Patoka Lake Aquatic Habitat Enhancement Plan

Crawford, Dubois, and Orange Counties

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Patoka Lake is an 8,800-acre flood control impoundment located in Crawford, Dubois, and Orange counties. The reservoir was created in 1977 when a dam was completed across the Patoka River 13 mi east of Jasper. As the second-largest reservoir in the state, Patoka Lake garners much recreational attention primarily in the form of boating and fishing. Eleven boat launching ramps provide anglers and boaters access to the lake. The Department of Natural Resources (DNR) operates seven State Recreation Areas at the lake. The Newton-Stewart State Recreation Area is the most developed with campgrounds, swimming beach, visitor center, marina, and other attractions.

Both the lake and the adjacent lands is co-managed by the Army Corp of Engineers (COE) and Department of Natural Resources (DNR) Division of State Parks. Aquatic vegetation is lacking in much of the lake and shoreline erosion is rampant due to lake level fluctuations and boat traffic. Many states have already established aquatic enhancement programs and much of our recommendations come from this previous work (Houser 2007, Wagner 2013, Kansas Department of Wildlife 2015). Habitat structures proposed for this project include but are not limited to: 260 Indiana Pallet Structures, 60 Pennsylvania Black Bass Nesting Structures, 60 Pennsylvania Porcupine Cribs, 20 Pennsylvania Porcupine Crib Juniors, 40 Hoosier Cubes, 20 felled trees, and riprap for shoreline stabilization.

This project will focus primarily on the main lake area of Patoka. This area has experienced the greatest decline in aquatic habitat and shoreline stability. Many of the arms of the lake still have adequate submerged woody timber present.

The average depth of the lake is 22 ft, however the main lake contains some of the deepest areas of Patoka Lake. Dissolved oxygen levels are typically adequate in the summer months down to 16 ft to sustain fishes. Thus, the Habitat Enhancement Zone (HEZ) is designated as the area between 5 ft and 16 ft at winter pool. Locations visually lacking existing structure were selected by on-the-ground observation as target areas to enhance. Seventy-five percent of the total area within each target area is assumed to be in the HEZ (Figure 1). The goal is to enhance at least 20% of the total HEZ among target areas which requires approximately 32.5 acres of habitat enhancement (Clark-Kolaks 2015). Depending on initial outcomes, secondary HEZs may be identified along main lake shoreline following the guidelines listed above.

Initial construction of structures will begin November through January every year beginning in 2019. Placement of structures will be completed as conditions allow during the same year they are built. We anticipate building and placing all proposed structures by 2021. Subsequent structures will be constructed and placed as time and materials allow in secondary HEZs. The construction and placement of all artificial structures in this plan must be coordinated with the Indiana Division of Fish and Wildlife (DFW). Representatives of the Fisheries Section (or a designated representative) will be on hand to supervise and assist in construction and placement of all artificial habitats designed for this project. Volunteers from the Indiana Bass Federation, Bass Unlimited, and other stakeholders will assist with construction efforts. Local businesses will be asked for the donation of materials including but not limited to: pallets, rock, lumber, and cinder blocks. All artificial habitats must be constructed to the specification(s) shown in the standard drawings attached to this document.

Trees will also be felled around the lakes' edge starting in 2019 and will continue until all proposed trees are cut. Estimates were calculated as 3-5 trees every 50 ft of identified shoreline and then divided in half to come up with the "Actual" proposed number of trees per location. The total number of trees proposed to be felled is 720 at the various locations (Figure 2).

Approximately 22,000 ft of shoreline erosion was visually identified on the main lake. Although exact riprap costs have yet to be determined for this project Boyd (2006) estimates installed riprap to cost between $120 and $180/ft based on a 2:1 slope (Boyd 2006). Given Boyd's estimate, this part of project would cost between $2.64 and $3.96 million. Due to high cost the amount of shoreline to receive riprap is unknown at this point due to fiscal and logistical constraints.

Since this is a multiyear approach the DFW will obtain an Individual Section 401 Water Quality Certification from the COE for 2019 through 2021. This plan will be reviewed and approved by the Indiana Division of Water and Division of Law Enforcement before any structures are placed.

