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IDAPA 37
TITLE 03
CHAPTER 07

37.03.07 - STREAM CHANNEL ALTERATION RULES

000. LEGAL AUTHORITY (RULE 0).
The purpose of these rules and minimum standards is to specify procedures for processing and considering applications for stream channel alterations under the provisions of Title 42, Chapter 38, Idaho Code. (7-1-93)

001. TITLE AND SCOPE (RULE 1).

01. Title. (7-1-93)

02. Scope. The minimum standards are intended to enable the Director to process, in a short period of time, those applications which are of a common type and which do not propose alterations which will be a hazard to the stream channel and its environment. It is intended that these rules and minimum standards be administered in a reasonable manner, giving due consideration, to all factors affecting the stream and adjacent property. (7-1-93)

002. WRITTEN INTERPRETATION (RULE 2).

003. ADMINISTRATIVE APPEALS (RULE 3).
Any owner who is aggrieved by a determination or order of the Director may request a hearing pursuant to the provisions of Section 42-1701A(3), Idaho Code, and the Department's adopted Rules of Procedure. (7-1-93)

004. -- 009. (RESERVED)

010. DEFINITIONS (RULE 10).

01. Alteration. To obstruct, diminish, destroy, alter, modify, relocate or change the natural existing shape of the channel or to change the direction of flow of water of any stream channel within or below the mean high water mark. It includes removal of material from the stream channel and emplacement of material or structures in or across the stream channel where the material or structure has the potential to affect flow in the channel as determined by the director. (7-1-93)

02. Applicant. Any individual, partnership, company, corporation, municipality, county, state or federal agency, their agent, or other entity proposing to alter a stream channel or actually engaged in constructing a channel alteration, whether authorized or not. (7-1-93)

03. Board. The Idaho Water Resource Board. (7-1-93)

04. Continuously Flowing Water. A sufficient flow of water that could provide for migration and movement of fish, and excludes those reaches of streams which, in their natural state, normally go dry at the location of the proposed alteration. IDWR will assume, subject to information to the contrary, that the USGS quadrangle maps accurately depict whether a stream reach is continuously flowing, at the location of the proposed alteration. Such exclusion does not apply to minor flood channels that are a part of a stream which is continuously flowing in the reach where the alteration is located. Also, such exclusion does not apply to streams which may be dry as a result of upstream diversion or storage of water. (7-1-93)

05. Department. The Idaho Department of Water Resources. (7-1-93)

06. Drop Structures, Sills and Barbs. Physical obstructions placed within a stream channel for the purpose of stabilizing the channel by decreasing stream gradient and velocity and by dissipating stream energy. (7-1-93)

07. Director. The Director of the Idaho Department of Water Resources. (7-1-93)

08. Mean High Water Mark. A water level corresponding to the "natural or ordinary high water

mark" as defined in Section 58-104(9), Idaho Code, and is the line which the water impresses on the soil by covering it for sufficient periods of time to deprive the soil of its terrestrial vegetation and destroy its value for commonly accepted agricultural purposes. (7-1-93)

09. **Non-Powered Sluice Equipment**. Equipment which is powered only by human strength. (7-1-93)

10. **Plans**. Maps, sketches, engineering drawings, photos, work descriptions and specifications sufficient to describe the extent, nature, and location of the proposed stream channel alteration and the proposed method of accomplishing the alteration. (7-1-93)

11. **Repair**. Any work needed or accomplished, to protect, maintain, or restore any water diversion structure and the associated stream channel upstream and downstream as necessary for the efficient operation of the water diversion structure. (7-1-93)

12. **Stream Channel**. A natural water course of perceptible extent with definite beds and banks which confines and conducts continuously flowing water. The channel referred to is that which exists at the present time, regardless of where the channel may have been located at any time in the past. For the purposes of these rules only, the beds of lakes and reservoir pool areas are not considered to be stream channels. (7-1-93)

13. **Base Flood Elevation**. The Base Flood (BF) is referred to as the one hundred (100) year flood and is a measure of flood magnitude based on probability. The base flood has a one percent chance of occurring or being exceeded in any given year, with the Base Flood Elevation (BFE) being the level of flooding reached during the BF or the one hundred (100) year flood event. (7-1-93)

011. -- 024. (RESERVED)

025. EXEMPTIONS (RULE 25).

01. **Work on Existing or Proposed Reservoir Projects**. Permits are not required under the provisions of Title 42, Chapter 38 for construction work on any existing or proposed reservoir project, including the dam, and such areas downstream as the Director may determine is reasonably necessary for construction and maintenance of the dam. (7-1-93)

02. **Snake and Clearwater Rivers**. Permits are not required for work within that portion of the Snake and Clearwater rivers from the state boundary upstream to the upper boundary of the Port of Lewiston Port District as it now exists or may exist in the future. (7-1-93)

03. **Cleaning, Maintenance, Construction or Repair Work**. No permit is required of a water user or his agent to clean, maintain, construct, or repair any diversion structure, canal, ditch, or lateral or to remove any obstruction from a stream channel which is interfering with the delivery of any water under a valid existing water right or water right permit. (7-1-93)

04. **Removal of Debris**. No permit is required for removal of debris from a stream channel provided that no equipment will be working in the channel and all material removed will be disposed of at some point outside the channel where it cannot again reenter the channel. (7-1-93)

026. -- 029. (RESERVED)

030. APPLICATIONS (RULE 30).

01. **Joint Application Permit Form**. The Department of Water Resources, Department of Lands, and the U.S. Army Corps of Engineers have developed a joint application for permit form which will suffice for the required application under the Stream Protection Act. An application should be filed at least sixty (60) days before the applicant proposes to start the construction and shall be upon the joint application form furnished by the Department. The application shall be accompanied by plans which clearly describe the nature and purpose of the proposed work. (7-1-93)

02. Applicant Following Minimum Standards. In those cases where the applicant intends to follow the minimum standards (Rule 055), detailed plans may be eliminated by referring to the specific minimum standard; however, drawings necessary to adequately define the extent, purpose, and location of the work will still be required. Plans shall include some reference to water surface elevations and stream boundaries to facilitate review. The application should show the mean high water mark on the plans; however, any water surface or water line reference available will be helpful as long as this reference is described. (Examples: present water surface, low water, high water.) (7-1-93)

03. Submission of Copies. The applicant shall submit one (1) copy of all necessary plans along with the application form. When drawings submitted are larger than eight and one half by eleven (8 1/2 x 11), the applicant shall provide the number of copies specified by the department. (7-1-93)

04. Stream Channel Alteration Permit. Any applicant proposing to operate a vacuum or suction dredge within or below the mean high water mark of a stream channel shall apply for and obtain a stream channel alteration permit. The vacuum or suction dredge shall only be operated in accordance with the conditions of the permit and with the applicable rules. (7-1-93)

031. -- 034. (RESERVED)

035. APPLICATION REVIEW (RULE 35).

01. Prior to Issuance of Permit. The following items shall be among those considered by the Director prior to issuing a permit: (7-1-93)

a. What is the purpose of doing the work? (7-1-93)

b. What is the necessity and justification for the proposed alteration? (7-1-93)

c. Is the proposal a reasonable means of accomplishing the purpose? (7-1-93)

d. Will the alteration be a permanent solution? (7-1-93)

e. Will the alteration pass anticipated water flows without creating harmful flooding or erosion problems upstream or downstream? (7-1-93)

f. What effect will the alteration have on fish habitat? (7-1-93)

g. Will the materials used or the removal of ground cover create turbidity or other water quality problems? (7-1-93)

h. Will the alteration interfere with recreational use of the stream? (7-1-93)

i. Will the alteration detract from the aesthetic beauty of the area? (7-1-93)

j. What modification or alternative solutions are reasonably possible which would reduce the disturbance to the stream channel and its environment and/or better accomplish the desired goal of the proposed alteration? (7-1-93)

k. Is the alteration to be accomplished in accordance with the adopted minimum standards? (7-1-93)

l. Are there public safety factors to consider? (7-1-93)

02. Proposed Alteration Which Does Not Follow Minimum Standards. In those cases where a proposed alteration does not follow the minimum standards, a copy of the application will be sent for review to those state agencies requesting notification. The Director shall provide for review by the Department of Lands, copies of applications on navigable rivers. The Director will provide a copy of any other application requested by the Department of Lands and may request review by other state agencies regardless of whether or not the proposed

alteration will comply with the minimum standards. (7-1-93)

036. -- 039. (RESERVED)

040. APPROVAL (RULE 40).

01. Conformance to Application. All work shall be done in accordance with the approved application, subject to any conditions specified by the department. (7-1-93)

02. Permits Allowed Without Review. A permit may be approved by the Director of the Department of Water Resources without review by other agencies in situations where the work is of a nature not uncommon to the particular area and where it is clear that the work will not seriously degrade the stream values except on navigable rivers which require review by the Department of Lands. All work approved in this manner shall be accomplished in accordance with the minimum standards. (7-1-93)

03. Reinstatement of Expired Permit. A permit which has expired may be reinstated by the Director after review by other agencies as determined by the Director. (7-1-93)

041. -- 044. (RESERVED)

045. ENFORCEMENT OF ACT (RULE 45).

01. Written Orders Issued by Designated Employees of Department. Employees of the Department designated by the Director may issue written orders directing an applicant to cease and desist, to ensure proper notice to applicants who are found to be altering a stream without a permit or not in compliance with the conditions of a permit. Such orders shall be in effect immediately upon issuance and will continue in force until a permit is issued or until the order is rescinded by the Director. (7-1-93)

