

**PROPOSED FISH HABITAT MANAGEMENT PLAN
FOR
RAYSTOWN LAKE, HUNTINGDON COUNTY, PA
U.S. ARMY CORPS OF ENGINEERS**



**US Army Corps
of Engineers**



**PLANS BY:
THE PA FISH & BOAT COMMISSION
DIVISION OF HABITAT MANAGEMENT, LAKE SECTION**



FISH HABITAT MANAGEMENT PROJECT
For
RAYSTOWN LAKE, HUNTINGDON COUNTY, PENNSYLVANIA
U.S. ARMY CORPS OF ENGINEERS
Plans designed by
THE DIVISION OF HABITAT MANAGEMENT
LAKE SECTION
PENNSYLVANIA FISH AND BOAT COMMISSION
Plans prepared by
Ben Page

MANAGEMENT PLAN

The purpose of this plan is to address the habitat needs of Raystown Lake as they relate to its fish species diversity and abundance, angler/boater use and shoreline erosion. This project is aimed at long-term and long-lasting artificial habitats that fit the reservoir's existing native habitat features.

This proposed plan will provide the basis for the Cooperative Habitat Improvement Program cooperator, USACE to place artificial fish habitat structures in Raystown Lake. Construction supervision, structure placement and design are the responsibility of the Pennsylvania Fish and Boat Commission's (PFBC), Division of Habitat Management (DHM) and/or its designee. All structures constructed must meet the requirements of the Division of Habitat Management's Lake Section. All structures included in this plan meet the requirements of the Department of Environmental Protection and the U.S. Army Corps of Engineers General Permits (BDWW-GP-1 & SPGP-5).

IMPOUNDMENT INVENTORY

Raystown Lake was physically surveyed by the Division of Habitat Management's Lake Section on July 31, 2018 using a Lowrance HDS12 sonar with StructureScan and an internal Lowrance GPS (global positioning system) with Insight USA on a 20' Boston Whaler Outrage utilizing a one 90-degree transducer and one LSS-1 imaging transducer. The survey was conducted to inventory the existing habitat features and locate high priority shoreline erosion sites.

ARTIFICIAL HABITATS

Artificial habitats (refuge, spawning, nesting and nursery) are designed to be effective, long lasting structures that allow fish to accomplish their daily and seasonal tasks with greater efficiency. Some artificial habitats have dual purposes and may also provide increased opportunities for anglers to catch and harvest fish (fish attraction). They can also provide increased surface areas for algae attachment, aquatic insect colonization and other food organisms which may increase fishery production (Wege, Anderson 1979) (Nilsen, Larimore 1973; Benke, et al. 1984). Many of these artificial habitats are designed to aide multiple fish species in completing various survival tasks (performance structures), which may also provide an opportunity to increase productivity within some impoundments.

Small fish may utilize habitat (artificial, native or natural) to avoid predation by occupying habitat where predators cannot forage (Glass 1971; Savino, Stein 1982) or (as predators) to utilize complex habitat as foraging areas (Werner, et al. 1983). Increasing complex habitat may allow coexistence of predators and prey through the creation of microhabitat types (Crowder, Cooper 1977). Increasing habitat complexity may positively influence predator efficiency by providing small fish with refuge in areas of high structure densities (Hall, Werner 1977; Werner, et al. 1983).

Complex structural cover may also provide important habitat for aquatic invertebrates (Nilsen, Larimore 1973; Benke, et al. 1984) and in turn provide foraging opportunities for juvenile and adult panfish that rely on invertebrates as a food source. Complex structure may also serve as habitat for prey resources of black bass (and other predators), thus increasing prey/predator efficiency. Game and panfish also benefit from complex habitat related to the advantages of camouflage (Angermeier, Karr 1984).

All artificial habitats used in this plan have undergone a minimum one-year design phase and two-year durability test. Materials and construction techniques used in the construction of Pennsylvania artificial habitat structures provide the best balance of structure longevity and invertebrate, plankton colonization and fish utilization.

FISH HABITAT MANAGEMENT PROJECT BACKGROUND

The fish habitat improvement project at Raystown Lake is a long lasting partnership project that dates back to 1994. Various volunteer labor forces have helped to build and place wooden habitat structures that benefit the fish and the anglers of Raystown. All of the habitat sites have been mapped out and are available in PDF format on the the PFBC website www.fishandboat.com.

In addition to the hundreds of submerged wooden structures that have been placed, USACE and PFBC have partnered to improve the shoreline fish habitat while stabilizing eroded banks. The rock type habitat serves several purposes including shoreline erosion control, fish habitat and improved angler access.



Wooden fish habitat structure built and placed by volunteers with assistance from USACE.

LAKE SHORELINE STABILIZATION

When shorelines erode, topsoil is exposed and can be washed into the lake by rain and wave action. This creates plumes of muddy water that degrade water quality by introducing phosphorus, nitrogen and silt to the system. By planning and placing habitat improvement devices, shorelines can be stabilized and erosion can be stopped. With less sediment flushing into the lake, water quality is improved.

Eroded shorelines typically recede over time leaving a few inches of silted water where the shoreline used to be. This provides poor habitat with no cover for fish. The silt that comes off of the eroded shoreline later settles on the bottom of the lake and can smother fish eggs and other aquatic life. In an effort to restore the shoreline to its original depth, rock devices can be placed to stabilize and protect the shoreline from future wave action. The rock placed along the shoreline in a fashion that will maximize cover for fish of all sizes. Not only does the added rock provide habitat for fish, it also provides habitat for the aquatic insects that fish feed on, such as mayfly larvae and crayfish. Fisheries monitoring has shown that multiple species of panfish, prefer to inhabit areas with fish habitat structure compared to areas with no structure.

The USACE and PFBC have completed four different shoreline stabilization projects at Raystown that have stabilized 1,665 feet of eroded shoreline. The structures proposed in this plan will further the efforts of USACE and PFBC to stabilize eroding banks and improve water quality and fish habitat in Raystown Lake. The previous shoreline stabilization projects have been completed using land-based heavy machinery via road access and parking lots. The proposed habitat sites within this plan require a habitat barge to access the shorelines. The shorelines outlined on the attached map do not have road access that can be used by land-based machinery. A barge that is capable of transporting 15-20 tons of rock material per load has proven to be an ideal solution for stabilizing remote shorelines. A similar barge has been used at the USACE Project Cowanesque Lake, Tioga County.



Eroded shoreline at Susquehannock Campground, Raystown Lake before and after stabilization project between PFBC and USACE.

