

Stream Habitat Development



Introduction

One of the purposes of streambank protection is to improve and protect wildlife habitat and biodiversity. Although adding stream and stream corridor habitat is not a required component of a protection project, these practices come with multiple benefits to a number of species.

This guide will explore some of the common habitat development practices that have been successfully implemented by the NRCS in Wisconsin. It includes recommendations on where each particular practice should be installed to maximize utility, and also a discussion of the pros and cons of each technique. All corresponding WI Standard Drawings are also included.

Knowledge of the fishery and fishery potential for a stream is essential when selecting the type of habitat development to install. The Field Office Technical Guide, Practice Standard 395 *Stream Habitat Improvement and Management* outlines criteria for installing habitat in streams. These plans require approval of the DNR fish manager. Be sure to review these criteria and coordinate with the DNR fish manager before beginning to plan habitat development.

There are many additional resources available on habitat development. The last page of this guide lists some them.

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Random Boulder Placement

Purpose:

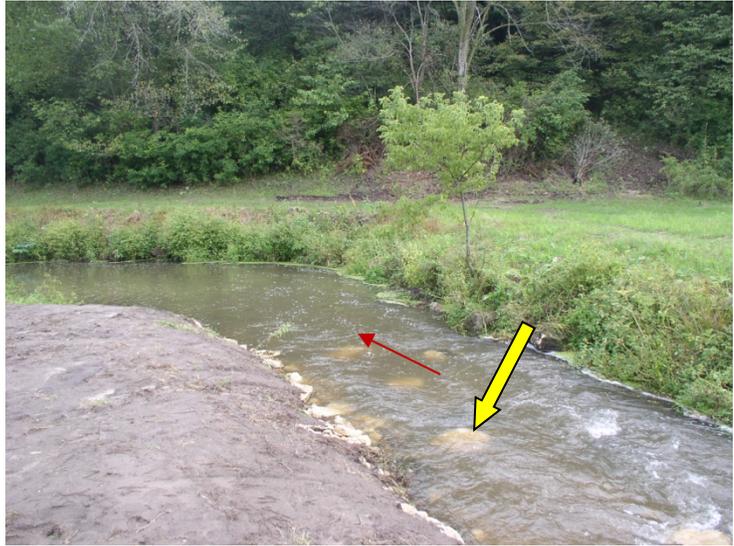
Encourages additional scouring and provides micro habitat for several species.

Location:

In runs and/or in existing scour holes.

Species:

The scouring and small overhangs primarily benefit trout but have the potential to benefit all fish species. If scouring down to native gravel beds is accomplished it can benefit all macro-invertebrates. If a shadow in the current creates deposition of fine sediments, it could be overwintering habitat for turtles such as the Wood, Map and Blanding's. Also if placed so some boulders protrude from water during normal flows can be loafing and perching areas for birds.



Caution:

Care needs to be taken in placement to ensure that currents are not deflected into stream banks, and also that the boulders will not catch flood debris which could cause stream bank erosion.

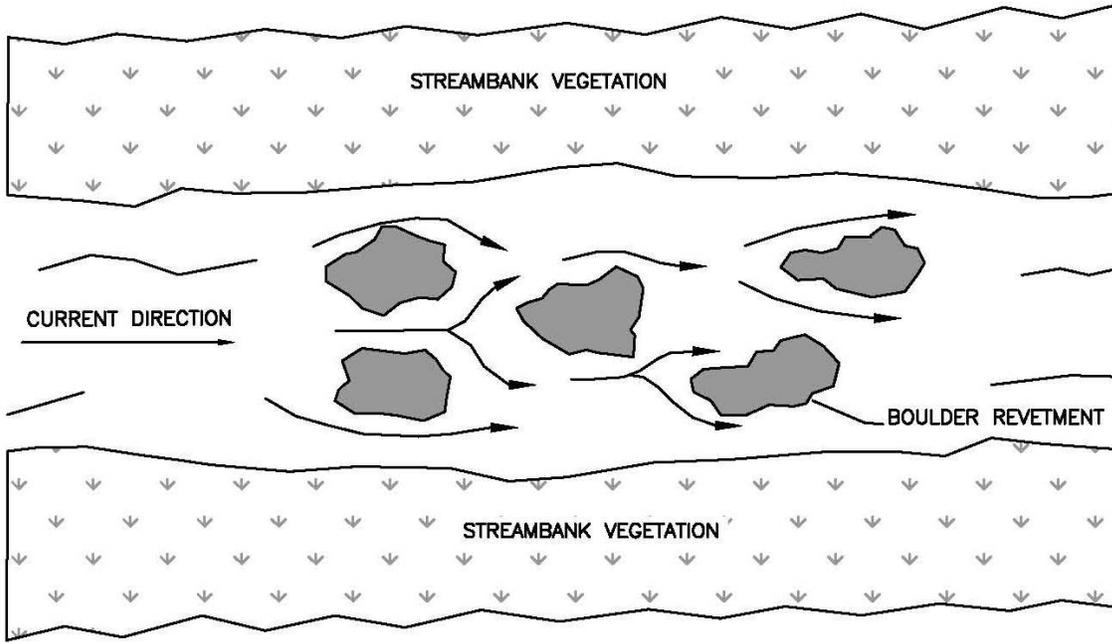
Pros

- Easy and inexpensive to install
- Very versatile-can be installed in almost any setting
- Potential to benefit many different species

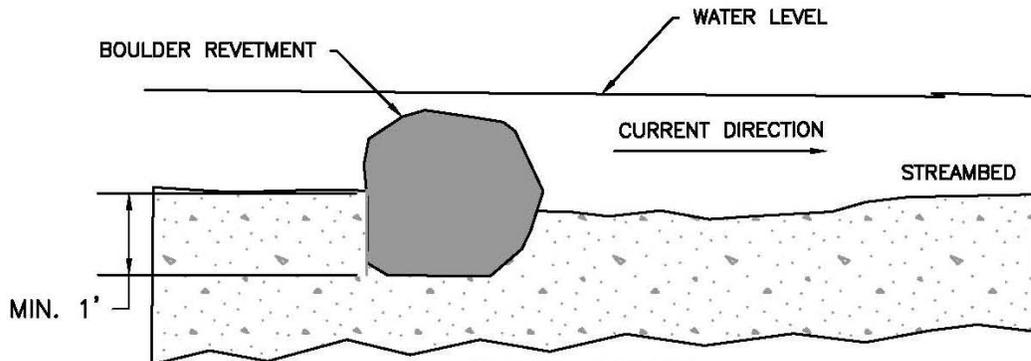
Cons

- Only creates small amounts of habitat

See next page for Standard Drawing WI-937.



PLAN VIEW



CROSS SECTION

- AVERAGE ROCK SIZE— 1.5'–3.5' DIA.—ROCK, SIZE IS SITE DEPENDENT.
- A MINIMUM OF ONE BOULDER PER SET OF BOULDER REVETMENTS SHOULD PROTRUDE FROM WATER SURFACE DURING TIMES OF ORDINARY FLOW TO ACT AS MID-STREAM PERCHING/LOAFING SITES.
- USE BOULDERS WITH IRREGULARITIES OR MULTIPLE BOULDERS TOGETHER TO PROVIDE SLIGHT OVERHANGING COVER.
- PLACE BOULDER REVETMENT SO CURRENT WILL NOT BE DEFLECTED INTO UNPROTECTED STREAM BANKS.



RANDOM BOULDER PLACEMENT

CLIENT: _____
 COUNTY: _____

Date _____
 Designed _____
 Drawn _____
 Checked _____
 Approved _____

Drawing Name
 WI-937
 Date
 12/2010
 Sheet of

Cross-Channel Logs

Purpose:

Creates and maintains pools (scour holes) to re-connect a stream's natural riffle pool sequence while providing habitat for several species. They can also be used to deflect water away from eroding banks or towards other stabilization structures.

Location:

Primarily installed immediately downstream of riffle areas. They are occasionally used in slow runs to add variances in habitat.



Species:

The scour holes created benefit all fish species. When used in conjunction with other habitat structures, this practice can also benefit turtle and snake species.

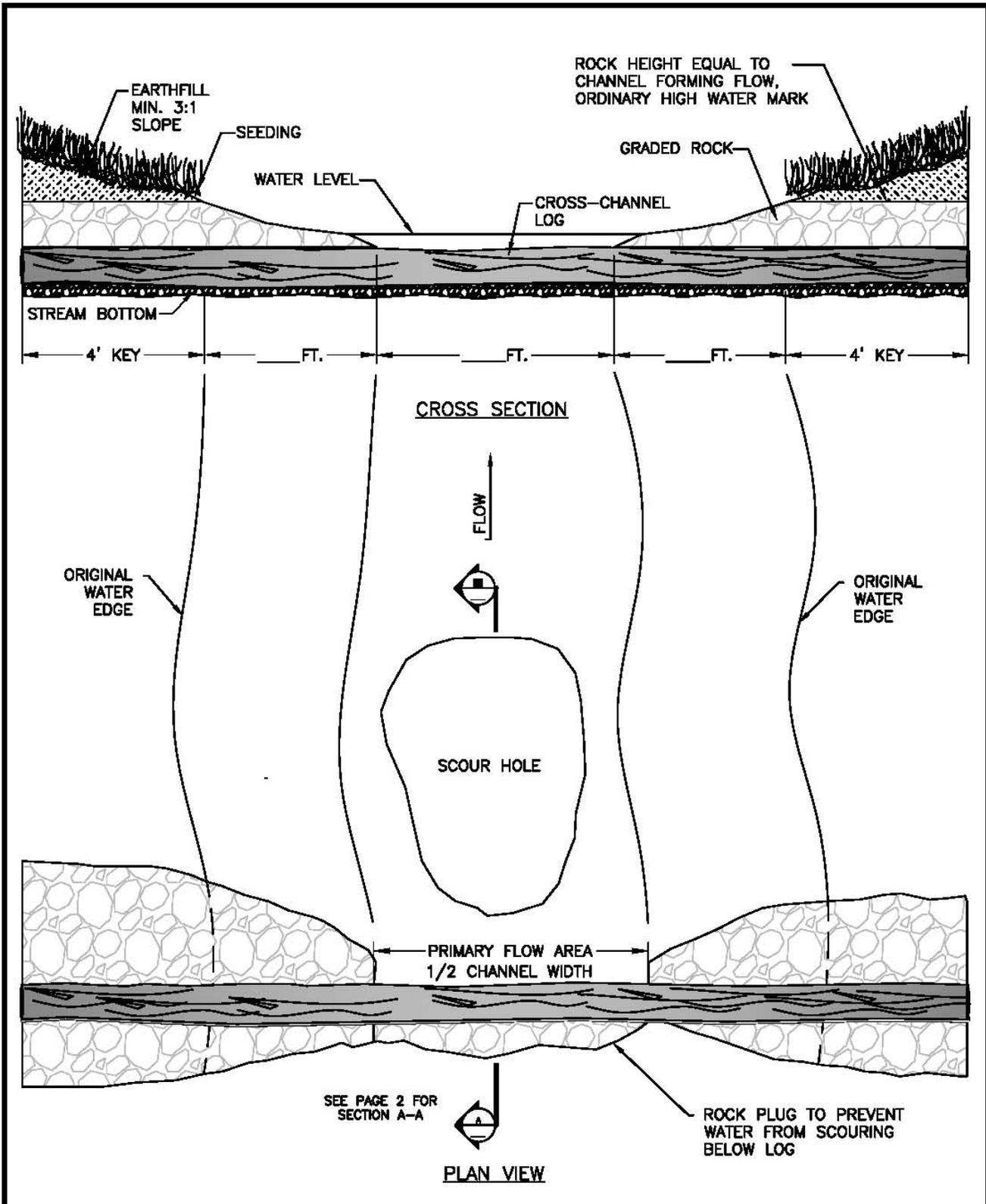
Pros

- Multi-purpose
- Can easily be used with other structures like escape logs and boulder retards
- Potential to benefit many different species
- Can use on site woody material – reduces cost

Cons

- Hauled in rock needed for proper installation – higher project costs
- Exact placement of rock needs to be precise and can require additional labor and expertise
- Does not maintain as large of a scour hold as a vortex weir

See next page for Standard Drawing WI-935.

