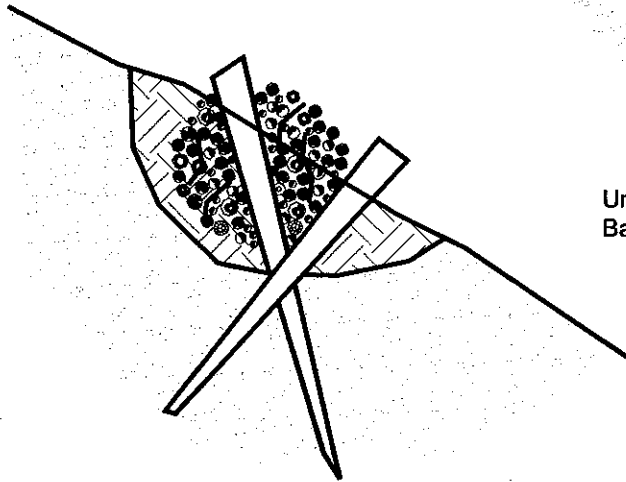
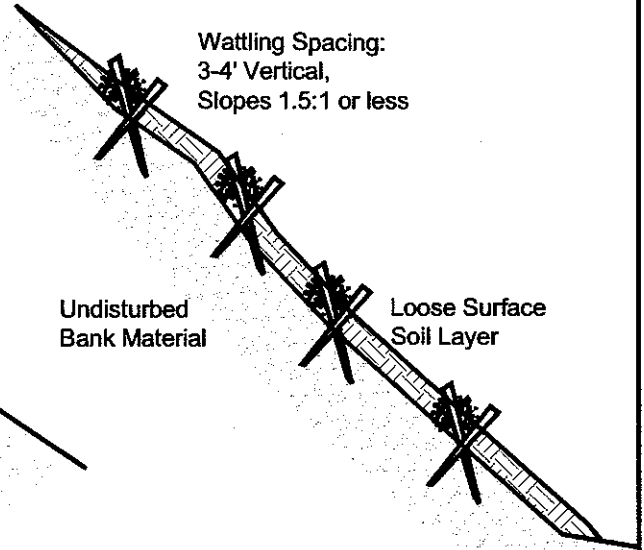


# Willow Wattling Bank Revegetation

Cross Section  
Installation  
Detail



Bank Installation

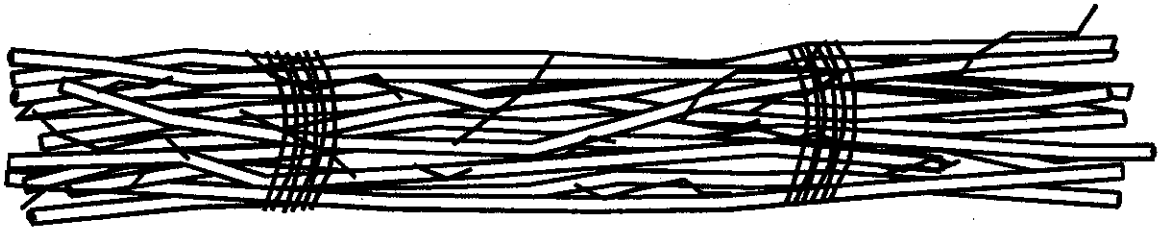


Wattling Spacing:  
3-4' Vertical,  
Slopes 1.5:1 or less


Undisturbed  
Bank Material

Loose Surface  
Soil Layer

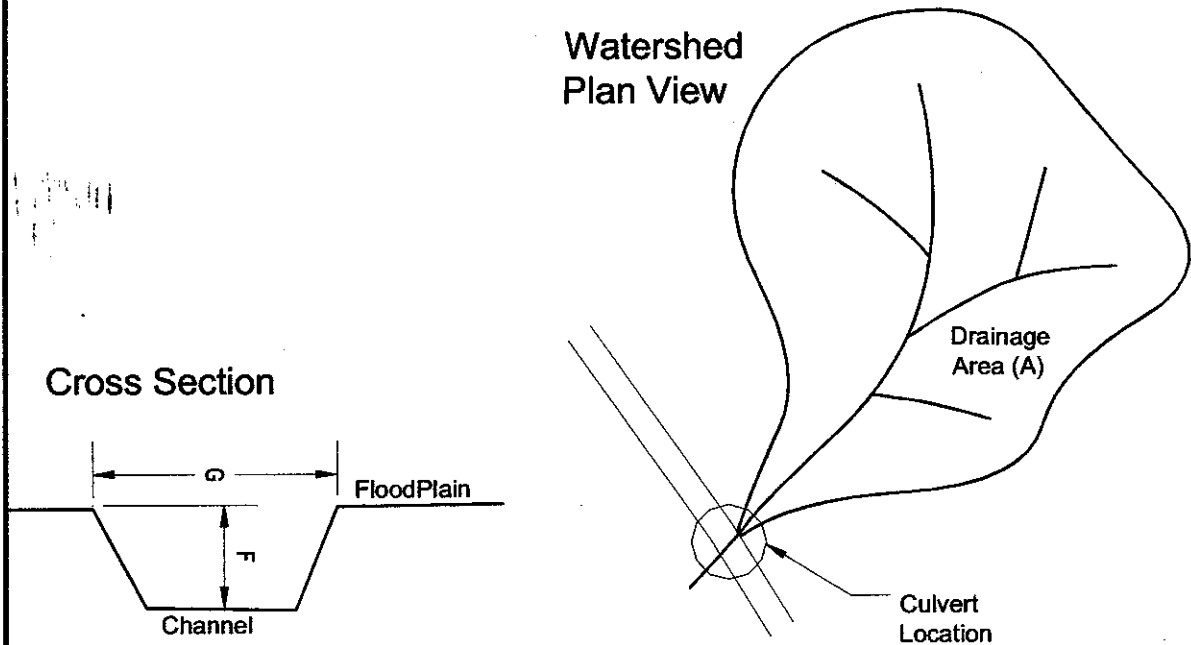
Willow Wattle Detail



Stems 1/2" to 1 1/2" Diameter 12-18 per a Bundle  
3-8 ft Long, 50% Dead Brush can be used

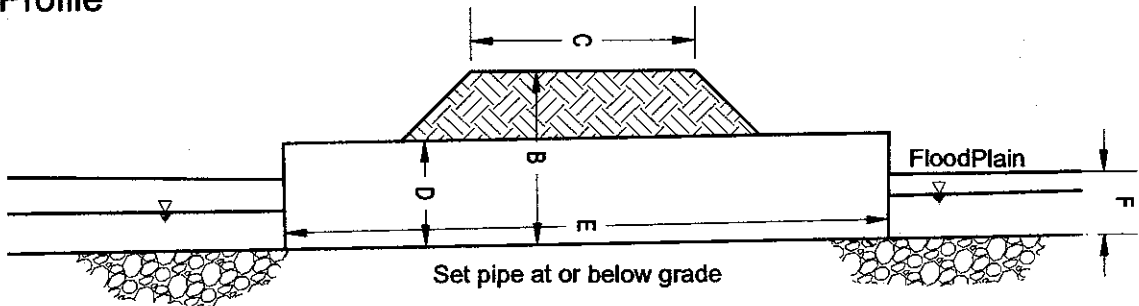
 <b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 8254 Missoula, MT 59807	PERMIT NO.:	DATE:	LOCATION:	PROJECT NAME:
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	CD Manual
	DRAWN BY: MW	CHECKED:	FIGURE:	DRAWING TITLE:
				Willow Wattle Bank Reveg

# Culvert Sheet



Drainage Area	A= _____	Culvert Length (C+(3.B))	E= _____
Precipitation (in)	ppt= _____	Channel Depth	F= _____
Design 25 yr. 100 yr. Flood	Q= _____	Channel Width	G= _____
Fill Height (ft) (Channel Bottom to Road)	B= _____	Culvert Type (Round, Arch, Box, _____)	
Road Width (ft)	C= _____	Culvert Diameter (in)	D= _____

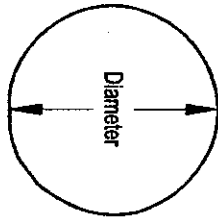
## Profile



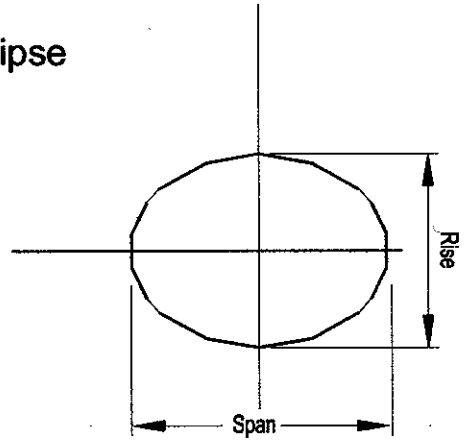
<p>LAND &amp; WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807</p>	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	PROJECT MANAGER:	<b>NOT TO SCALE</b>	FILENAME:	DRAWING TITLE: <b>Willow Wattle Bank Reveg</b>
	DRAWN BY: <b>MW</b>	CHECKED:	FIGURE:	