02. Failure to Comply with Stream Protection Act. Failure to comply with any of the provisions of the Stream Protection Act (Chapter 38, Title 42, Idaho Code), may result in issuance of an Idaho uniform citation and/ or the cancellation of any permit by the Director without further notice and the pursuit in a court of competent jurisdiction, such civil or criminal remedies as may be appropriate and provided by law. The Director may allow reasonable time for an applicant to complete stabilization and restoration work. (7-1-93)

046. -- 049. (RESERVED)

050. EMERGENCY WAIVER (RULE 50).

01. Waiver of Provisions of Stream Protection Act. Section 42-3808, Idaho Code, provides for waiver of the provisions of the Stream Protection Act in emergency situations where immediate action must be taken to protect life or property including growing crops. The Director will not consider failure to submit an application for a stream channel alteration far enough ahead of the desired starting time of the construction work as an emergency situation. (7-1-93)

02. Verbal Waivers. A verbal waiver may be granted initially; however, all verbal requests for waivers shall be followed up by the applicant in writing within fifteen (15) days of any initial authorization to do work. If the applicant is unable to contact the Director to obtain an emergency waiver, he may proceed with emergency work; however, he must contact the Director as soon as possible thereafter. Proving that a bonafide emergency did actually exist will be the responsibility of the applicant. (7-1-93)

03. Emergency Waiver. Work authorized by an emergency waiver shall be limited to only that which is necessary to safeguard life or property, including growing crops, during the period of emergency. (7-1-93)

04. Conformance to Conditions of Waiver. The applicant shall adhere to all conditions set by the Director as part of a waiver. (7-1-93)

05. Waivers Granted by Designated Employees. The Director may delegate the authority to grant

waivers to designated employees of the Department. Names and telephone numbers of such employees will be made available to any interested applicant upon request. (7-1-93)

051. -- 054. (RESERVED)

055. MINIMUM STANDARDS (RULE 55).
These standards are intended to cover the ordinary type of stream channel alteration and to prescribe minimum conditions for approval of such construction. Unless otherwise provided in a permit, these standards shall govern all stream channel alterations in this state. An applicant should not assume that because an application utilizes methods set forth in these standards it will automatically be approved. These minimum standards include the following items: (7-1-93)

01. Construction Procedures. (7-1-93)

02. Dumped Rock Riprap. (7-1-93)

03. Gabions. (7-1-93)

04. Drop Structures, Sills and Barbs. (7-1-93)

05. Dikes and Levees. (7-1-93)

06. Jetties. (7-1-93)

07. Culverts and Bridges. (7-1-93)

08. Removal of Sand and Gravel Deposits. (7-1-93)

09. Suction Dredges and Non-Powered Sluice Equipment. (7-1-93)

10. Piling. (7-1-93)

11. Pipe Crossings. (7-1-93)

12. Concrete Plank Boat Launch Ramps. (7-1-93)

056. CONSTRUCTION PROCEDURES (RULE 56).

01. Conformance to Procedures. Construction shall be done in accordance with the following procedures unless specific approval of other procedures has been given by the Director. When an applicant desires to proceed in a manner different from the following, such procedures should be described on the application. (7-1-93)

02. Operation of Construction Equipment. No construction equipment shall be operated below the existing water surface without specific approval from the Director except as follows: Fording the stream at one (1) location only will be permitted unless otherwise specified; however, vehicles and equipment will not be permitted to push or pull material along the streambed below the existing water level. Work below the water which is essential for preparation of culvert bedding or approved footing installations shall be permitted to the extent that it does not create unnecessary turbidity or stream channel disturbance. Frequent fording will not be permitted in areas where extensive turbidity will be created. (7-1-93)

03. Temporary Structures. Any temporary crossings, bridge supports, cofferdams, or other structures that will be needed during the period of construction shall be designed to handle high flows that could be anticipated during the construction period. All structures shall be completely removed from the stream channel at the conclusion of construction and the area shall be restored to a natural appearance. (7-1-93)

04. Minimizing Disturbance of Area. Care shall be taken to cause only the minimum necessary disturbance to the natural appearance of the area. Streambank vegetation shall be protected except where its removal

is absolutely necessary for completion of the work adjacent to the stream channel. (7-1-93)

05. Disposal of Removed Materials. Any vegetation, debris, or other material removed during construction shall be disposed of at some location out of the stream channel where it cannot reenter the channel during high stream flows. (7-1-93)

06. New Cut of Fill Slopes. All new cut or fill slopes that will not be protected with some form of riprap shall be seeded with grass and planted with native vegetation to prevent erosion. (7-1-93)

07. Fill Material. All fill material shall be placed and compacted in horizontal lifts except as provided for in Rule Subsection 060.05 for uncompacted dike and levee construction. Areas to be filled shall be cleared of all vegetation, debris and other materials that would be objectionable in the fill. (7-1-93)

08. Limitations on Construction Period. The Director may limit the period of construction as needed to minimize conflicts with fish migration and spawning, recreation use, and other uses. (7-1-93)

057. DUMPED ROCK RIPRAP (RULE 57).

01. Placement of Riprap. Riprap shall be placed on a granular bedding material or a compact and stable embankment. (7-1-93)

02. Sideslopes of Riprap. Sideslopes of riprap shall not be steeper than 2:1 (2' horizontal to 1' vertical) except at ends of culverts and at bridge approaches where a 1 1/2:1 sideslope is standard. (7-1-93)

03. Minimum Thickness of Riprap. The minimum thickness of the riprap layer shall equal the dimension of the largest size riprap rock used or be eighteen (18) inches, whichever is greater. When riprap will be placed below high water level, the thickness of the layer shall be fifty percent (50%) greater than specified below. (7-1-93)

04. Riprap Protection. Riprap protection must extend at least one (1) foot above the anticipated high water surface elevation in the stream. (7-1-93)

05. Rock Used for Riprap. Rock for riprap shall consist of sound, dense, durable, angular rock fragments, resistant to weathering and free from large quantities of soil, shale, and organic matter. The length of a rock shall not be more than three (3) times its width or thickness. Rounded cobbles, boulders, and streambed gravels are not acceptable as dumped riprap. (7-1-93)

06. Size and Gradation of Riprap. Riprap size and gradation are commonly determined in terms of the weight of riprap rock. The average size of riprap rock shall be at least as large as the maximum size rock that the stream is capable of moving. The maximum size of riprap rock used shall be two (2) to five (5) times larger than the average size. (7-1-93)

07. Methods Used for Determining Gradation of Riprap. There are many methods used for determining the gradation of riprap rock. One of these many acceptable methods is shown in Table 1 below the Far West States (FWS) method shown in APPENDIX A - Table 1A at the end of this chapter.

GRADATION OF RIPRAP IN POUNDS		
Max. Weight of Stone required (lbs)	**Min. and Max. Range in weight of Stones (lbs)**	**Weight Range 75 percent of Stones (lbs)**
150	25 - 150	50 - 150
200	25 - 200	50 - 200
250	25 - 250	50 - 250
400	25 - 400	100 - 400

GRADATION OF RIPRAP IN POUNDS		
Max. Weight of Stone required (lbs)	**Min. and Max. Range in weight of Stones (lbs)**	**Weight Range 75 percent of Stones (lbs)**
600	25 - 600	150 - 600
800	25 - 800	200 - 800
1000	50 - 1000	250 - 1000
1300	50 - 1300	325 - 1300
1600	50 - 1600	400 - 1600
2000	75 - 2000	600 - 2000
2700	100 - 2700	800 - 2700

(7-1-93)

08. **Use of Filter Material**. A blanket of granular filter material or filter fabric shall be placed between the riprap layer and the bank in all cases where the bank is composed of erodible material that may be washed out from between the riprap rock. Filter material shall consist of a layer of well-graded gravel and coarse sand at least six (6) inches thick. (7-1-93)

09. **Toe Protection**. Some suitable form of toe protection shall be provided for riprap located on erodible streambed material. (7-1-93)

a. Various acceptable methods of providing toe protection are shown in APPENDIX B at the end of this chapter. (7-1-93)

b. In addition to the approved methods of providing toe protection as shown in APPENDIX B at the end of this chapter, any other reasonable method will be considered by the Director during review of a proposed project. (7-1-93)

10. **Extension of Riprap Area**. Riprap shall extend far enough upstream and downstream to reach stable areas, unless protected against undermining at ends by the method shown in APPENDIX C, Figure 3 at the end of this chapter. On extremely long riprap sections, it is recommended that similar cutoff sections be used at several intermediate points to reduce the hazard that would be created if failure of the riprap occurred at any one (1) location. (7-1-93)

11. **Finished Surface**. Placement shall result in a smooth, even finished surface. Compaction is not necessary. (7-1-93)

12. **Placement of Riprap**. The full course thickness of the riprap shall be placed in one (1) operation. Dumping riprap long distances down the bank or pushing it over the top of the bank with a dozer shall be avoided if possible. Material should be placed with a backhoe, loader, or dragline. Dumping material near its final position on the slope or dumping rock at the toe and bulldozing it up the slope is a very satisfactory method of placement, if approval is obtained for the use of equipment in the channel. (7-1-93)

13. **Design Procedure**. Design procedure using the Far West States (FWS) method. (7-1-93)

a. The FWS method uses a single equation to deal with variables for riprap. (7-1-93)

D75 = 3.5/CK WDS for Channel Banks

where: D75 = Size of the rock at seventy five percent (75%) is finer in gradation, in inches.