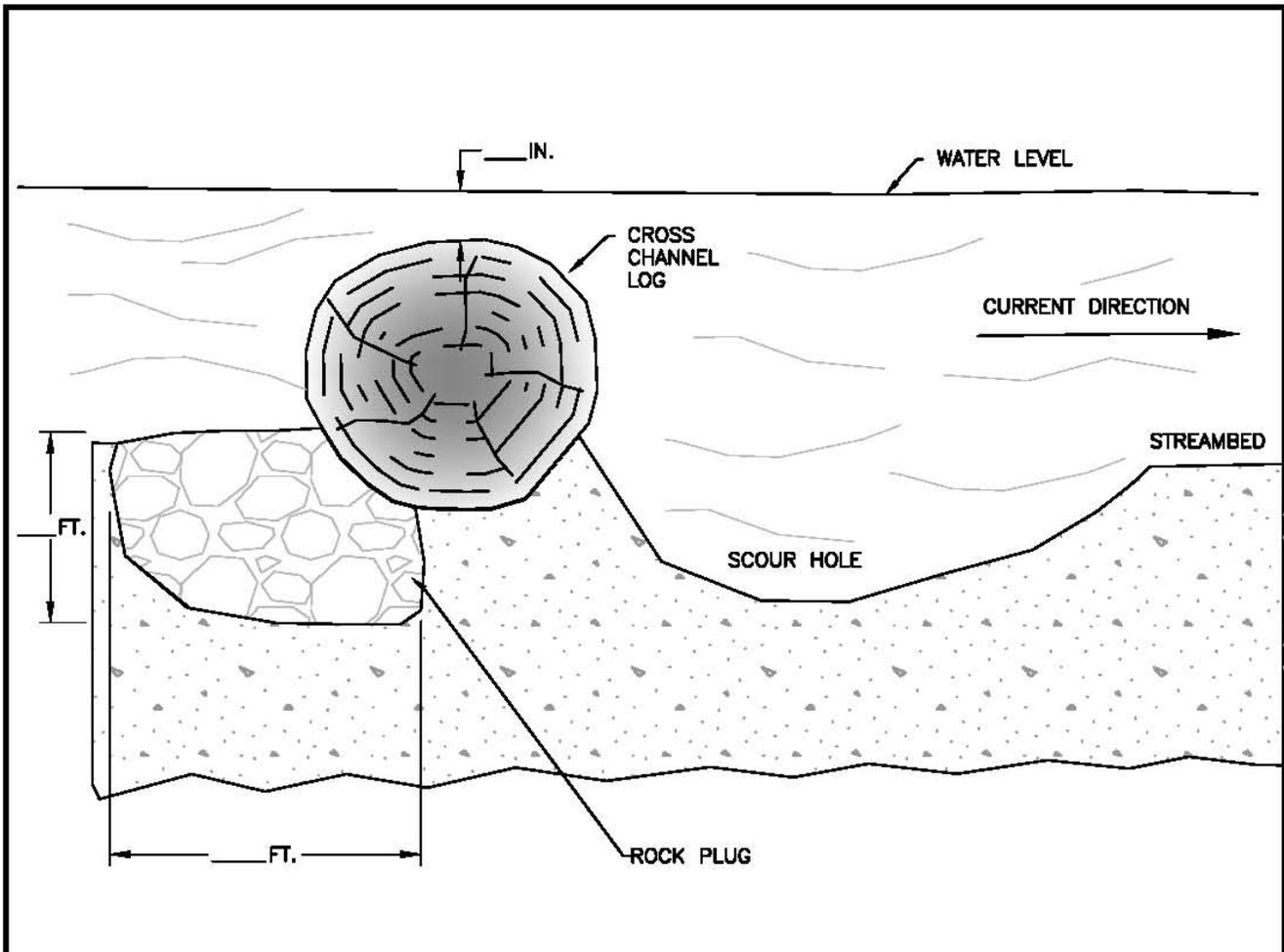


CROSS CHANNEL LOG

CLIENT: _____
 COUNTY: _____

Designed _____ Date _____
 Drawn _____
 Checked _____
 Approved _____

DWG Name/Date
 WI-935/7-10
 Page
 1 of 2
 Sheet XX of _____



SECTION A-A

NOTE: ROOT WADS, BOULDER RETARDS OR ESCAPE LOGS CAN BE ADDED TO SCOUR HOLE FOR ADDED HABITAT ENHANCEMENT

ROCK GRADATION	
PERCENT PASSING BY WEIGHT	SIZE IN INCHES
100	
60-85	
25-50	
5-20	
0-5	

QUANTITIES	
ROCK RIPRAP FOR ROCK PLUG (W.C.S.* 9)	CU. YD.

*W.C.S. = WIS. CONSTRUCTION SPECIFICATION
 *ESTIMATED TO THE NEAT LINES AND GRADE

WI-935

Vortex Weir

Purpose:

Creates and maintains scour holes which serve as habitat for fish. They also re-connect a stream's natural riffle pool sequence.

Locations:

Primarily used immediately downstream of riffle areas. They can occasionally be used in slow runs to add variances in habitat.



Species:

All fish species are benefitted from the creation of the large scour hole. With the addition of other habitat development structures like escape logs or root wads, vortex weirs can also benefit turtle and amphibian species.

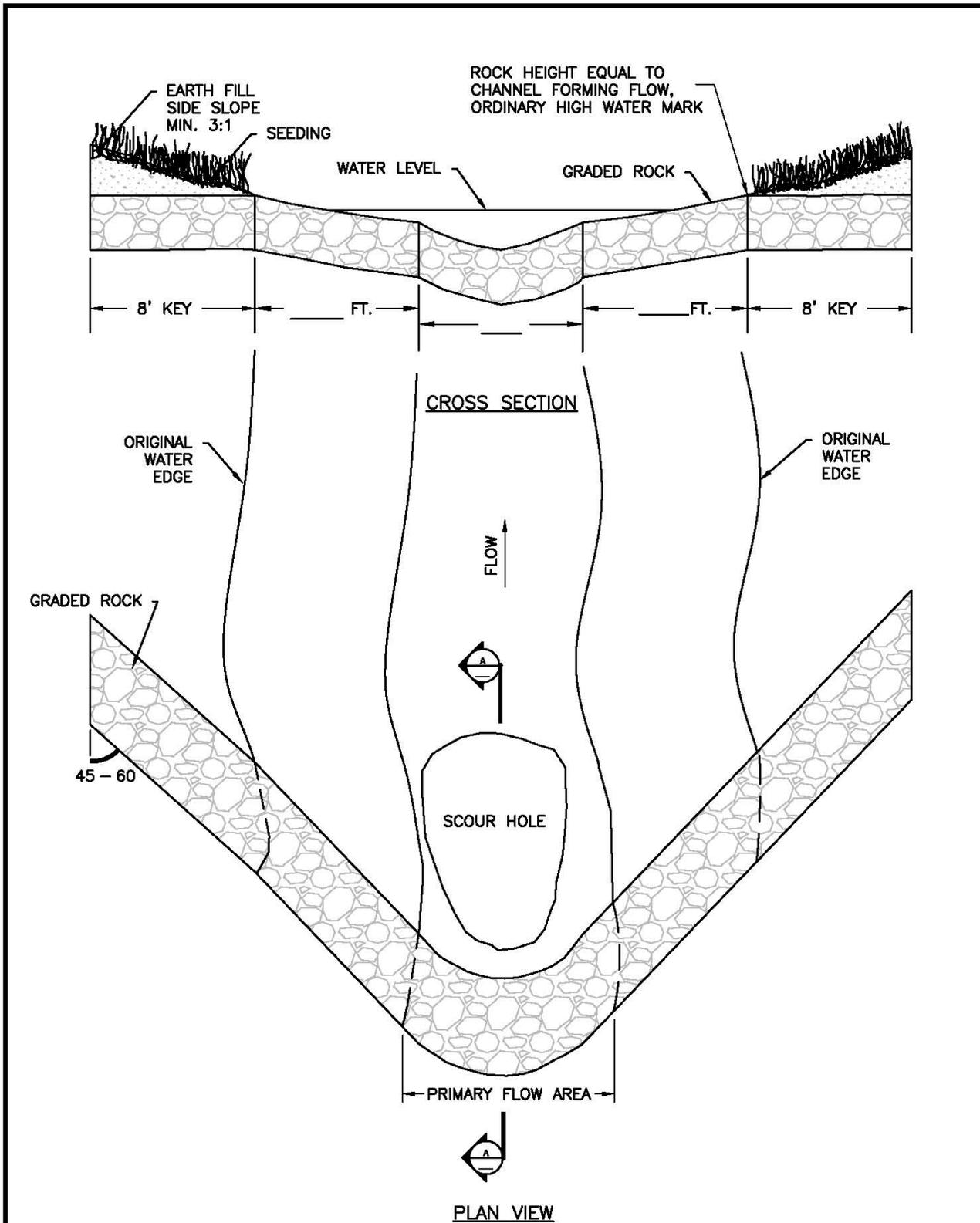
Pros

- Most effective practice for creating and maintaining scour holes
- Can easily be used with other structures like escape logs, root wads, or random boulder placements
- Potential to benefit many different species