LITERATURE CITED

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Approved by: Daniel P. Carnahan, South Region Fisheries Supervisor

Date: August 8, 2019

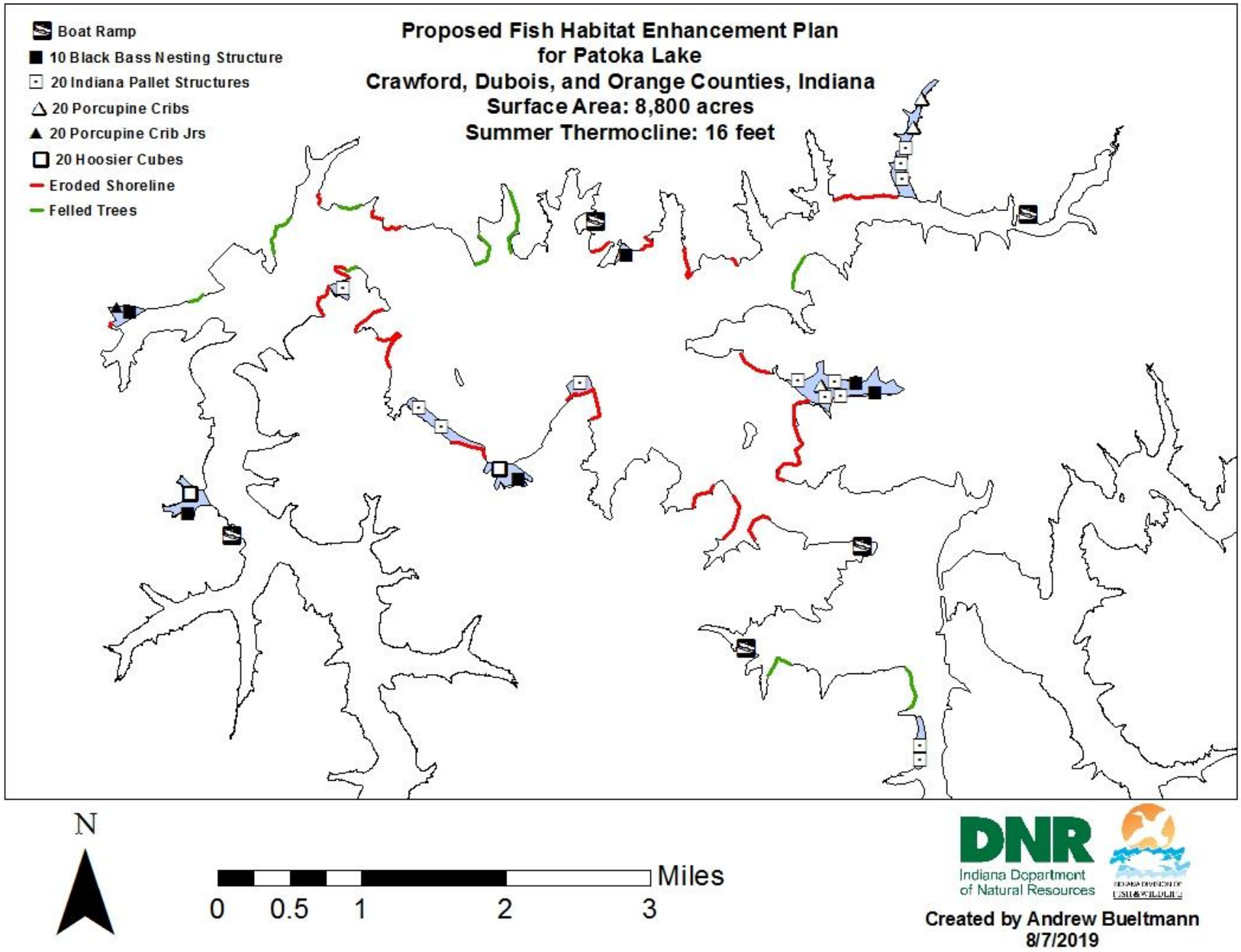


Figure 1. Proposed Fish Habitat Enhancement Plan for Patoka Lake.