W	=	Specific weight of water, usually 62.4 lbs./cu.ft.
D	=	Depth of flow in stream, in feet in flood stage
S	=	Channel slope or gradient, in ft/ft.
C	=	A coefficient relating to curvature in the stream
K	=	A coefficient relating to steepness of bank slopes

(7-1-93)

b. The coefficient, C, is based on the ratio of the radius of curvature of the stream, (CR), to the water surface width, (WSW), so it is necessary for the user to make field determination of these values. The coefficient varies from 0.6 for a curve ratio of 4 to 6, up to 1.0 for a straight channel. If the computed ratio for a particular project is less than 4, the designer should consider some modification less than 4.

CR/WSW	C
4 - 6	0.60
6 - 9	0.75
9 - 12	0.90
Straight Channel	1.00

(7-1-93)

c. The coefficient, K, ranges from 0.5 for a 1.5:1 sideslope to 0.87 for 3:1 sideslope. No values are given for steeper or flatter slopes. Slopes steeper than 1.5:1 are not recommended. If slopes flatter than 3:1 are desired, it would be conservative to use the K-value for 3:1 slopes.

Bankslope	K
1.5:1	0.50
1.75:1	0.63
2.0:1	0.72
2.5:1	0.80
3.0:1	0.87

(7-1-93)

Table 1A in APPENDIX A, located at the end of this chapter.

058. GABIONS (RULE 58).

01. Wire Enclosed Gabion Riprap. This protection consists of filling wire "cages" with available rock and securing individual cages together to form a stable slope protection. Aesthetics can be improved by arranging the individual gabions in a manner that will allow planting of vegetation. (7-1-93)

02. Placement of Gabions. Gabions shall be placed on a well-compacted and stable embankment. (7-1-93)

03. Toe Protection. In general, toe protection shall consist of protection equivalent to at least one (1) of the following: (7-1-93)

a. Extend gabions, on slope, at least three (3) feet below streambed or to non-erodible material. (7-1-93)

b. Extend gabions out from toe along streambed of an erodible channel a horizontal distance of at least five (5) times the thickness of the gabion mattress. (7-1-93)

04. Mattress or Retaining Wall Gabion Placements. Gabions may be placed to form either a mattress or a retaining wall as shown in Figures 4 and 5 in APPENDIXES D and E, located at the end of this chapter. Minimum thickness of mattress shall be twelve (12) inches unless otherwise approved by the Director. (7-1-93)

a. Gabion retaining walls shall be constructed in accordance with the illustrated criteria as shown in Figure 5 in APPENDIX E, (located at the end of this chapter), and shall have a minimum horizontal thickness of three (3) feet. Fill above gabion retaining walls shall not exceed a slope of one and one half to one (1 1/2:1). Retaining walls shall not exceed a height of ten (10) feet above streambed unless the Director has approved detailed design plans for the project. (7-1-93)

b. The wall shall be founded on a stable non-erodible base unless a mattress is provided to prevent undermining as shown in Figure 6 in APPENDIX F, located at the end of this chapter. (7-1-93)

05. Single Unit Construction. Gabions are to be of single unit construction -- the base, ends, and sides to be woven into a single unit. (7-1-93)

a. Wire. Wire mesh shall be heavily galvanized steel woven wire no smaller than twelve (12) gage. Mesh size shall be coordinated with rock gradation as specified in Rule Subsection 058.06. All ties, hog rings, lacing and other wire used shall be nine (9) gage galvanized wire unless otherwise approved. (7-1-93)

b. Size of Gabion. No individual compartment within a gabion shall have a length, width, or height exceeding four (4) feet except that gabion mattress sections one (1) foot or less in thickness may have a horizontal length up to six (6) feet. (7-1-93)

c. Seams. Gabion baskets shall have corners tied or laced together at least every four (4) inches along edges. (7-1-93)

d. Ties Between Gabion Baskets. At least two (2) ties shall be made between gabions for every square foot of contact area. (7-1-93)

06. Rock Used for Gabion Fill. Rock used for gabion fill shall be sound, dense, durable rock which is free from earth and organic matter. The maximum size of the rock shall not exceed the gabion thickness and seventy percent (70%) of the rock by weight must exceed, in least dimension, the mesh opening in the wire. (7-1-93)

07. Filter Blanket. A filter blanket of well-graded gravel and coarse sand at least six (6) inches thick, or suitable filter fabric, shall be placed between the bank and the gabions in cases where the bank is composed of fine erodible material. For filter design using the FWS method, see USDA, Soil Conservation Service, Idaho Technical Note No. 6 or equivalent design criteria. (7-1-93)

08. Riprap Protection. Riprap protection shall extend at least one (1) foot above the anticipated high water surface elevation in the stream; however, it is not required that protection be extended above the elevation of the top of the bank. (7-1-93)

09. Locating Ends of Gabion. Whenever it is necessary to locate the ends of gabion protection in areas that may be subject to erosive damage, minimum cutoffs shall be provided to prevent undermining as shown in Figure 7 in APPENDIX G. Views shown are cross-sections at end of gabion section looking down along the sideslope of the channel. (7-1-93)

059. DROP STRUCTURES, SILLS AND BARBS (RULE 59).

01. Drop Structures. A drop structure shall be constructed of rocks, boulders and/or logs placed within a stream channel to act as a low level dam. Placement of a drop structure perpendicular to stream flow will decrease the stream gradient, dissipate stream energy and decrease stream velocity through an increase in water surface elevation immediately above the structure. Drop structures shall comply with the following criteria: (7-1-93)

a. Maximum water surface differential across (upstream water surface elevation minus downstream water surface elevation) a drop structure shall not exceed two (2) feet. The department shall approve the final elevation of any structure. (7-1-93)

b. Rock drop structures shall be constructed of clean, sound, dense, durable, angular rock fragments, and/or boulders of size and gradation, such that the stream is incapable of moving the material during peak flows. Rocks shall be keyed into the stream banks to minimize the likelihood of bank erosion, (See Figure 8 in APPENDIX H located at the end of this chapter). (7-1-93)

c. Log drop structures are acceptable in four (4) designs including the single log dam, the stacked log dam, the three (3) log dam, and the pyramid log dam. Log ends shall be keyed into both banks at least one-third (1/3) of the channel width or a distance sufficient to prevent end erosion. To prevent undercutting, the bottom log shall be imbedded in the stream bed or hardware cloth, cobbles or boulders shall be placed along the upper edge. Minimum log size for a single log structure shall be determined by on-site conditions and shall be placed to maintain flow over the entire log to prevent decay. Each log drop structure must be accompanied by downstream scour protection, such as a rock apron (See Figure 9 in APPENDIX I located at the end of this chapter. (7-1-93)

d. All drop structures shall be constructed to facilitate fish passage and centralized scour pool development. (7-1-93)

02. Sills. A sill shall be constructed of the same material and in the same manner as a drop structure. The top of the sill may not exceed the elevation of the bottom of the channel. The purpose of a sill is to halt the upstream movement of a headcut, thus precluding the widening or deepening of the existing channel. (See Figure 10 in APPENDIX J located at the end of this chapter). (7-1-93)

03. Barb or Partial Drop Structure. A barb or partial drop structure shall be constructed in the same manner and of the same material as a drop structure and placed into the stream channel to act as a low level dam and grade control structure. The barb will decrease stream gradient, dissipate stream energy and redirect stream flow. (7-1-93)

a. Barbs shall be constructed of clean, sound, dense, angular rock fragments, of size and gradation such that the stream is incapable of moving the material during peak flows. (7-1-93)

b. Barbs shall be constructed with a downstream angle of no less than one hundred (100) degrees and no greater than one hundred thirty-five (135) degrees unless otherwise specified. (7-1-93)

c. Barbs shall "extend" into the channel a distance of not more than twenty percent (20%) of the width of the channel unless otherwise specified by the Director. (7-1-93)

d. Barbs shall be keyed into the bank a distance equal to or greater than the width of the structure and down to bed level. Whenever moisture is encountered in the construction of the keyways, willow cuttings or clumps shall be placed before and during rock placement in such a manner that the base of the cutting is in permanent moisture and the top extends a minimum of six (6) inches above grade (see Figure 11 in APPENDIX K located at the end of this chapter). (7-1-93)

060. DIKES AND LEVEES (RULE 60).

01. Standards for Dikes. The following standards apply to dikes with heights from ground level to water surface elevation no greater than twelve (12) feet. Approval of higher dikes will be based on evaluation of a detailed design for the particular proposal. Permits for such structures are needed only when all or part of the structure is located below the mean high water mark (see Figure 12 in APPENDIX L located at the end of this chapter). (7-1-93)

02. Location of Dikes. Dikes shall be located in the best possible foundation material available and shall not obstruct the natural flow of or raise the water surface in the channel. (7-1-93)

03. Figure 13. Figure 13 in APPENDIX L, located at the end of this chapter, shows the most desirable location for a dike, because such an alignment results in minimum erosion and maintenance for the dike and the least possible disturbance to the stream; however, each applicant must decide what alignment is most suited to solve a particular problem. (7-1-93)

04. Dike or Levee Foundation Areas. Dike or levee foundation areas shall be clear of all trees, brush, stumps, logs, roots, boulders and other undesirable material which would interfere with scarifying the area. (7-1-93)

a. Organic soils shall be removed except where fill used for the levee will primarily consist of organic material. (7-1-93)

b. Unsuitable material at old channel crossings shall be removed and banks of the old channel shall be no steeper than one to one (1:1) before fill is placed. (7-1-93)

05. Pervious Foundation. When the foundation is pervious enough that piping may occur, a core trench shall be constructed down to an impervious layer or to some reasonable depth if impervious material is not present. Construction of the core trench shall comply with the following criteria: (7-1-93)

a. The core trench shall be located approximately along the centerline of the dike. (7-1-93)

b. When impervious material is not encountered in the core trench, drains shall be provided on the land side of the trench (use a graded sand-gravel filter blanket) with the minimum trench depth as follows to ensure stability:

Design Water Surface Above Ground Level	Minimum Core Trench Depth Below Ground Level
0 - 6'	3'
6 - 12'	6'

(7-1-93)

c. The width of the bottom of the core trench shall be adequate to allow movement of construction equipment to place and compact material. Sideslopes of the trench shall not be steeper than one to one (1:1). (7-1-93)

d. Core trench backfill shall consist of the most impervious material available and shall be well compacted. (7-1-93)

06. Existing Drains. All existing drains entering the channel shall be maintained by installing conduits through dikes. Conduits shall be installed on firm foundations and backfill material shall be thoroughly compacted in lifts.) (7-1-93)

07. Minimum Design Water Level Surface. The minimum design water surface elevation that shall be provided for is as follows: The dike shall provide at least two (2) feet of freeboard above the design water surface.

