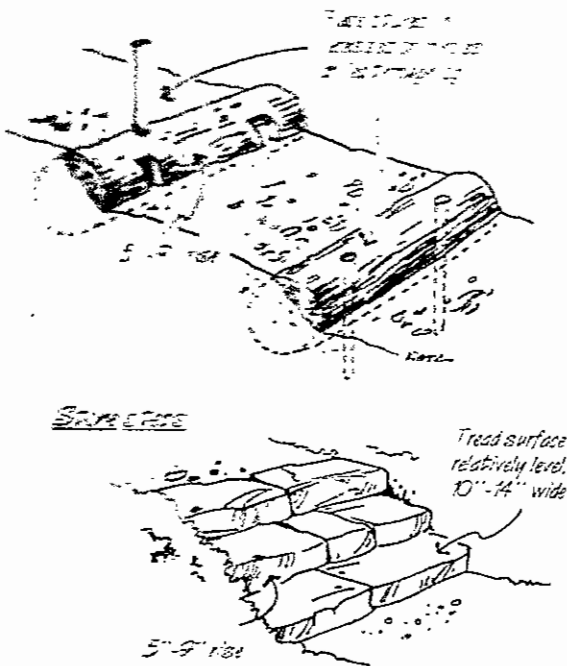


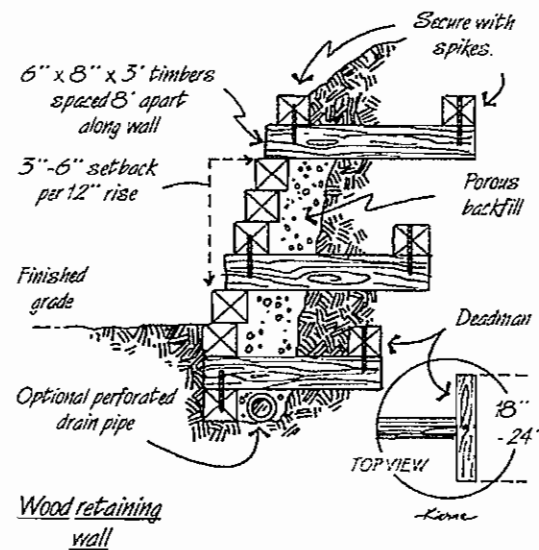
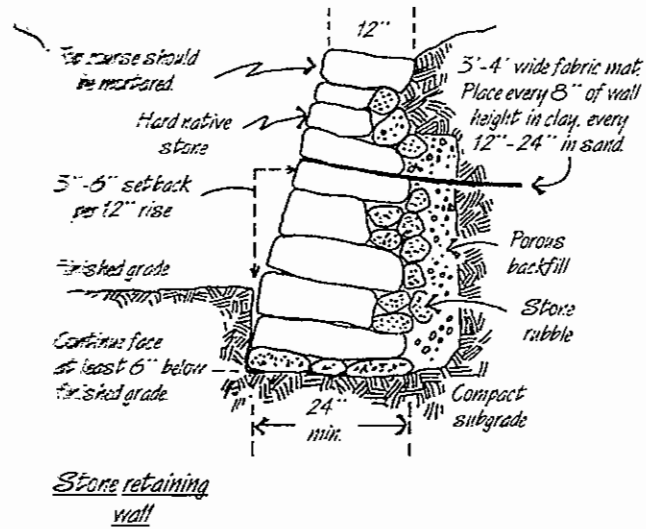
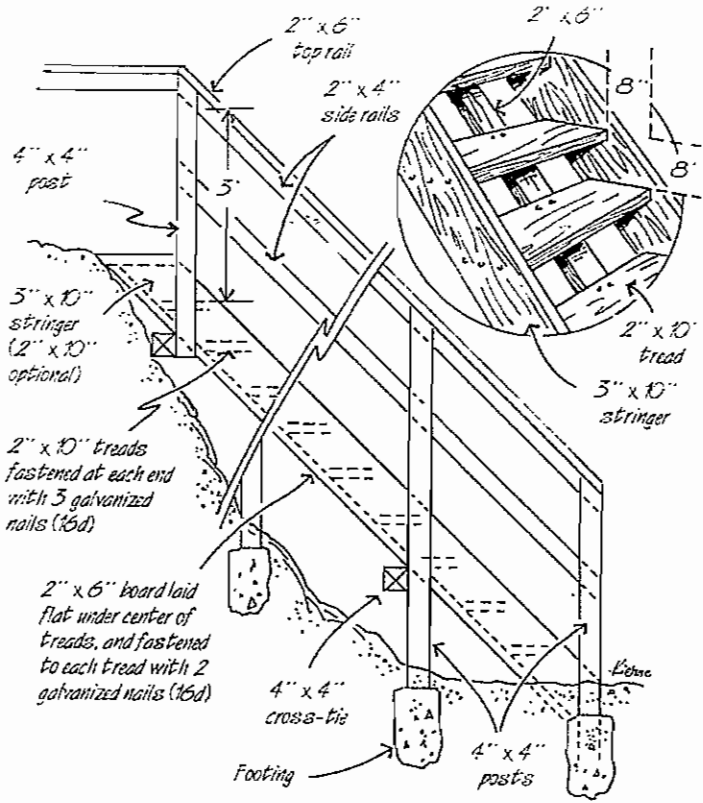
WOODEN RETAINING WALLS FOR NATURAL SURFACE TRAIL STRUCTURES