# Steel Culvert Shapes

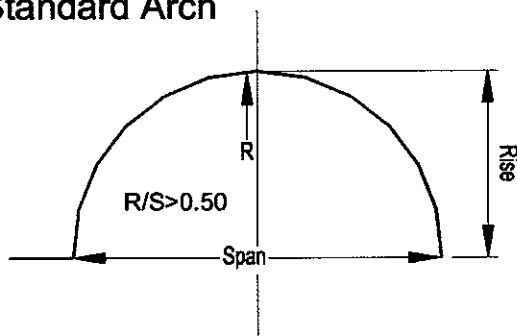
Round



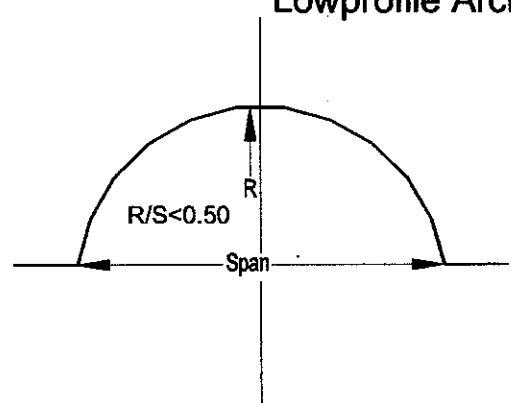
Ellipse



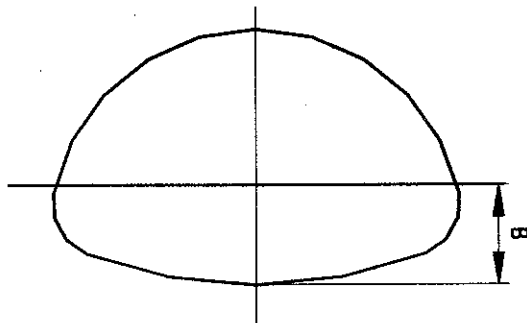
Standard Arch



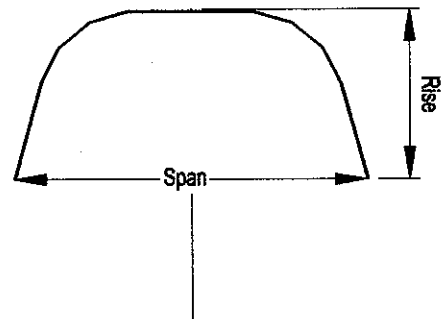
Lowprofile Arch




Pipe-Arch or Squashed

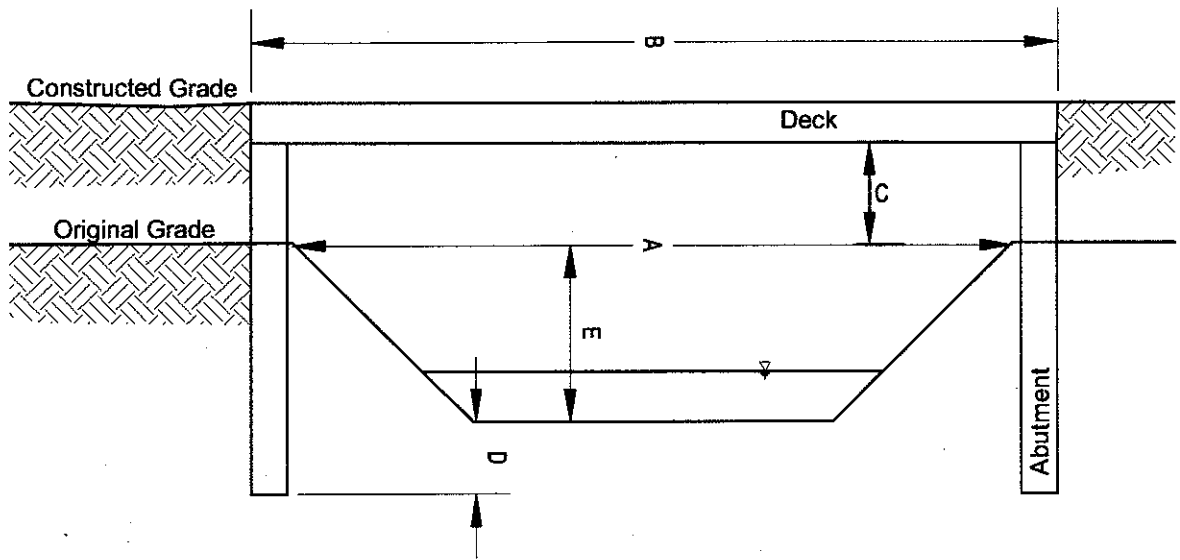


Box

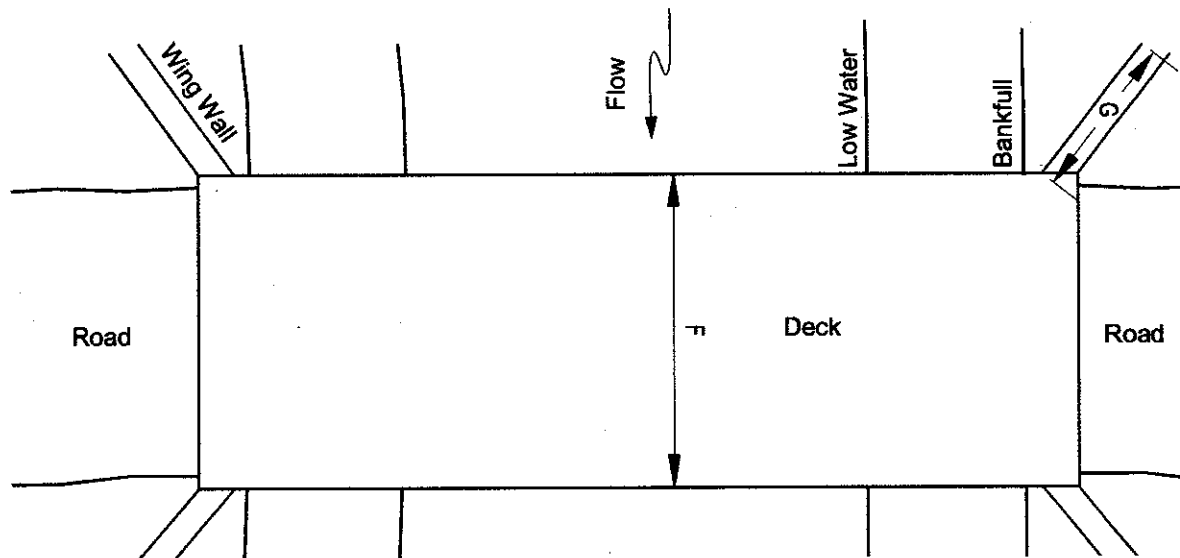



 <b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	PROJECT MANAGER:	<b>NOT TO SCALE</b>	FILENAME:	DRAWING TITLE: <b>Culvert Shapes</b>
	DRAWN BY: <b>MW</b>	CHECKED:	FIGURE:	

# Bridge Template



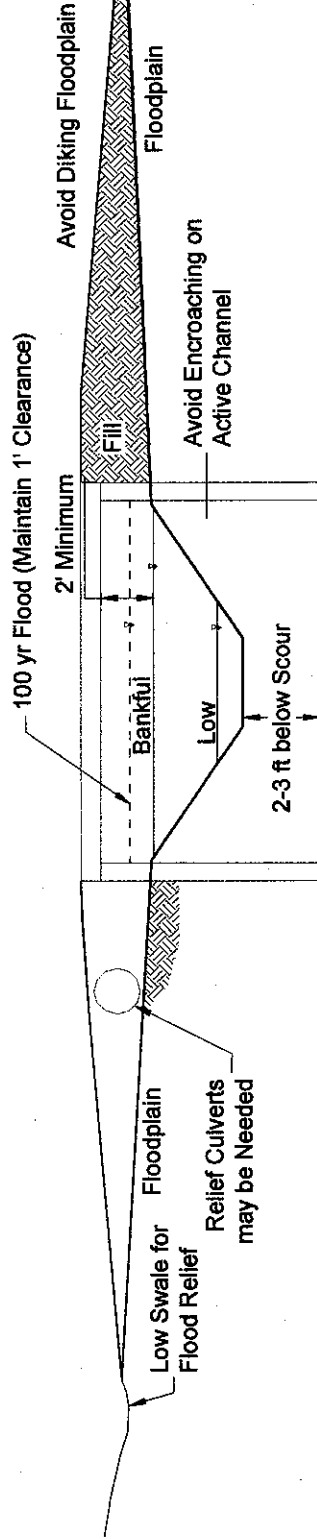
Bankfull Width	A= _____	Road Width	F= _____
Span	B= _____	Wingwall Length (E+C)x1.5	G= _____
Stringer/Bankfull Clearance	C= _____	Bridge Type	_____
Abutment Footing Depth	D= _____	Abutment Type	_____
Bankful Depth	E= _____		



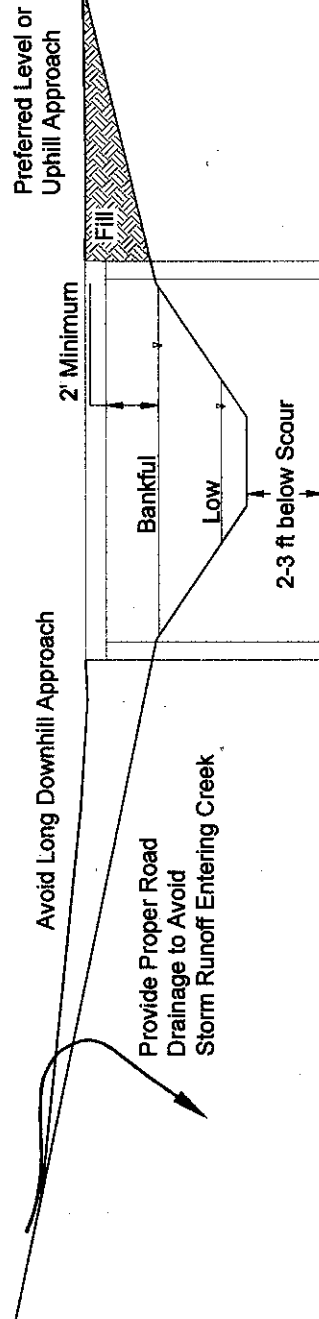
 <b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME:
	PROJECT MANAGER:	<b>NOT TO SCALE</b>	FILENAME:	<b>CD Manual</b>
DRAWN BY: <b>MW</b>	CHECKED:	FIGURE:	DRAWING TITLE: <b>Bridge Template</b>	

# Bridge Cross Sections

## Unincised Channel



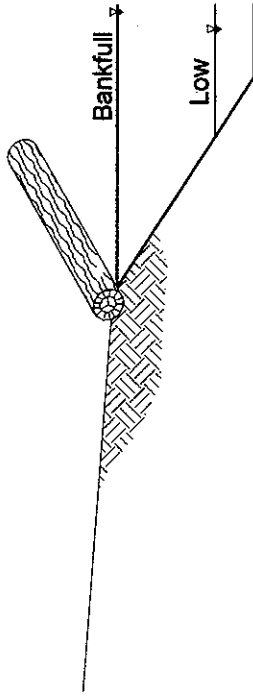
## Incised Channel



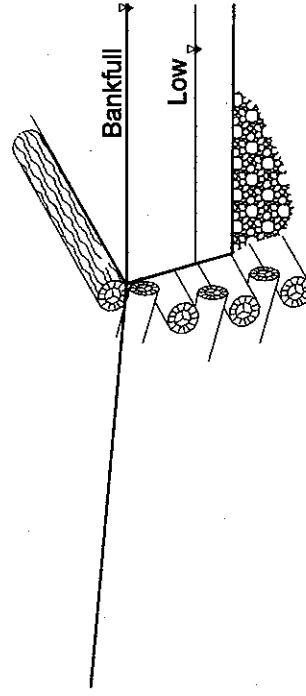
PERMIT NO: PROJECT MANAGER: P.O. BOX 924 MISSOULA, MT 59807	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	SCALE: <b>Not to Scale</b>	FILENAME:	DRAWING TITLE: <b>Bridge Cross Sections</b>
CHECKED:	FIGURE:		
DRAWN BY: <b>MW</b>			

# Bridge Abutments

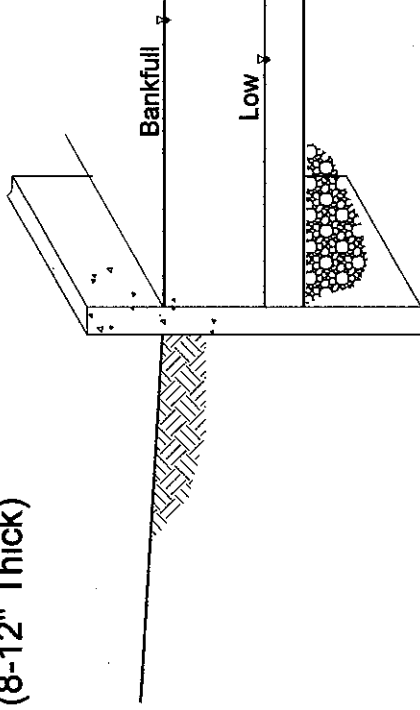
Log Sill  
(24" Diameter)



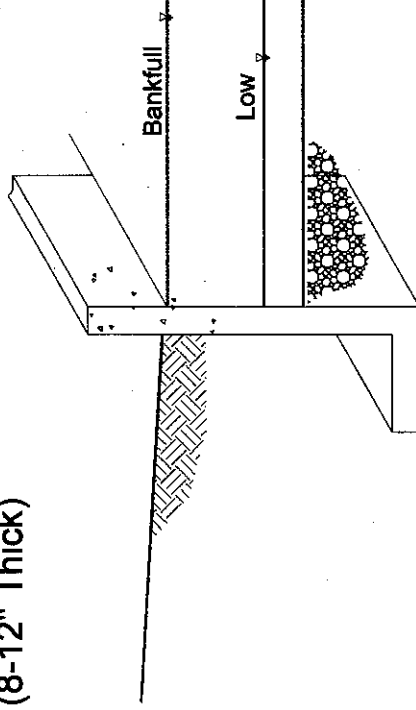
Log Crib



Concrete Wall  
(8-12" Thick)



Cantilever  
(8-12" Thick)



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Missoula, MT 59807

PERMIT NO.  
PROJECT MANAGER:  
DRAWN BY: MW

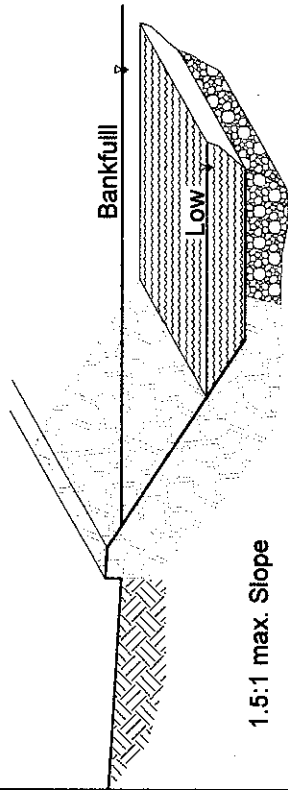
DATE:  
SCALE: Not to Scale  
CHECKED:

LOCATION:  
FILENAME:  
FIGURE:

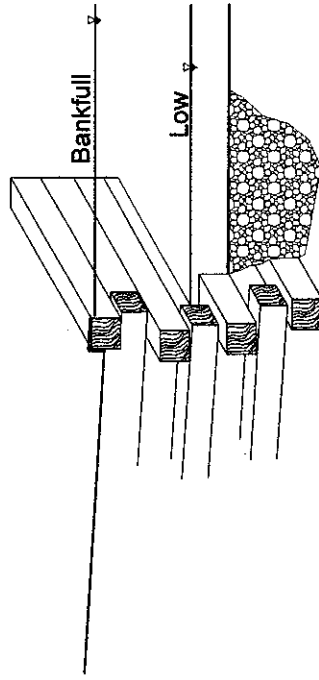
PROJECT NAME:  
**CD Manual**  
DRAWING TITLE:  
**Bridge Abutments**

# Bridge Abutments

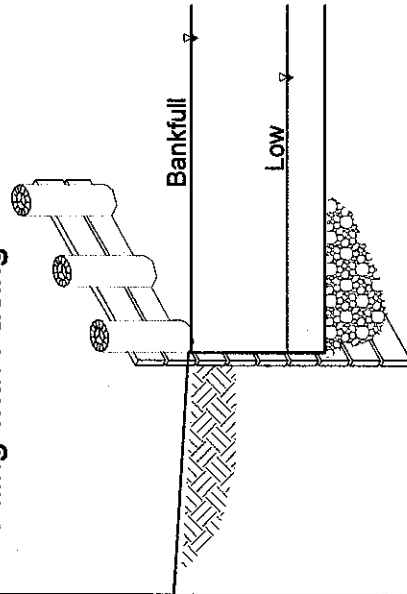
## Rip Rap



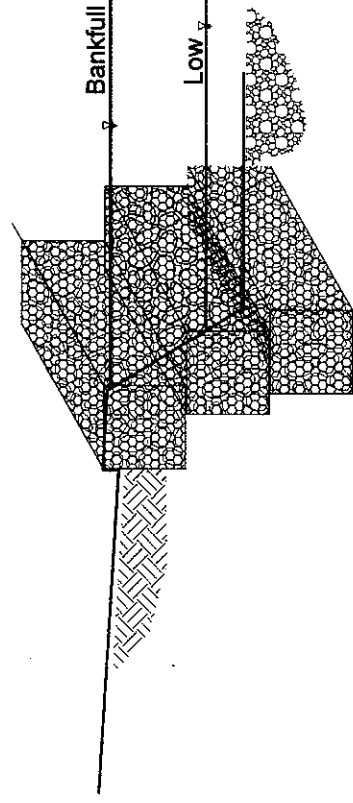
## Timber Crib



## Piling with Facing



## Gabion Basket




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 P.O. BOX 8254  
 Missoula, MT 59807