Drainage Area	Design Flow Frequency
Less than 50 sq. mil.	25 years
50 sq. mi. or more	50 years or greatest flow of record, whichever is more

(7-1-93)

08. Height of Dike or Levee. The height of a dike or levee shall be increased during construction enough to ensure the required freeboard after settlement. Minimum height increases are as follows:

Fill Material	Minimum Height Increase
Normal compacted fill	5%
Uncompacted Dragline construction	20%
Near-saturated organic matter	40%

(7-1-93)

09. Compacted Mineral Soil. Compacted mineral soil having a high specific gravity and capable of achieving low permeability is the most desirable fill material and may be utilized on all dikes or levees. (7-1-93)

a. Organic fill material shall not be used on levees having a design water surface more than six (6) feet above land surface, unless specific approval from the Director is obtained. (7-1-93)

b. Silty or sand material shall not be used for fill unless provisions are specified on the application and/or plans which will adequately protect this material from erosion. (7-1-93)

10. Cross-Section of Dike or Levee. The cross-section of a dike or levee shall conform to the minimum criteria shown in Rule 061.01, Table 2 and Figure 14 in APPENDIX L, located at the end of this chapter. In those instances where the location of a dike or the nature of the fill material is such that erosion of the fill is likely, some suitable form of slope protection such as riprap or grass shall be provided. (See the appropriate riprap specification for standards required. Embankments constructed of silty or sandy materials shall receive particular attention with regard to slope protection.) (7-1-93)

061. JETTIES (RULE 61).

01. Use of Jetties. Use of jetties shall not be permitted on curves having less than a two hundred (200) foot radius unless hydraulic analysis can be provided to show that they will achieve the desired results.

MINIMUM CRITERIA FOR DIKE OR LEVEE CROSS-SECTION		
Height to Design Water Surface	**Minimum Top Width**	**Steepest Allowable Sideslope**
Compacted mineral fill:		
0 - 6'	6'	1 1/2:1
over 6' - 12'	8'	2:1
Silty, sandy, or organic fill:		
0 - 6'	8'	2:1
Dumped, uncompacted fill:		
0 - 6'	6'	2:1
over 6' - 12'	8'	2 1/2:1 (or 3:1 on stream side and 2:1 on land side)
When road on top: (turnaround areas also needed)	10'	

MINIMUM CRITERIA FOR DIKE OR LEVEE CROSS-SECTION		
Height to Design Water Surface	**Minimum Top Width**	**Steepest Allowable Sideslope**
When fill unstable during rapid drawdown or severe wave action anticipated)	3:1 on stream side	
Permeable soil of low plasticity used	3:1	

(7-1-93)

a. Jetties shall not extend into the stream from the bank more than twenty percent (20%) of the channel width unless it can be demonstrated that undesirable effects will not be created. (7-1-93)

b. Jetties shall be spaced close enough together to provide continuous protection along the streambank unless other provisions for protection between the jetties are provided. Section Subsection 061.01, Table 2, shows one (1) method of locating jetties. (7-1-93)

02. Height of Jetty. The height shall be at least equal to the design streamflow depth unless the jetty is specifically designed for fish shelter or streambank toe protection only. (See details in Figure 16 in APPENDIX M, located at the end of this chapter.) (7-1-93)

a. Jetties shall always be protected from erosion at their contact with the bank and streambed by extending the fill and/or riprap down to non-erodible material or beyond the maximum anticipated scour depth. The minimum scour depth considered shall be two (2) feet. (7-1-93)

b. Minimum top width for a jetty shall be three (3) feet unless otherwise specified by the Director. (7-1-93)

c. The steepest allowable sideslopes for a jetty shall be as follows unless otherwise specified by the Director.

Type of Jetty	Maximum Sideslope
Full flow height	1 1/2:1
Low partial flow height	2:1

(7-1-93)

d. Jetties shall be protected from erosive damage either by placing rock riprap or other protective cover at areas subject to erosion or by constructing the jetty using a material resistant to erosion. (7-1-93)

e. Full flow height jetties shall be protected from erosive damage on the upstream side and end. (7-1-93)

f. Low jetties that will be subject to flow over the entire structure shall be protected from erosive damage on all exposed surfaces. (7-1-93)

03. Pervious or Impervious Fills. Jetties may be constructed as either pervious or impervious fills. (7-1-93)

a. Construction of a pervious jetty will require the use of fill material such as well-graded angular rock which will not be eroded or otherwise weakened by allowing seepage to flow through it. Rock filled wire gabions are also suitable for construction of pervious jetties where angular rock of adequate size is not available. (7-1-93)

b. Impervious fill shall be placed in horizontal lifts and thoroughly compacted. Fill consisting primarily of silty material shall not be used. This type of construction requires the use of rock riprap or other suitable protection in areas subject to erosive action. (7-1-93)

062. CULVERTS AND BRIDGES (RULE 62).

01. Culverts and Bridges. Culverts and bridges shall be capable of carrying streamflows and shall not significantly alter conditions upstream or downstream by causing flooding, turbidity, or other problems. The appearance of such installations shall not detract from the natural surroundings of the area. (7-1-93)

02. Location of Culverts and Bridges. Culverts and bridges should be located so that a direct line of approach exists at both the entrance and exit. Abrupt bends at the entrance or exit shall not exist unless suitable erosion protection is provided. (7-1-93)

03. Ideal Gradient. The ideal gradient (bottom slope) is one which is steep enough to prevent silting but flat enough to prevent scouring due to high velocity flows. It is often advisable to make the gradient of a culvert coincide with the average streambed gradient. (7-1-93)

a. Where a culvert is installed on a slope steeper than twenty percent (20%), provisions to anchor the culvert in position will be required. Such provisions shall be included in the application and may involve the use of collars, headwall structures, etc. Smooth concrete pipe having no protruding bell joints or other irregularities shall have such anchoring provisions if the gradient exceeds ten percent (10%). (7-1-93)

04. Size of Culvert or Bridge Opening. The size of the culvert or bridge opening shall be such that it is capable of passing design flows without overtopping the streambank or causing flooding or other damage. (7-1-93)

a. Design flows shall be based upon the following minimum criteria:

Drainage Area	Design Flow Frequency
Less than 50 sq. mi.	25 Years
Over 50 sq. mi. or more	50 years or greatest flow of record, whichever is more

(7-1-93)

b. For culverts and bridges located on U.S. Forest Service or other federal lands, the sizing should comply with the Forest Practices Act as adopted by the federal agencies or the Department of Lands. (7-1-93)

c. For culverts or bridges located in a community qualifying for the national flood issuance program, the minimum size culvert shall accommodate the one hundred (100) year design flow frequency. (7-1-93)

d. If the culvert or bridge design is impractical for the site, the crossing may be designed with additional flow capacity outside the actual crossing structure, provided there is no increase in the Base Flood Elevation.
(NOTE: When flow data on a particular stream is unavailable, it is almost always safe to maintain the existing gradient and cross-section area present in the existing stream channel. Comparing the proposed crossing size with others upstream or downstream is also a valuable means of obtaining information regarding the size needed for a proposed crossing.) (7-1-93)

e. Minimum clearance shall be at least one (1) foot at all bridges. This may need to be increased substantially in the areas where ice passage or debris may be a problem. Minimum culvert sizes required for stream crossings: (7-1-93)

i. Eighteen (18) inch diameter for culverts up to seventy (70) feet long; (7-1-93)

ii. Twenty-four (24) inch diameter for all culverts over seventy (70) feet long. (7-1-93)

f. In streams where fish passage is of concern as determined by the director, an applicant shall comply with the following provisions and/or other approved criteria to ensure that passage will not be prevented by a proposed crossing. (7-1-93)

g. Minimum water depth shall be approximately eight (8) inches for salmon and steelhead and at least three (3) inches in all other cases. (7-1-93)

h. Maximum flow velocities for streams shall not exceed those shown in Figure 17 in APPENDIX N, located at the end of this chapter, for more than a forty-eight (48) hour period. The curve used will depend on the type of fish to be passed. (7-1-93)

i. Where it is not feasible to adjust the size or slope to obtain permissible velocities, the following precautions may be utilized to achieve the desired situation. (7-1-93)

j. Baffles downstream or inside the culvert may be utilized to increase depth and reduce velocity. Design criteria may be obtained from the Idaho Fish and Game Department. (7-1-93)

k. Where multiple openings for flow are provided, baffles or other measures used in one (1) opening only shall be adequate provided that the opening is designed to carry the main flow during low-flow periods. (7-1-93)