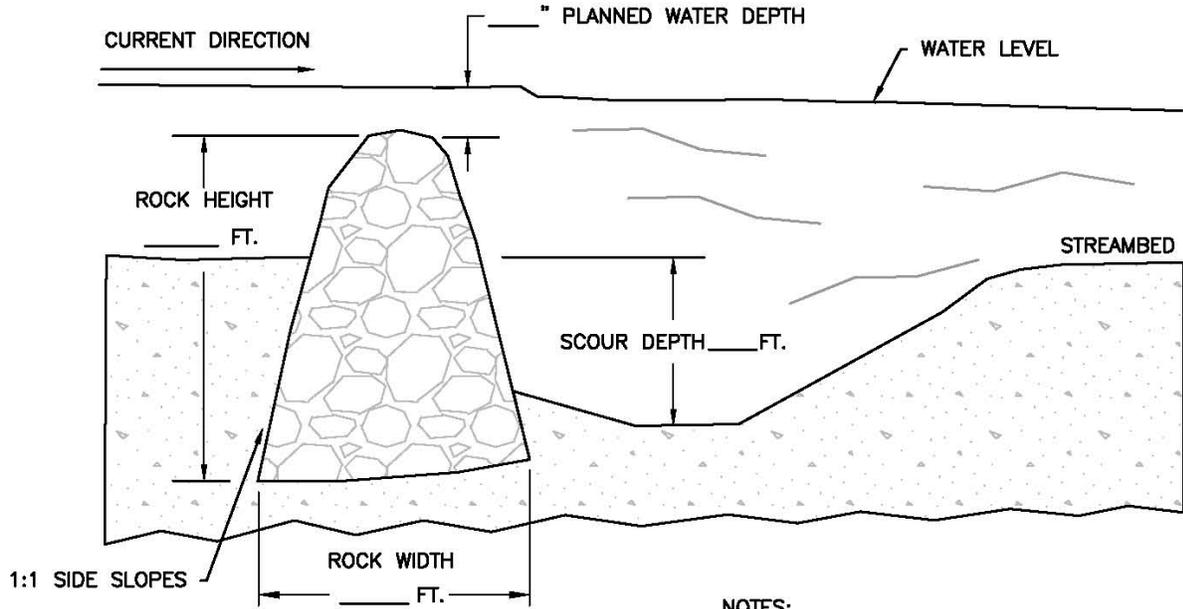
Cons

- Hauled in rock needed for proper installation – higher project costs
- Exact placement of rock needs to be precise and can require additional labor and expertise
- More difficult to install on narrow streams

See next page for Standard Drawing WI-932.



<p>NRCS Natural Resources Conservation Service United States Department of Agriculture</p>	VORTEX WEIR		Date _____ DWG Name/Date WI-932 / 7-10
	CLIENT: _____ COUNTY: _____	Designed _____ Drawn _____ Checked _____ Approved _____	Page 1 of 2 Sheet XX of ____



- NOTES:
1. ROCK DEPTH BELOW STREAMBED MUST BE GREATER THAN THE ANTICIPATED DEPTH OF THE SCOUR HOLE
 2. ROOT WADS, BOULDER RETARDS ESCAPE LOGS, ETC. CAN BE ADDED TO SCOUR HOLE FOR ADDED HABITAT ENHANCEMENT.

SECTION A-A

ROCK GRADATION	
PERCENT PASSING BY WEIGHT	SIZE IN INCHES
100	
60-85	
25-50	
5-20	
0-5	

QUANTITIES	
ROCK RIPRAP FOR VORTEX WEIR (W.C.S.* 9)	CU. YD.

*W.C.S. = WIS. CONSTRUCTION SPECIFICATION
 *ESTIMATED TO THE NEAT LINES AND GRADE

WI-832

Escape Logs

Purpose:

Provide sunning areas for snakes, turtles and amphibians.

Location:

Installed in areas with deep, slow moving water.

Species:

All water dwelling snake, turtle and amphibian species benefitted. They can also serve as bird perches and provide minor overhead cover for fish.

Caution:

Care needs to be taken in placement to ensure that currents are not deflected into stream banks.



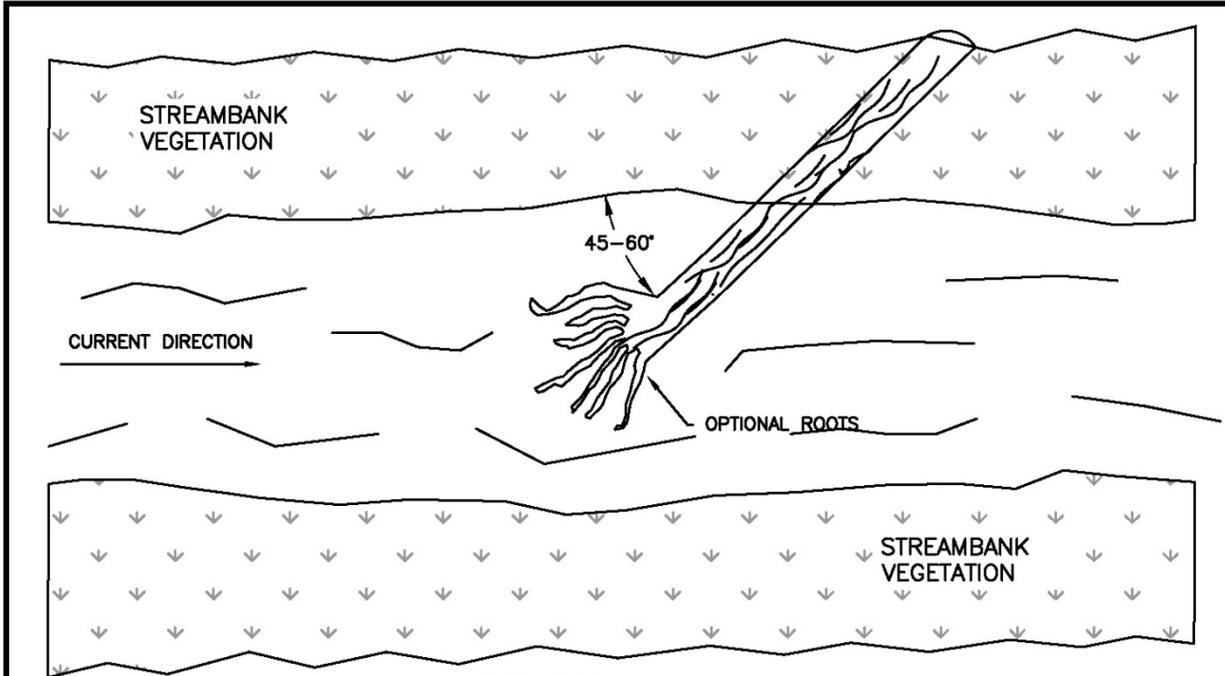
Pros

- Potential to benefit many different species
- Can use on site woody material – reduces cost

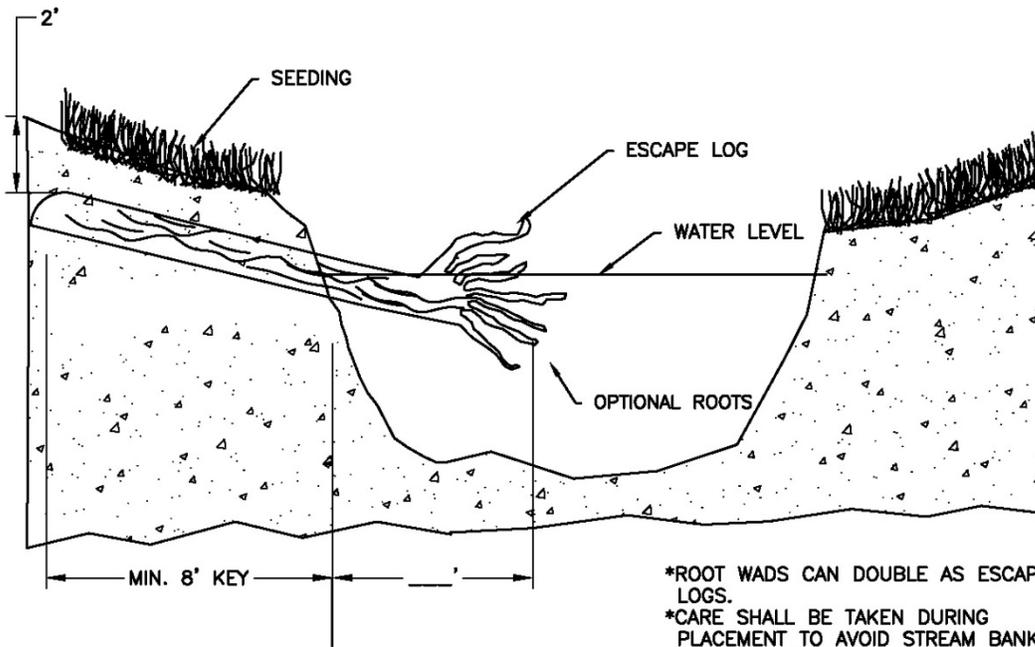
Cons

- Since logs are exposed to the atmosphere, they will not have as long of a lifetime as structures that are fully submerged

See next page for Standard Drawing WI-942.



PLAN VIEW



CROSS SECTION

- *ROOT WADS CAN DOUBLE AS ESCAPE LOGS.
- *CARE SHALL BE TAKEN DURING PLACEMENT TO AVOID STREAM BANK EROSION ON OPPOSITE BANK.
- *THE LOG SHOULD EMERGE MIN. 3'-4' FROM EDGE OF STREAM BANK.
- *ROOTS/LIMBS SHALL BE TRIMMED SO AS TO BE BELOW THE ORDINARY HIGH WATER MARK.

 Natural Resources Conservation Service United States Department of Agriculture	<u>ESCAPE LOG</u>	Date _____	Drawing Name
	CLIENT: _____	Designed _____	WI-942
	COUNTY: _____	Drawn _____	Date
		Checked _____	11/2013
	Approved _____		Sheet of _____

Log Deflectors

Purpose and Location:

Log deflectors have many functions depending on their location.

They are most commonly placed on eroding stream banks to guide the water away from the affected area. In long, wide stagnant runs they can narrow the stream and recreate some meander. In all settings given enough time, they encourage the development of a mudflat downstream of the structure.