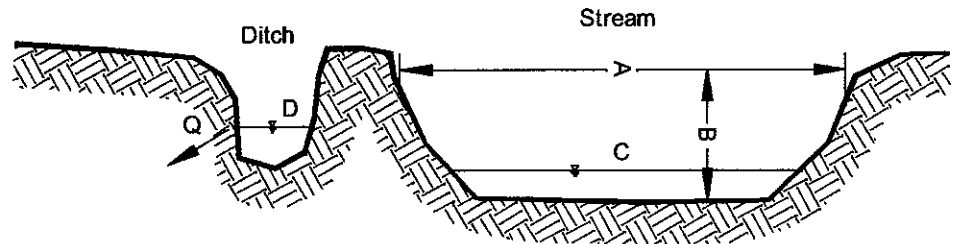
PERMIT NO.  
 PROJECT MANAGER:  
 DRAWN BY: **MW**

DATE:  
 SCALE: **Not to Scale**  
 CHECKED:

LOCATION:  
 FILENAME:  
 FIGURE:

PROJECT NAME:  
**CD Manual**  
 DRAWING TITLE:  
**Bridge Abutments**

# Diversion Design



Cross Section

Channel Width A = \_\_\_\_\_

Bankfull Depth B = \_\_\_\_\_

Low Water Elevation C = \_\_\_\_\_

Required Ditch Operating Level D = \_\_\_\_\_

Headwater Requirement (D-C) \_\_\_\_\_

Peak Ditch Diversion Rate (cfs) \_\_\_\_\_

Channel Stability Lateral Good / Fair / Poor

Channel Stability Vertical Good / Fair / Poor

Bedload/Sediment Low / Moderate / High  
Low <---Expertise--> High

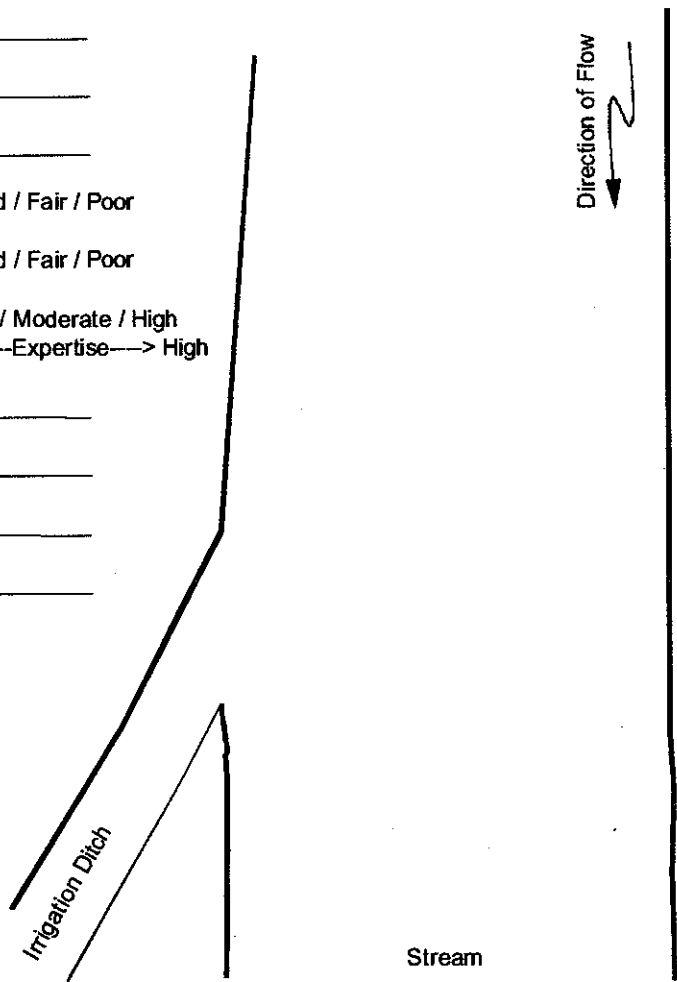
Diversion Structure Type \_\_\_\_\_

Headgate Type \_\_\_\_\_

Bank Protection Type \_\_\_\_\_

Provisions for Fish Passage \_\_\_\_\_

Direction of Flow

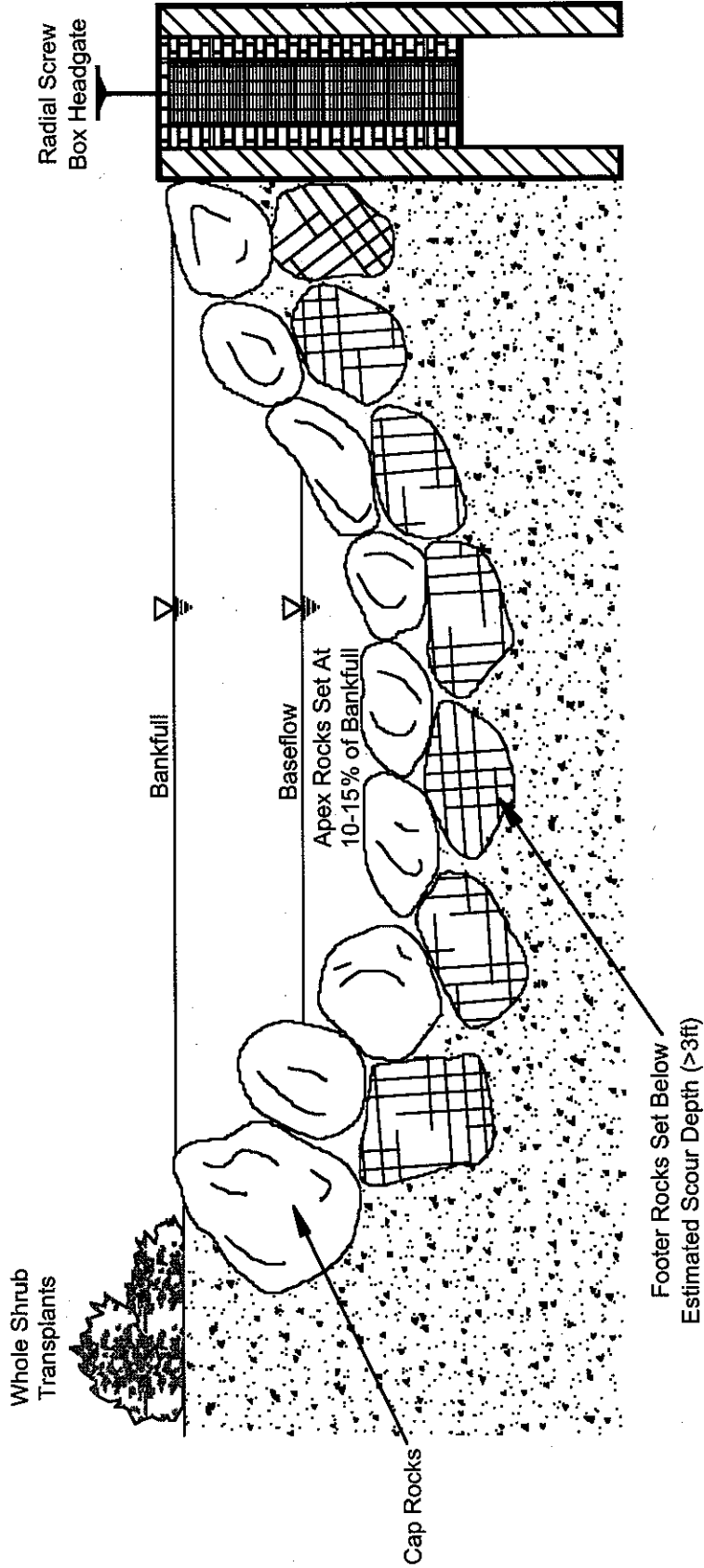


Stream  
Plan View  
(Sketch Details)

<p>LAND &amp; WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807</p>	PERMIT NO.	DATE:	LOCATION:	PROJECT NAME
	PROJECT MANAGER	NOT TO SCALE	FILENAME:	CD Manual
	DRAWN BY: MW	CHECKED:	FIGURE:	DRAWING TITLE
				Diversion Design



# Cross Vane Diversion Structure Cross Sectional View



Note: Design specifications are site specific and subject to change.

PROJECT NAME  
**CD Manual**

DRAWING TITLE  
**Cross Vane Diversion Structure**

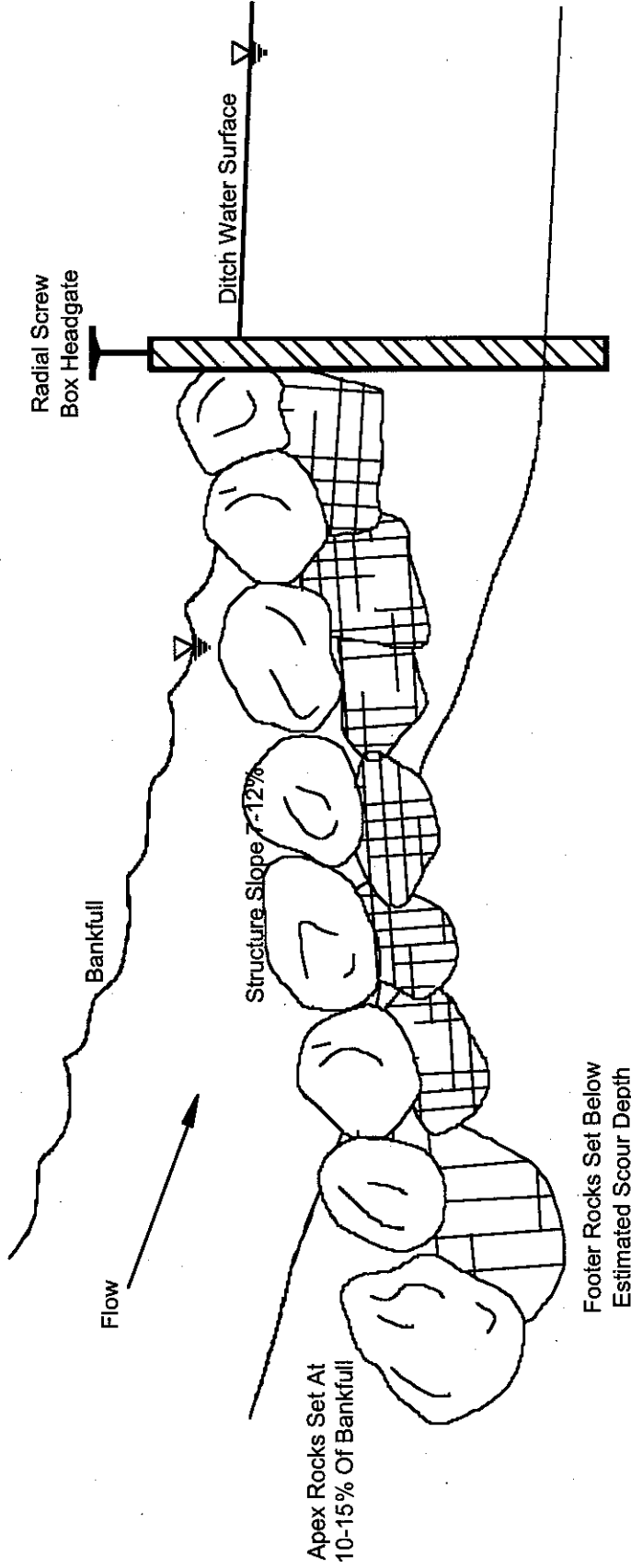
LOCATION:  
FILENAME: CTSV.CWG  
FIGURE:

DATE:  
SCALE: **Not to Scale**  
CHECKED:

PERMIT NO:  
PROJECT MANAGER:  
DRAWN BY: **J.S.**

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P.O. BOX 9254  
Missoula, MT 59807

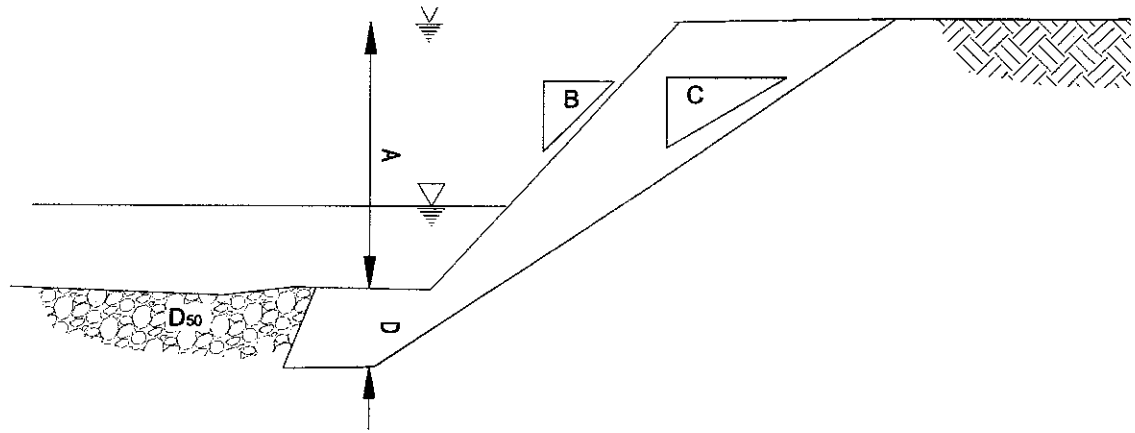
# Cross Vane Diversion Structure Longitudinal Profile View



Note: Design specifications are site specific and subject to change.

LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO. _____	DATE _____	LOCATION _____	<b>CD</b> <small>MANUAL</small>
	PROJECT MANAGER _____	SCALE: Not to Scale	FILENAME: lngv.dwg	DRAWING TITLE: <b>Cross Vane Diversion Structure</b>
DRAWN BY: J.S.	CHECKED: _____	FIGURE _____	FIGURE _____	FIGURE _____

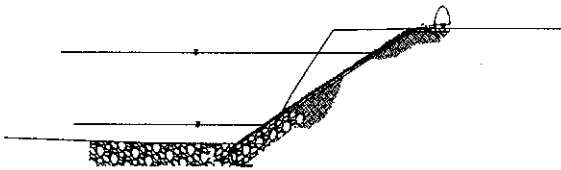
# Bank Protection Treatment



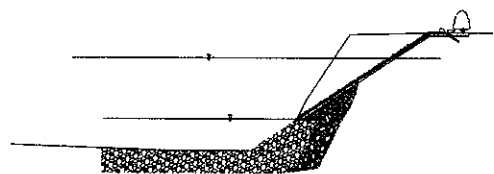
Bankfull Depth (Avg) \_\_\_\_\_  
 Existing Slope \_\_\_\_\_  
 Bed Material (Avg Diameter) \_\_\_\_\_  
 Bank Material (silt/clay, gravel, sand, \_\_\_\_\_  
 Existing Vegetation (none, grass, shrubs, trees) \_\_\_\_\_  
 Channel Slope (from Topo Map) \_\_\_\_\_  
 Shear Stress (lb/ft<sup>2</sup>) ( $\tau \sim 62.4AB$ ) \_\_\_\_\_  
 Constructed Slope \_\_\_\_\_  
 Footer Depth \_\_\_\_\_  
 Bank Length \_\_\_\_\_  
 Design Bank Protection \_\_\_\_\_ max moderate low  
 Design Bank Protection Technique: \_\_\_\_\_

A = \_\_\_\_\_  
 B = \_\_\_\_\_ (vertical, 1:1, 1.5:1, 2:1 3:1)  
 D<sub>50</sub> = \_\_\_\_\_ (silt/clay, gravel, sand)  
 \_\_\_\_\_ (none, grass, shrubs, trees)  
 \_\_\_\_\_  
 C = \_\_\_\_\_ (vertical, 1:1, 1.5:1, 2:1 3:1)  
 D = \_\_\_\_\_

**Geotextile with Stone Toe**



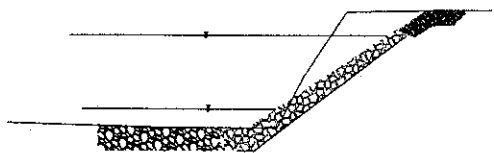
**Geotextile with Rock Toe**



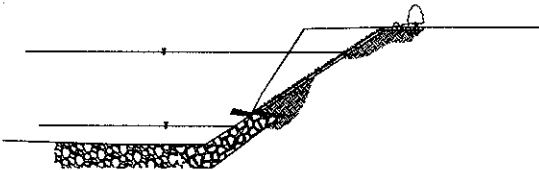
**Root Wad**



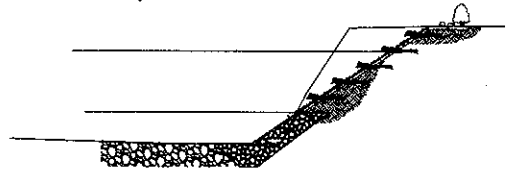
**Rip Rap**



**Geotextile with Rip Rap Toe**



**Encapsulated Soil Revetment**



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 P.O. BOX 8254  
 Missoula, MT 59807

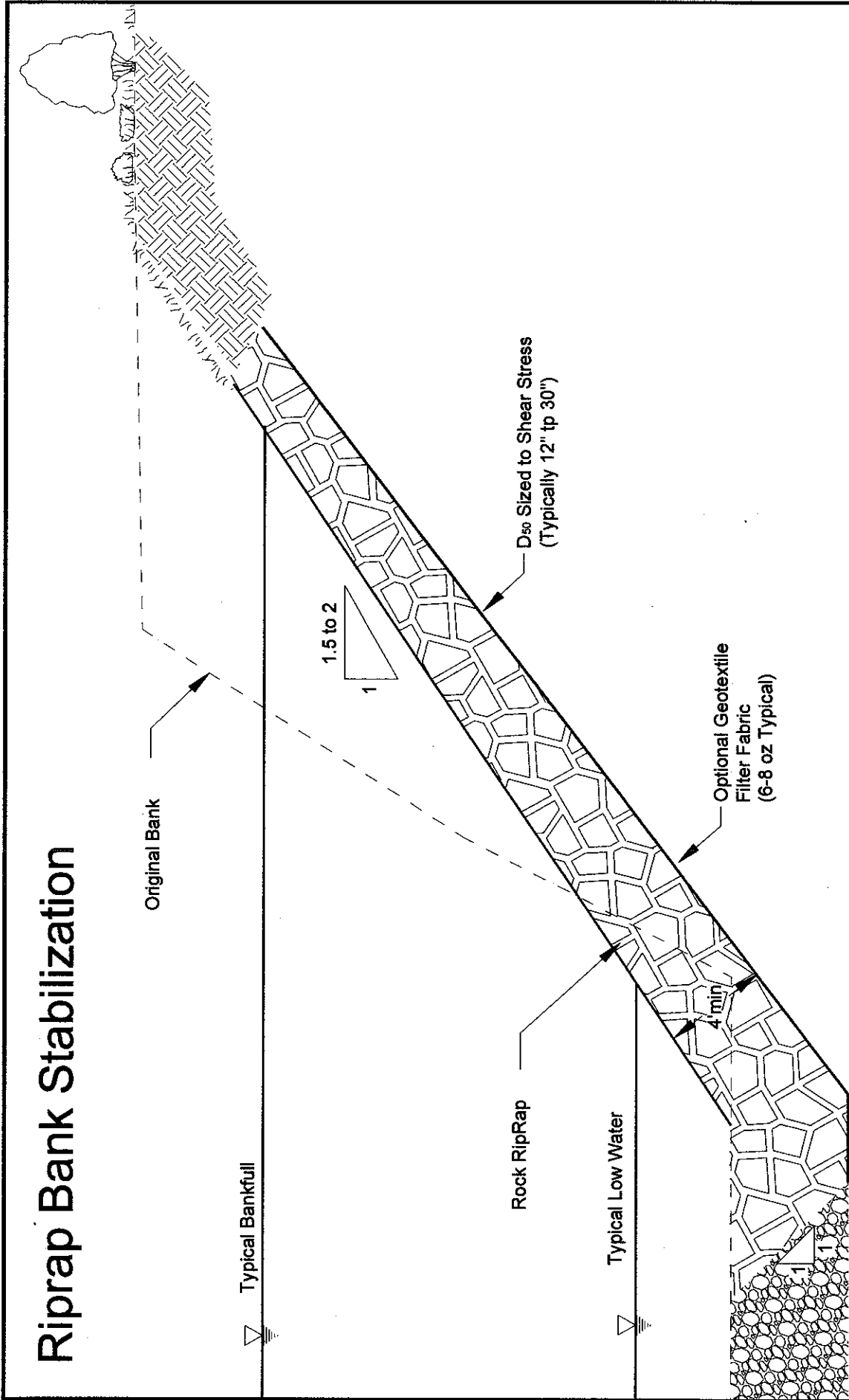
PERMIT NO: \_\_\_\_\_  
 PROJECT MANAGER: \_\_\_\_\_  
 DRAWN BY: **MW**

DATE: \_\_\_\_\_  
**NOT TO SCALE**  
 CHECKED: \_\_\_\_\_

LOCATION: \_\_\_\_\_  
 FILENAME: \_\_\_\_\_  
 FIGURE: \_\_\_\_\_

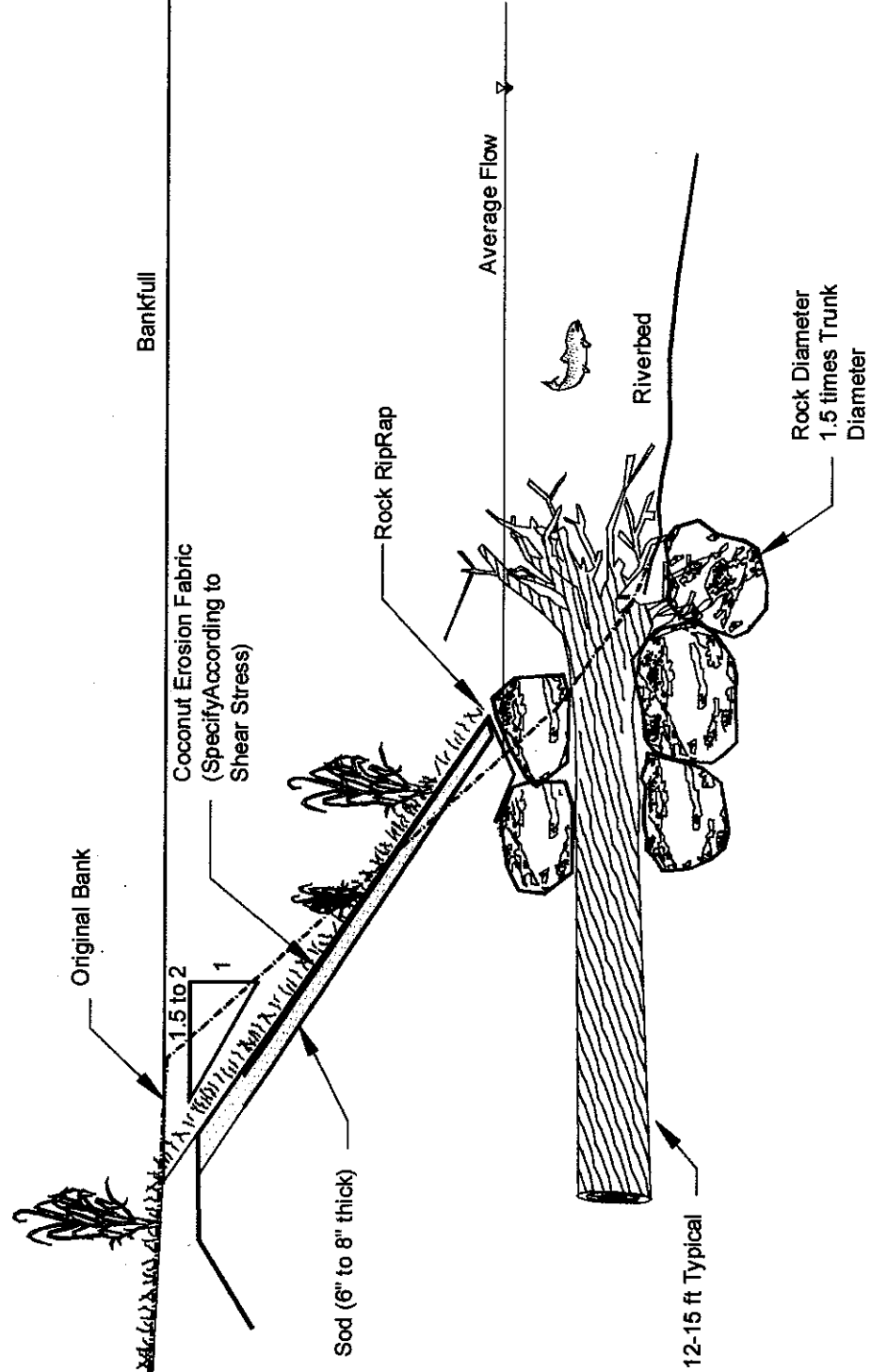
PROJECT NAME:  
**CD Manual**  
 DRAWING TITLE:  
**Bank Protection Treatment**

# Riprap Bank Stabilization



PERMIT NO: PROJECT MANAGER: LAND & WATER CONSULTING, INC. P.O. BOX 8294 MISSOURI, MO 63007	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	SCALE: <b>Not to Scale</b>	FILENAME:	DRAWING TITLE: <b>Riprap Bank Stabilization</b>
CHECKED BY: <b>MW</b>	FIGURE:		