05. Construction of Crossings. When crossings are constructed in erodible material, upstream and downstream ends shall be protected from erosive damage through the use of such methods as dumped rock riprap, headwall structures, etc., and such protection shall extend below the erodible streambed and into the banks at least two (2) feet unless some other provisions are made to prevent undermining. (7-1-93)

a. Where fish passage must be provided, upstream drops at the entrance to a culvert will not be permitted and a maximum drop of one (1) foot will be permitted at the downstream end if an adequate jumping pool is maintained below the drop. (7-1-93)

b. Downstream control structures such as are shown in Figure 18 in APPENDIX O, located at the end of this chapter, can be used to reduce downstream erosion and improve fish passage. They may be constructed with gabions, pilings and rock drop structures. (7-1-93)

06. Multiple Openings. Where a multiple opening will consist of two (2) or more separate culvert structures, they shall be spaced far enough apart to allow proper compaction of the fill between the individual structures. The minimum spacing in all situations shall be one (1) foot. In areas where fish passage must be provided, only one (1) opening shall be constructed to carry all low flows. Low flow baffles may be required to facilitate fish passage. (7-1-93)

07. Areas to be Filled. All areas to be filled shall be cleared of vegetation, topsoil, and other unsuitable material prior to placing fill. Material cleared from the site shall be disposed of above the high water line of the stream. Fill material shall be reasonably well-graded and compacted and shall not contain large quantities of silt, sand, organic matter, or debris. In locations where silty or sandy material must be utilized for fill material, it will be necessary to construct impervious sections both upstream and downstream to prevent the erodible sand or silt from being carried away (see Figure 19, APPENDIX P, located at the end of this chapter), Sideslopes for fills shall not exceed one and one half to one (1.5:1). Minimum cover over all culvert pipes and arches shall be one (1) foot. (7-1-93)

08. Installation of Pipe and Arch Culvert. All pipe and arch culverts shall be installed in accordance with manufacturer's recommendations. (7-1-93)

a. The culvert shall be designed so that headwaters will not rise above the top of the culvert entrance unless a headworks is provided. (7-1-93)

063. REMOVAL OF SAND AND GRAVEL DEPOSITS (RULE 63).

01. Removal of Sand and Gravel. This work consists of removal of sand and gravel deposits from within a stream channel. The following conditions shall be adhered to unless other methods have been specified in detail on the application and approved by the Director. (7-1-93)

02. Removal Below Water Surface. Sand and gravel must not be removed below the water surface existing at the time of the work. Where work involves clearing a new channel for flow, removal of material below water level will be permitted to allow this flow to occur; however, this must not be done until all other work in the new channel has been completed. (7-1-93)

03. Buffer Zone. A buffer zone of undisturbed streambed material at least five (5) feet in width or as otherwise specified by the Director shall be maintained between the work area and the existing stream. The applicant shall exercise reasonable precautions to ensure that turbidity is kept to a minimum and does not exceed state water quality standards. (7-1-93)

04. Movement of Equipment. Equipment may cross the existing stream in one (1) location only, but shall not push or pull material along the streambed while crossing the existing stream. (7-1-93)

05. Disturbing Natural Appearance of Area. Work must be done in a manner that will least disturb the natural appearance of the area. Sand and gravel shall be removed in a manner that will not leave unsightly pits or other completely unnatural features at the conclusion of the project. (7-1-93)

064. SUCTION DREDGES AND NON-POWERED SLUICE EQUIPMENT (RULE 64).

01. Standards for Suction Dredges. The following standards shall apply only to uses of suction dredges with nozzle diameter of five (5) inches or less and rated at fifteen (15) HP or less and non-powered sluice equipment moving more than one-quarter (1/4) cubic yard per hour. (7-1-93)

02. Operating Permit. A permit for the operation of a suction dredge may authorize the use of the dredge within a drainage basin or a large portion of a drainage basin except as otherwise determined by the Director. (7-1-93)

03. Mechanized Equipment Prohibited Below High Water Mark. There shall be no use of mechanized equipment below the mean high water mark except for the dredge itself, and any life support system necessary to operate the dredge. (7-1-93)

04. Operation of Dredge. The operation of the dredge shall be done in a manner so as to prevent the undercutting of streambanks. (7-1-93)

05. Permit Required for Non-Powered Operation -- More Than Five People. A permit shall be required for any non-powered operation in which more than five (5) people are working the same area. (7-1-93)

06. Permit Required for Non-Powered Operation -- More Than Thirty-Three Percent of Stream Width. A permit shall be required for any non-powered operation if the disturbed area exceeds thirty-three percent (33%) of the stream width at the mining location. (7-1-93)

07. Limitation of Mining Sites. Only one (1) mining site per one hundred (100) linear feet of stream channel shall be worked at one (1) time unless waived by the Director. (7-1-93)

065. PILING (RULE 65).

01. Standards for Pilings. The following standards apply to a piling associated with a boat or swimming dock, a log boom, a breakwater, or bridge construction. (7-1-93)

02. Replacement of Pilings. In replacing a piling the old piling shall be completely removed from the channel, secured to the new piling or cut at stream bed level. (7-1-93)

03. Condition of Pilings. Chemicals or compounds used for protection of piles and lumber shall be thoroughly dried to prevent bleeding, weeping or dissolution before placing such piles and lumber over, in or near water. (7-1-93)

04. Prohibited Materials. The application of creosote, arsenicals or phentachlorophenol (Penta) to timber shall not occur in, or over water. (7-1-93)

066. PIPE CROSSINGS (RULE 66).

01. Standards for Pipe Crossings. The following standards apply to pipe crossings to be installed below the bed of a stream or river such as utility crossings of a gas line, sewer line, electrical line, communication line, water line or similar line. (7-1-93)

02. Depth of Line. The line shall be installed below the streambed to a depth which will prevent erosion and exposure of the line to free flowing water. In areas of high stream velocity where scouring may occur, the pipe shall be encased in concrete or covered with rock riprap to prevent the pipeline from becoming exposed. (7-1-93)

03. Pipe Joints. The joints shall be welded, glued, cemented or fastened together in a manner to provide a water tight connection. (7-1-93)

04. Construction Methods. Construction methods shall provide for eliminating or minimizing discharges of turbidity, sediment, organic matter or toxic chemicals. A settling basin or cofferdam may be required for this purpose. (7-1-93)

05. Cofferdam. If a cofferdam is used, it shall be completely removed from the stream channel upon completion of the project. (7-1-93)

06. Revegetation of Disturbed Areas. Areas disturbed as a result of the alteration shall be revegetated with plants and grasses native to these areas. (7-1-93)

067. CONCRETE PLANK BOAT LAUNCH RAMPS (RULE 67).

01. Construction of Concrete Plank Boat Launch Ramps. Concrete plank boat launch ramps, shall be constructed with individual sections of precast, reinforced concrete planks linked together to provide a stable non-erosive water access. Typical plank size is twelve feet by fourteen inches by four inches (12’ x 14” x 4”). (See Figure 20, APPENDIX Q, located at the end of this chapter). (7-1-93)

02. Construction of Planks. All planks shall be constructed with Type II low alkali cement. (7-1-93)

03. Concrete Planks. All concrete planks shall have a smooth form finish, free of rock pockets and loose materials. Figure 22 shows a typical launch plank detail. (See Figures 21 and 22 in APPENDIXES R and S). (7-1-93)

04. Assembly of Planks. The planks shall be assembled out of the water and slid into place on a constructed launch ramp where water velocities do not exceed two (2) feet per second. In waters exceeding (2) feet per second the ramp sections shall be linked together and fastened to pre-positioned stringers anchored into the launch ramp. (See Figure 23, APPENDIX T, located at the end of this chapter). (7-1-93)

05. Water Depth. The water depth above the lower end of the ramp section shall not be less than three (3) feet during low level or low flow periods. (See Figure 20, APPENDIX Q, located at the end of this chapter). (7-1-93)

06. Construction of Boat Ramp. The boat launch ramp shall have a base constructed of sound, dense, durable, angular rock resistant to weathering and free from soil, shale and organic materials. Rounded cobbles, boulders and streambed material are not acceptable as base material in areas with stream flow velocities greater than two (2) fps. Base materials shall be covered with a layer of (three-fourths inches (3/4”) min.) crushed rock with a

minimum depth of two inches (2”). The ramp shall have a minimum and maximum slope of ten percent (10%) and fifteen percent (15%) respectively, and shall be constructed in a manner to avoid long incursions into the stream channel. All ramps and fill material shall be protected with rock riprap in accordance with Rule 057 when stream flow velocities exceed two (2) fps. (See Figure 24, APPENDIX U, located at the end of this chapter). (7-1-93)

068. -- 069. (RESERVED)

070. HEARINGS ON DENIED, LIMITED, OR CONDITIONED PERMIT OR OTHER DECISIONS OF THE DIRECTOR (RULE 70).
Any applicant who is granted a limited or conditioned permit, or who is denied a permit, may seek a hearing on said action of the Director by serving on the Director written notice and request for a hearing before the Board within fifteen (15) days of receipt of the Director’s decision. Said hearing will be set, conducted, and notice given as set forth in the Rules promulgated by the Board under the provisions of Title 67, Chapter 52, Idaho Code. (7-1-93)

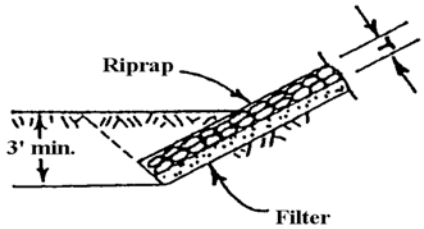
071. -- 999. (RESERVED)