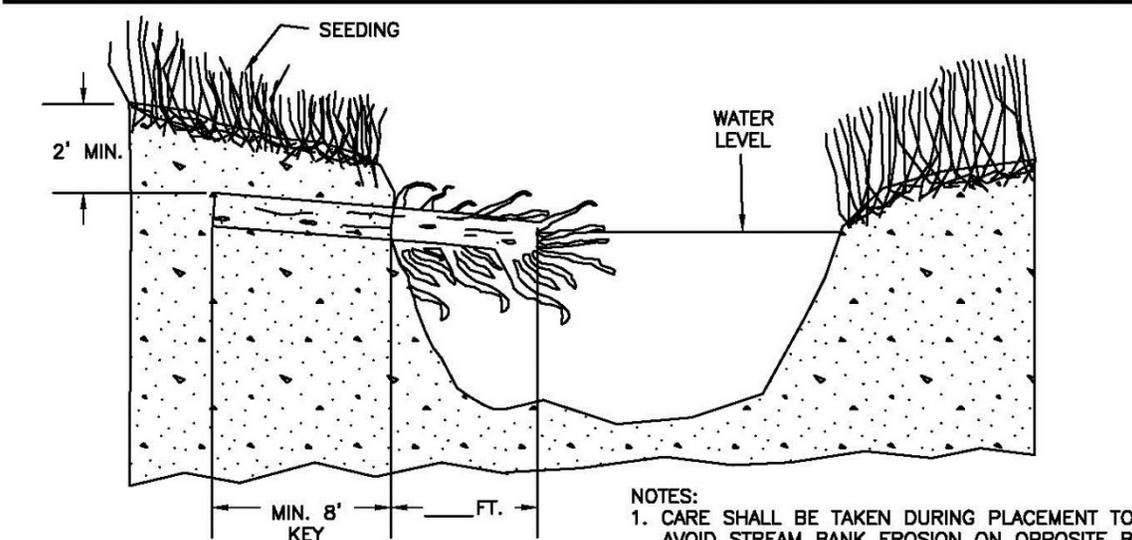
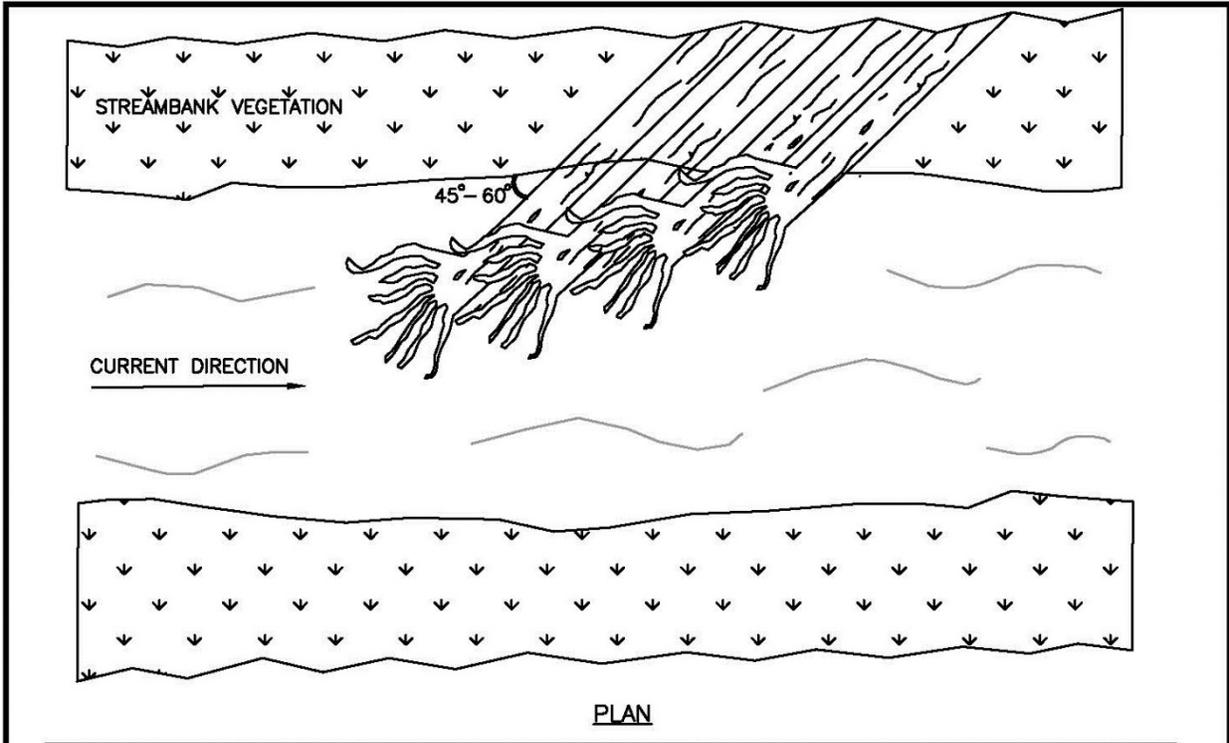
Species:

Root wads on the logs can serve as cover for reptile, amphibian, and fish species or as a perching area for birds. The mudflat that develops downstream can be utilized by amphibians and turtles as a basking area, as well as a feeding ground for shore birds.

Pros
<ul style="list-style-type: none"> • Multi-purpose • Can be used in many different areas • Potential to benefit many different species • Can use on site woody material – reduces cost

Cons
<ul style="list-style-type: none"> • More difficult to install – requires expertise from the equipment operator • Effectiveness of this technique could vary between streams and from flood event to flood event • Since portions of the logs are exposed to the atmosphere, they will not have as long of a lifetime as structures that are fully submerged

See next page for Standard Drawing WI-934.



- NOTES:
1. CARE SHALL BE TAKEN DURING PLACEMENT TO AVOID STREAM BANK EROSION ON OPPOSITE BANK.
 2. ROOT WADS MUST BE PRESENT ON EACH LOG.
 3. THE LOG DEFLECTOR SHALL CONSIST OF THREE LOGS AT A MIN 24" DBH OR FIVE LOGS OF APPROX. 16" DBH.
 4. THE MAJORITY OF THE LOG SHALL BE SUBMERGED WITH APPROX. 15% OF THE LOG EMERGED. CARE SHALL BE TAKEN TO KEEP THE LOG BELOW THE OHWM.

CROSS SECTION

 <p>Natural Resources Conservation Service United States Department of Agriculture</p>	LOG DEFLECTOR		Date _____	Drawing Name
	CLIENT: _____	Designed _____	_____	WI-934
	COUNTY: _____	Drawn _____	_____	Date
		Checked _____	_____	11/13
	Approved _____	_____	_____	Sheet of _____

Rock Deflectors

Purpose and Location:

Rock deflectors have many functions depending on their location.

They are most commonly placed on eroding stream banks to guide the water away from the affected area. In long, wide stagnant runs they can narrow the stream and recreate some meander. In all settings with time, they encourage the development of a mudflat downstream of the structure. They are also used often to redirect current into another habitat structure, such as a set of lunger structures.



Species:

The mudflat that develops downstream can be utilized by amphibians and turtles as a basking area, as well as a feeding ground for shore birds.

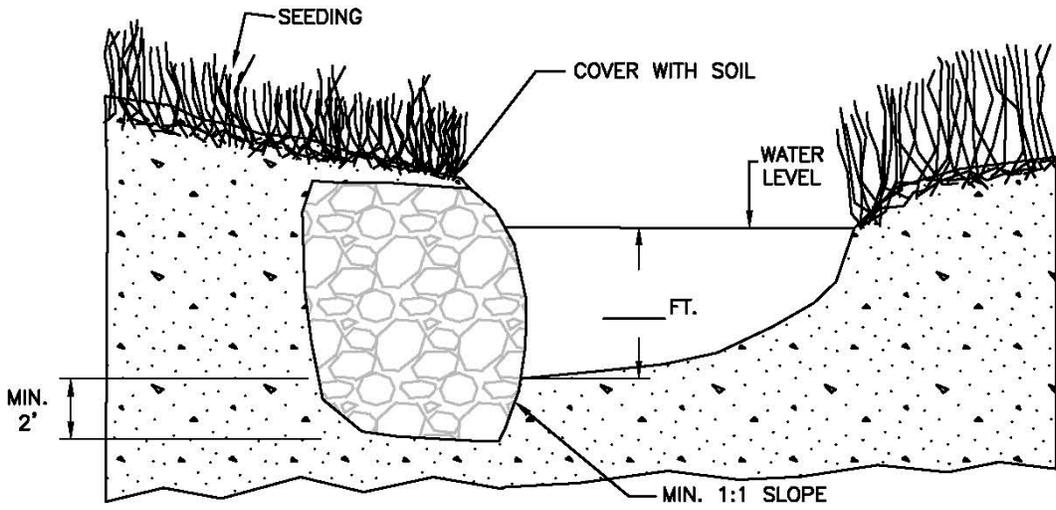
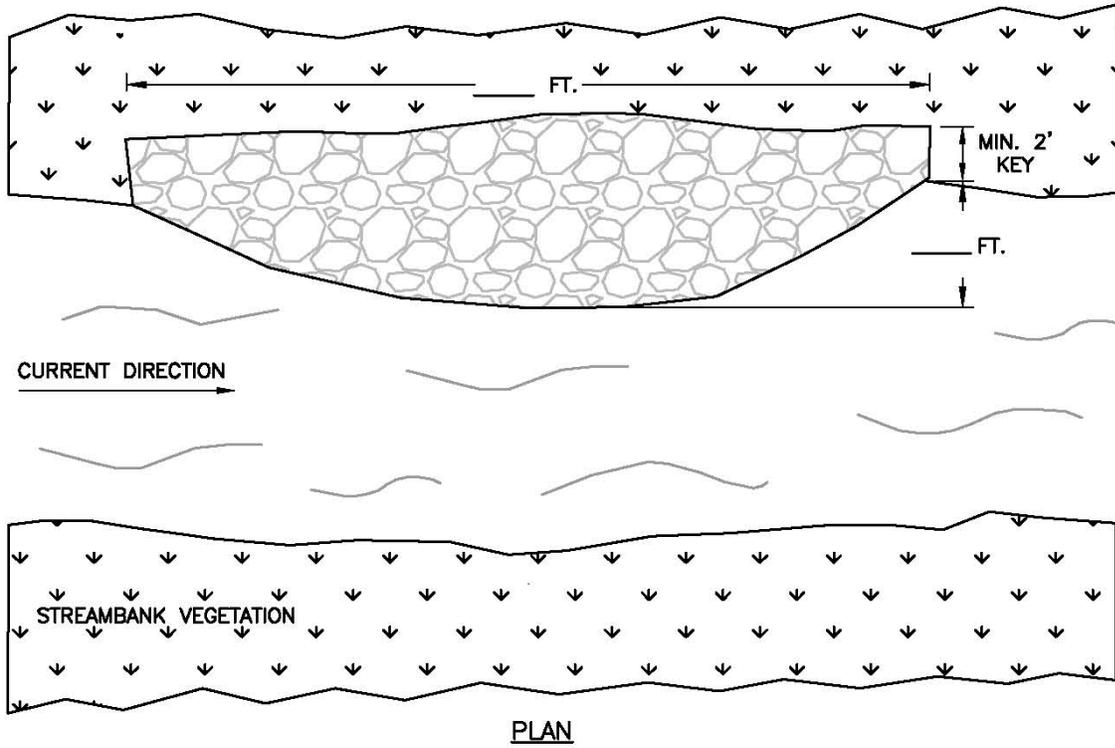
Pros

- Multi-purpose
- Immediate, permanent solution to erosion problems
- Can be used in many different areas
- Potential to benefit many different species
- Natural in appearance after establishment of vegetation

Cons

- More difficult to install – requires expertise from the equipment operator
- More expensive since they can require large quantities of rock
- Improper placement can cause serious erosion to banks on opposite side of the stream

See next page for Standard Drawing WI-933.