PENNSYLVANIA ROCK SAWTOOTH DEFLECTORS

The Rock Sawtooth Deflector is normally used as a flowing water fish enhancement device (Lutz 2007). Sawtooth deflectors have been used successfully in numerous PA impoundments as a treatment for shoreline erosion and shoreline aquatic habitat enhancement. Rock sawtooth deflectors provide armoring to wind/wave eroded shores and manage wave action by deflecting water.

Rock sawtooth style deflectors are constructed from R-7 (40"-60") size stone and R5 (18"-24") size stone. Root wad deflectors or trees may also be incorporated to increase the habitat complexity of the lakeshore. A total of 380 structures are proposed at four sites at approximately 1'-3' depths.



ACRES OF IMPACT

The proposed habitat sites consist of 3,800 linear feet of eroded shoreline. Sawtooth Deflectors average 10' of reach from shoreline to water. Multiplying the linear feet by the depth amounts to 0.872 acres (38,000 sq. ft.). The acquisition of the habitat barge will also enable the PFBC and USACE to add additional acres of habitat in the form of rock rubble reefs. PFBC Division of Fisheries Management has suggested that several rock rubble reefs be added to future fish habitat management plans at Raystown Lake.

STRUCTURE CONSTRUCTION AND PLACEMENT

The construction and placement of all artificial structures in this plan may be coordinated with the Lake Section of the Division of Habitat Management. Representatives of the Lake Section (or a designated representative) will be on hand to supervise and assist in construction of all artificial habitats designed for this project. Specialized PFBC tools and equipment may also be utilized by the cooperators to accomplish construction of artificial structures supervised by Habitat Management Staff. Placement of artificial habitats can, in most cases, be accomplished by specially equipped DHM watercraft, operated by trained Lake Section staff. Other state and/or federal watercraft and operators may also be utilized to accomplish projects managed by the Division of Habitat Management. All artificial habitats must be constructed to the specification shown in the standard drawings attached to this plan packet.

LITERATURE CITED

- Angermeier, P. L., and J. R. Karr. Relationship between woody debris and fish habitat in a small warmwater stream. *Transactions of the American Fisheries Society* 113: 716-726.
- Benke, A. C., T. C. Van Aardsall, Jr. D. M. Gillespie and F. K. Parrish, 1984. Invertebrate productivity in a subtropical blackwater river: the importance of habitat and life history. *Ecological Monographs* 54: 25-63.
- Benson, B. J. And J.J. Magunson "Spatialheterogeneity of Littoral Fish Assemblages in Lakes: Relation to Species Diversity and Habitat Structure." *Canadian Journal of Fisheries and Aquatic Sciences*, 1992.
- Crowder, L. B., and W.E. Cooper. 1982. Habitat structural complexity and the interaction between bluegills and their prey. *Ecology* 63:1801-1813
- Glass, N. R. 1971.Computer analysis of predator energetics in the largemouth bass. Pages325-363in B. C. Pattern, 1971.
- Hall, D. J., and E. E. Werner, 1977. Seasonal distribution of fishes in the littoral zone of a Michigan Lake. *Transactions of the American Fisheries Society* 106:545-555
- Lutz, K. J., Habitat Improvement for Trout streams. Pennsylvania Fish & Boat Commission, Division of Habitat Management, 2007.
- Nilsen, H. C and R. W. Larimore. 1973. Establishment of invertebrate communities on log substrates in the Kaskaskis River, Illinois. *Ecology* 54:366-374
- Savino, J. F. and R. A. Stein. 1982. Predator-prey interaction between largemouth bass and bluegills as influenced by simulated, submerged vegetation. *Transactions of the American Fisheries Society* 111: 255-266.
- Wege, G. J., Anderson, R.O. "Influence of artificial structures on largemouth bass and bluegill in small ponds". Johnson and Stein 1979.
- Werner, E. E., J. F. Gilliam, D. J. Hall and G. G. Mittelbach. 1983. An Experimental test on the effects of predation of risk on habitat use in fish. *Ecology* 64: 1540-1548

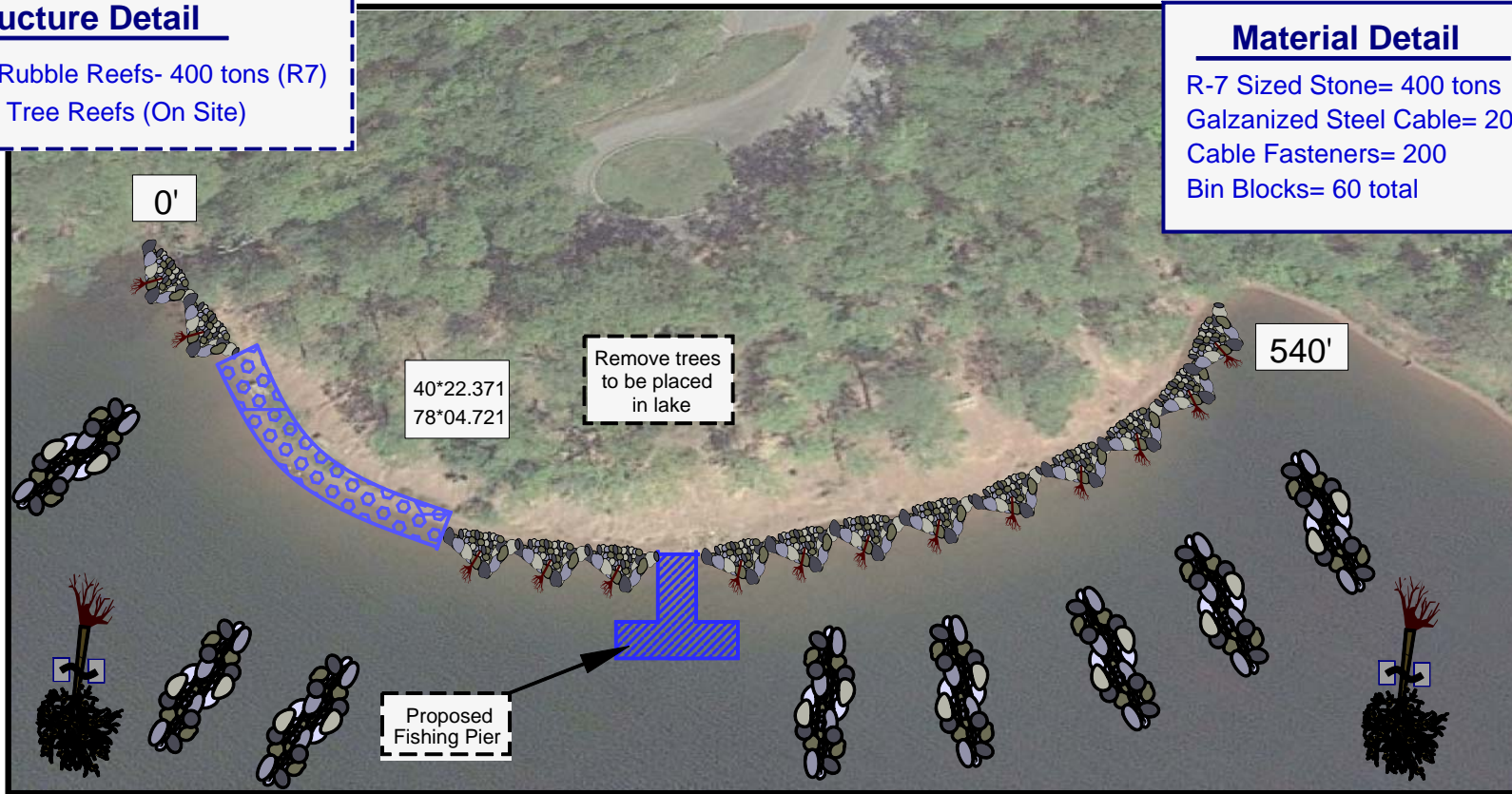
Raystown Lake, Twin Hollows Access Shoreline Project Phase 1