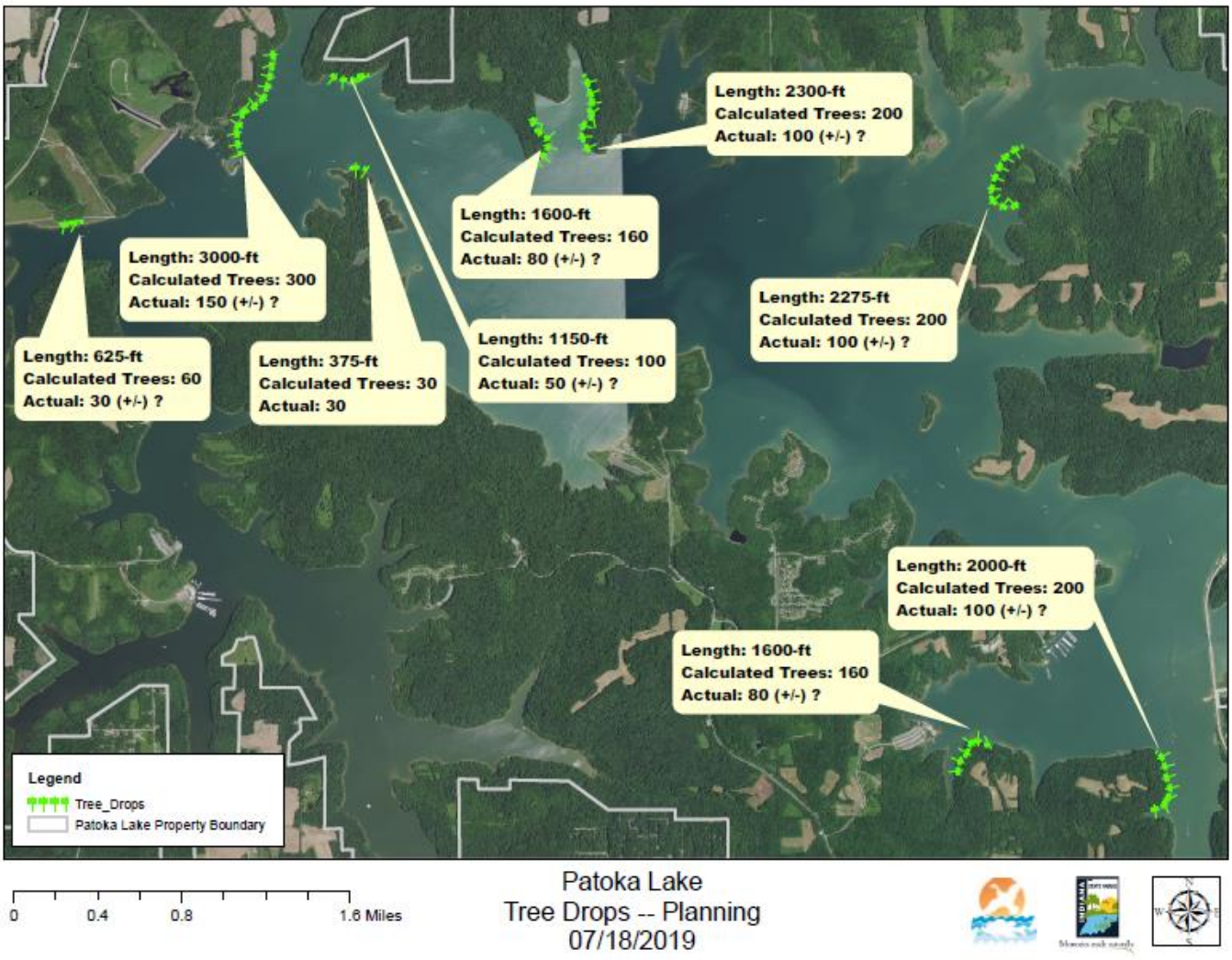


Figure 2. Proposed tree felling plan for Patoka Lake.