CROSS SECTION

NOTE: CARE SHALL BE TAKEN DURING PLACEMENT TO AVOID STREAMBANK EROSION ON OPPOSITE BANK.

ROCK GRADATION	
PERCENT PASSING BY WEIGHT	SIZE IN INCHES
100	
60-85	
25-50	
5-20	
0-5	

QUANTITIES	
ROCK RIPRAP FOR ROCK DEF. (W.C.S.* 9)	CU. YD.

*W.C.S. = WIS. CONSTRUCTION SPECIFICATION
 *ESTIMATED TO THE NEAT LINES AND GRADE



ROCK DEFLECTOR

CLIENT: _____
 COUNTY: _____

Date _____
 Designed _____
 Drawn _____
 Checked _____
 Approved _____

Drawing Name
 WI-933
 Date
 7/10
 Sheet XX of ____

Root Wads

Purpose:

Provide additional micro-habitat and cover for several species. They can also serve as escape logs and sunning areas.

Location:

Placed in deep scour holes, and often used in conjunction with other structures like vortex weirs or cross channel logs.



Species:

Provides overhead cover and micro-habitat for fish, amphibians, and reptiles.

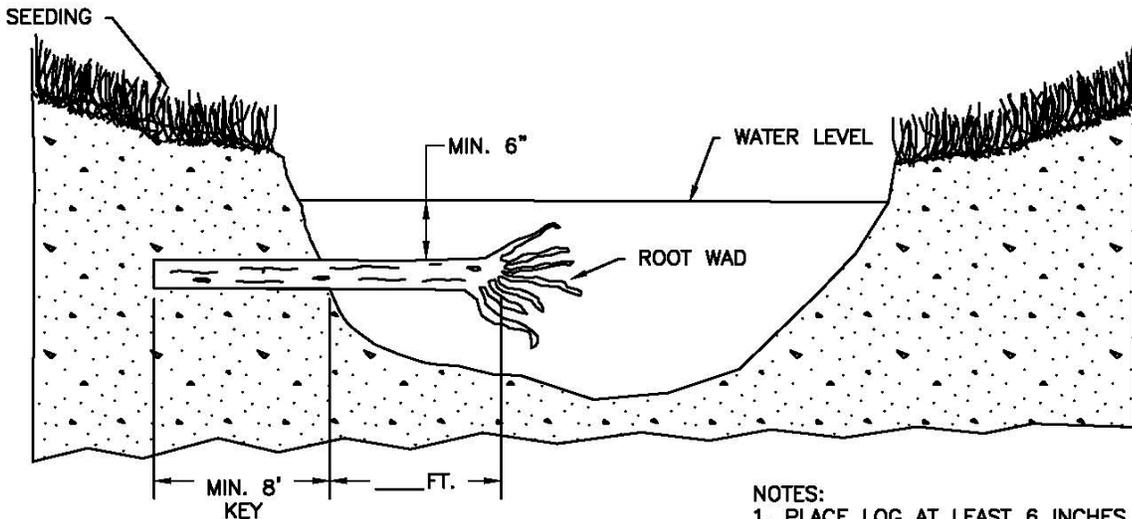
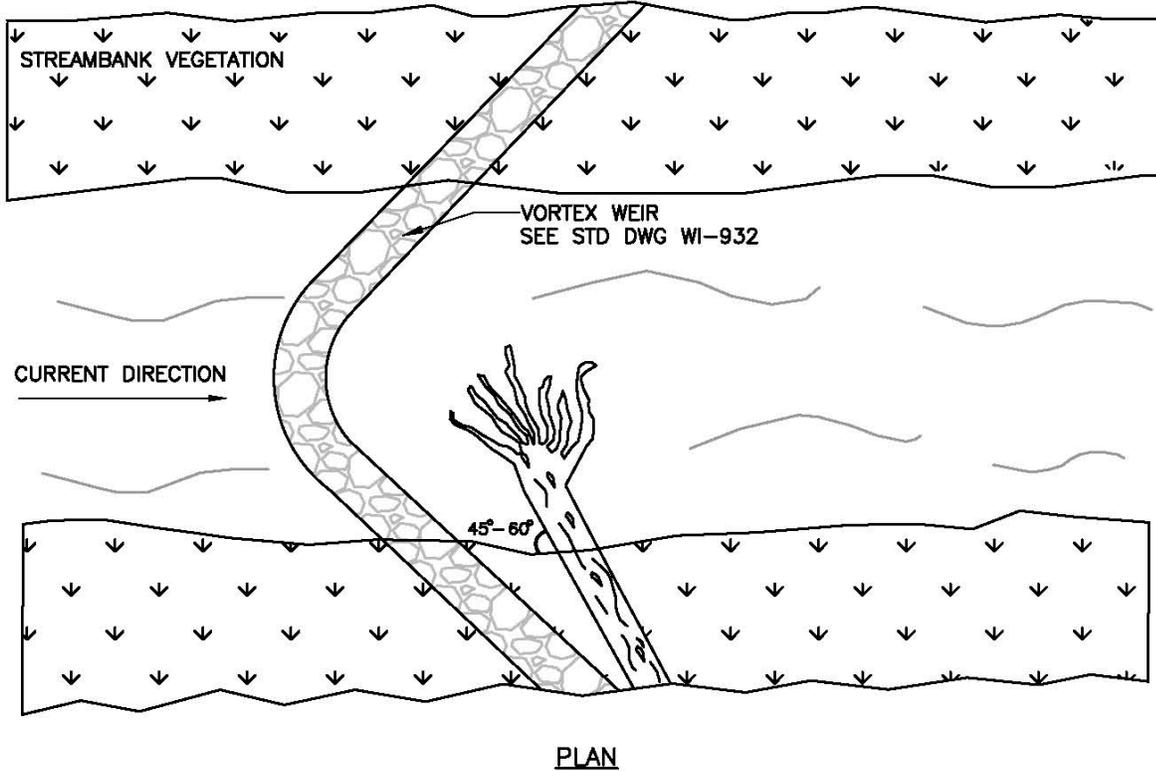
Pros

- Can be used in along with other habitat structures
- Potential to benefit many different species
- Can use on site woody material – reduces cost

Cons

- If improving public recreation (fishing) is the purpose of the project, a root wad decreases the fishability of the scour hole

See next page for Standard Drawing WI-936.



- NOTES:
1. PLACE LOG AT LEAST 6 INCHES BELOW THE WATERLINE.
 2. PLACE LOG AT A 45-60 DEGREE ANGLE UPSTREAM FROM BANK.
 3. REFERENCE WI STD DWG 932 FOR DETAILS ON VORTEX WEIR CONSTRUCTION.



ROOT WAD

CLIENT: _____

COUNTY: _____

Designed _____	Date _____
Drawn _____	
Checked _____	
Approved _____	

Drawing Name WI-936
Date 7/10
Sheet XX of ____

Snake Hibernaculum

Purpose:

Provides a unique habitat for snake species that require a high humidity or saturated over-wintering area with temperatures above freezing.

Location:

Placed outside of the primary floodplain in an area that will provide 2'-3' of ordinary summer water table at the bottom of the trench with a minimum of 5' of soil cover from the top of the ordinary summer water table to the soil surface to provide necessary temperature buffering. The entrance should be placed with a southerly or westerly exposure. Also, if site conditions allow, a snake hibernaculum could be incorporated in the beginning or end section of Rip-Rap. Only one hibernaculum needed per roughly 1-2 mile segment of stream.



Species:

Snake species such as Milk, Garter and Western Fox snakes with the unique over-wintering needs mentioned above.

Caution:

Proper trench safety construction protocol should always be followed.

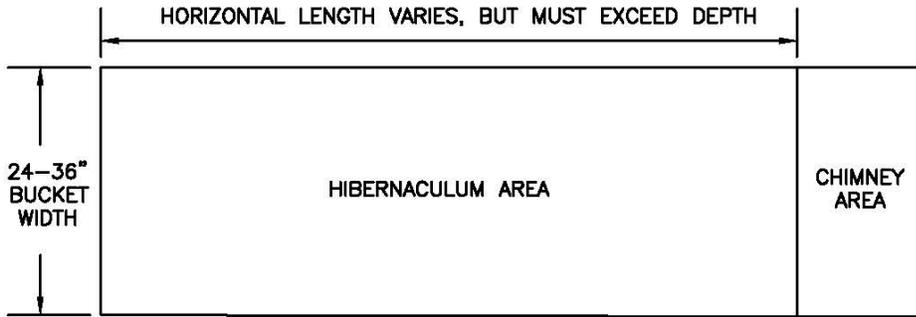
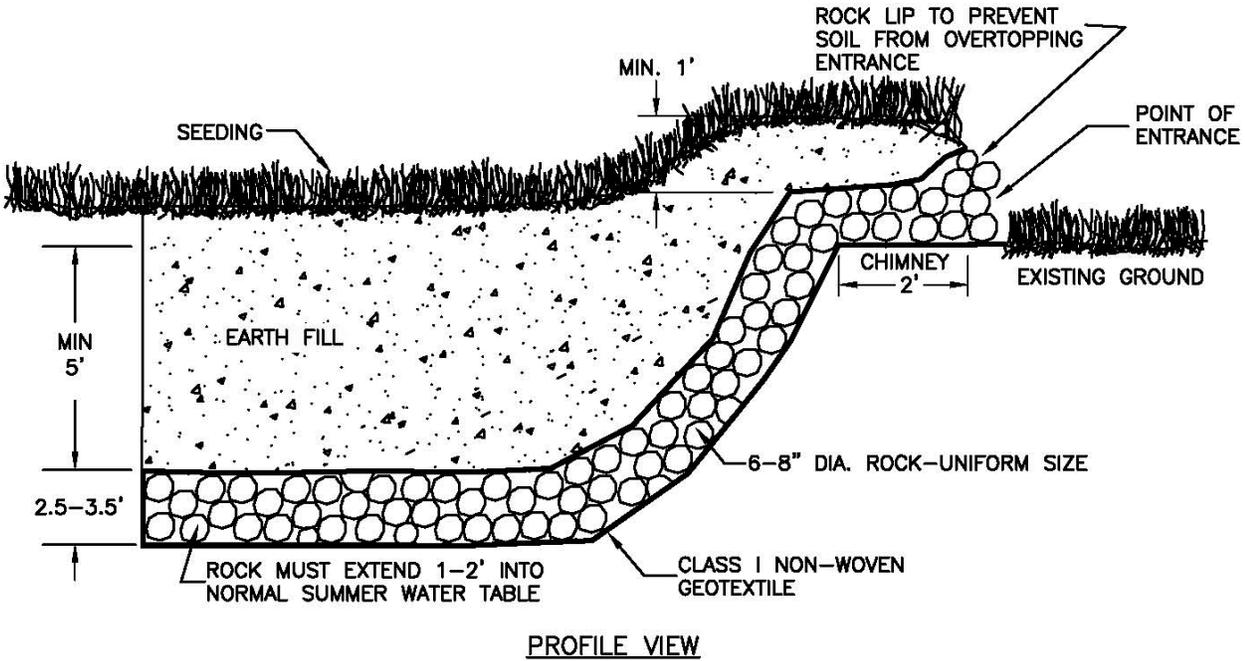
Pros

- Provides a unique habitat for snake species that would not normally be accommodated

Cons

- Requires a large amount of rock – increased project cost

See next page for Standard Drawing WI-941.