Structure Detail

- 20 Rock Rubble Reefs- 400 tons (R7)
- 40 Felled Tree Reefs (On Site)

Material Detail

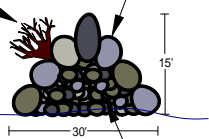
- R-7 Sized Stone= 400 tons
- Galvanized Steel Cable= 2000'
- Cable Fasteners= 200
- Bin Blocks= 60 total



Plan View

Root-wads buried with Stone
Tree trunk at least 10' long

Large R-8 (40") Stone
Entrenched into the Substrate



Shoreline will be graded to a Minimum of a 3 : 1 Slope

Reclaim with Stone
R- 6 (18"-24") Stone is the base layer
R-4 (6"-12") Stone is second layer
Topped off with a layer of 2RC

**Lake Habitat Improvement Plan
for
Raystown Lake, Huntingdon County
by
PA Fish and Boat Commission
Division of Habitat Management**

Drawn By: Mike Swartz Habitat Manager: Mike Swartz Date 09/16/2019

NOT TO SCALE
FIT IN FIELD
ALL SIZES APPROXIMATE

Note ● Blue Text Indicates Proposed Sites
● Black Text Indicates Proposed Sites



Section View

Disturbed areas will be Hydroseeded
and follow proper E&S Guidelines

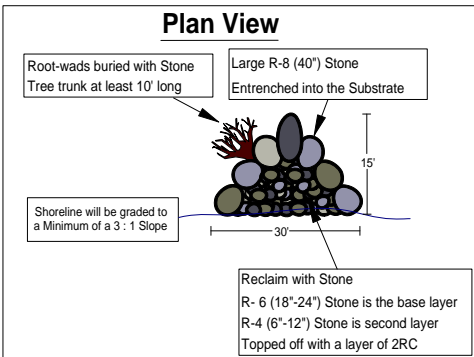
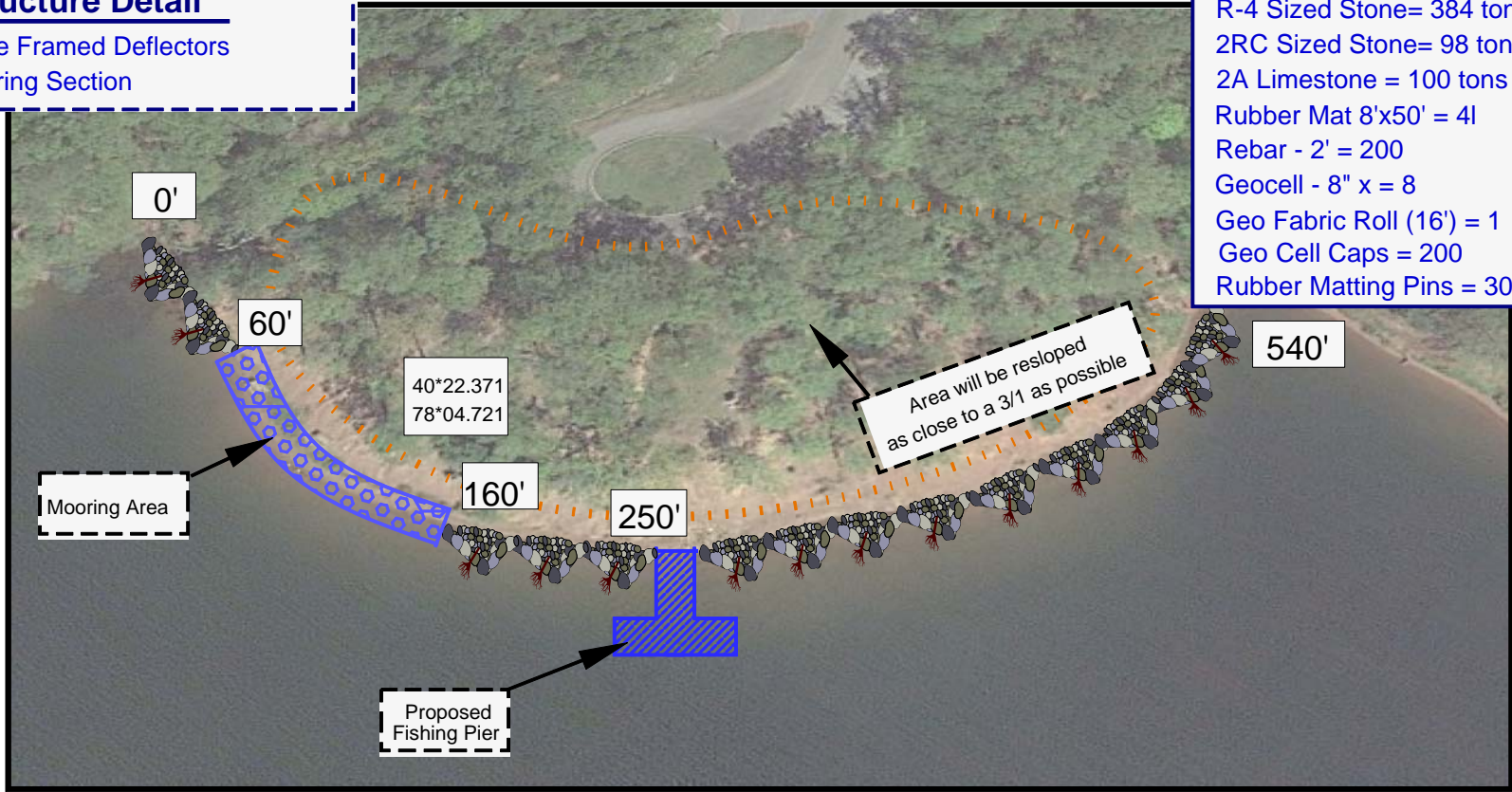