The following diagrams are not intended to be a substitute for professional engineering or architectural advice. The user is responsible for determining the appropriateness of the design for the specific site conditions and for obtaining the necessary permits.

STONE STEPS

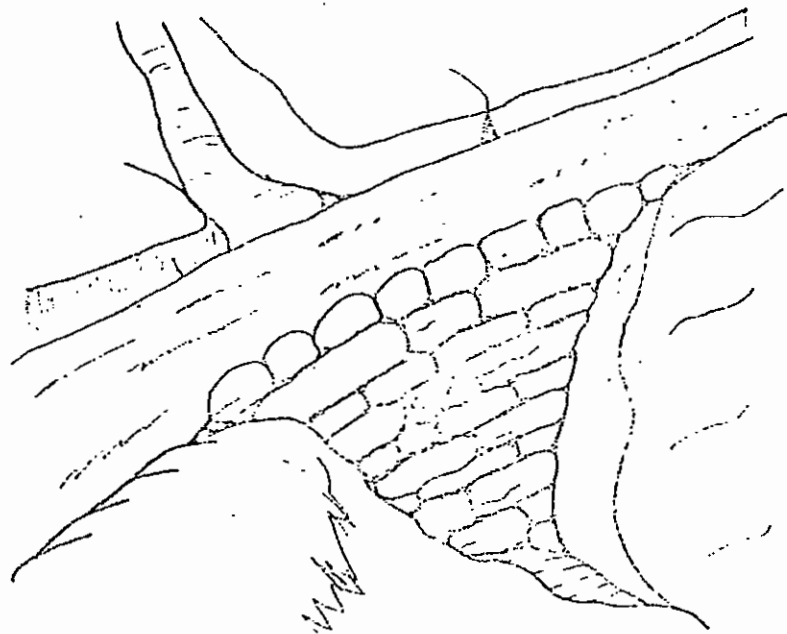


WOODEN RETAINING WALL



ROCK RETAINING WALL

NOT TO SCALE



TYPICAL ROCK RETAINING WALL

PLACE LARGE ROCK
FOR OUTSIDE
TOP COURSE

IN SLOPE WALL 2" OR 3"
PER FOOT OF RISE

CUSHION MATERIAL
MINIMUM DEPTH 6"

HEADER STONES

MIN WIDTH 2'