APPENDIX A
Table 1A

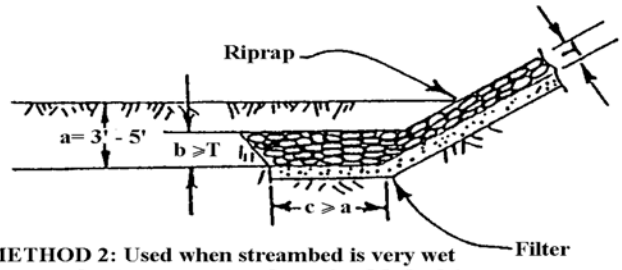
Riprap Gradation Using FWS Method

% Finer by Weight (Lbs.)	Minimum Size (Lbs.)	Maximum Size (Lbs.)
D_{100}	1.33 X D_{75}	2.0 X D_{75}
D_{75}	1.0 X D_{75}	1.67 X D_{75}
D_{50}	0.67 X D_{75}	1.17 X D_{75}
D_{25}	0.33 X D_{75}	0.77 X D_{75}
D_0	None	0.33 X D_{75}

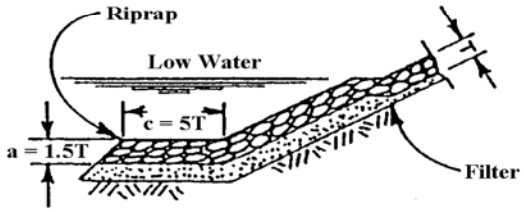
APPENDIX B



METHOD 1: This is most suited to areas where the toe is dry during construction.



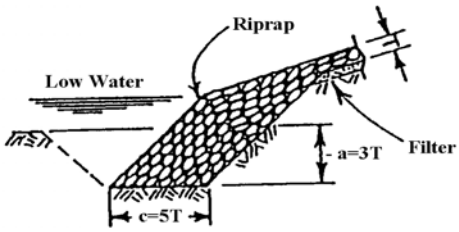
METHOD 2: Used when streambed is very wet or groundwater presesnt makes using Method 1 impractical.



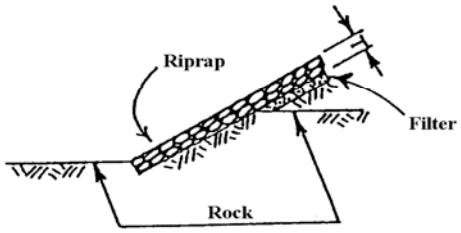
METHOD 3: Often used when toe is underwater during construction. Both Methods 2 and 3 utilize the idea that undermining will cause rock at toe blanket to settle into eroded area providing protection during scouring.

FIGURE 2. Acceptable toe protection

APPENDIX B (CONTINUED)



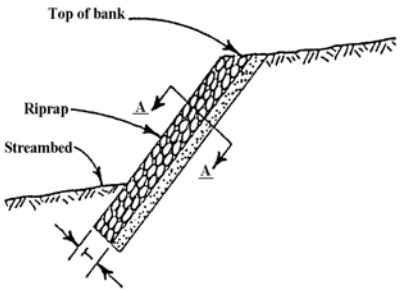
METHOD 4: Used underwater in areas with extremely bad streambed erosion conditions which make Method 3 unfeasible. This method may also be preferred where Mehtod 3 would destroy fish spawing beds.

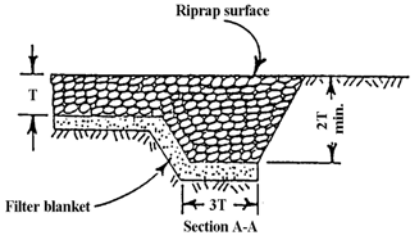


METHOD 5: When the streambed is non-erodible, no special provisions for toe protection are needed other than insuring that the riprap is well keyed to the rock.

FIGURE 2. Acceptable toe protection ***continued***

APPENDIX C



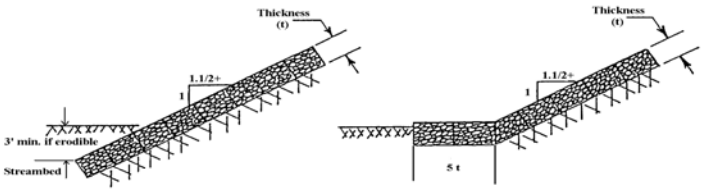


View shown above is cross section at end of riprap looking down along the sideslope toward streambed.

FIGURE 3. Protction against undermining

APPENDIX D

FIGURE 4. Mattress Construction



APPENDIX E

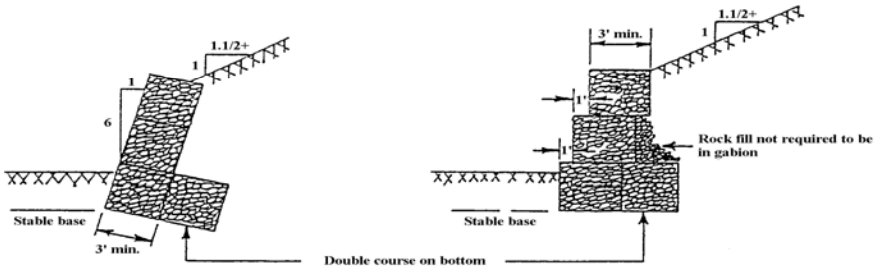


FIGURE 5. Retaining wall construction

APPENDIX F

FIGURE 6. Placement of mattress toe protection

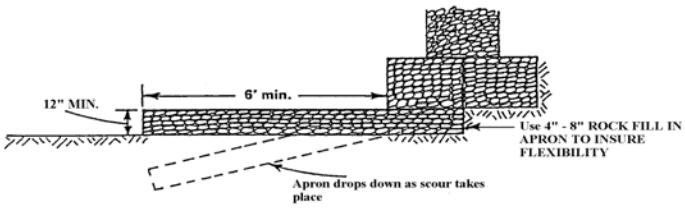


FIGURE 6. Placement of mattress toe protection

APPENDIX G

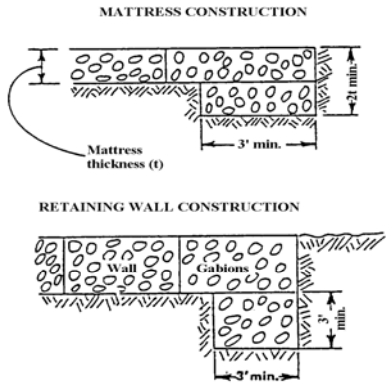
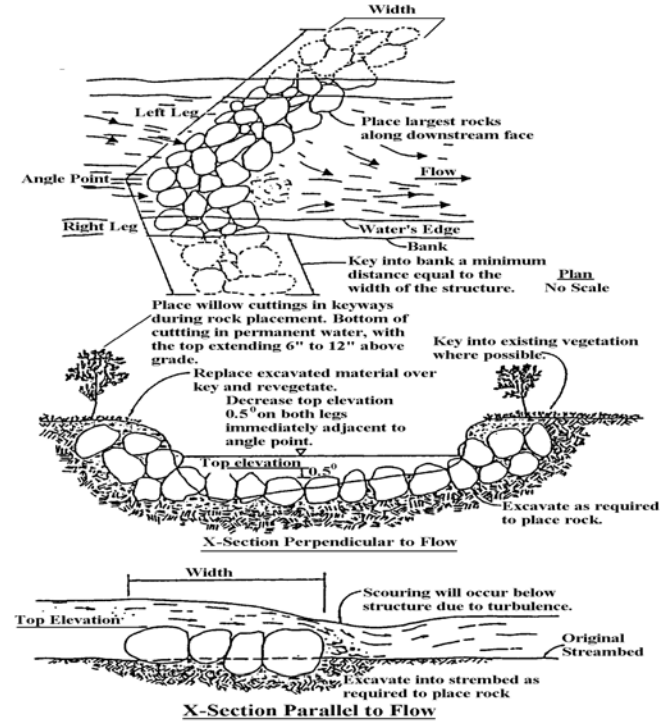


FIGURE 7. Minimum cutoffs - views shown are cross-sections at end of gabion section looking down along the sideslope of the channel

