Module 13: Plan Reading and Review

Learning Objectives

At the end of this module, you will be able to:

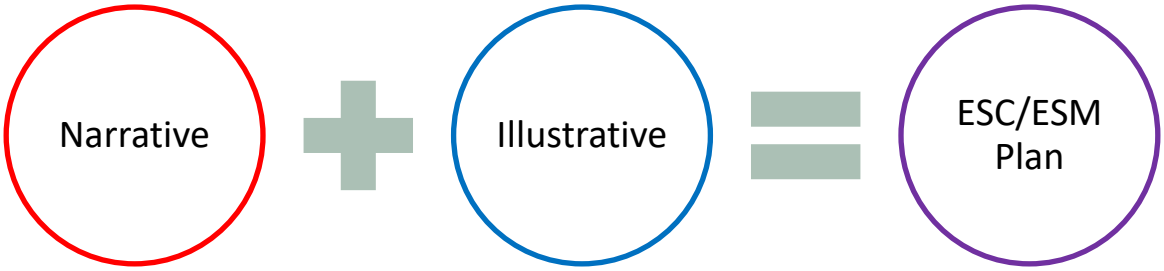
- Identify and describe the two portions that make up an ESC plan
- Compare and contrast similar contour line shapes of different topographic features
- Review a basic ESC plan

13a. Plan Reading Skills

The Erosion and Sediment Control (ESC) or Erosion Control and Stormwater Management (ESM) plan shows how to develop the site and the sequencing, or phasing, of the project's construction. It should be separate from the building construction drawings and other information not related to erosion and sediment control requirements, so the plan reviewer, inspector, site supervisor, and/or RLD do not need to conduct time-consuming searches to find the relevant details.

The ESC or ESM plan consists of two parts:

- Narrative, which discusses the project description in paragraph form; and
- Illustrative, which shows the project development on map sheets.



The topics within a typical plan review checklist are discussed and included within this module as guidance and contains the different sections of consideration for both the narrative and illustrative portions of an ESC or ESM plan. Plan review checklists are encouraged for use as a job aide for plan reviewers and as a guide for those preparing an ESC or ESM plan for submittal and approval. If your locality does not already have a formal plan review checklist, create your own based on specific needs related to your locality, including any more stringent requirements.

NOTES:

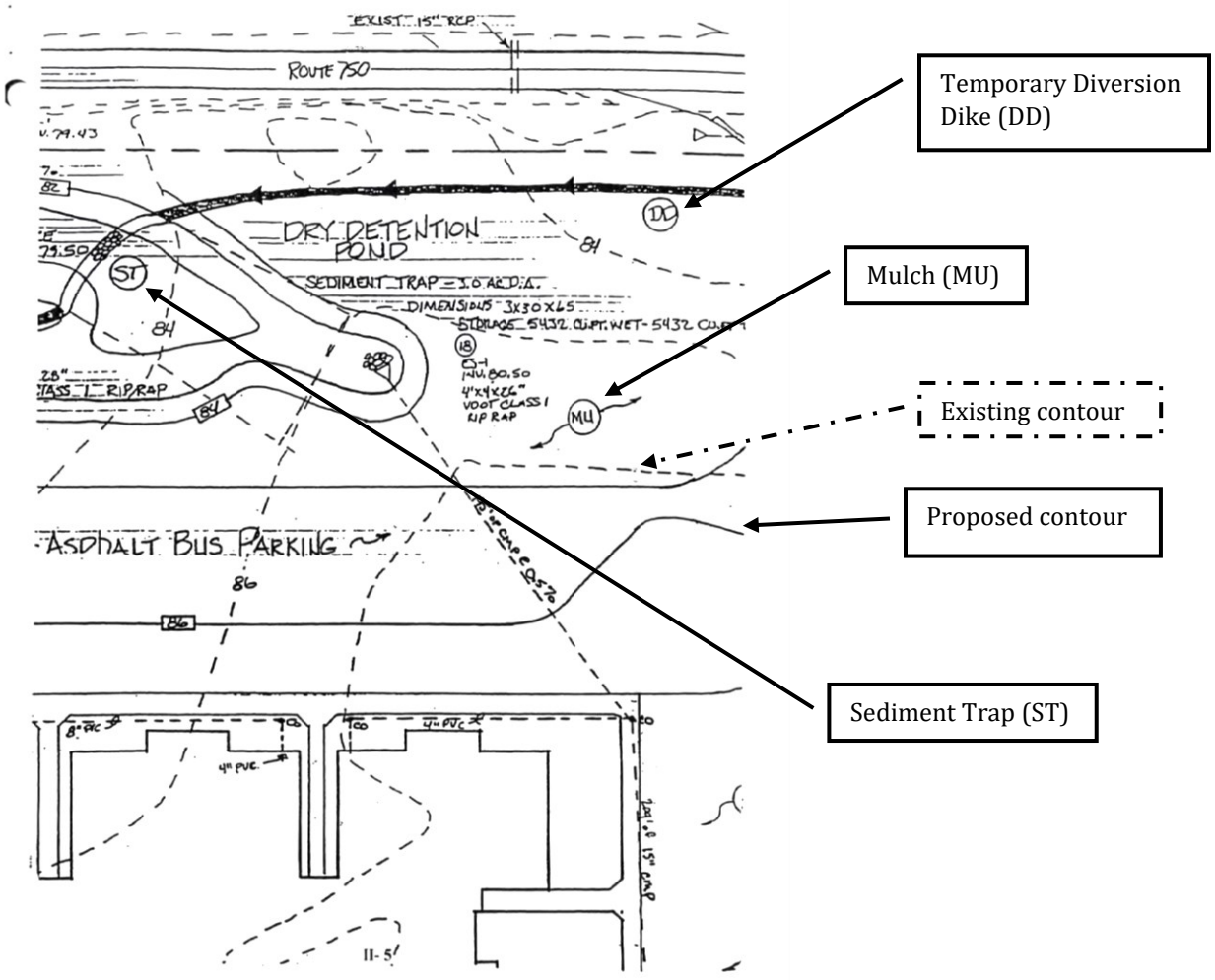
1. The stormwater components of an ESM plan are covered in the SWM certification courses.