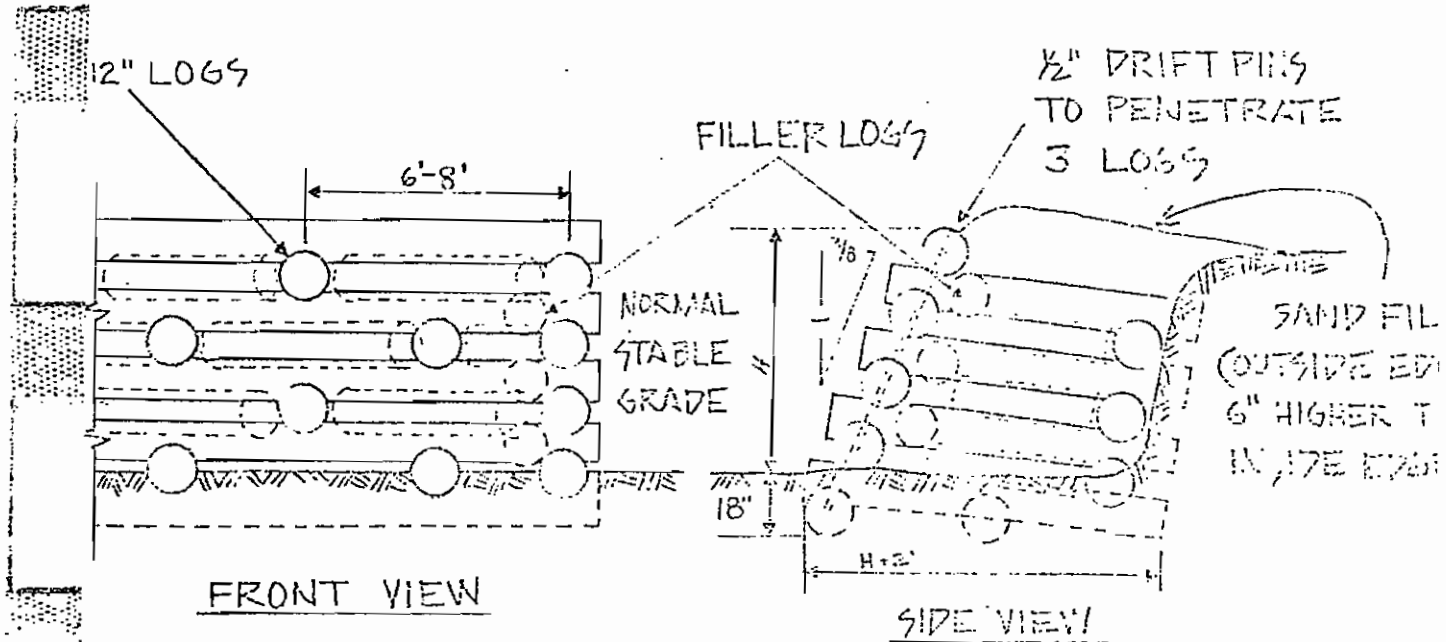
PREPARE FOOTING IN EARTH
OR SOLID ROCK. USE LARGEST
ROCKS ON BOTTOM

CROSS SECTION

FIGURE 20

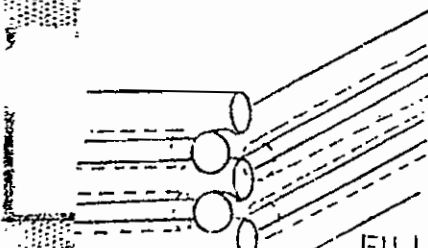
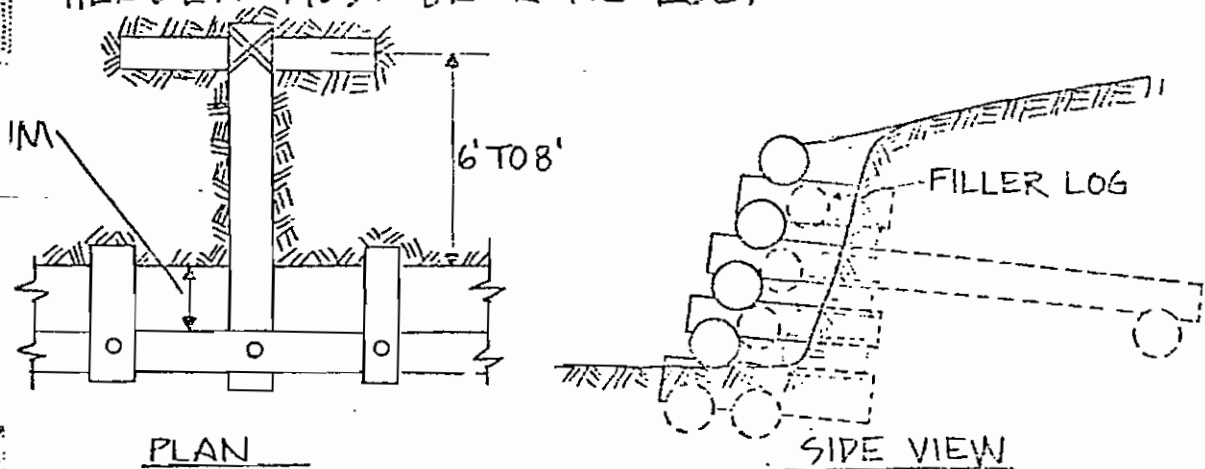
LOG RETAINING WALL