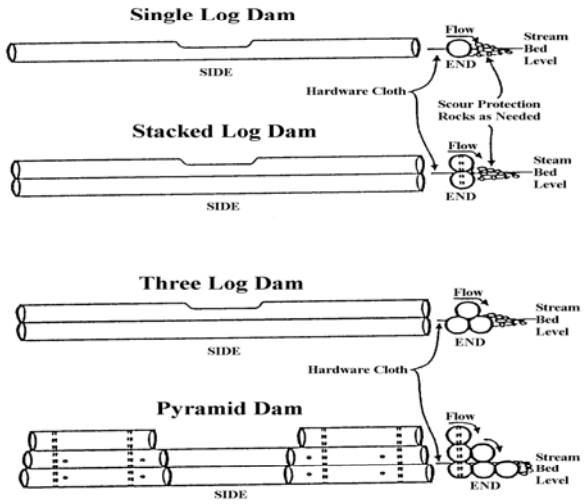
APPENDIX H



ROCK DROP STRUCTURE DETAILS

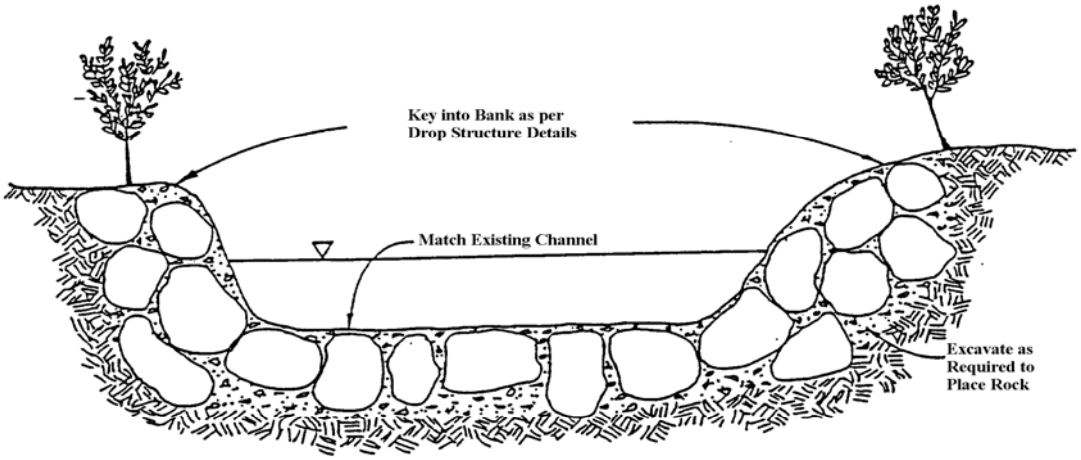
No Scale

APPENDIX I



LOG DROP STRUCTURE DETAILS
No Scale

APPENDIX J

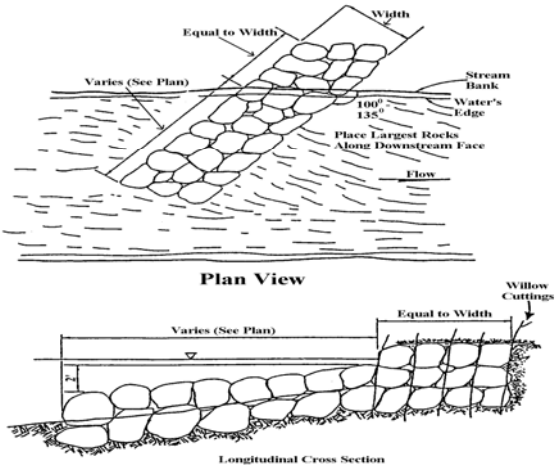


X-Section Perpendicular to Flow

SILL DETAILS

No Scale

APPENDIX K



BARB DETAILS

No Scale

STREAM CHANNEL ALTERATIONS

Minimum Criteria for Dike or Levee Cross-Section		
Height to Design Water Surface	**Minimum Top Width**	**Steepest Allowable Sideslope**
Compacted mineral fill: 0 - 6 over 6’ - 12’	6’ 8’	1 1/2:1 2:1
Silty, sandy, or organic fill: 0 - 6’	8’	2:1
Dumped, uncompacted fill: 0 - 6’ over 6’ - 12’	6’ 8’	2:1 2 1/2:1 (or3:1 on stream side and 2:1 on land side)
When road on top: (turnaround areas also needed)	10’	
When fill unstable during rapid drawdown or severe wave action anticipated:		3:1 on stream side
Permeable soil of low plasticity used		3:1

APPENDIX L

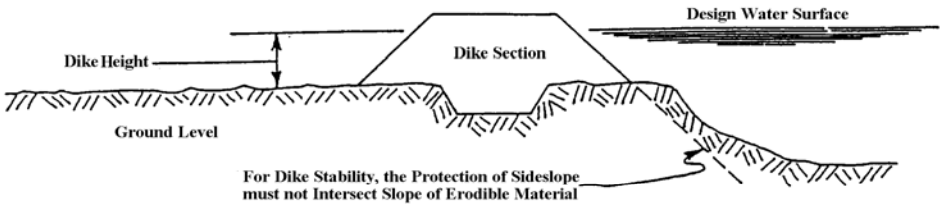


FIGURE 12. Dike Cross-Section

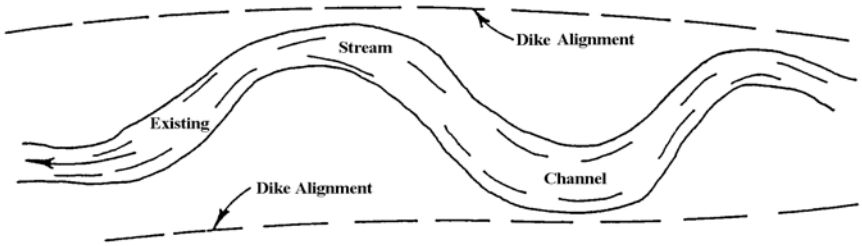


FIGURE 13. Desirable Dike Location

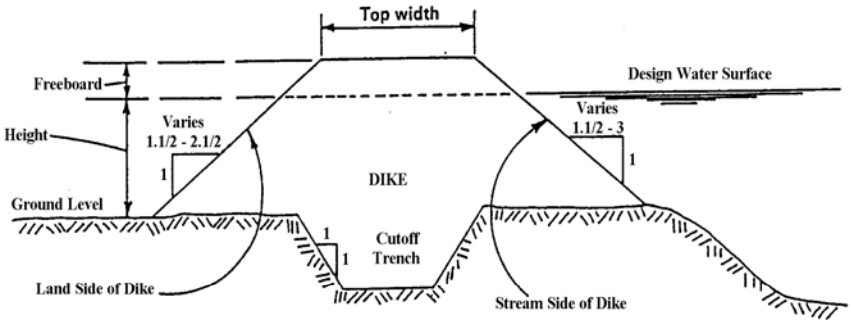
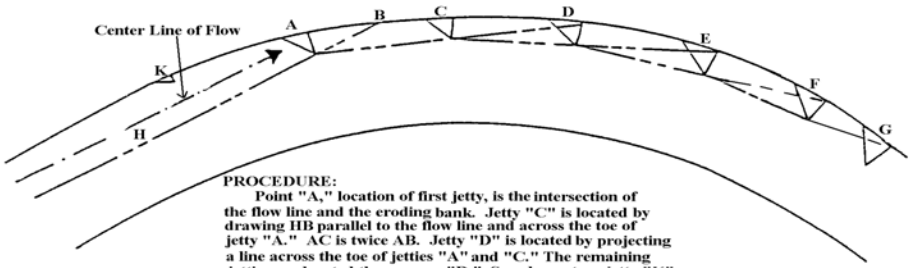


FIGURE 14. Minimum Criteria for Dike or Levee Cross-Section

APPENDIX M

FIGURE 15. Method of Locating Jetties



PROCEDURE:
Point "A," location of first jetty, is the intersection of the flow line and the eroding bank. Jetty "C" is located by drawing HB parallel to the flow line and across the toe of jetty "A." AC is twice AB. Jetty "D" is located by projecting a line across the toe of jetties "A" and "C." The remaining jetties are located the same as "D." Supplementary jetty "K" located AC distance upstream from "A."

Source: U.S. Department of Agriculture Soil Conservation Service

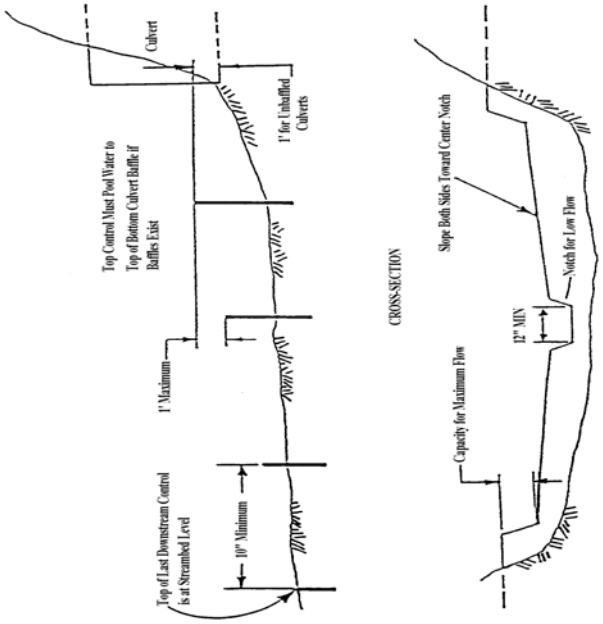


FIGURE 16. Downstream Control Structures Used to Reduce Downstream Erosion and Improve Fish Passage