Appendix

Indiana Pallet Structure

Pennsylvania Black Bass Nesting Structure

Pennsylvania Porcupine Crib

Pennsylvania Porcupine Crib Junior

Hoosier Cube

Budget

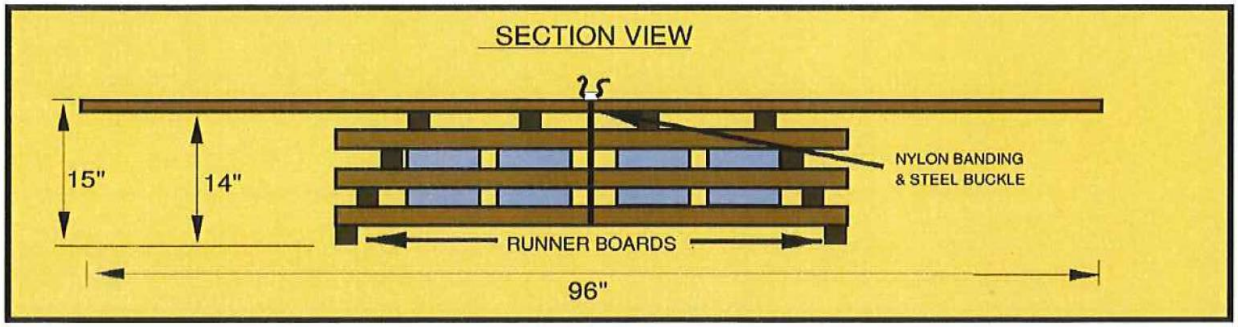
INDIANA PALLET STRUCTURE DESIGN

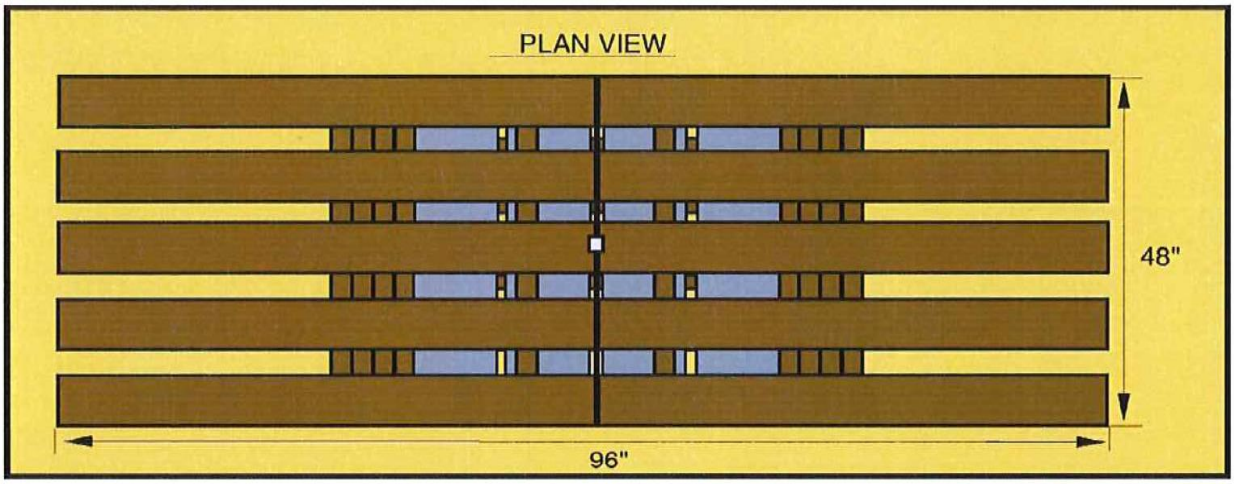
Materials	Number needed	Cost per structure
2.5” Countersinking-Head Polymer-Coated Deck Screws	About 60	$3.31
Non-treated hardwood pallets	5	free
8 8” Cinder blocks	8	free

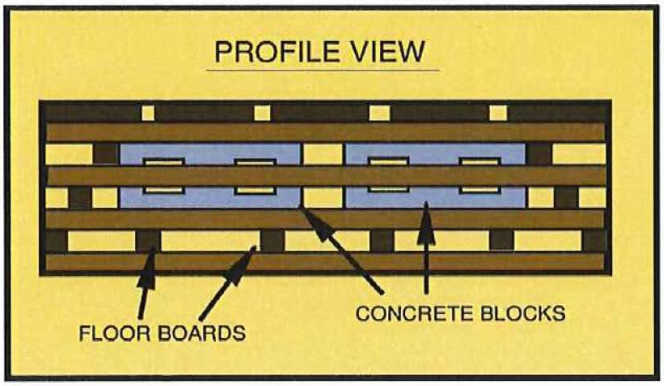
Construction:

1) Only **chemically untreated** pallets should be used. Reinforce exterior boards of pallets with screws, one screw per end. This will ensure that if the nails rust the boards will stay attached.
2) Form a triangle with three pallets (two leaning against each other **on top** of the base).
3) On one open end of the triangle place a pallet upright in a fashion where it covers the open end of the triangle.
4) Fasten the upright pallet to the two pallets leaning against each other with one screw in each slat from the upright pallet.
5) Insert 8 cinder blocks on top of the base.
6) Complete structure by attaching another upright pallet to the remaining opening of the triangle following instructions from step 4 (cinderblocks should remain within structure if properly constructed).