PEELED CEDAR OR TREATED SOFTWOOD (PINE) IS PREFERRED



TERNATE CONSTRUCTION

TO BE USED ONLY FOR PROTECTING PLACES ALONG BANK WHERE FULL WALL CANNOT BE CONSTRUCTED. EVERY THIRD HEADER MUST BE A TIE LOG.



FILLER LOG DETAIL

FILLER LOGS PLACED BEHIND OUTSIDE LOGS TO HOLD FILL MATERIAL

VI. STRUCTURE

A. Bridges

No bridge will be built until the Forest Engineer determines the most economical type of installation and provides construction plans or guidance. Bridges require a permit from the State of Michigan. Contact the Forest Hydrologist for specifics on obtaining a permit.

B. Retaining Walls

Retaining walls are structures of wood or stone designed to stabilize the trail base on a sideslope. Logs should be used only if rock is not readily available and only when sideslopes do not exceed 50 percent. A solid foundation of earth is a must to obtain a rigid, safe retaining wall.

a. Rock retaining wall (see Figure 20).

The thickness of the rock wall at the base should be at least one-half the height of the wall, or a minimum of 2 feet if the vertical height is less than 5 feet. The outer edge of trail should be at least 6 inches higher than the inside.

Only rocks which are sound, durable, and have a good bearing surface should be used. The largest rocks readily available that can be safely handled should be used in the body of a wall. Smaller rocks may be used for filling voids. Round rocks should not be used in a wall.

Joints in walls should always be staggered at least 6 inches or more horizontally from the adjacent joint in the next course. At least one-fourth of the front and rear faces of the wall should be headers having a length at least two and one-half times their

thickness. All projecting points should be removed from top bottom of main rocks so that each is laid with good bearing on the broadest face. All headers must be laid with their greatest dimension extending into the wall and never parallel to it except at corners. Here, alternating headers should cross. The outer face of the wall should have an inward slope of at least 3 inches to every foot of height. The wall should have a front and rear face well tied together with header stones of suitable size.

Drainage should be provided around, beneath, or through the retaining wall so that water cannot accumulate behind it.

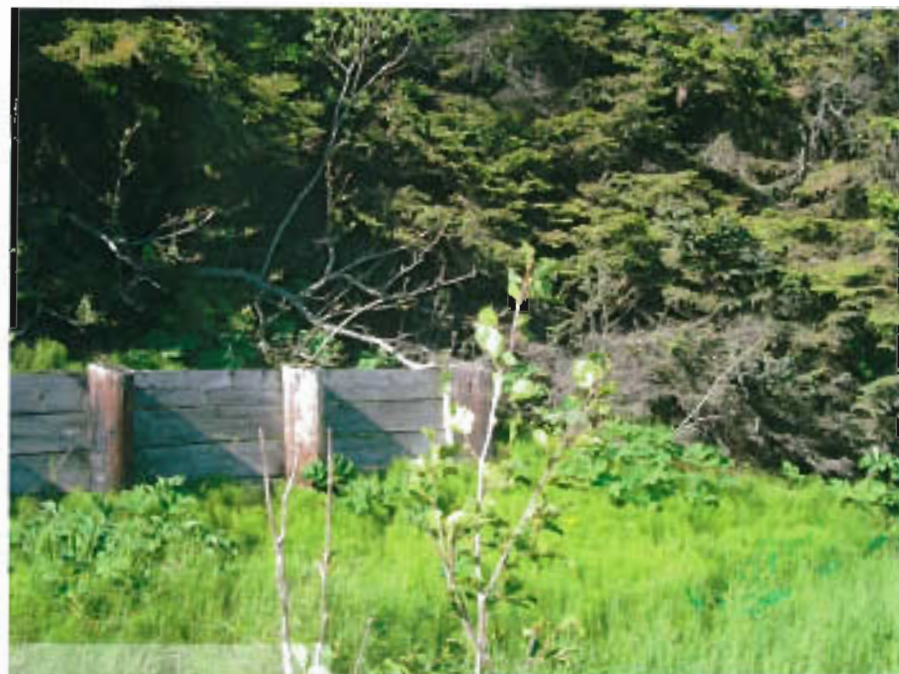
b. Log Retaining Wall (See Figure 21)