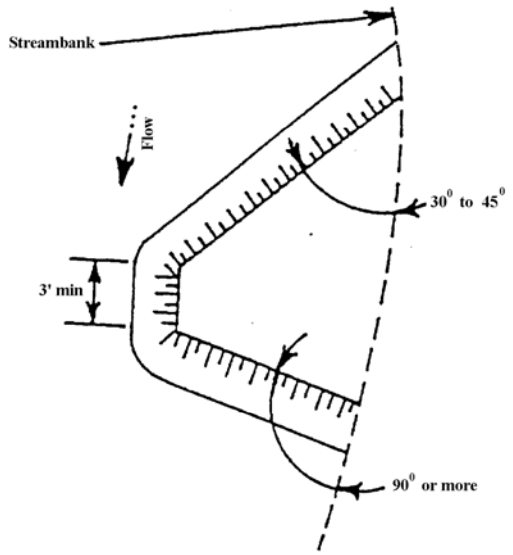


FIGURE 16. Jetty Height in Relation to Streamflow Depth

APPENDIX N

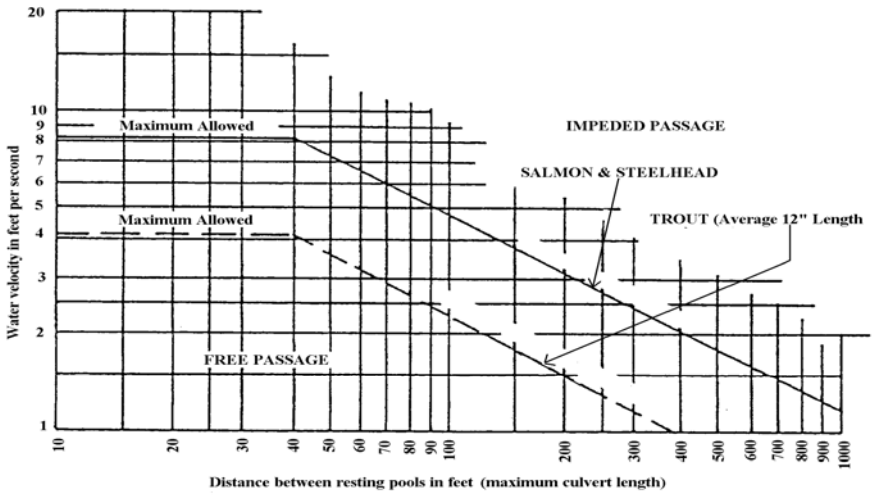


FIGURE 17. Swimming capability of migrating salmon and trout
(Alaskan Curve)

APPENDIX O

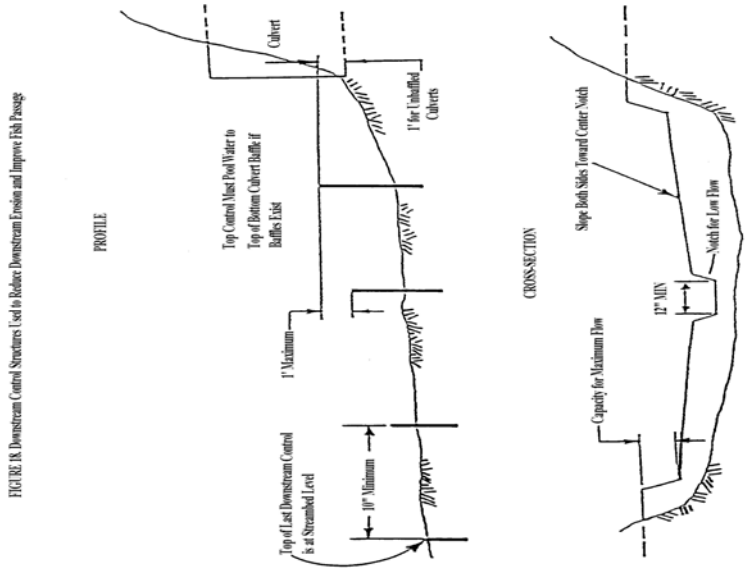


FIGURE 18. Downstream Control Structures Used to Reduce Downstream Erosion and Improve Fish Passage

APPENDIX P

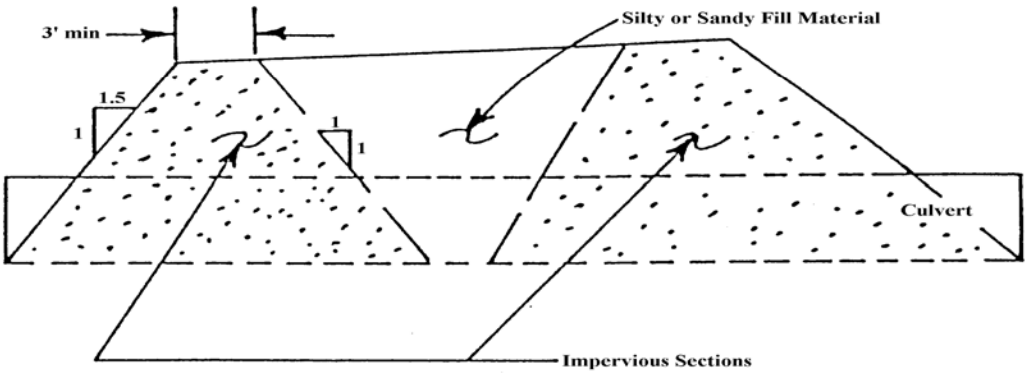
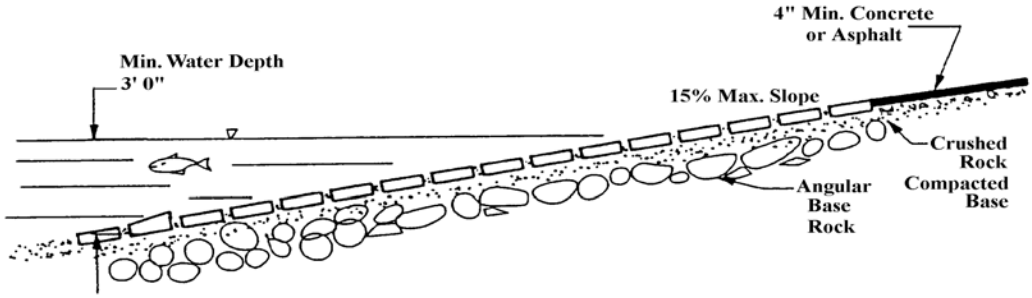


FIGURE 19. Culvert Backfill Using Silty or Sandy Material

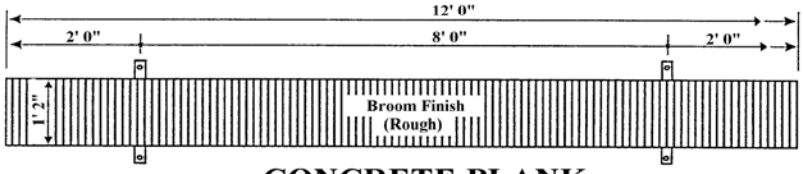
APPENDIX Q



LAUNCH RAMP SECTION

No Scale
Figure 20

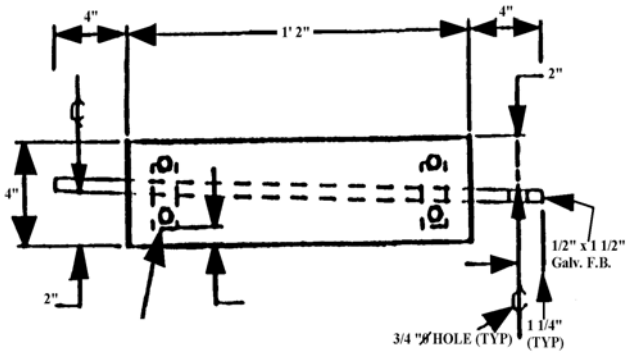
APPENDIX R



CONCRETE PLANK

No Scale
Figure 21

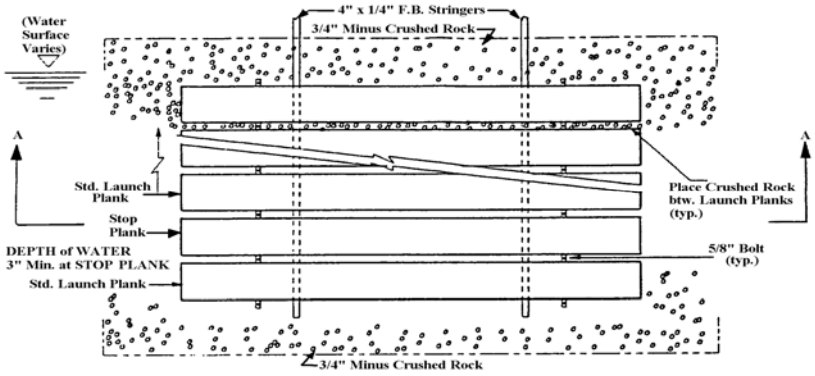
APPENDIX S



CONCRETE LAUNCH PLANK DETAIL

No Scale
Figure 22

APPENDIX T

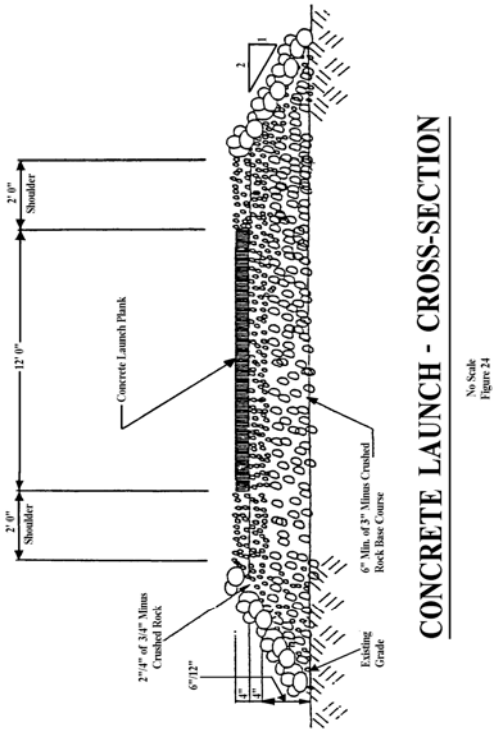


Place crushed rock as shown. Position stringers under planks in order shown and secure with 5/8" bolts. Slide planks on stringers, adding planks as needed, to desired water depth. Stringers consist of 2 - 4" x 1/4" x 20' lng. stl. flat bar w/ clevis pin hole one end. Pull flat bar stringers up grade from water when planks are positioned and bolted together, remove when last plank has been set in place.

CONCRETE LAUNCH-PLAN VIEW

Figure 23
No Scale

APPENDIX U



CONCRETE LAUNCH - CROSS-SECTION

No Scale
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