Rock will be keyed into existing bank

Raystown Lake, Twin Hollows Access Shoreline Project Phase 2

Structure Detail
 14 Stone Framed Deflectors
 100' Moring Section

Material Detail
 R-8 Sized Stone=336 tons
 R-6 Sized Stone= 112 tons
 R-4 Sized Stone= 384 tons
 2RC Sized Stone= 98 tons
 2A Limestone = 100 tons
 Rubber Mat 8'x50' = 4l
 Rebar - 2' = 200
 Geocell - 8" x 8
 Geo Fabric Roll (16') = 1
 Geo Cell Caps = 200
 Rubber Matting Pins = 300

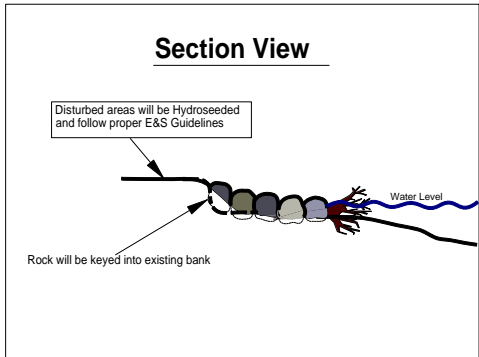


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Drawn By: Mike Swartz Habitat Manager: Mike Swartz Date 09/16/2019

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FIT IN FIELD
ALL SIZES APPROXIMATE

Note ● Blue Text Indicates Proposed Sites
● Black Text Indicates Proposed Sites



Raystown Lake, Huntingdon County (Seven Points)

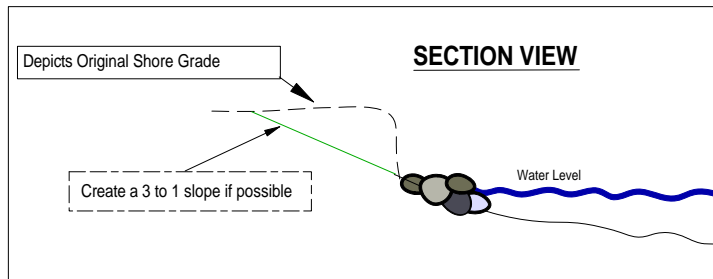
Structure Detail

150 Sawtooth Deflectors

Material Detail

R-7 Sized Stone= 1600 tons

R-5 Sized Stone= 1600 tons



**Lake Habitat Improvement Plan
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by
PA Fish and Boat Commission
Division of Habitat Management**

Drawn by: KDB Habitat Manager: Mike Swartz Date: 7/9/18

NOT TO SCALE
FIT IN FIELD

ALL SIZES APPROXIMATE



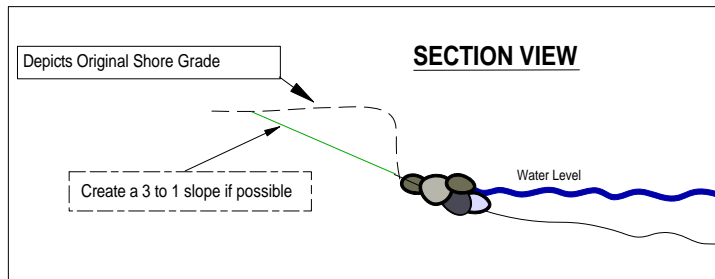
Raystown Lake, Huntingdon County (MM 11)

Structure Detail

- 17 Sawtooth Deflectors
- 15 Rock Rubble Reefs

Material Detail

- R-7 Sized Stone= 600 tons
- R-5 Sized Stone= 1,500 tons



Lake Habitat Improvement Plan
for
Raystown Lake, Huntingdon County
by
PA Fish and Boat Commission
Division of Habitat Management

Drawn by: MBS Habitat Manager: Mike Swartz Date: 3/18/19

NOT TO SCALE
FIT IN FIELD
ALL SIZES APPROXIMATE



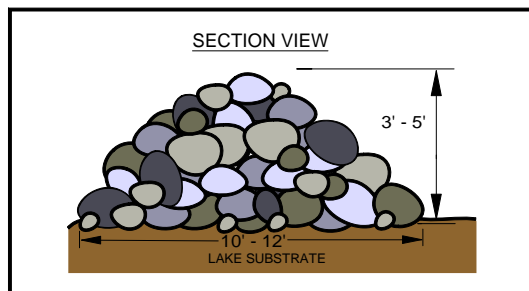
Raystown Lake, Huntingdon County (Trough Creek Point 15)

Structure Detail

15 Rock Rubble Reefs

Material Detail

R-5 Sized Stone= 900 tons



Lake Habitat Improvement Plan
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by
PA Fish and Boat Commission
Division of Habitat Management

Drawn by: MBS Habitat Manager: Mike Swartz Date: 3/18/19

NOT TO SCALE
FIT IN FIELD
ALL SIZES APPROXIMATE



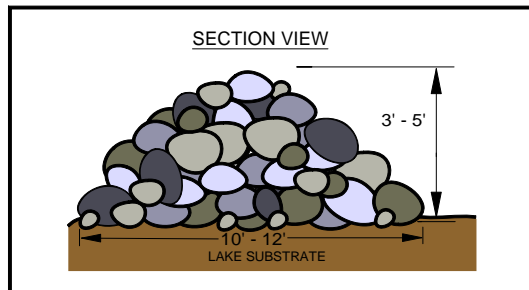
Raystown Lake, Huntingdon County (Site #6, MM 14)