PENNSYLVANIA BLACK BASS NESTING STRUCTURE (Houser 2007)







MATERIALS AND NOTES

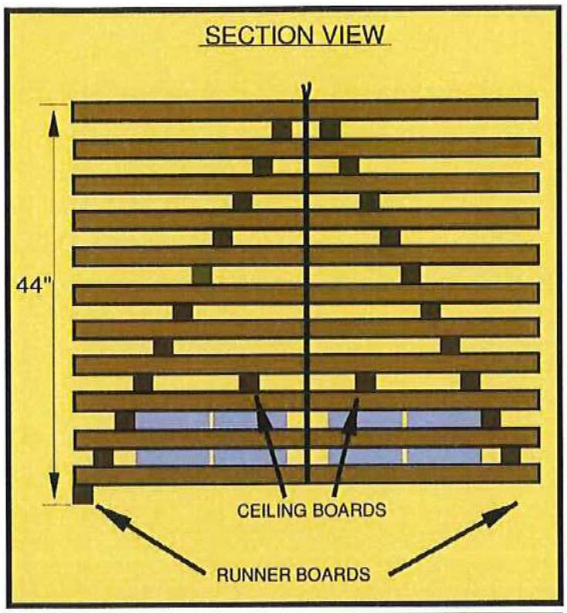
MATERIALS:

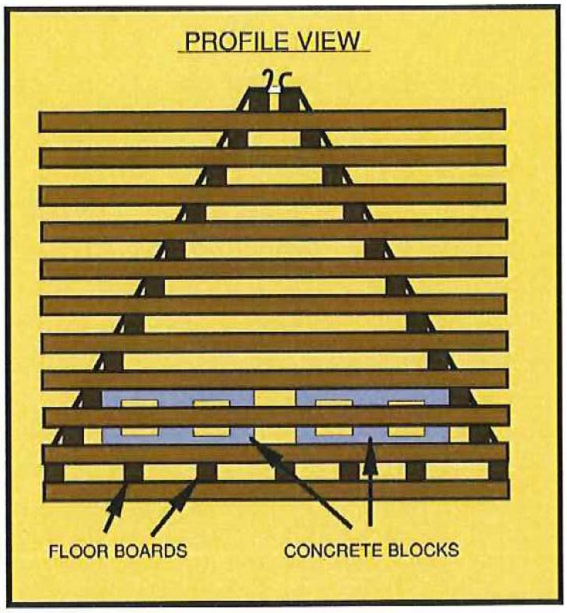
ROUGH CUT HEMLOCK LUMBER 2" X 2" X 4' - 20 PIECES
ROUGH CUT HEMLOCK LUMBER 1" X 8" X 8' - 5 PIECES
8" X 8" X 16" 2 CORE CONCRETE BLOCKS- 8 TOTAL
COMMON NAILS (16D) - 2 LB
COMMON NAILS (10D) - 1 LB
NYLON BANDING- 18'
STEEL BUCKLE- 1 TOTAL

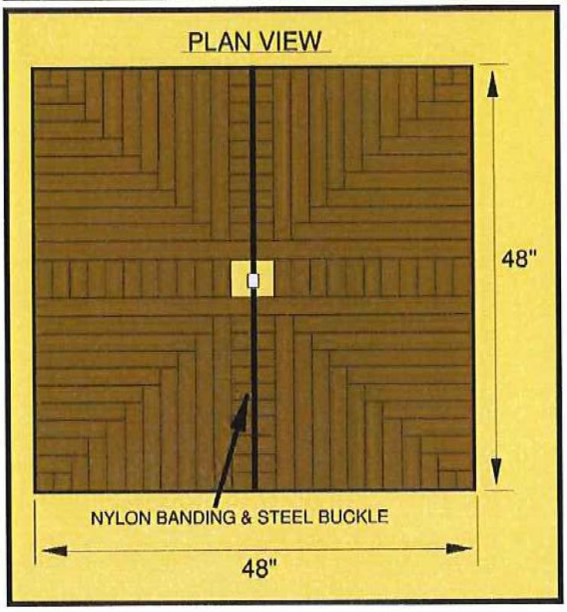
NOTES:

LUMBER MUST BE TRUE DIMENSIONAL
LUMBER MUST BE GREEN (FRESH CUT)
YELLOW POPLAR MAY BE SUBSTITUTED FOR HEMLOCK
CONCRETE BLOCKS MINIMUM WEIGHT: 35 LBS
NYLON BANDING: 600 LBS TENSILE STRENGTH
NOT TO SCALE
ALL SIZES ARE APPROXIMATE
FIT IN FIELD