A bench is excavated in the sideslope on which to construct the retaining wall. Sill logs, 12 inch diameter, are placed parallel to the sideslope and buried in the bench. The first course of logs is seated on and perpendicular to the sills with their ends buried in the sideslope. The second course of logs are seated on the first and so on until the wall is raised to the desired height.

Sand fill is placed behind the wall in 6 inch layers. Each layer is compacted before the next layer is added. As each layer is added a filler log is placed to fill the space (chink) between the course of logs.

The outer face of the wall should be insloped 3 inches for every foot of rise.

Drift pins (1/4 inch) are used to bind the logs together. Logs should be predrilled to avoid splitting. Make the outer edge of the trail on a retaining wall at least 6 inches higher than the inside edge.

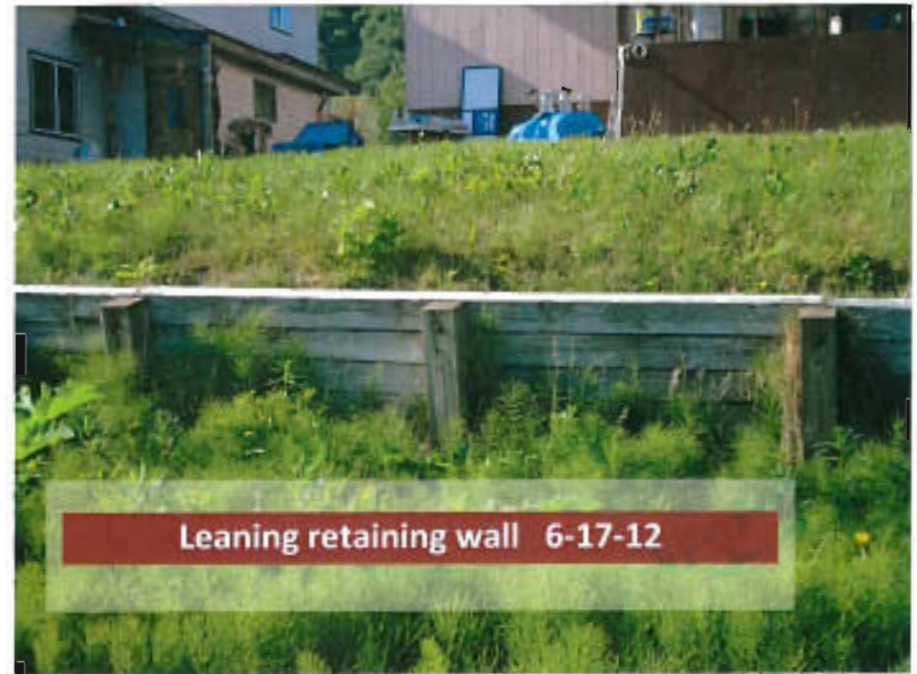


Retaining wall at the East end of the Spit
parking area. 6-17-12





Retaining wall at the Homer Theatre,
back parking area. 6-17-12



Leaning retaining wall 6-17-12



Retaining wall viewed from deck next to lighthouse at Stavin Marvin's. 6-17-12