Structure Detail

15 Rock Rubble Reefs

Material Detail

R-5 Sized Stone= 900 tons



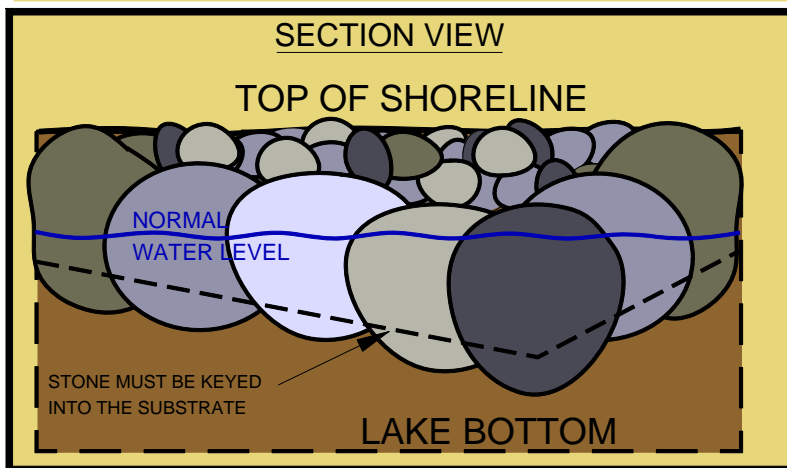
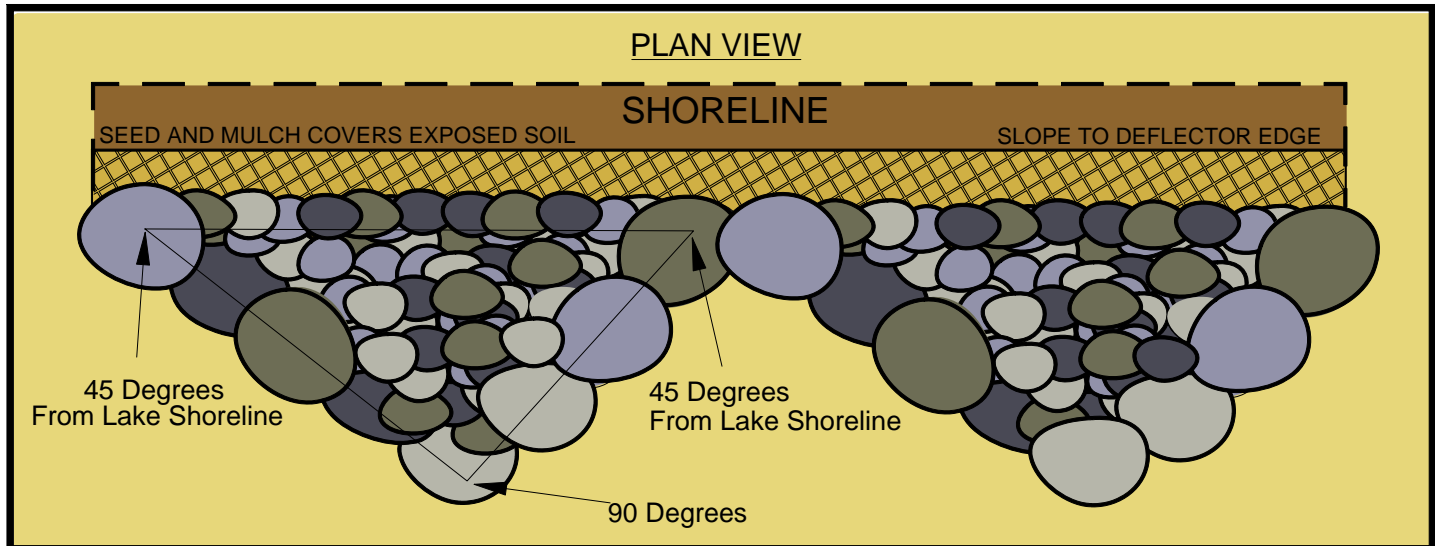
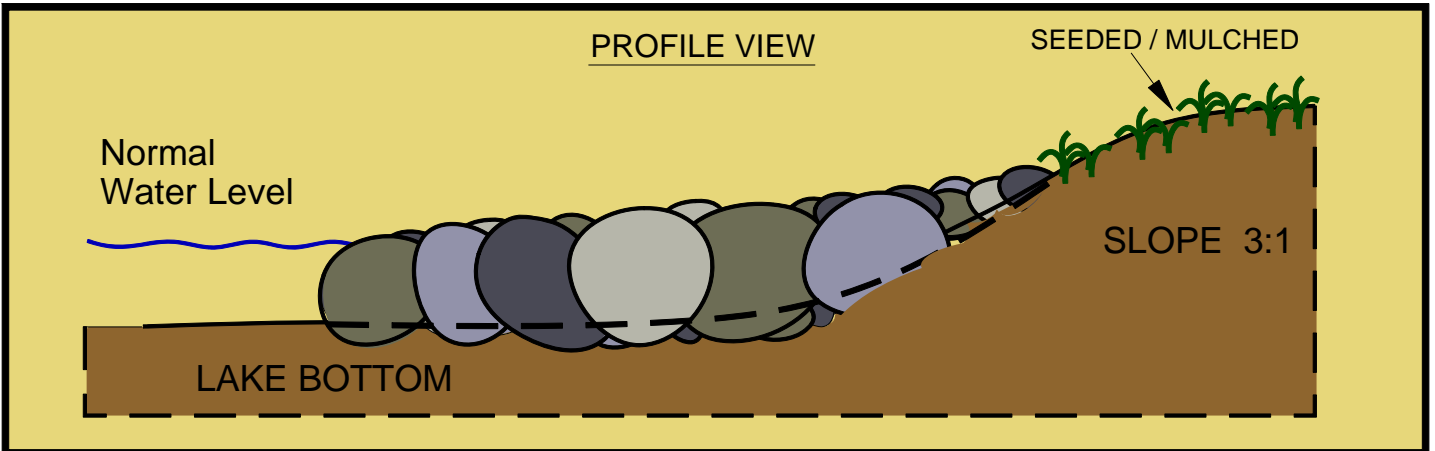
Lake Habitat Improvement Plan
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Raystown Lake, Huntingdon County
by
PA Fish and Boat Commission
Division of Habitat Management