# Geotextile Covered Bank with Single Root Wad Footer



LAND & WATER CONSULTING, INC.  
 P.O. BOX 8234  
 Missoula, MT 59707

PERMIT NO.  
 PROJECT MANAGER  
 DRAWN BY: MP/MW

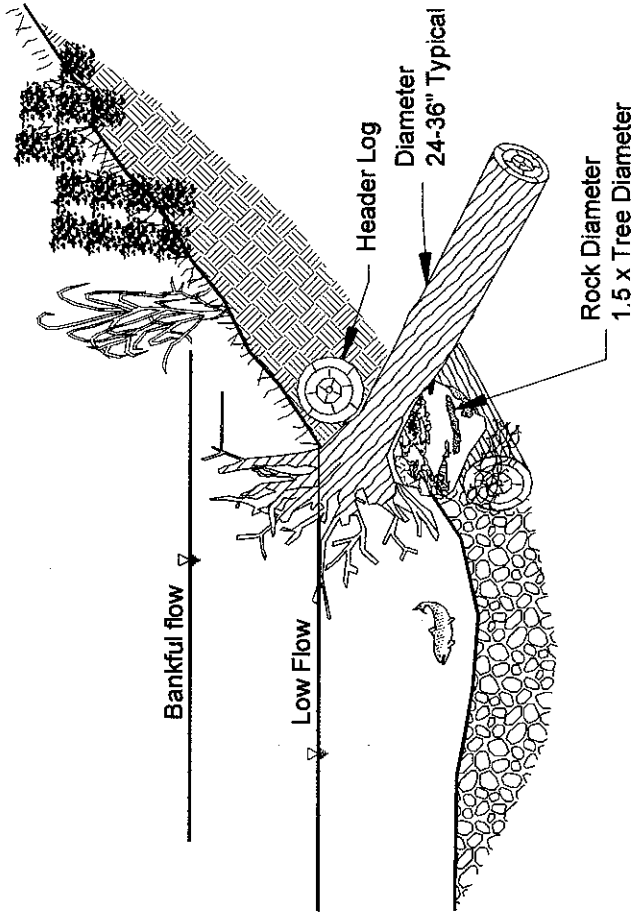
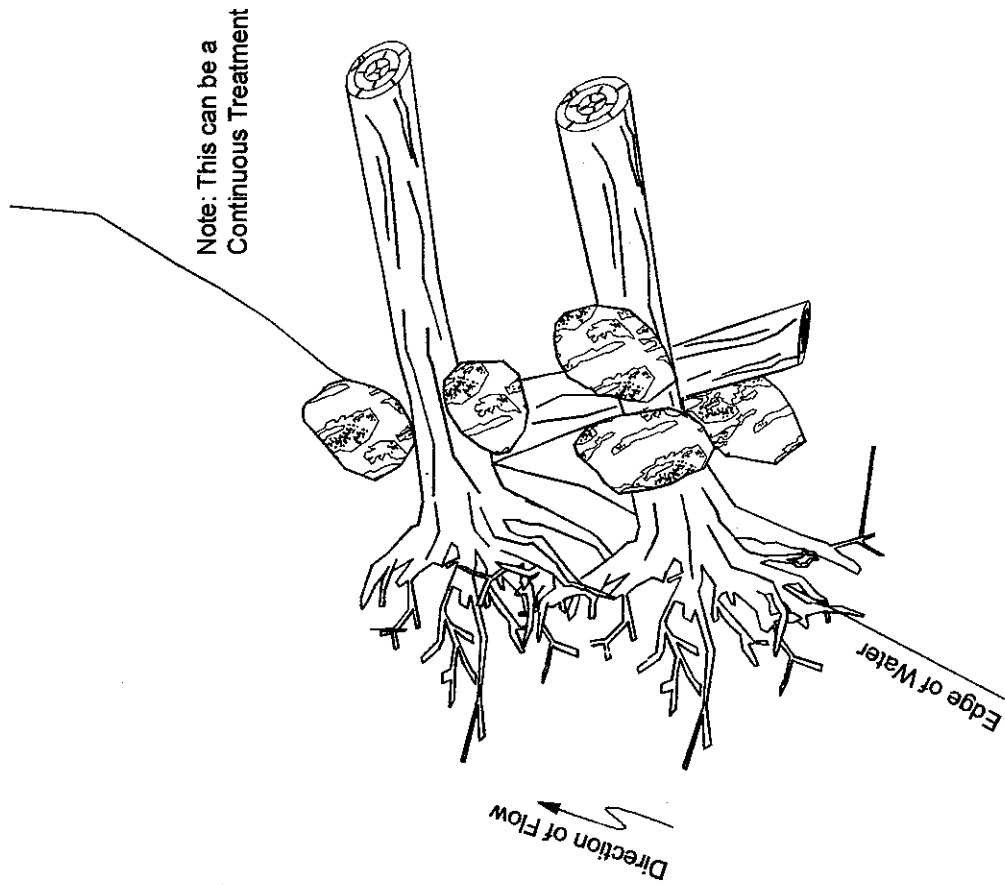
DATE  
 SCALE: Not to Scale  
 CHECKED

LOCATION  
 FILENAME  
 FIGURE

PROJECT NAME  
**CD Manual**  
 DRAWING TITLE  
**Geotextile Bank with Root Wad**

# Root Wad Detail Plan View

# Root Wad Detail Cross Section



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 P.O. BOX 8264  
 Missoula, MT 59807

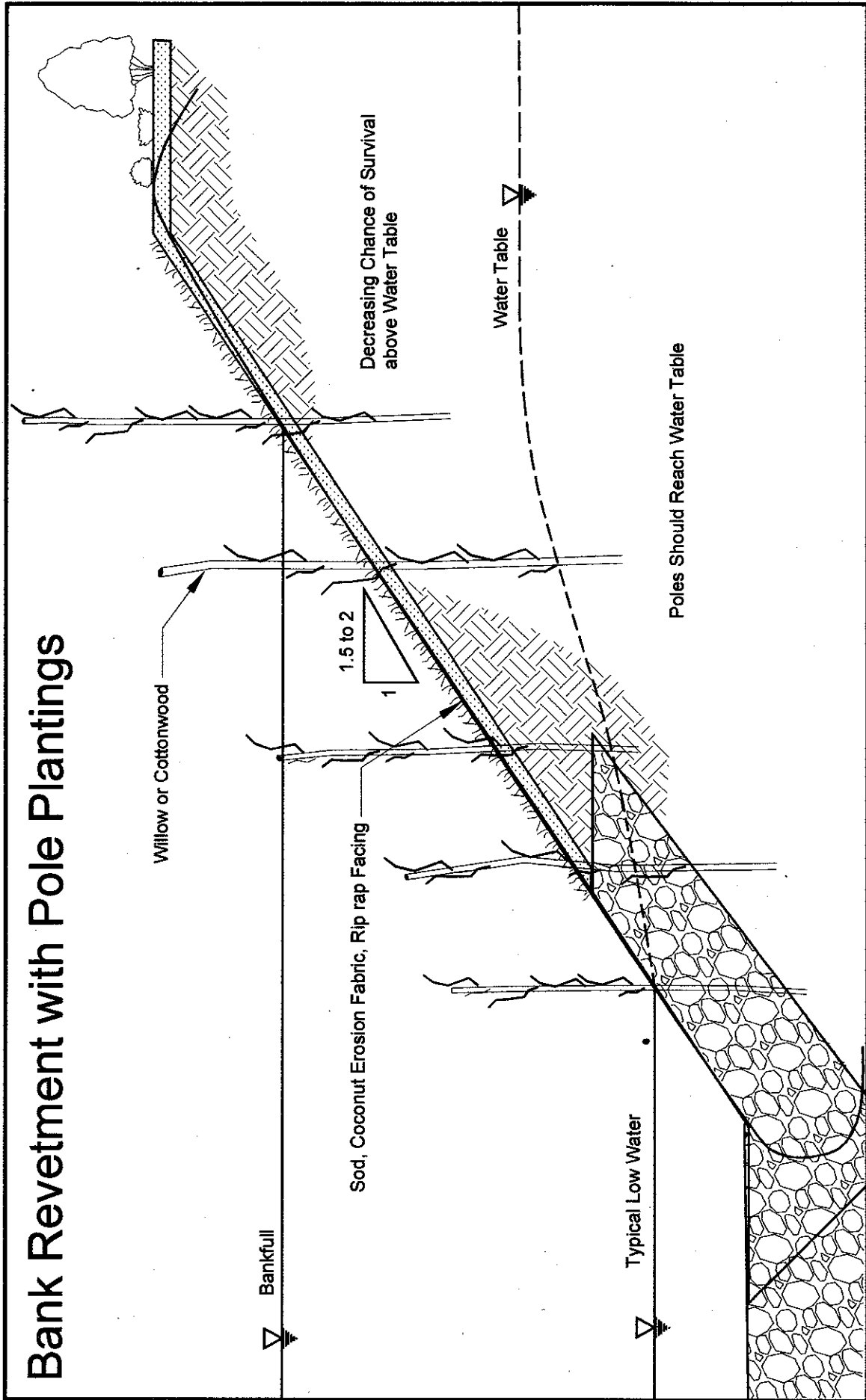
PERMIT NO.  
 PROJECT MANAGER:  
 DRAWN BY: MW

DATE:  
 SCALE: Not to Scale  
 CHECKED:

LOCATION:  
 FILENAME:  
 FIGURE:

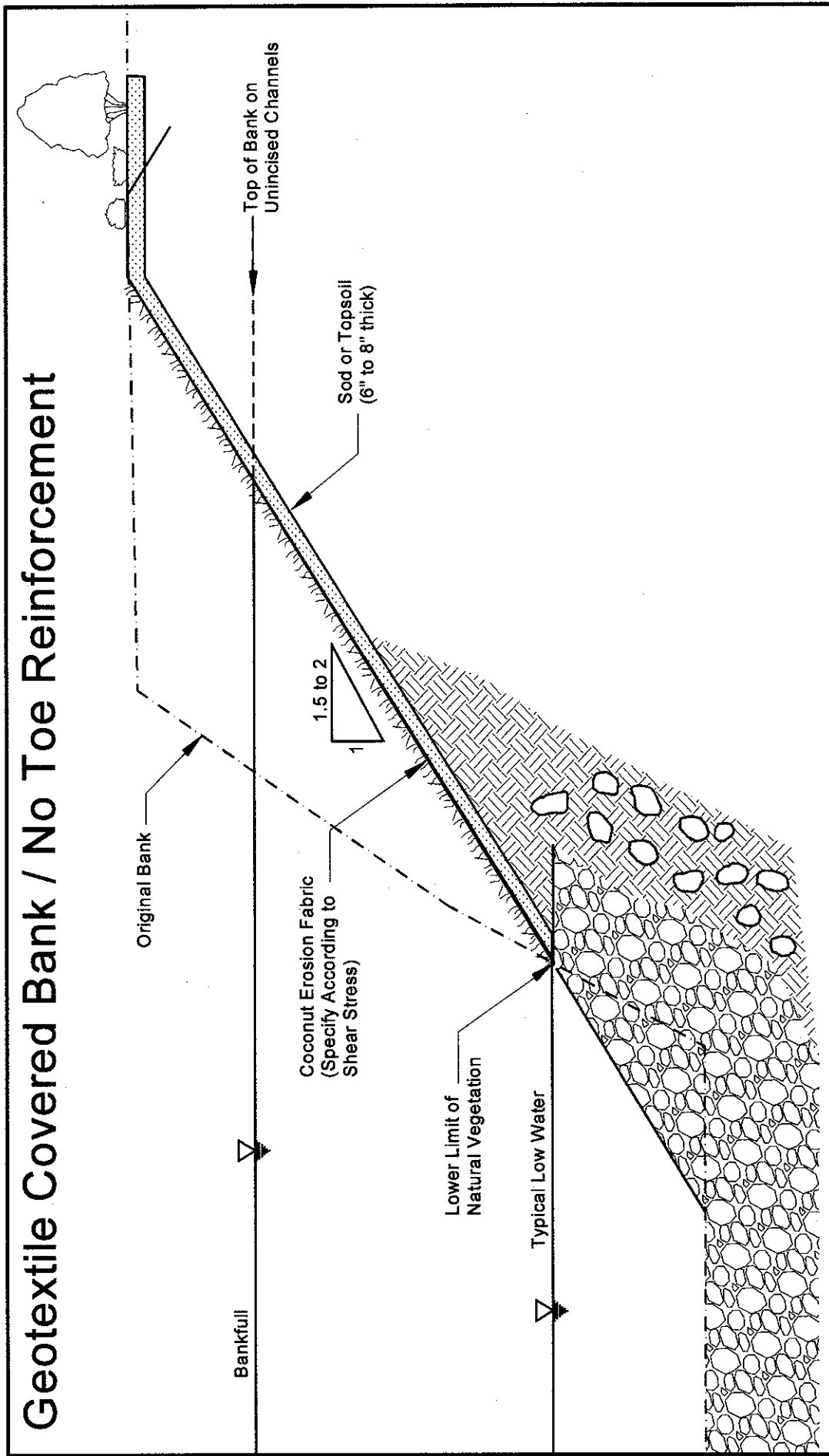
PROJECT NAME  
**CD Manual**  
 DRAWING TITLE  
**Rootwad Detail**

# Bank Revetment with Pole Plantings



<b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 8264 Missoula, MT 59607	PERMIT NO.:	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	PROJECT MANAGER:	SCALE: <b>Not to Scale</b>	FILENAME:	DRAWING TITLE: <b>Pole Planting</b>
DRAWN BY: <b>MW</b>	CHECKED:	FIGURE:		

