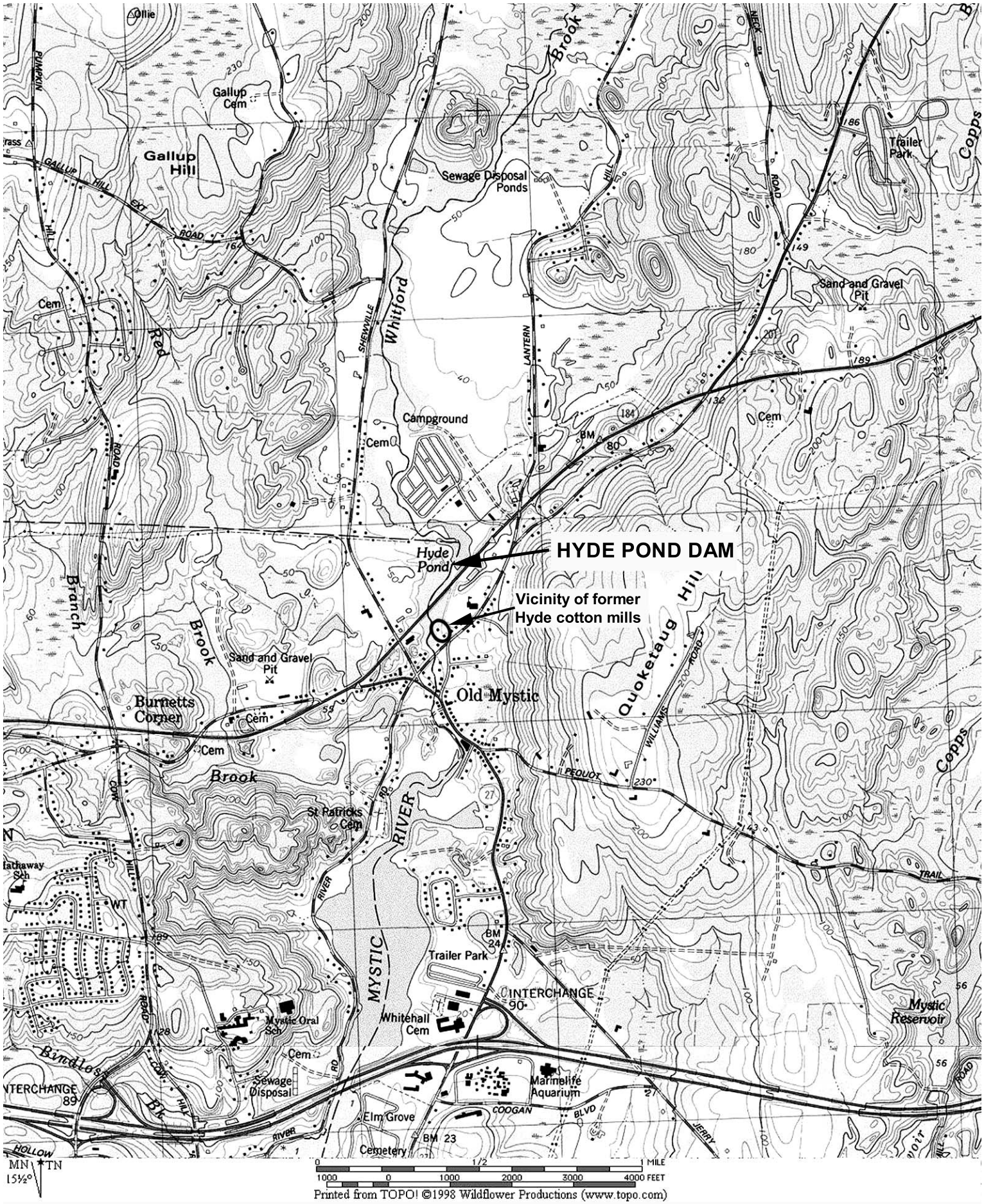


Figure 1. HYDE POND DAM LOCATION ON MYSTIC AND OLD MYSTIC 7.5-MINUTE U.S.GS. QUADRANGLES

Figure 2. OLD MYSTIC VILLAGE c1868

Hyde Bros. two mills are at top. Source: Beers et al. 1868

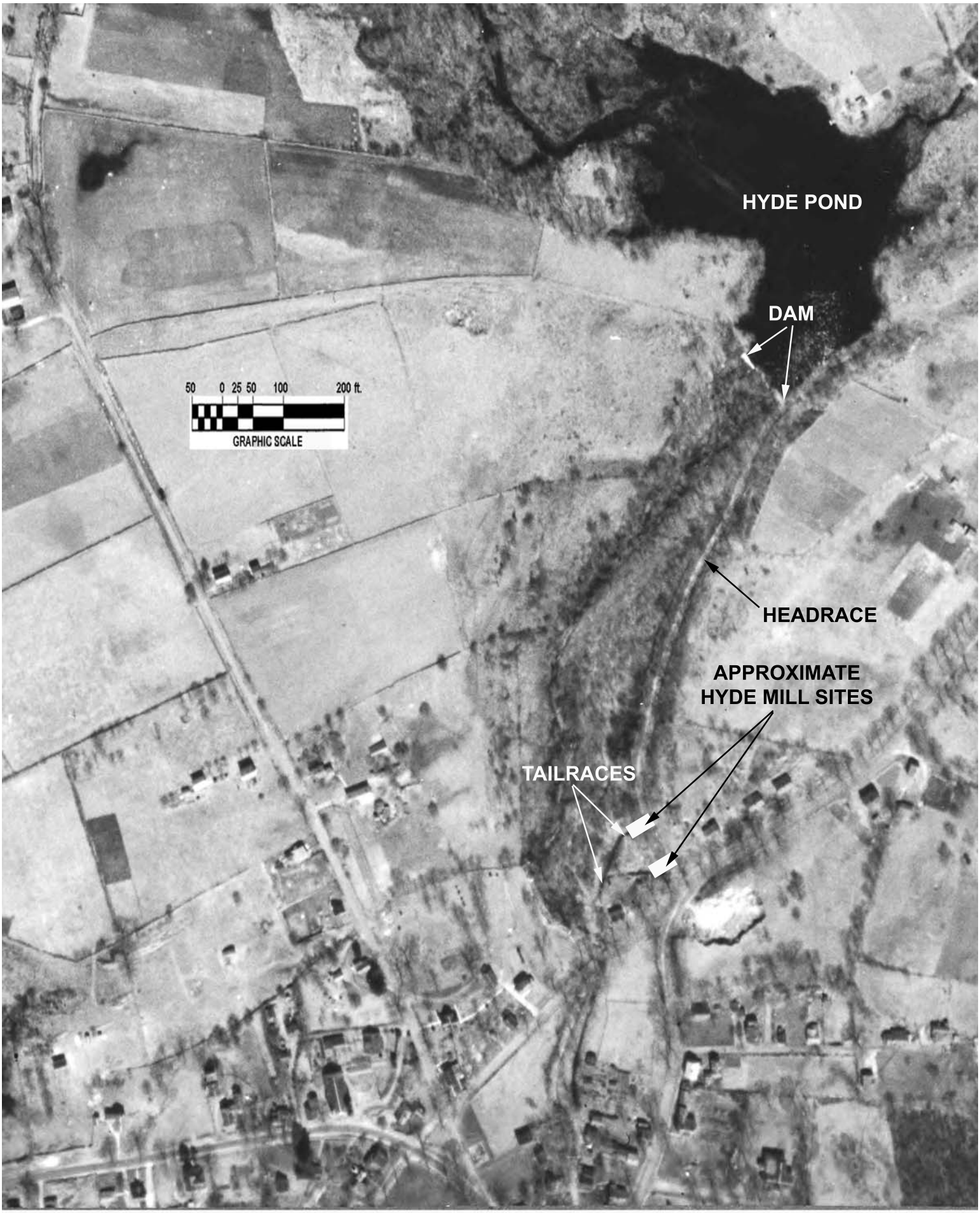


Figure 3. LOCATIONS OF DAM, HEADRACE, TAILRACES, AND APPROXIMATE HYDE MILLS SITES IN 1934
base image: Fairchild Aerial Survey 1934

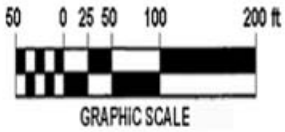



Figure 4. EXTANT REMAINS OF HYDE MILL SYSTEM COMPONENTS