Drawn by: BSP Habitat Manager: Mike Swartz Date: 3/18/19

NOT TO SCALE
FIT IN FIELD
ALL SIZES APPROXIMATE



PENNSYLVANIA STYLE STONE FRAMED DEFLECTOR STANDARD DRAWING



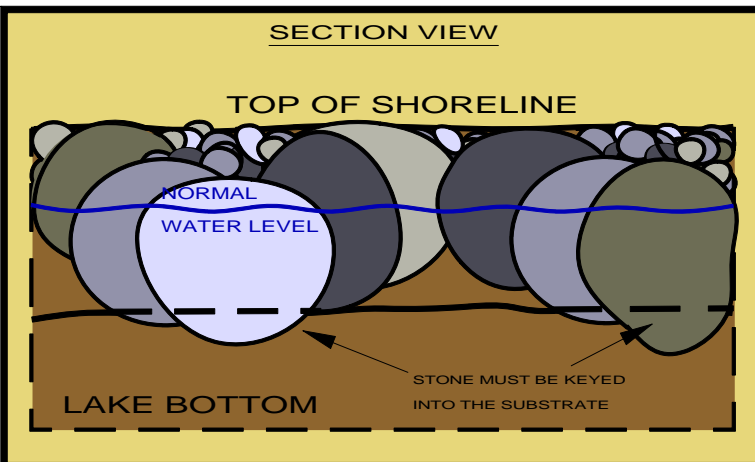
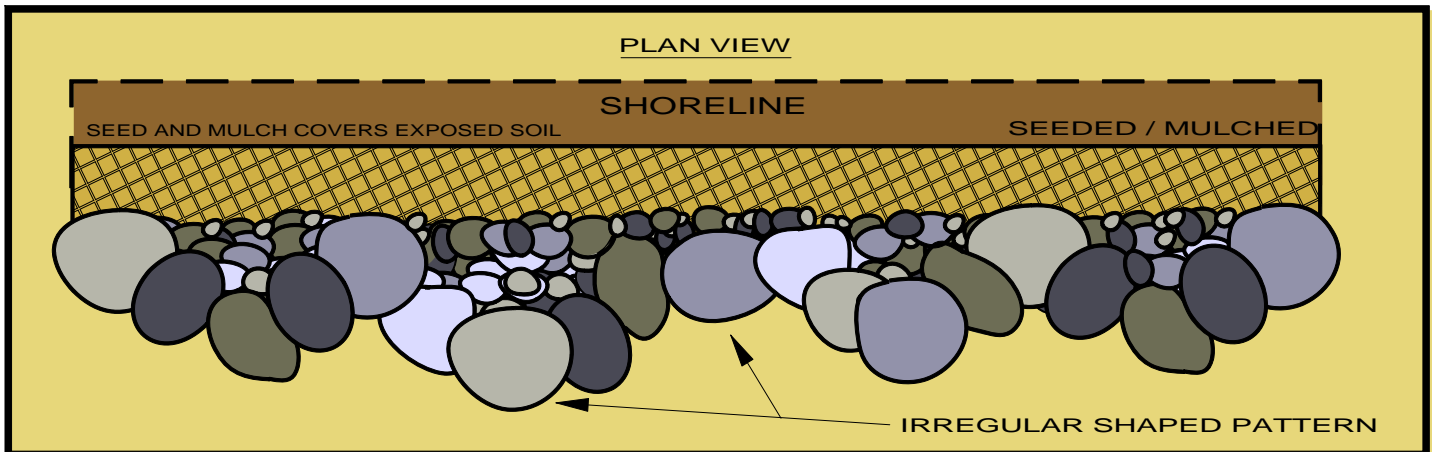
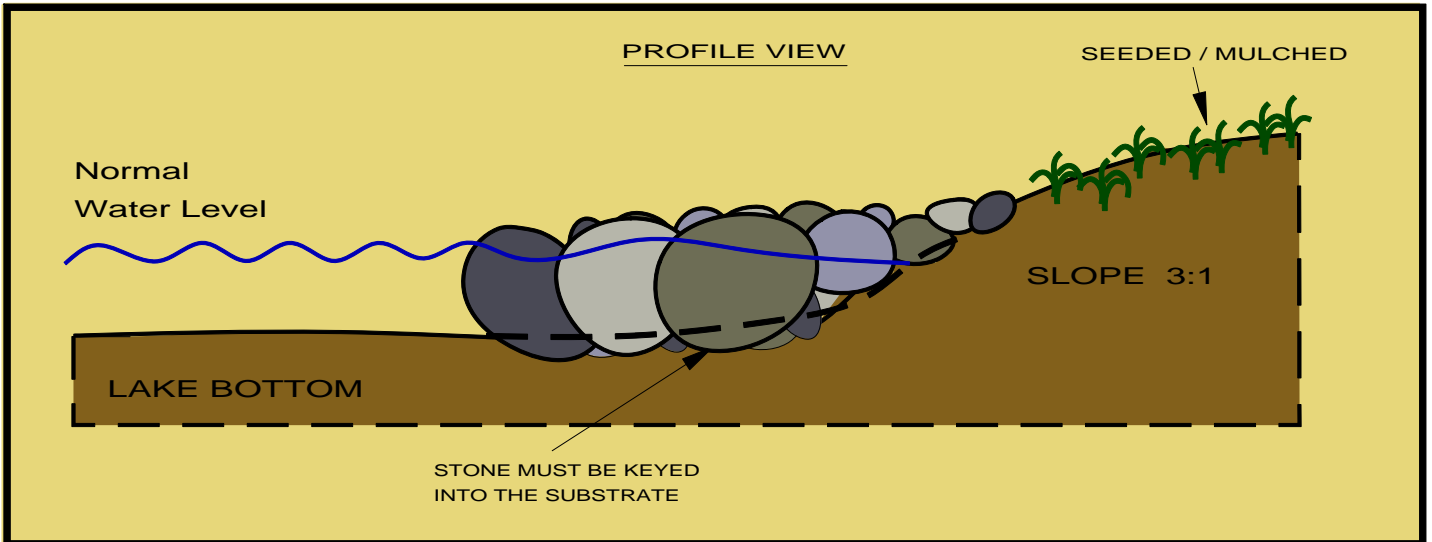
MATERIALS AND NOTES

MATERIALS:
 R8 SANDSTONE (40+")
 R5 SANDSTONE (9"-18")
 R4 SANDSTONE (6"-12")
 2RC GRAVEL
 OPTIONAL: LOG/ROOT WAD MAY BE ADDED