PENNSYLVANIA PORCUPINE CRIB (Houser 2007)





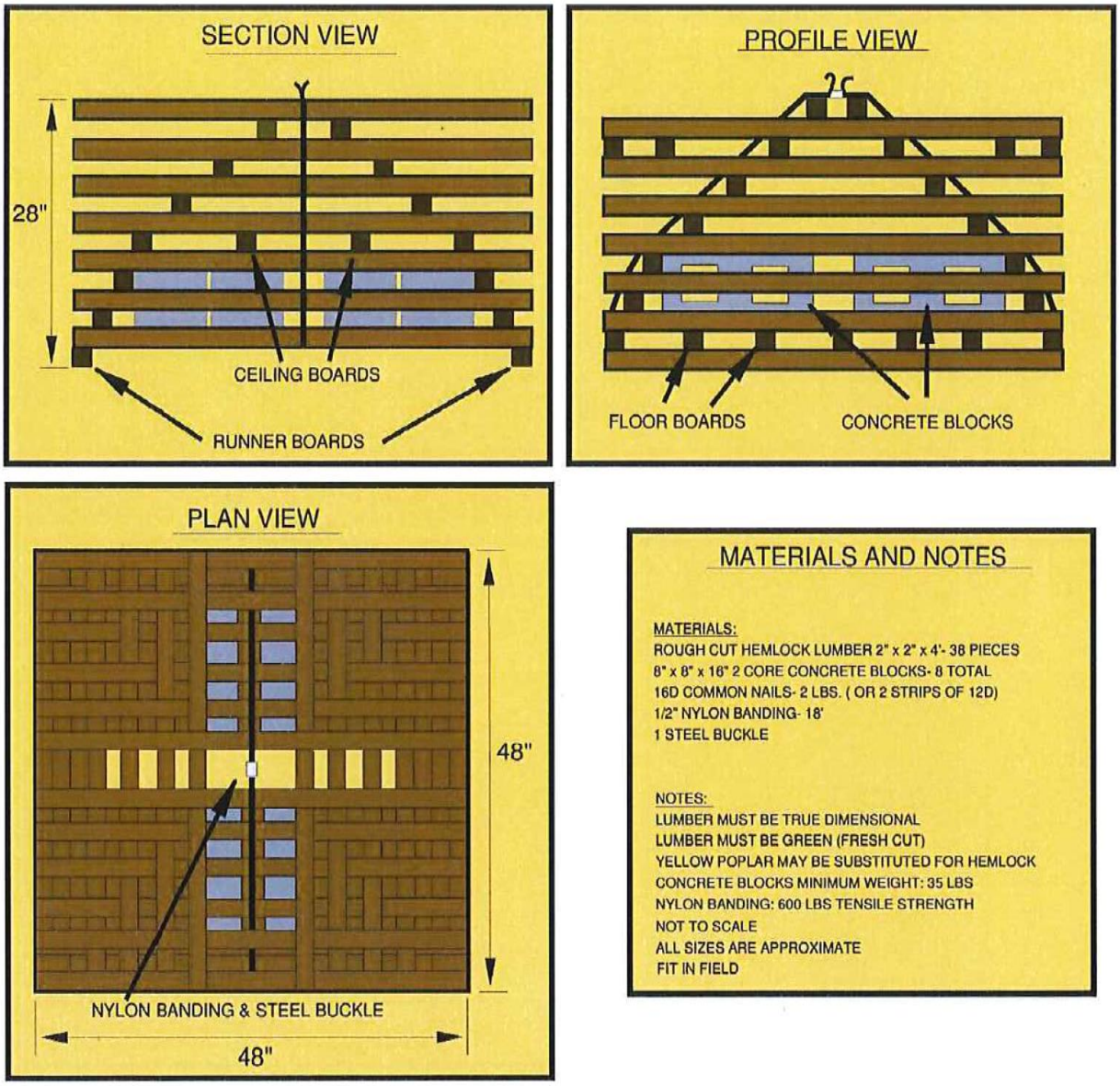


MATERIALS AND NOTES

MATERIALS:
ROUGH CUT HEMLOCK LUMBER 2" x 2" x 4'- 50 PIECES
6" x 6" x 16" 2 CORE CONCRETE BLOCKS- 8 TOTAL
16D COMMON NAILS- 2 LBS. (OR 2 STRIPS OF 12D)
1/2" NYLON BANDING- 18'
1 STEEL BUCKLE