PLAN VIEW

NOTES:

1. STRUCTURE PROVIDES SNAKE OVER-WINTERING HABITAT.
2. HIBERNACULUM SHOULD BE PLACED OUT OF THE PRIMARY FLOODPLAIN WITH A SOUTHERN OR WESTERN EXPOSURE FOR THE POINT OF ENTRANCE.
3. A MINIMUM OF 5 FEET OF EARTH FILL SHALL COVER THE ROCK. THIS ACTS AS A BUFFER TO MAINTAIN A HIBERNACULUM TEMPERATURE OF AT LEAST 51 DEGREES FAHRENHEIT.
4. A SOIL BERM MAY BE REQUIRED TO ISOLATE THE HIBERNACULUM FROM THE RIVER BANK. THIS IS TO BE FLAGGED BY THE TECHNICIAN IN THE FIELD.
5. ONE BACKHOE BUCKET OF SOIL SHALL BE SPRINKLED ON TOP OF PLACED ROCK BEFORE COVERING WITH GEOTEXTILE AND EARTHFILL.

QUANTITIES	
ROCK RIPRAP (W.C.S.* 9)	CU. YD.
GEOTEXTILE--CLASS I NON-WOVEN (W.C.S. 13)	SQ. YD.

*W.C.S. = WIS. CONSTRUCTION SPECIFICATION
*ESTIMATED TO THE NEAT LINES AND GRADE



Snake HIBERNACULUM

CLIENT: _____
COUNTY: _____

Designed _____ Date _____
Drawn _____
Checked _____
Approved _____

Drawing Name
WI-941
Date
7/10
Sheet XX of --

Turtle Hibernaculum

Purpose:

When stream bank stabilization practices occur such as shaping and rip-rapping, turtle habitat is destroyed. Installing these lunkers provides an alternative habitat location for snapping turtles to over-winter.

Location:

These lunkers should be installed within a reasonable distance from bank stabilization projects and should be positioned in the shadow of the current. Best results are achieved if the lunker is installed adjacent to a structure that deflects flow (such as a rock deflector) and creates a back eddy to promote sedimentation.

Species:

The snapping turtle will be the primary species of benefit since they over-winter in tall eroding stream corners.

Special Notes:

- The hibernaculum should have no rock behind them
- A dredged hole should be dug in front of the lunker to serve as a sediment trap to catch fine sediments – this is where the turtles will burrow down to over-winter
- Care needs to be taken to ensure that no stream current will prevent sedimentation from occurring

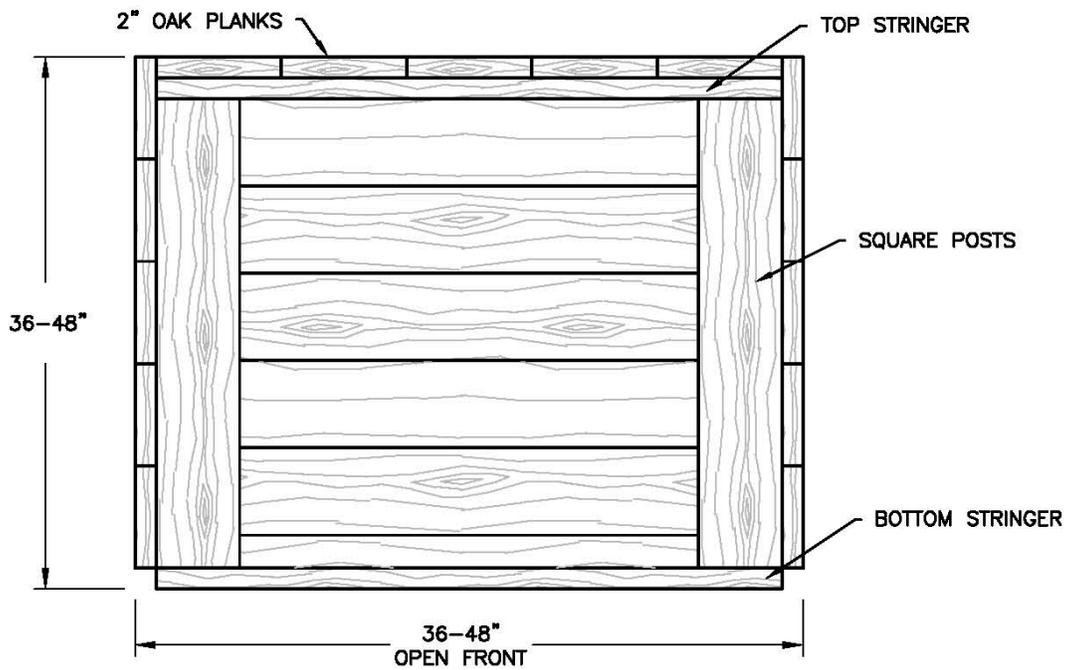
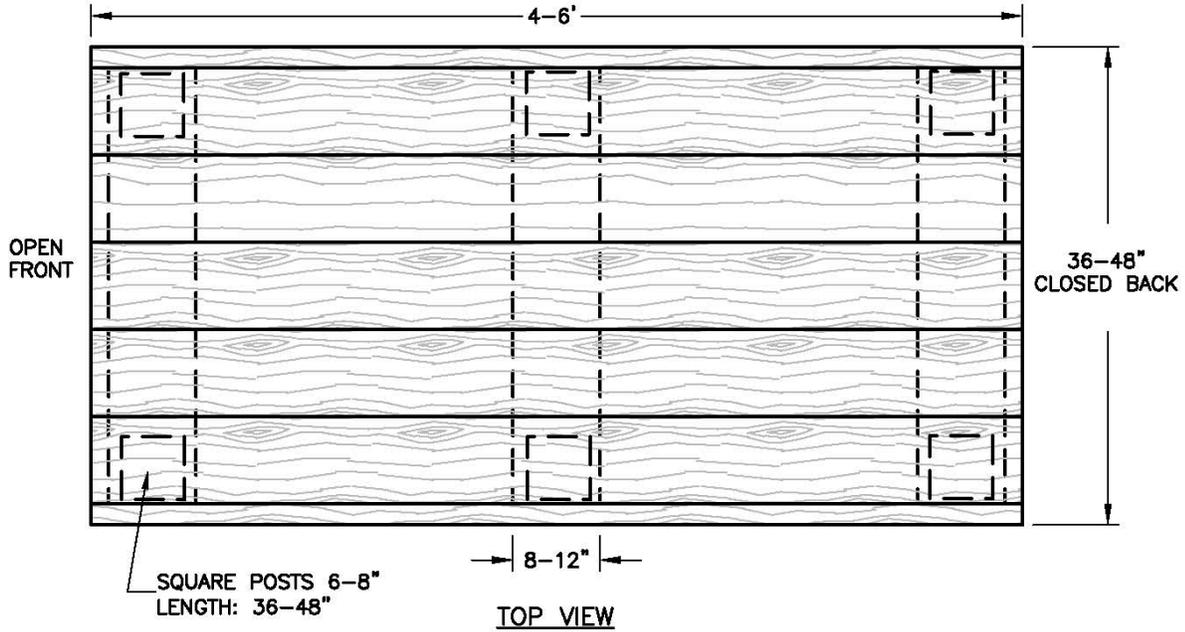
Pros

- Provides a unique over-wintering habitat for snapping turtles
- Contractors familiar with stream habitat restoration should be able to complete these project fairly easily

Cons

- This is a new practice, therefore there is no research to confirm the effectiveness of the technique

See next page for Standard Drawing WI-940.



- NOTES:**
1. STRUCTURES ARE BUILT USING OAK PLANKS 2" THICK BY 8-12" WIDE.
 2. STRUCTURES ARE NAILED TOGETHER WITH 20D RING SHANK NAILS.

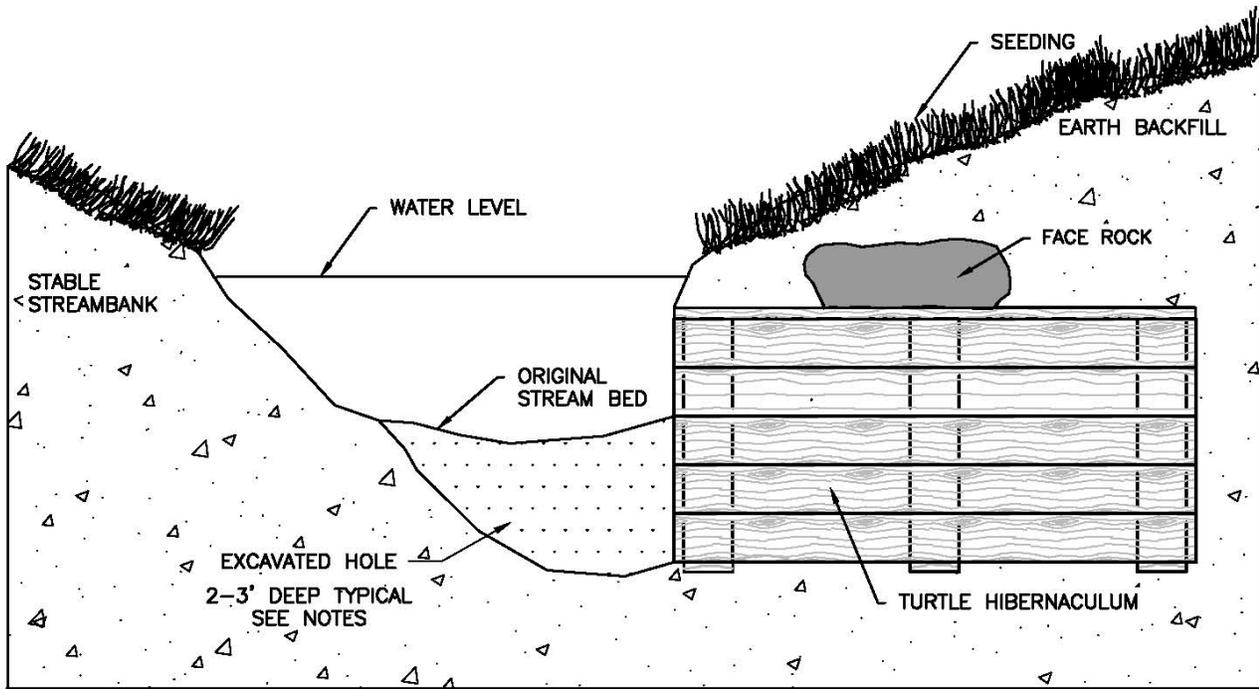
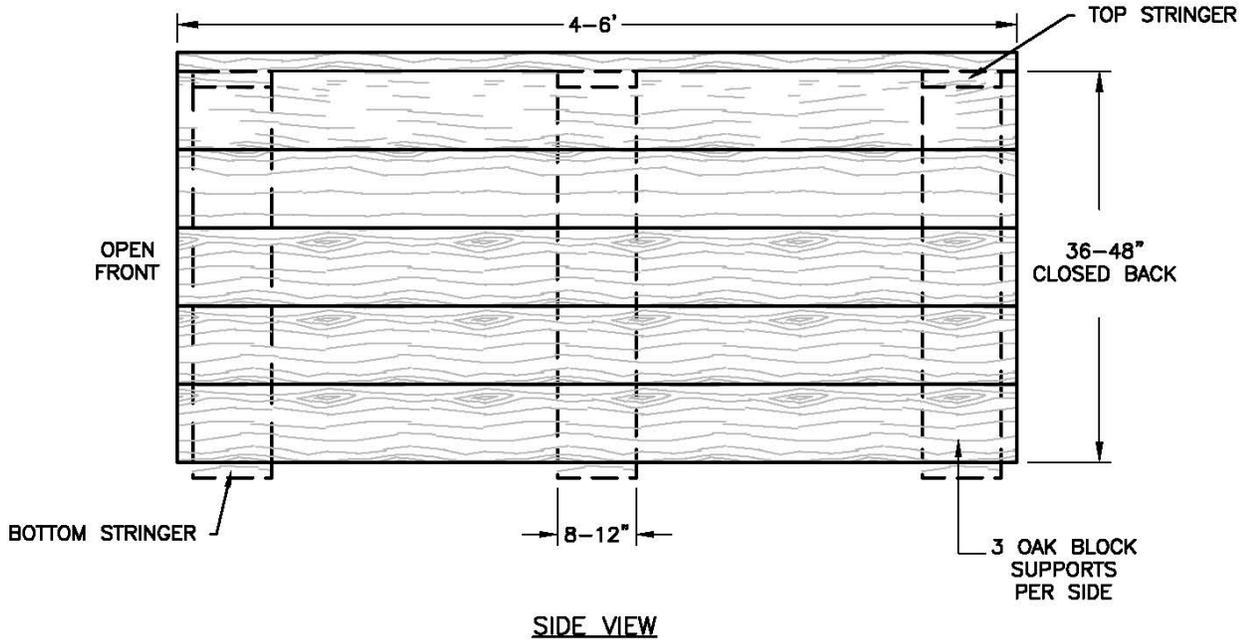