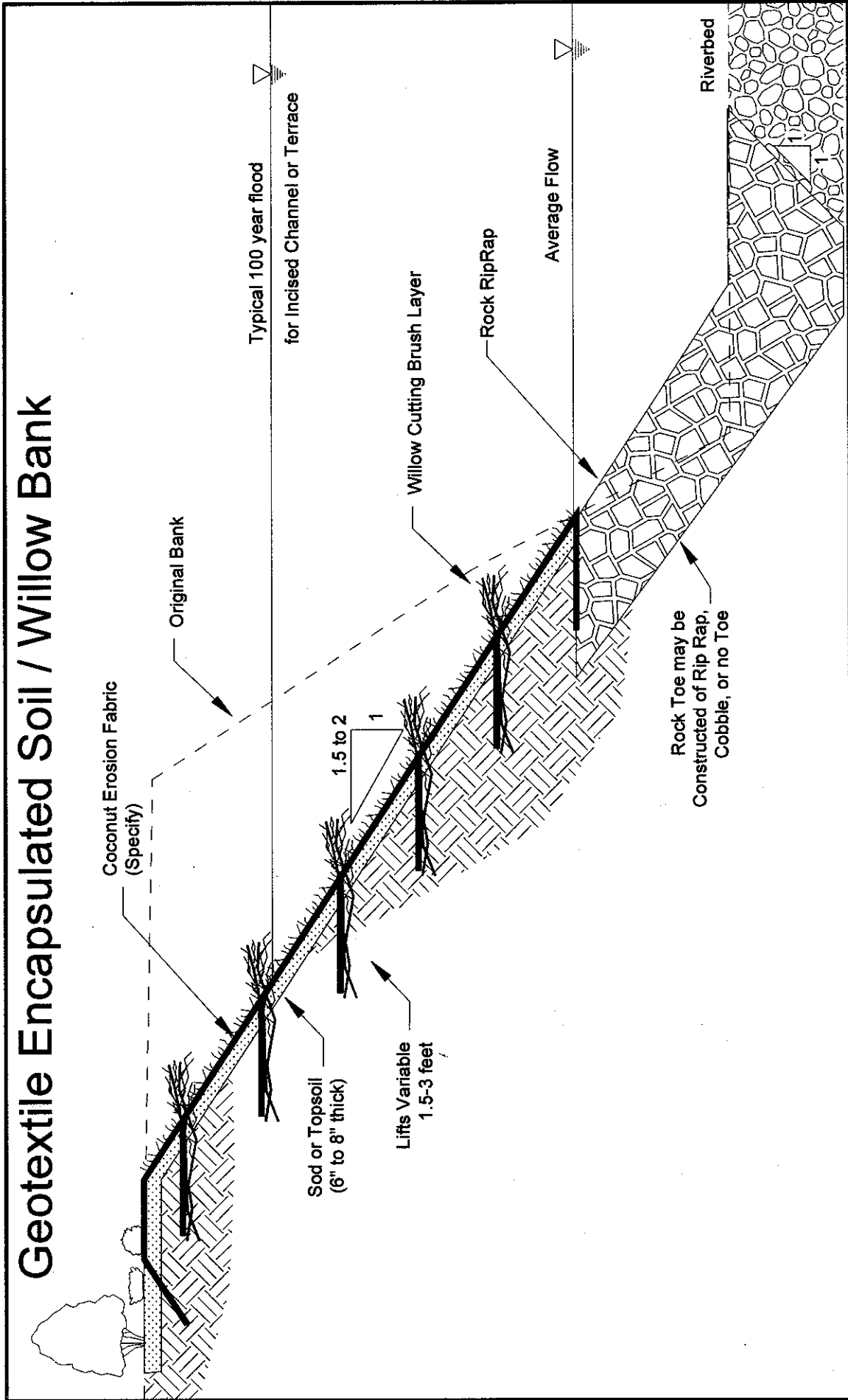
# Geotextile Covered Bank / No Toe Reinforcement



<b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 9254 Missoula, MT 59807	PERMIT NO.: _____ PROJECT MANAGER: _____ DRAWN BY: <b>MP/IMW</b>	DATE: _____ SCALE: <b>Not to Scale</b> CHECKED: _____	LOCATION: _____ FILENAME: _____ FIGURE: _____	PROJECT NAME: <b>CD Manual</b> DRAWING TITLE: <b>Geotextile Covered Bank / No Toe Reinforcement</b>
---	--	---	---	--

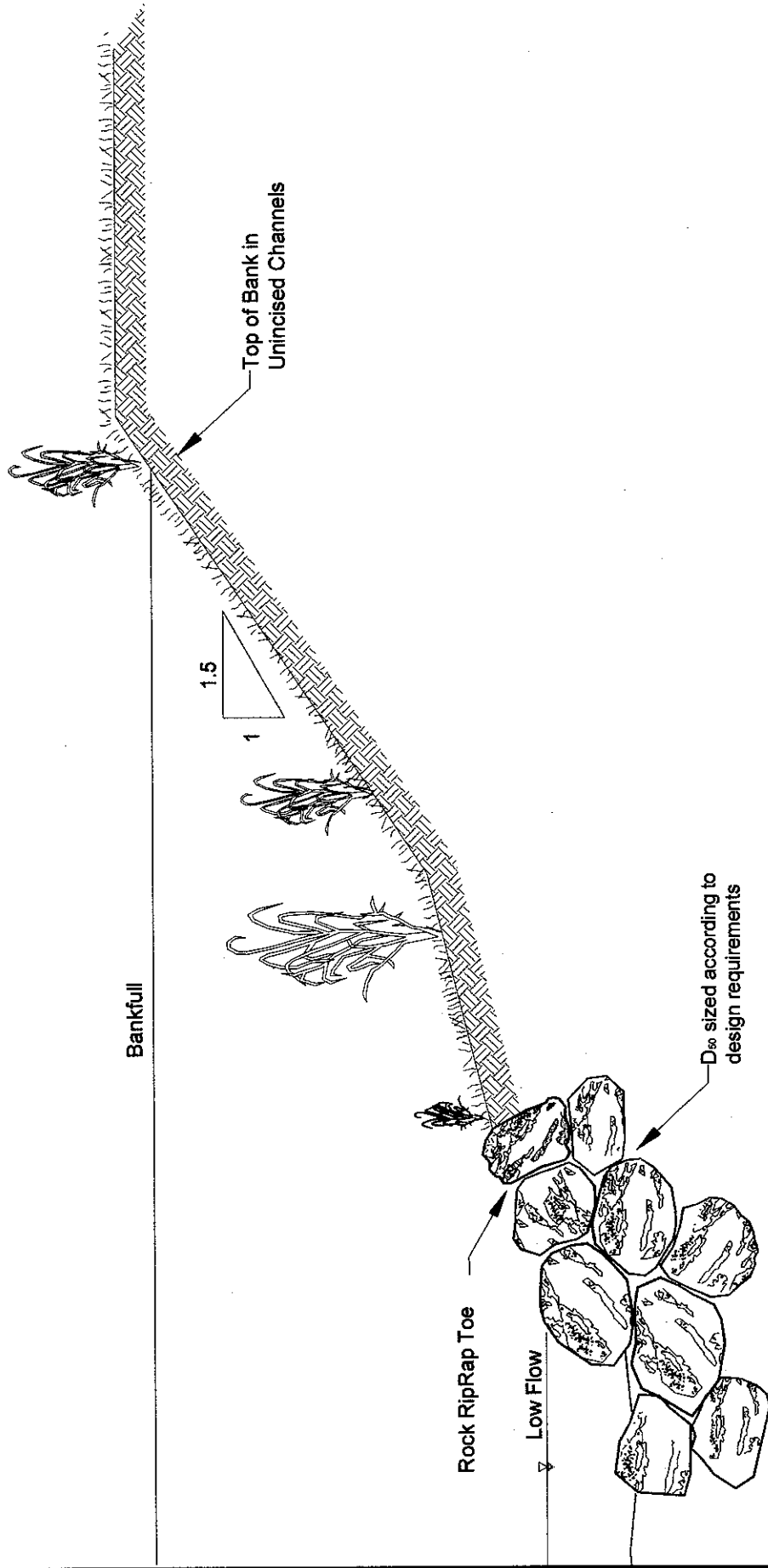


# Geotextile Encapsulated Soil / Willow Bank



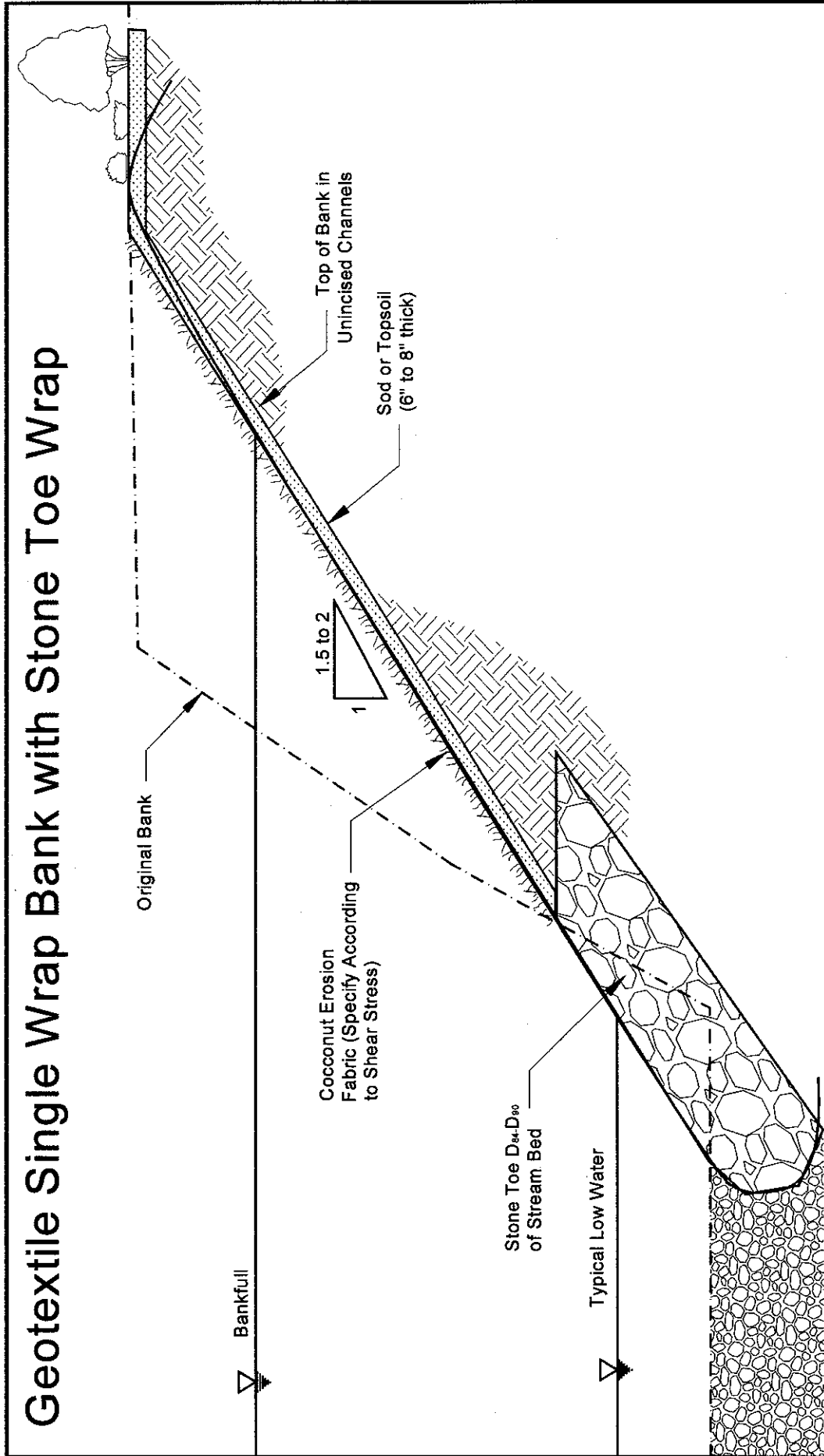
<b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 824 MISSOULA, MT 59807	PERMIT NO. _____ PROJECT MANAGER _____ DRAWN BY: <b>MP/MW</b>	DATE: _____ SCALE: <b>Not to Scale</b> CHECKED: _____	LOCATION: _____ FILENAME: _____ FIGURE: _____	PROJECT NAME: <b>CD Manual</b> DRAWING TITLE: <b>Geotextile Encapsulated Soil / Willow Bank</b>
--	---	---	---	--

