Part 650 – Engineering Field Handbook

IL 650.06 Grade Stabilization Structure Guidance

A. Rock Lined Chutes

(1) Velocity

Maximum velocities for flow in a rock lined chute during the total design storm flow are as follows:

Illinois Department of Transportation Rock Riprap Gradation	Typical Median Rock Size (D_{50})	Maximum Chute Flow Velocity
RR4	8 inches	8 ft/sec
RR5	10 inches	9.5 ft/sec

(2) Rock Depth

Minimum rock depth to line the chute should be 1.5 times the D_{50} rock size or 18 inches, whichever is greater. The D_{50} is defined as the opening size that will allow 50% of the rocks in the gradation to pass through.

B. Block Lined Chutes

Velocity

The maximum velocity in a concrete block lined chute must not exceed 20 ft/sec for the principal spillway storm and 25 ft/sec for the total design storm flow.

C. Tail water

Tail water is required for many open flow types of structures, as a means of dissipating energy in the turbulent water flowing from the structure. Dissipating the energy helps prevent damage to the downstream channel and exit portion of the structure. Following are some requirements and guidelines for tail water on different types of structures, as measured during the total design flow event:

Structure Type	**Tail Water Depth Requirement *(minimum)***
Chutes	Chute entrance head
Straight Overfall Drop Structures	One-third of the height of the overfall

D. Side Inlet Structures

Estimating Downstream Channel Flow Depth

(i) Tail water on a side inlet structure depends on the flow characteristics of the downstream channel into which the structure outlets. During the total design storm, the receiving channel will carry not only the flow coming from the side inlet structure, but

also the flow from the drainage area of the receiving channel above the location of the side inlet. Storm rainfall patterns are rarely uniform over a large area, which makes the hydrology of the side inlet structure difficult to model. Also, the time of concentration of the side inlet structure will typically be different from that of the receiving channel, making the peak flows arrive at the location of the side inlet at different times.

(ii) To simplify the hydrologic analysis for typical NRCS grade stabilization structures, the flow in the channel downstream of a side inlet structure during the total design storm can be estimated using the following criteria, as long as the site conforms to the drainage area ratio listed:

- Given: The drainage area of the downstream channel is at least 3 times the size of the drainage area of the side inlet structure.
- During the total design storm event, the downstream channel can be estimated to be carrying twice the total design storm flow of the side inlet structure.

(iii) If the side inlet structure does not meet the criteria listed above, other methods must be used to determine the tail water depth.