TURTLE HIBERNACULUM

CLIENT: _____
COUNTY: _____

Designed _____ Date _____
Drawn _____
Checked _____
Approved _____

DWG Name/Date
WI-940/ 7/10
Page
1 of 3
Sheet of _____

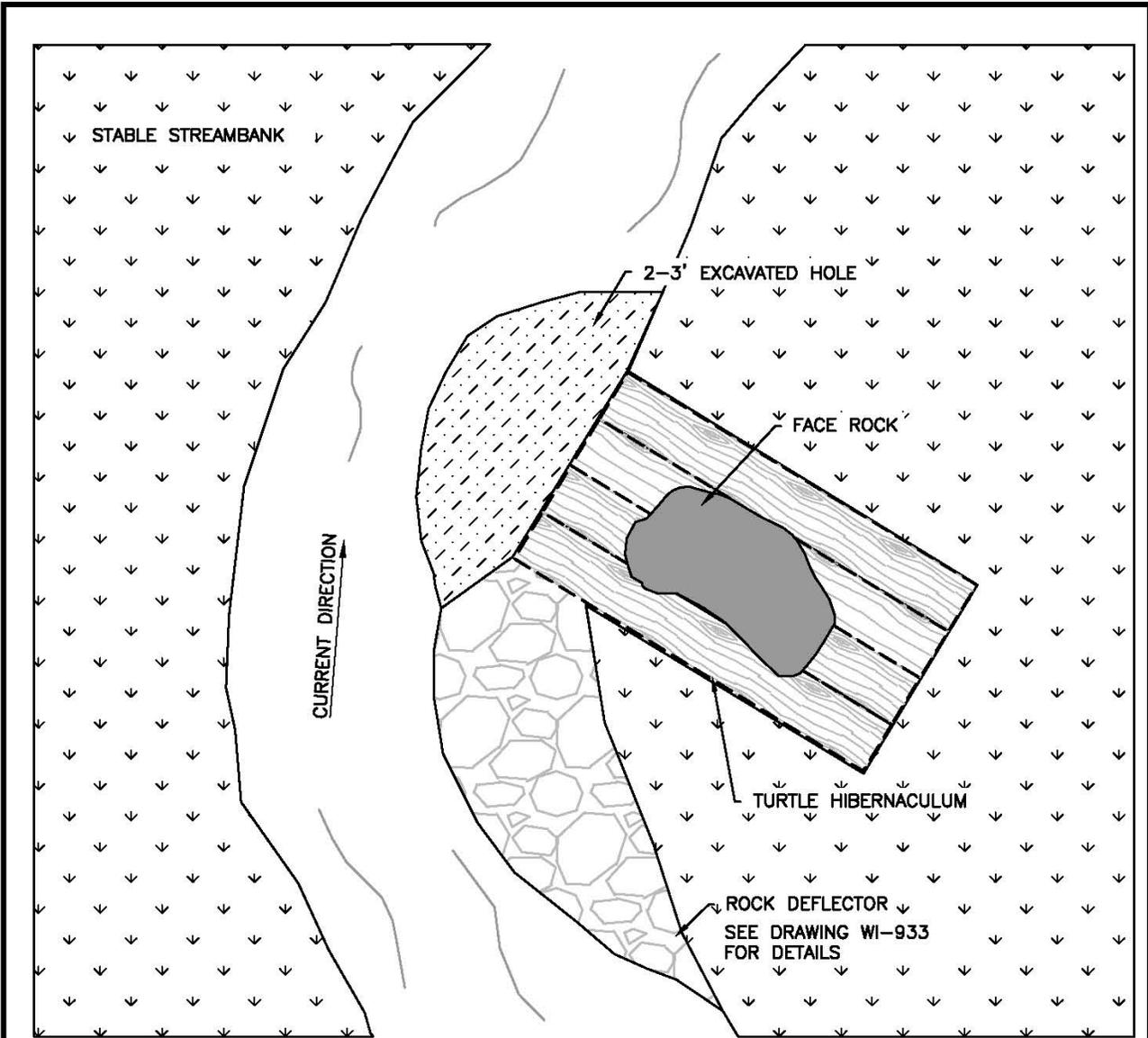


CONSTRUCTED SIDE VIEW

NOTES:

1. THE STRUCTURE MUST BE FULLY SUBMERGED TO PREVENT THE LUMBER FROM ROTTING. DEPTH OF EXCAVATED HOLE MAY BE INCREASED TO ENSURE FULL SUBMERSION.
2. THE BOTTOM OF THE HIBERNACULUM SHOULD BE A MINIMUM OF 2 FEET BELOW THE EXISTING STREAM BED TO HELP ACCUMULATE A DEPTH OF AT LEAST 2 FEET OF FINE SEDIMENTS WITHIN THE STRUCTURE.
3. A ROCK DEFLECTOR WILL BE INSTALLED TO FURTHER ENCOURAGE SEDIMENT ACCUMULATION. SEE PAGE 3 FOR DETAILS.
4. TURTLE HIBERNACULUM SHOULD SET INTO THE BANK 4-6 FEET.

WI-840



PLAN VIEW

NOTE: THE HIBERNACULUM SHOULD BE PLACED DIRECTLY BEHIND A STRUCTURE WHICH DEFLECTS THE FLOW OF THE STREAM AND CREATES A BACK EDDY, CAUSING SEDIMENT ACCUMULATION. THIS BACK EDDY WILL BE ACCENTUATED BY THE EXCAVATED HOLE IN FRONT OF THE HIBERNACULUM. THE FILLING OF FINE SEDIMENT MAKES IT SUITABLE HABITAT FOR TURTLES TO BURROW INTO.

QUANTITIES	
2" OAK PLANK-8" WIDTH, 4-6' LENGTH (15-18/UNIT)	EACH
6-8" SQUARE POSTS, 36-48" LENGTH (6/UNIT)	EACH
2" OAK PLANK-8" WIDTH, 36-48" LENGTH (6/UNIT)	EACH
2" OAK PLANK-8" WIDTH, 36-48" LENGTH (5-6/UNIT)	EACH
20D RING SHANK NAILS	AS NEEDED

*ESTIMATED TO THE NEAT LINES AND GRADE

WI-840

Trout Lunker & Mini-Trout Lunker

Purpose:

To provide a unique habitat for trout.

Location:

Primarily placed on eroding stream corners while stream bank stabilization techniques such as shaping and rip-rap are being performed, but can be placed in any location where stream flow will pass through the lunker keeping them clean of sediment deposition.

Species:

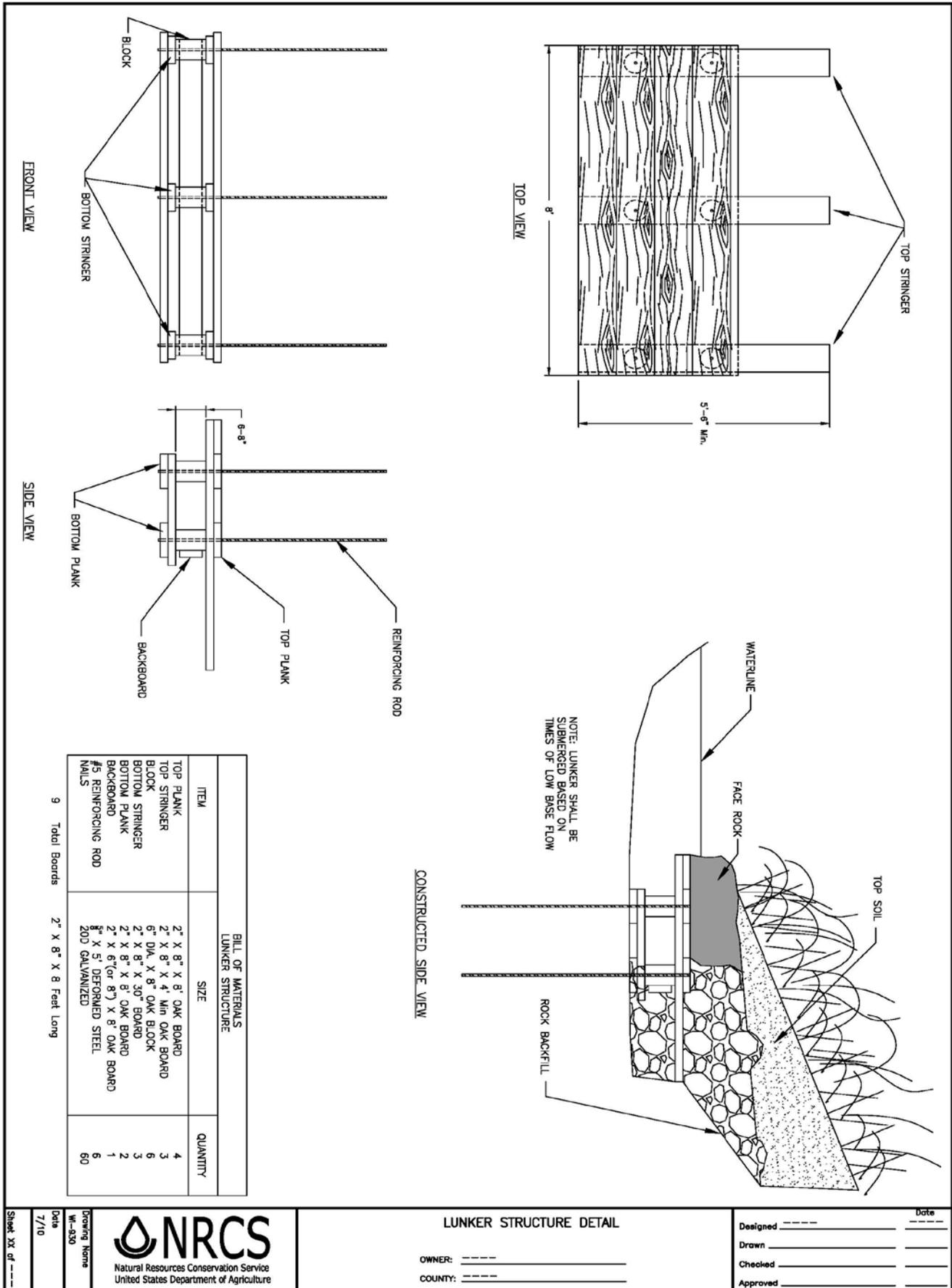
Primarily Brown Trout, but will also be utilized by Brook Trout.



Pros
<ul style="list-style-type: none">• Very effective habitat development technique – they have proven to increase the holding capacity for trout in a proper stream

Cons
<ul style="list-style-type: none">• Favors Brown Trout over other fish species• Relatively expensive to install

See next pages for Standard Drawings WI-930 and WI-930A.

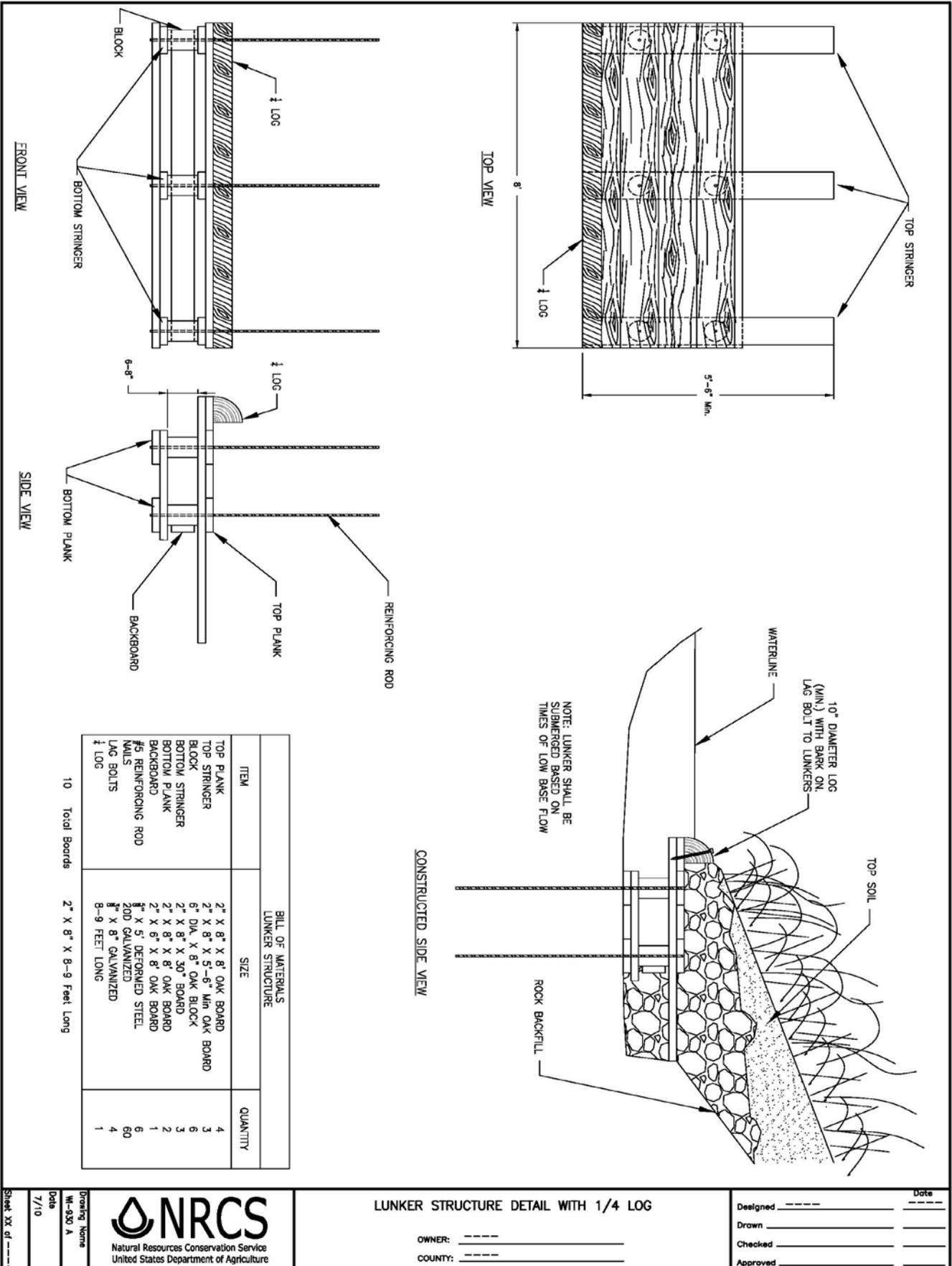


LUNKER STRUCTURE DETAIL

OWNER: _____
 COUNTY: _____

Designed _____ Date _____
 Drawn _____
 Checked _____
 Approved _____

Drawing Name
 WI-930
 Date
 7/10
 Sheet XX of ____



LUNKER STRUCTURE DETAIL WITH 1/4 LOG

OWNER: _____
 COUNTY: _____

Designed _____ Date _____
 Drawn _____
 Checked _____
 Approved _____



Drawing Name: WI-430 A
 Date: 7/10

Sheet XX of _____

Brush Bundle

Purpose:

Induces sedimentation to allow the stream to constrict itself naturally. Adds woody material to the stream which serves as cover for many species.

Location:

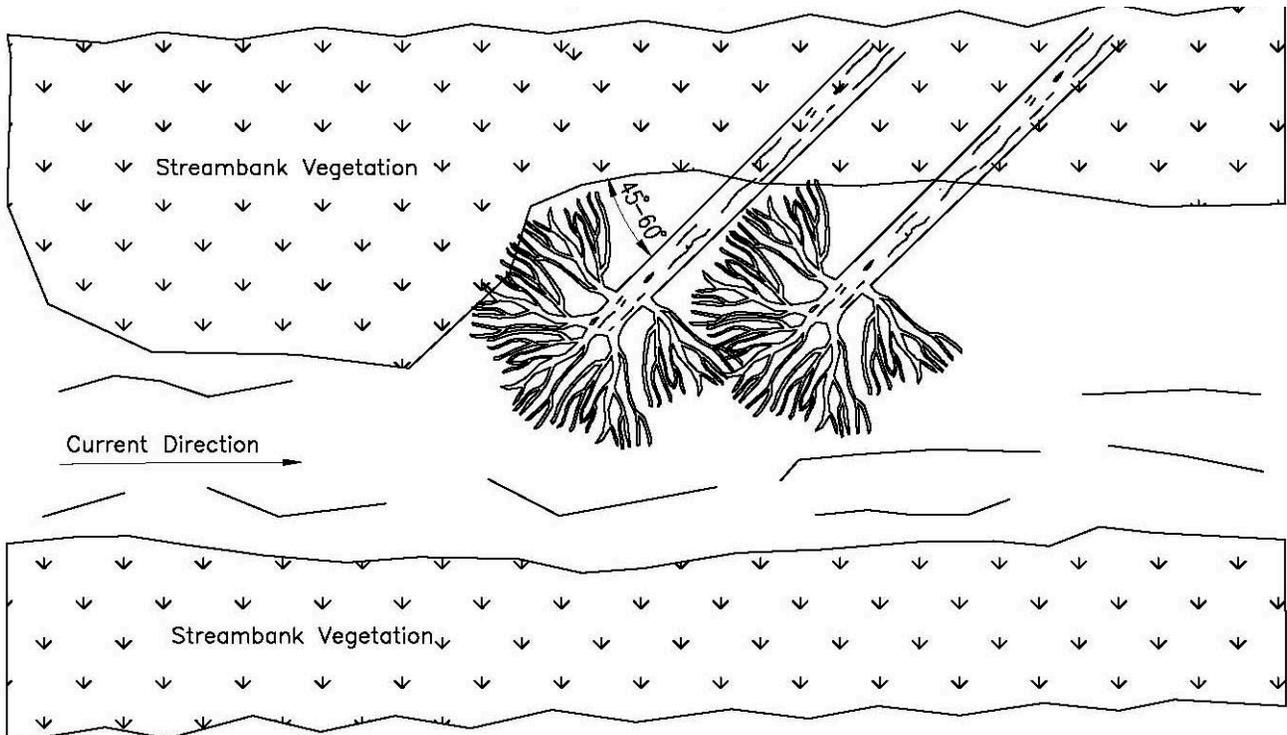
In sections of stream in the shadow of the current, such as behind point bars or deflector structures.

Species:

Benefits reptile and amphibian species by adding cover.

Pros
<ul style="list-style-type: none">• Can use on-site woody material – reduced cost• Relatively easy to install• Potential to benefit several species

Cons
<ul style="list-style-type: none">• There have not been enough of these structures installed to determine the overall effectiveness – it is possible that there would be a minimal effect on sedimentation.



Other Resources

Glossary of Wisconsin Trout Habitat Development Techniques by Robert L. Hunt, illustrations by Ruth King, has been published by the Wisconsin Department of Natural Resources, 1987.

Unit Construction Of Trout Habitat Improvement Structures For Wisconsin Coulee Streams by David M. Vetrano, Administrative Report No. 27, 1988.

Driftless Riparian Habitat Guide prepared by Jeff Hastings with Trout Unlimited. Report No. 060109, 2009.