# Stone Toe



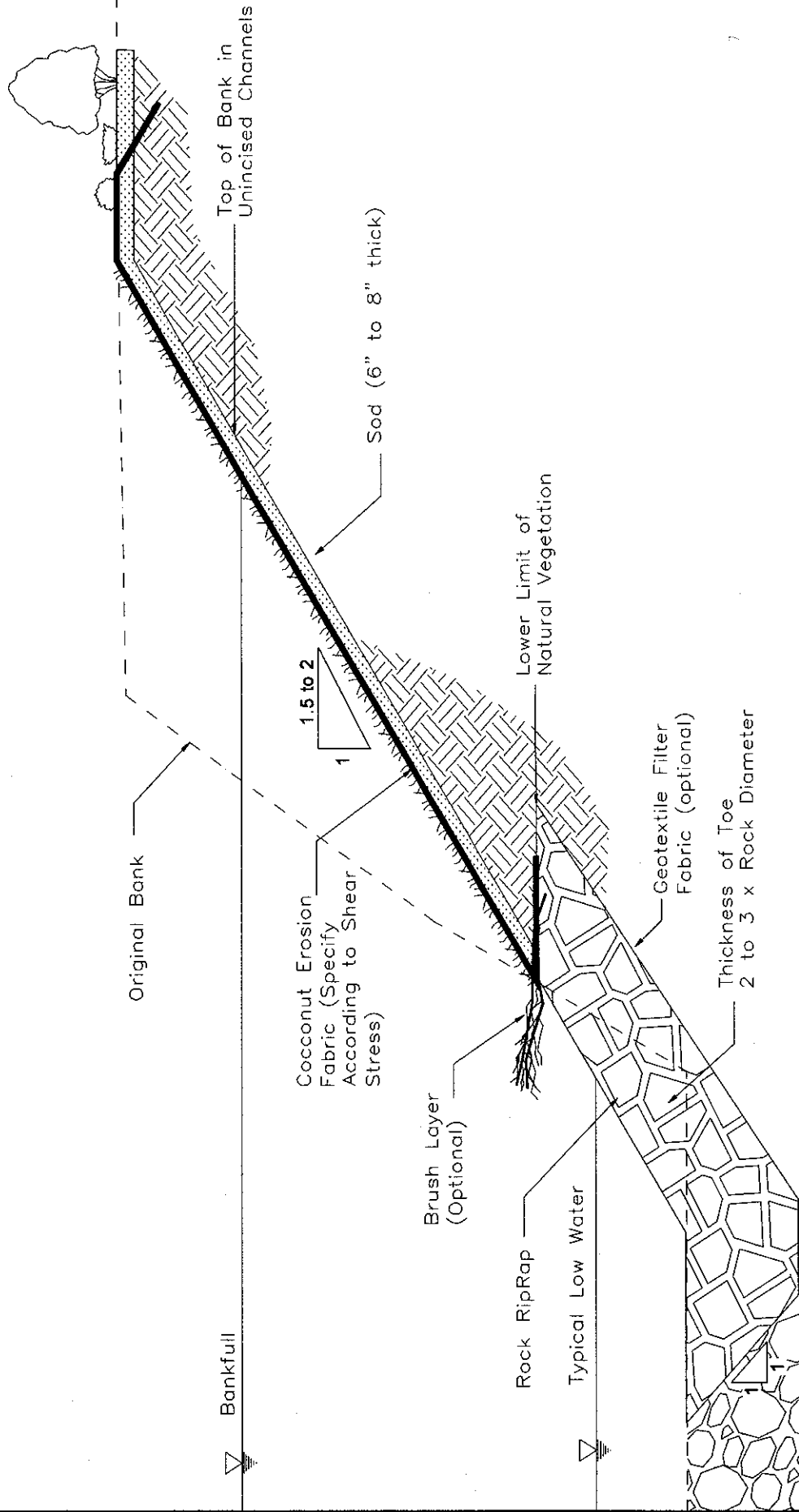
PERMIT NO.	DATE:	LOCATION:	PROJECT NAME
	SCALE: Not to Scale	FILENAME:	CD Manual
PROJECT MANAGER:	CHECKED:	FIGURE:	ISSUING TITLE
DRAWN BY: MW			Stone Toe
LAND & WATER CONSULTING, INC. P.O. BOX 1234 MISSOULA, MT 59807			

# Geotextile Single Wrap Bank with Stone Toe Wrap



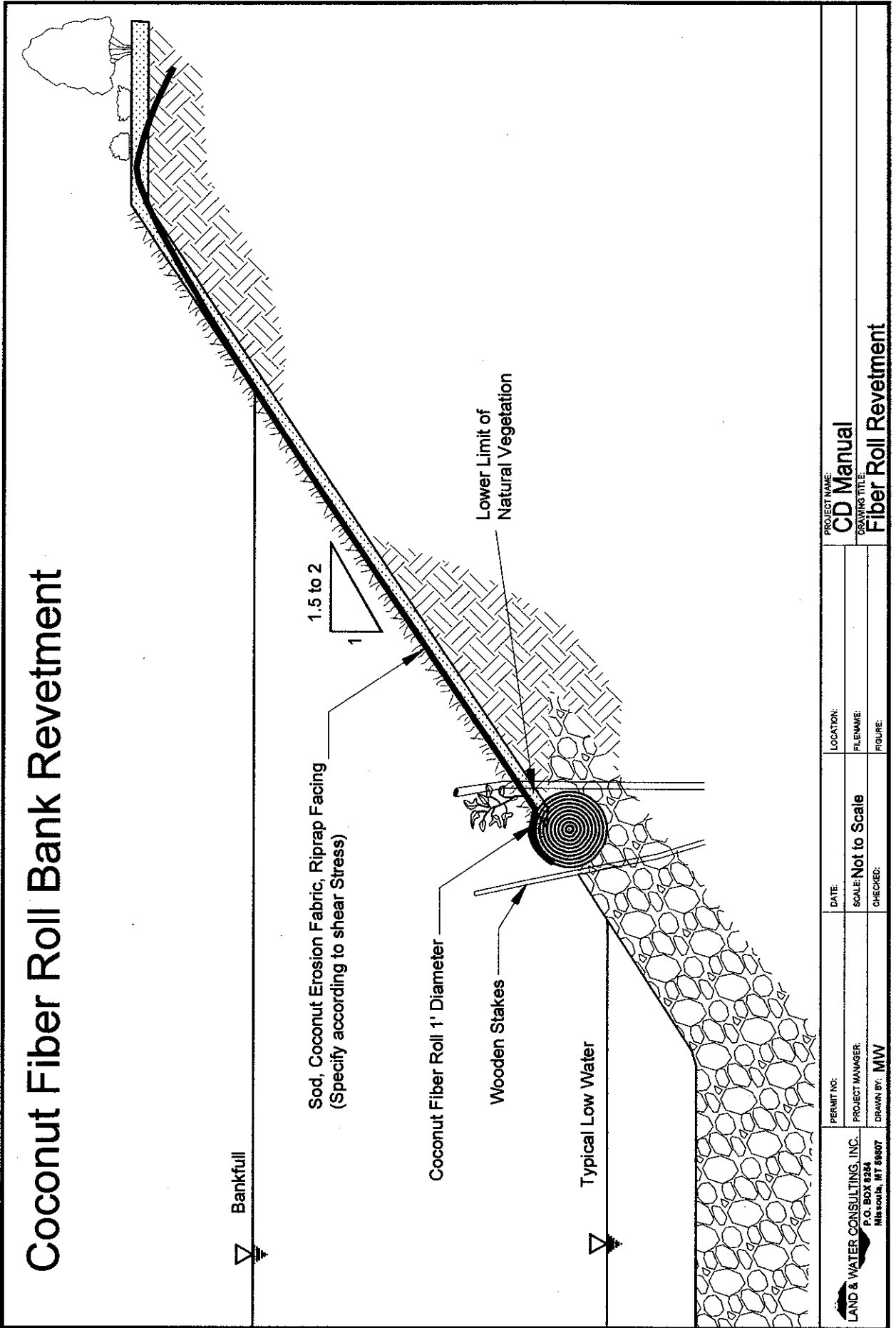
PERMIT NO. <b>AND &amp; WATER CONSULTING, INC.</b> P.O. BOX 8234 Missoula, MT 59807	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	SCALE: <b>Not to Scale</b>	FILENAME:	DRAWING TITLE: <b>Geotextile single wrap bank with Stone Toe Wrap</b>
PROJECT MANAGER: DRAWN BY: <b>MP/MW</b>	CHECKED:	FIGURE:	

# Geotextile Single Wrap Bank with Rip Rap Toe



<b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 128 MISSOULA, MT 59801	PROJECT NO: H98-143	DATE: Sept 98	LOCATION: Missoula, MT	PROJECT NAME: <b>CD Manual</b>
	PROJECT MANAGER: B. Anderson	SCALE: N/A	FILENAME: GEO_RRToe	DRAWING TITLE: <b>Geotextile single wrap bank with Rip Rap Toe</b>
DRAWN BY: MP	CHECKED:	FIGURE: 1		

# Coconut Fiber Roll Bank Revetment



LAND & WATER CONSULTING, INC.  
P.O. BOX 424  
Missoula, MT 59807

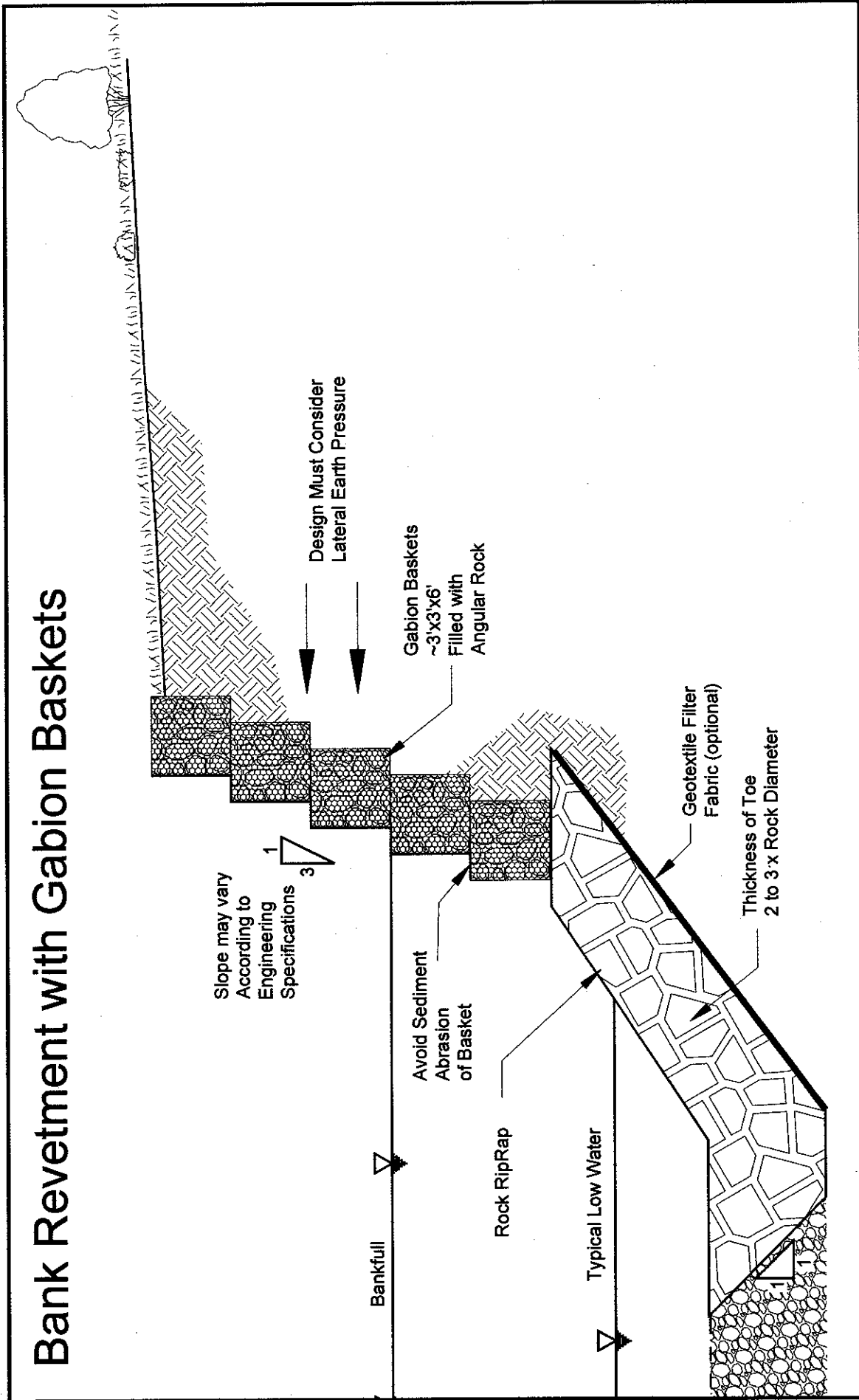
PERMIT NO.  
PROJECT MANAGER  
DRAWN BY: MW

DATE:  
SCALE: Not to Scale  
CHECKED:

