GUIDELINES FOR ESTABLISHING FREEBOARD FOR BRIDGE CROSSINGS AND FLOOD PROTECTION PROJECTS

BACKGROUND

Freeboard is the additional capacity in a stream above the calculated capacity required for the 1 percent flow. Freeboard provides a safety factor for such things as normal wave action, inaccuracies in determination of friction factors, and minor silt and debris deposits. **The freeboard guidelines should also be followed when streams are modified as part of major land development proposals.** The Federal Emergency Management Agency (FEMA) has set guidelines for the determination of freeboard. In order for an area to be removed from a flood zone designated by FEMA following completion of a flood control project, the project must meet the FEMA guidelines. These freeboard guidelines are followed by the SCVWD in the design of flood protection projects **and should be followed for the design of bridges and other street crossings.**

A. Where the design water surface[1] is above natural ground, the following criteria shall be considered a minimum:

1. Federal Emergency Management Agency (FEMA) guidelines. FEMA currently specifies that levees shall have a minimum of 3 feet of freeboard with an additional foot of freeboard required 100 feet on either side of structures that are within the leveed section of creek or where the flow is constricted such as at bridges. FEMA also requires an additional ½ foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee. To comply with these requirements, use as a minimum 3½ feet of freeboard within leveed sections and 4 feet within 100 feet of bridges or other constrictions.
2. For floodwalls, use the same freeboard criteria as for levees. (Basis—SCVWD guideline)
3. If two-tenths of the total energy (depth of flow + [v2/2g]) is greater than the freeboard requirement of A-1 or A-2 above, then the computed value shall be used for freeboard. (Basis—Natural Resource Conservation Service [NRCS] guideline)

B. Where the design water surface is below natural ground, the following criteria shall be considered a minimum:

1. One foot of freeboard shall be used for constructed, nonnatural channels where large amounts of vegetation are not anticipated in the channel. (Basis—Corps of Engineers guideline)
2. For all channels, if two-tenths of the total energy is greater than the freeboard requirement of B-1 above, then the computed value shall be used for freeboard. (Basis—NRCS guideline)

C. For bridges, the following criteria shall be considered minimum:

1. At new bridges, freeboard shall be the same as in the existing or proposed channel either upstream or downstream, whichever is greater. When the bridge structure encroaches into the freeboard area, there shall not be an increase in water surface for bank full flow. The intent is to define a system (bridge and channel) with a uniform level of protection. (Basis—SCVWD guideline)

[1] Defined by recent flood protection projects or determined according to local topography and site conditions. For more information, contact SCVWD.

2. Where an existing bridge or culvert can convey the design flow under pressure, it must be structurally sound and must be able to resist the resultant lateral and uplift forces.
(Basis—SCVWD guideline)

D. Other Considerations:

1. Evaluate all bridges with debris loads on the piers. (suggest Corps practice of three times pier diameter as blockage)
2. Freeboard should also contain the flow defined by the 80 percent confidence limit statistical parameter where practical to do so.
3. All channels with super-critical flow will use sequent depth plus freeboard.
4. All channels will include freeboard for super-elevation of water surface at curves in addition to requirements specified in Sections A, B, and C above.
5. In areas of the County where there is the possibility of continued land surface subsidence, additional freeboard allowances should be considered.

GRADING OPTIONS NEXT TO STREAMS

INTRODUCTION

The details in this Design Guide are intended to provide clarification to G&S V.A, which calls for all grading next to streams to address drainage and avoid the concentration of flow over the stream bank. For all major redevelopment and new development, grading should be addressed in stormwater permit provisions. The applicants will have to observe urban runoff pollution prevention regulations during grading operations. In addition, the following grading guidelines would also be useful to single family homeowners interested in minimizing erosion and saturation of the streambank and maintaining slope stability and riparian habitat.

ADDITIONAL INFORMATION REQUIRED

In addition to the urban runoff pollution prevention regulations, permit applicants should also be asked to provide the following information:

- Existing trees that are to remain and those proposed to be removed
- The species of tree and its diameter at 4 feet from the ground
- Source of fill and hazmat certification

This will help in assess if the proposed grading method is the most appropriate for the site so as to avoid other impacts.

OPTIONS FOR GRADING

This Design Guide provides 5 options of how to design grading. Any other proposal which satisfactorily meets the goals of preventing over-bank drainage and the placement of fill along the riparian protection area by future lot owners may be considered. The selection of a particular option will be influenced by a site's finished grades needed to provide for streets, building pads and positive drainage to the storm sewer system.

Option #1 is the preferred option because it avoids disturbance to the riparian corridor and does not direct drainage over bank.

In other cases, applicants might need to use one of the Options 2- 5, because of the need to raise the site elevation. Option 2 avoids disturbance to the riparian corridor and minimizes the drainage directed over bank. Options 3 and 4 are similar but more costly. Option 5 would only be suitable if there is no riparian vegetation and it conforms to adjacent property upstream and downstream. **Fill placed within the riparian area should be suitable for planting.**