NOTES:
 LIMESTONE CAN SUBSTITUTE SANDSTONE
 LARGER STONES MAKE A TRIANGULAR FRAME
 FRAME ROCKS SHOULD BE KEYED INTO LAKE SUBSTRATE
 STONE FRAME IS BACK FILLED WITH SMALLER STONE
 DEFLECTORS ARE BLENDED INTO THE SHORELINE
 SEED AND MULCH ARE SPREAD OVER EXPOSED TOPSOIL
 RIPARIAN BUFFER MAY BE ESTABLISHED
 NOT TO SCALE
 ALL SIZES ARE APPROXIMATE
 FIT IN FIELD

SUGGESTED EQUIPMENT:
 EXCAVATOR WITH THUMB
 TRACKED LOADER OR SKIDSTEER

PENNSYLVANIA STYLE SAW-TOOTHED DEFLECTOR
STANDARD DRAWING FOR LAKES



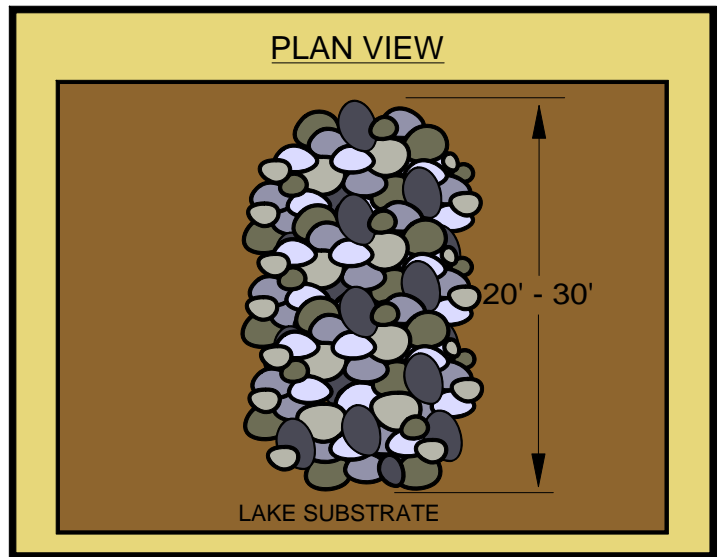
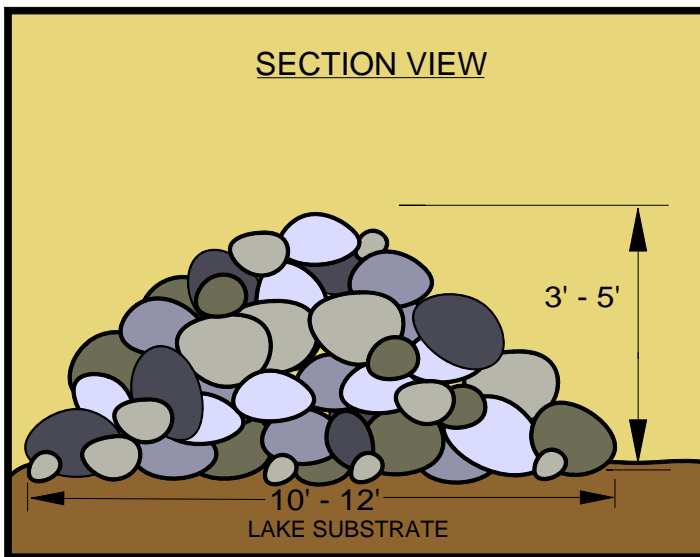
MATERIALS AND NOTES

MATERIALS:
R SANDSTONE (9"-18")
R7 SANDSTONE (18"-30")

NOTES:
LIMESTONE CAN SUBSTITUTE SANDSTONE
DEFLECTORS ARE BLENDED INTO THE SHORELINE
SEED AND MULCH COVER EXPOSED TOPSOIL
RIPARIAN BUFFER MAY BE ESTABLISHED
NOT TO SCALE
ALL SIZES ARE APPROXIMATE
FIT IN FIELD

SUGGESTED EQUIPMENT:
EXCAVATOR WITH HYDRALIC THUMB
SKIDSTEER OR PAYLOADER

PENNSYLVANIA STYLE ROCK RUBBLE REEFS STANDARD DRAWING



MATERIALS AND NOTES

MATERIALS:

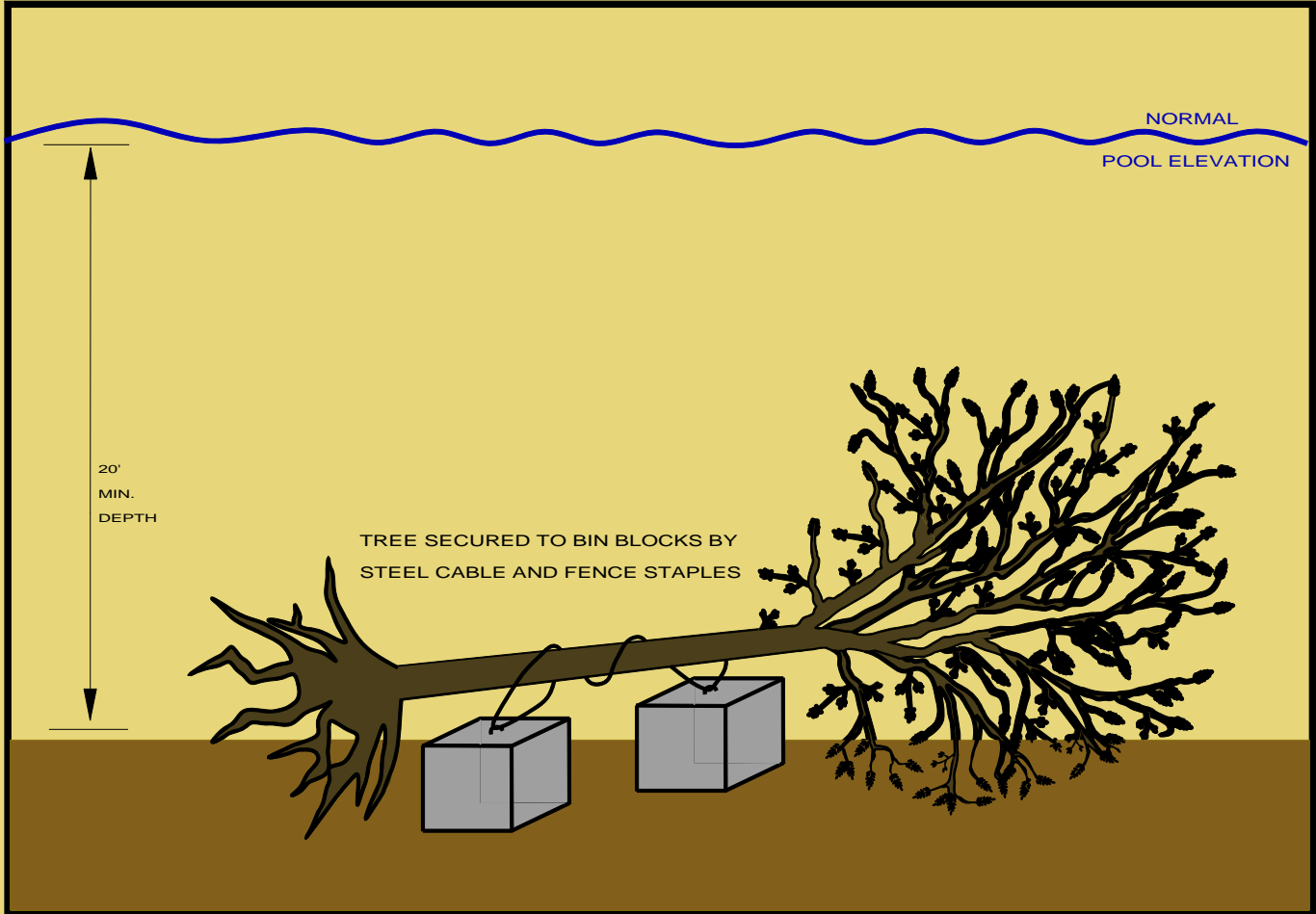
R5 - R7 SANDSTONE - (12"-30")