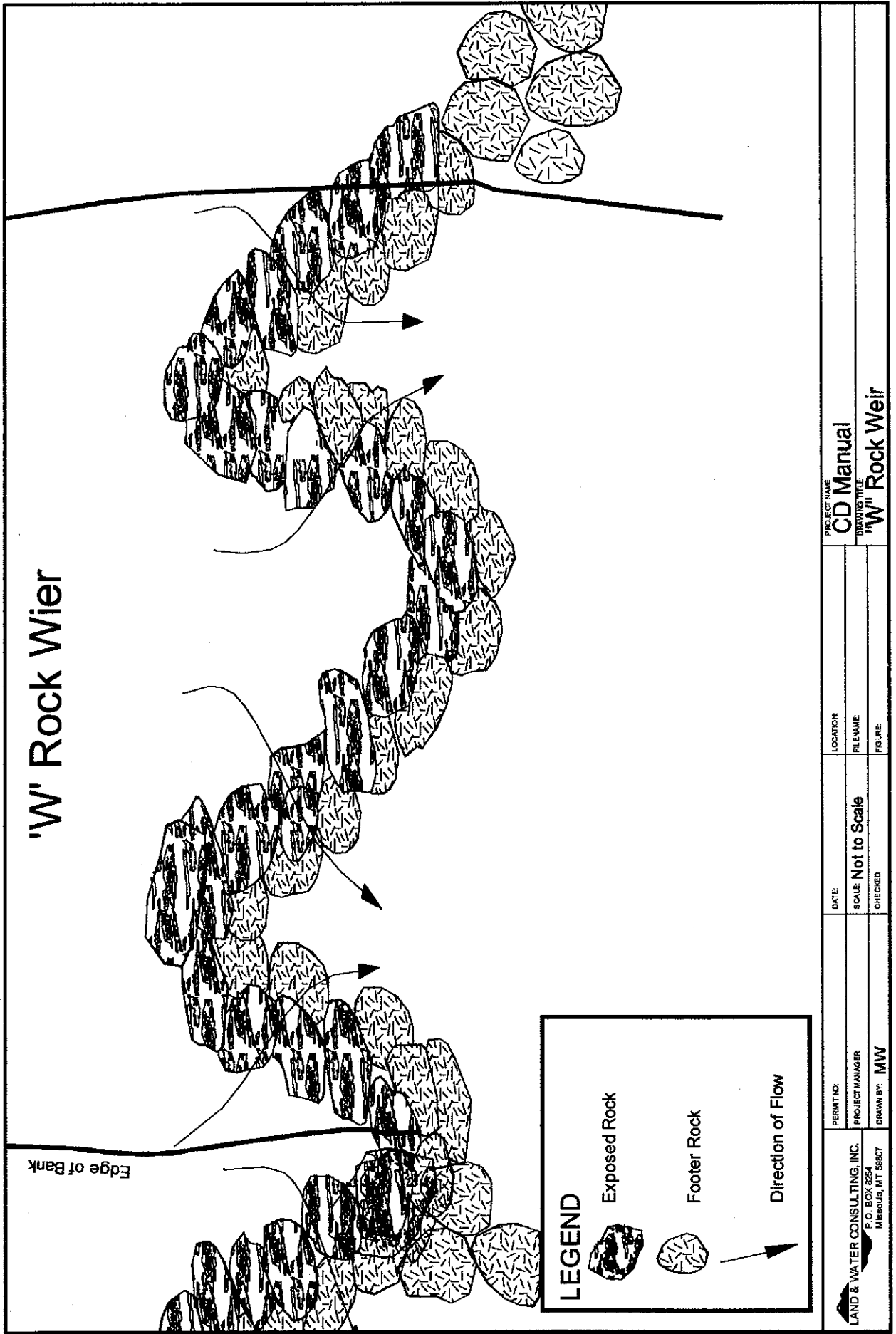
LOCATION:  
FILENAME:  
FIGURE:

PROJECT NAME:  
**CD Manual**  
DRAWING TITLE:  
**Fiber Roll Revetment**

# Bank Revetment with Gabion Baskets



<b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 8284 MISSOULA, MT 59807	PERMIT NO.: _____ PROJECT MANAGER: _____ DRAWN BY: <b>MW</b>	DATE: _____ SCALE: <b>Not to Scale</b> CHECKED: _____	LOCATION: _____ FILENAME: _____ FIGURE: _____	PROJECT NAME: <b>CD Manual</b> DRAWING TITLE: <b>Bank Revetment with Gabion Baskets</b>
---	--	---	---	--



'W' Rock Wier

Edge of Bank

**LEGEND**

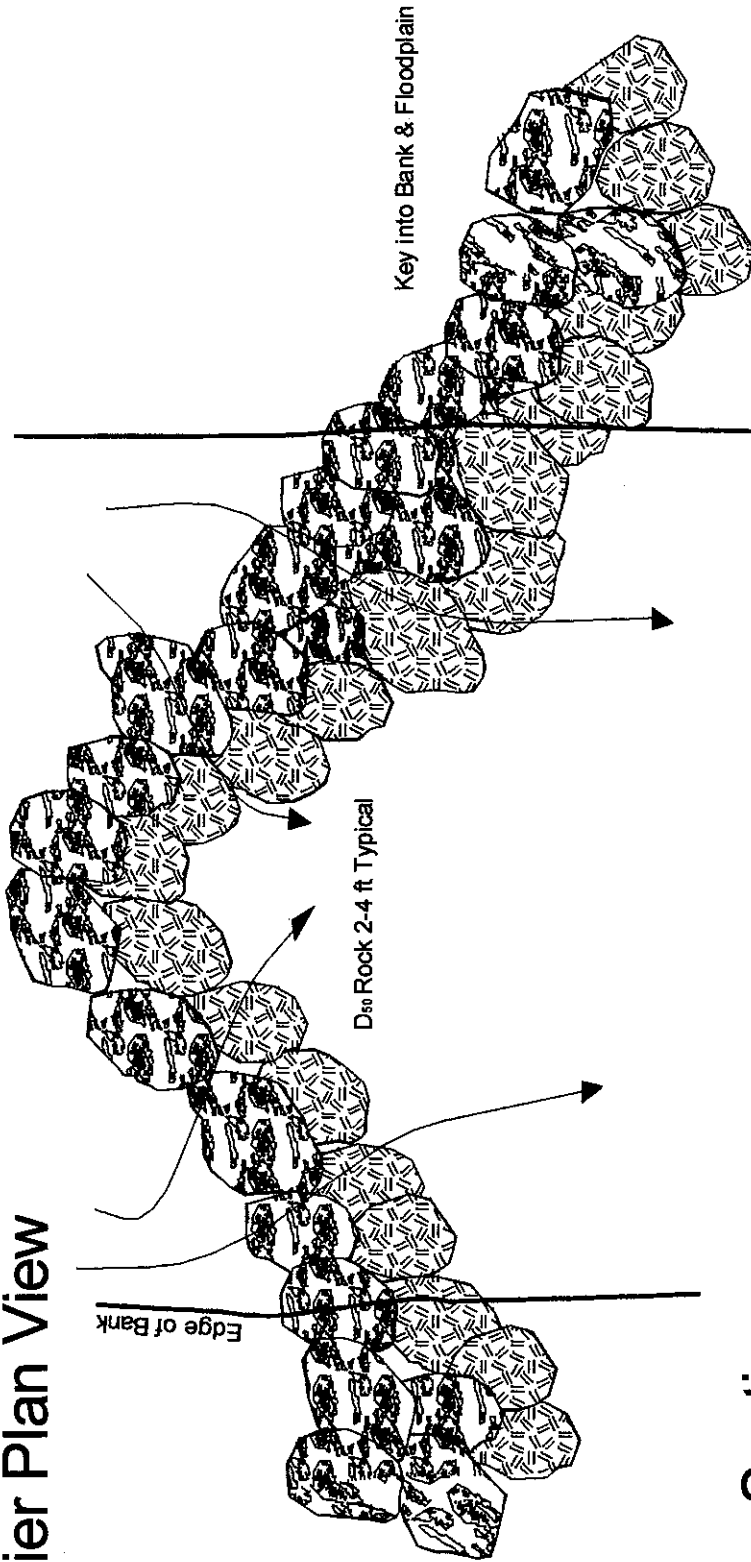
Exposed Rock

Footer Rock

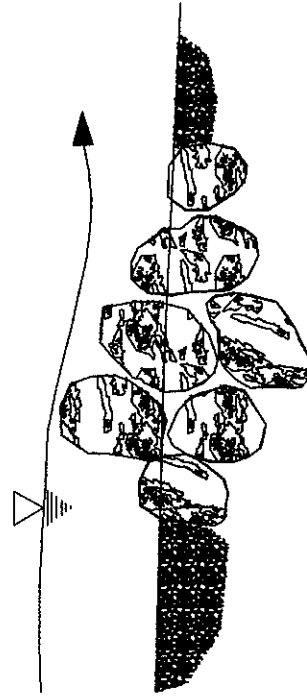
Direction of Flow

LAND & WATER CONSULTING, INC. P.O. BOX 2254 MISSOULA, MT 59807	PERMIT NO.:	DATE:	LOCATION:	PROJECT NAME: <b>CD Manual</b>
	PROJECT MANAGER:	SCALE: <b>Not to Scale</b>	FILENAME:	DRAWING TITLE: <b>'W' Rock Wier</b>
DRAWN BY: <b>MW</b>	CHECKED:	FIGURE:		

# V Wier Plan View



# Cross Section



**LEGEND**

- Exposed Rock
- Footer Rock
- Direction of Flow

**LAND & WATER CONSULTING, INC.**  
 P.O. BOX 854  
 Missoula, MT 59807

PERMIT NO:  
 PROJECT MANAGER:  
 DRAWN BY: **MW**

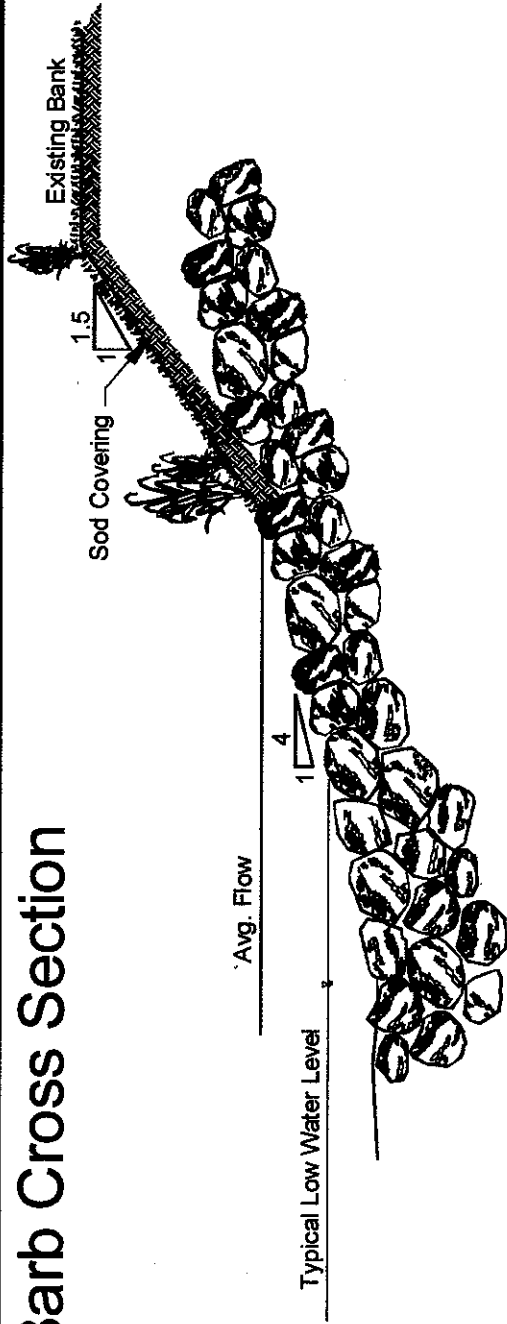
DATE:  
 SCALE: **Not to Scale**  
 CHECKED:

LOCATION:  
 FILENAME:  
 FIGURE:

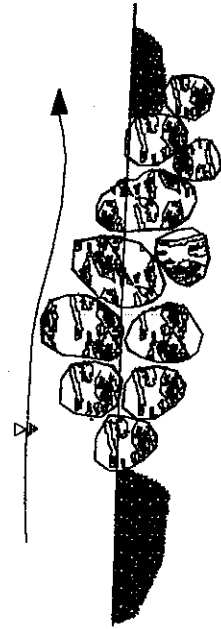
PROJECT NAME:  
**CD Manual**  
 DRAWING TITLE:  
**1 1/2" Rock Weir**



# Rock Barb Cross Section

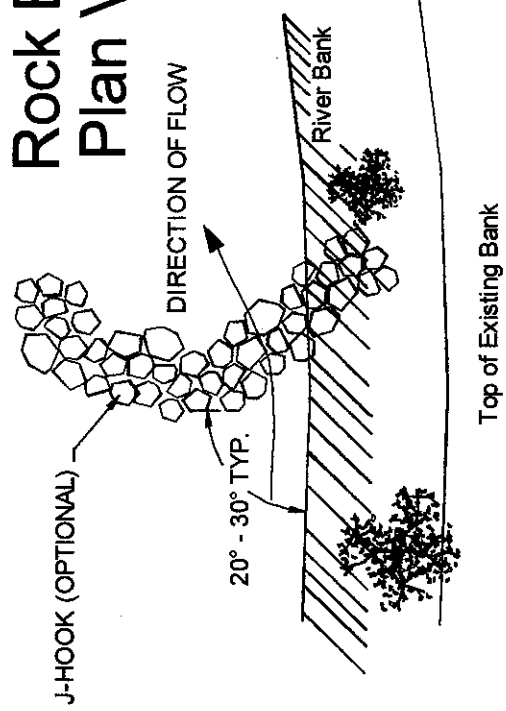


# Rock Barb Cross Section



Rock 2-4 ft Diameter Typical

# Rock Barb Plan View



<b>LAND &amp; WATER CONSULTING, INC.</b> P.O. BOX 6284 Missouri, MI 6507	PERMIT NO.	DATE	LOCATION	PROJECT NAME: <b>CD Manual</b>
	PROJECT MANAGER	SCALE <b>Not to Scale</b>	FILENAME	DRAWING TITLE: <b>Rock Barb</b>
	DRAWN BY: <b>MWV</b>	CHECKED:		