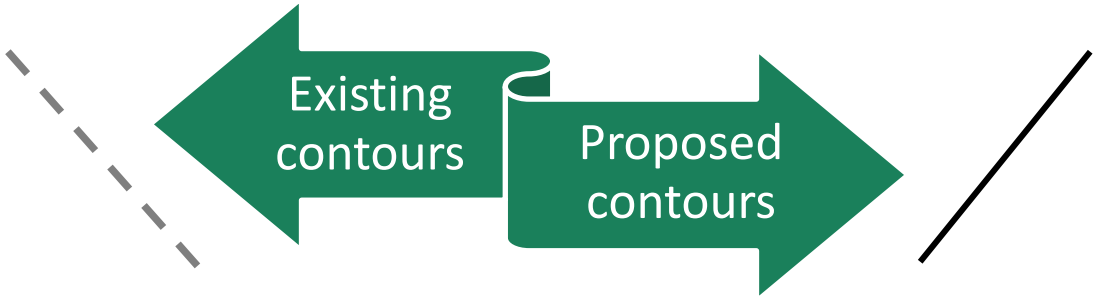
2. DEQ's Office of Stormwater Management has an ESC/SWM Plan Submission Checklist required for plan submittal and approval. This checklist can be viewed at: https://www.deq.virginia.gov/permits/water/stormwater-construction/plan-review

Plans should be clear and should not leave room for interpretation. Any guesswork during plan review would also lead to guessing in the field by the site supervisor or inspector.

A plan must also be reviewed for compliance with the Minimum Standards. An adequate plan will address all applicable Minimum Standards for that project site. This is also when the reviewer determines if a variance has been requested and if it is appropriate to grant the variance.

After reading the narrative portion of an ESC or ESM plan, in order to complete your review properly, you will need to be able to review the illustrative portion of the ESC or ESM plan, so you need to understand some of the common features of a plan and develop your plan reading skills.