NOTES:

RECOMMENDED DENSITY IS 60 TONS/REEF
LIMESTONE CAN SUBSTITUTE SANDSTONE
STONE SIZE MAY VARY BY AVAILABILITY
NOT TO SCALE
ALL SIZES ARE APPROXIMATE
FIT IN FIELD

PENNSYLVANIA ANCHORED TREE STANDARD DRAWING

PROFILE VIEW



MATERIALS AND EQUIPMENT

MATERIALS:

LARGE HARDWOOD TREE - 1 PIECE
1/4" GALVANIZED CABLE 20' - 1 PIECE
FENCE POST STAPLES - 8 TOTAL
3-TON BIN BLOCKS - 2 TOTAL

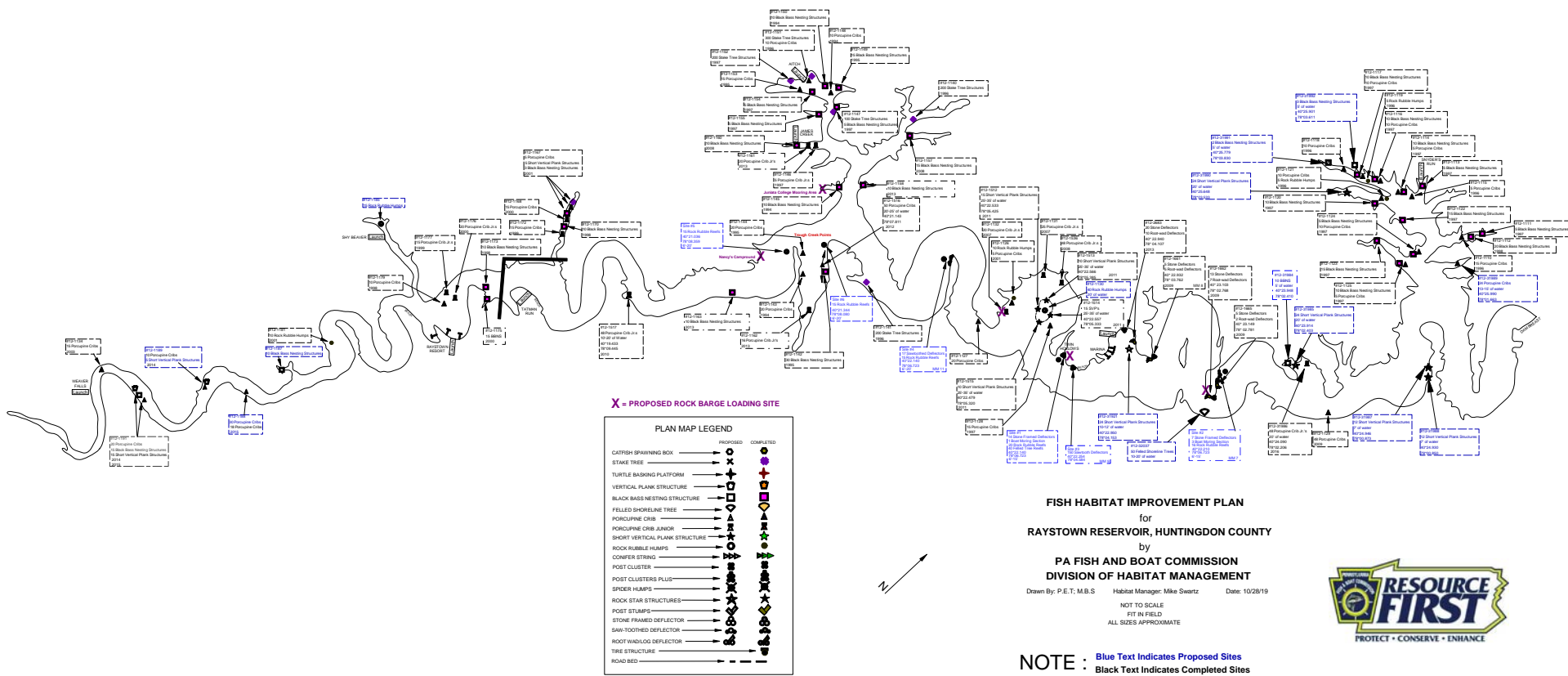
SUGGESTED EQUIPMENT:

EXCAVATOR W/ THUMB
HABITAT BARGE
CABLE CUTTERS
MINI SLEDGEHAMMER

NOTES

NOTES:

STEEL CABLE AND STAPLES MUST BE USED
TREES SHOULD BE KEPT IN FULL WITH ROOT WAD
AREA MUST BE RESTRICTED WHILE HARVESTING TREES
NOT TO SCALE
ALL SIZES ARE APPROXIMATE
FIT IN FIELD



*PFBC/USACE FISH HABITAT IMPROVEMENT MASTER PLAN INCLUDES LARGE-SCALE AND VOLUNTEER-SCALE PROPOSED PROJECTS PLUS ALL PREVIOUSLY COMPLETED PROJECT SITES