NOTES:
LUMBER MUST BE TRUE DIMENSIONAL
LUMBER MUST BE GREEN (FRESH CUT)
YELLOW POPLAR MAY BE SUBSTITUTED FOR HEMLOCK
CONCRETE BLOCKS MINIMUM WEIGHT: 35 LBS
NYLON BANDING: 600 LBS TENSILE STRENGTH
NOT TO SCALE
ALL SIZES ARE APPROXIMATE
FIT IN FIELD

PENNSYLVANIA PORCUPINE CRIB JR. (Houser 2007)



Cube Fish attractor design

Hoosier Cube Fish Attractor Materials Cost Estimate

Materials to build 1 attractor	Cost per Attractor unit
16 – $1^1/_2$" dia. PVC deep fit***** "T's"	$38.08
40ft. - $1^1/_2$" dia. sch. 40 PVC pipe	$29.60
100ft. – 4"dia. Corr. drain line	$38.72
10 high tensile strength zip ties**	$1.00
80 – 1" **self-tapping** screws	$3.00
Heavy duty PVC cement	$1.45
Total cost per unit:	$*111.85 ea.*

***** - deep fit has a larger lip on the fitting, allowing for a better fit compared to shallow fittings.

** - lower tensile strength zip ties break under the stress of deploying the attractor.

Construction:

1) The 1.5" white PVC pipe comes in 10ft. lengths. Cut 3, 3 ft. lengths from each 10ft. piece of PVC. The remaining 1ft. piece can be cut into 2-3 in. pieces, which will be used to connect some of the fittings.
2) Connect and glue the 3ft. white PVC pipe to the fittings to form a cube frame. Use the self-tapping screws to reinforce the glued fittings (see photo below).
3) Drill several 3/8in holes in various locations around the completed PVC frame. This will allow it to fill with water when deployed – making it easier to sink.
4) Once the PVC frame is complete use a heavy-duty zip tie (or aluminum wire) to attach one end of the 100 ft. piece (uncut) of black corrugated drain line to the PVC frame.
5) Once the end of the corrugated drain line is attached to the PVC frame, begin to push the corrugated drain line in and out of the PVC frame. Use additional zip ties to attach the corrugated drain line to various locations on the PVC frame. Use the entire 100 ft. length of corrugated drain line. It does not matter how the corrugated drain line is strung through the PVC frame. It is simply providing the cover for the fish to hide in.

Cube Fish Attractors

Indiana Pallet Structures (260)

Materials	Amount	Units	Total Cost
Pallet	1,300	Inividual	$0.00
Screws	130	Pound	$509.60
Cinderblocks	2,080	Individual	$2,080.00
		Cost/Structure	**$9.96**
		Total Cost	**$2,589.60**

Black Bass Nesting Structure (60)

Materials	Amount	Units	Total Cost
Lumber	7,200	Running Feet	$7,440.00
Screws	60	Box	$420.00
Cinder Blocks	240	Individual	$240.00
Strap	600	Feet	$120.00
		Cost/Structure	**$137.00**
		Total Cost	**$8,220.00**

Porcupine Cribs (60)

Materials	Amount	Units	Total Cost
Lumber	6,120	Running Feet	$4,284.00
Screws	60	Box	$420.00
Cinder Blocks	240	Individual	$480.00
Strap	1,200	Feet	$24.00
		Cost/Structure	**$86.80**
		Total Cost	**$5,208.00**

Porcupine Crib Juniors (20)

Materials	Amount	Units	Total Cost
Lumber	1,530	Running Feet	$1,292.00
Screws	15	Box	$105.00
Cinder Blocks	120	Individual	$120.00
Strap	340	Feet	$6.75
		Cost/Structure	**$76.18**
		Total Cost	**$1,523.60**

Hoosier Cubes (40)

Materials	Amount	Units	Total Cost
PVC Pipe	1,600	Feet	$1,184.00
Screws	3,200	Individual	$120.00
Cable Ties	400	Individual	$40.00
Perforated Tile	4,000	Feet	$1,548.80
PVC Cement	10	Can	$58.00
PVC Tee Fittings	640	Individual	$1,523.20
		Cost/Structure	**$111.85**
		Total Cost	**$4,474.00**

Total Cost: $22,015.20