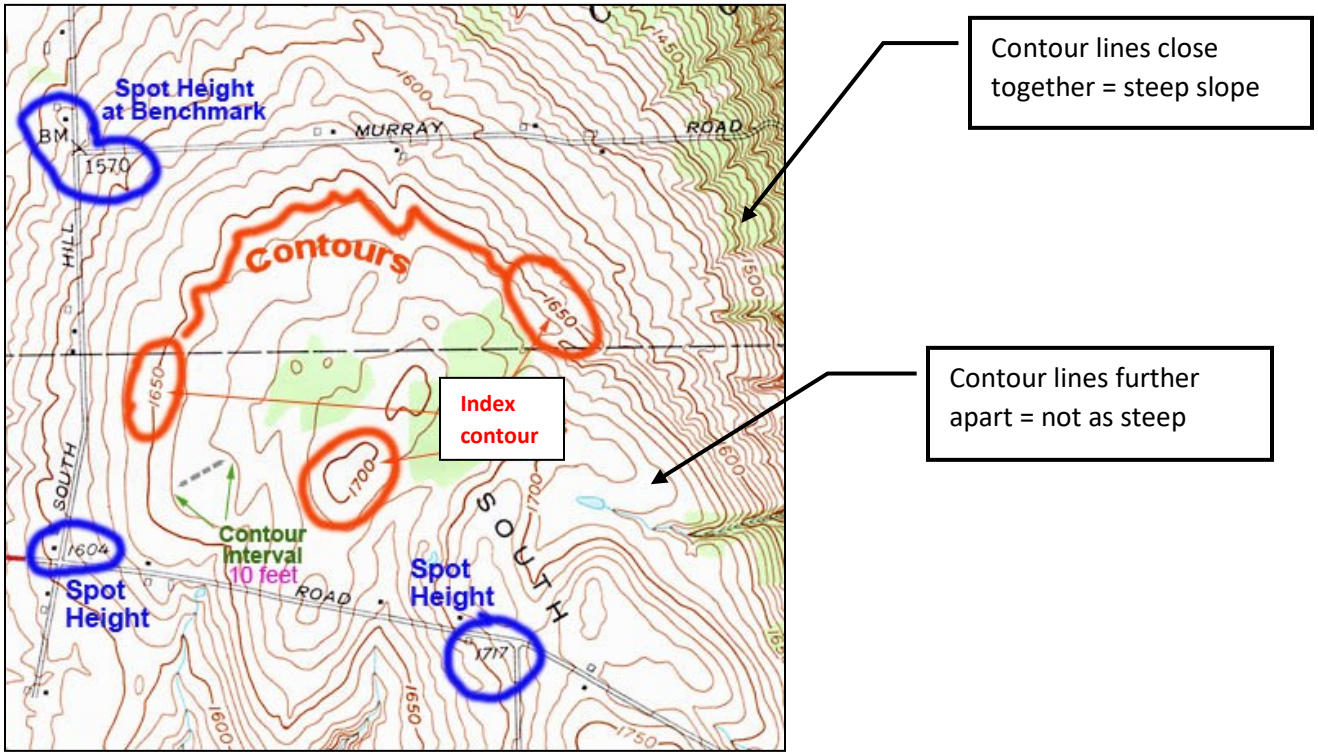


Contour line: a line on a map connecting points of equal elevation (height relative to sea level)

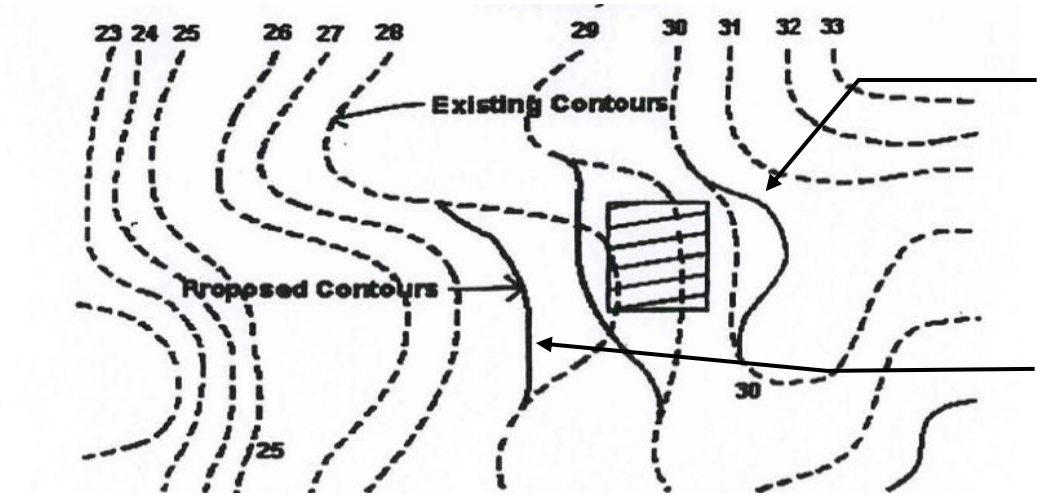
Contour interval: the difference in elevation between two adjacent contour lines

Index contour: contour lines that are labeled to help you find the contour interval

Benchmark: point of known elevation

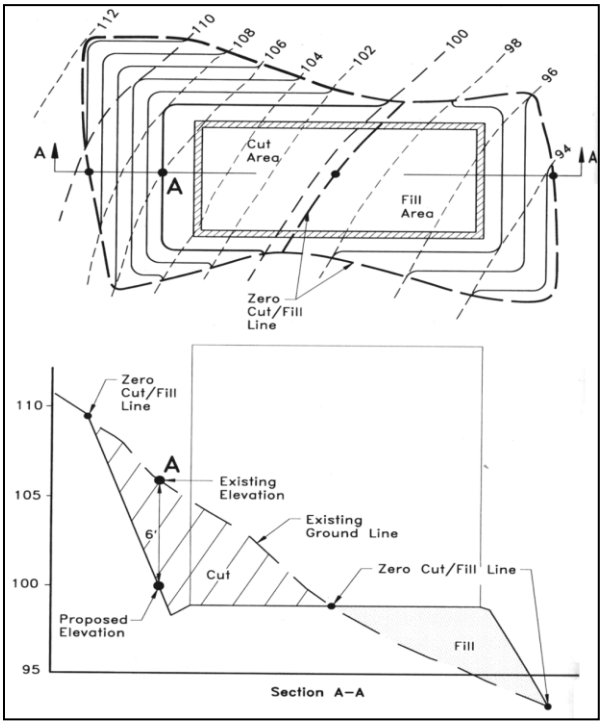


Cut and fill: the excavating of material in one place and the depositing of it nearby



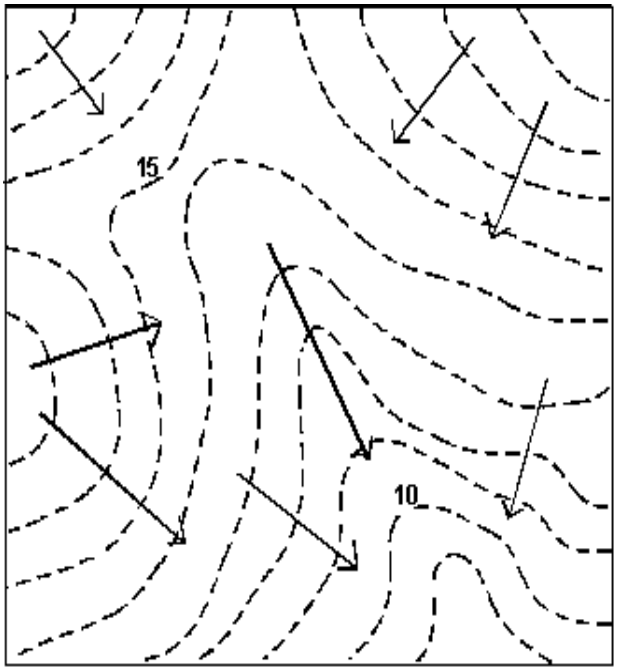
Cut – proposed contour moves toward higher elevation

Fill – proposed contour moves toward lower elevation

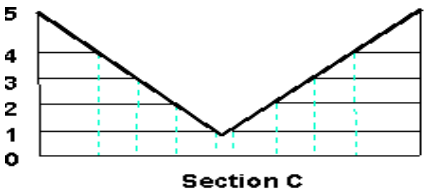


Cut and fill

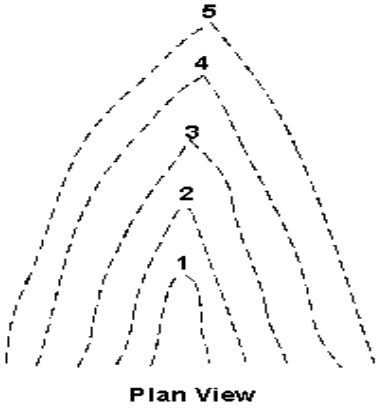
Drainage: always flows perpendicular (at a right angle) to the contour, toward lower elevation



Valleys and swales: a long, low area of land, often with a drainage way, river, or stream running through it, which is surrounded by higher ground

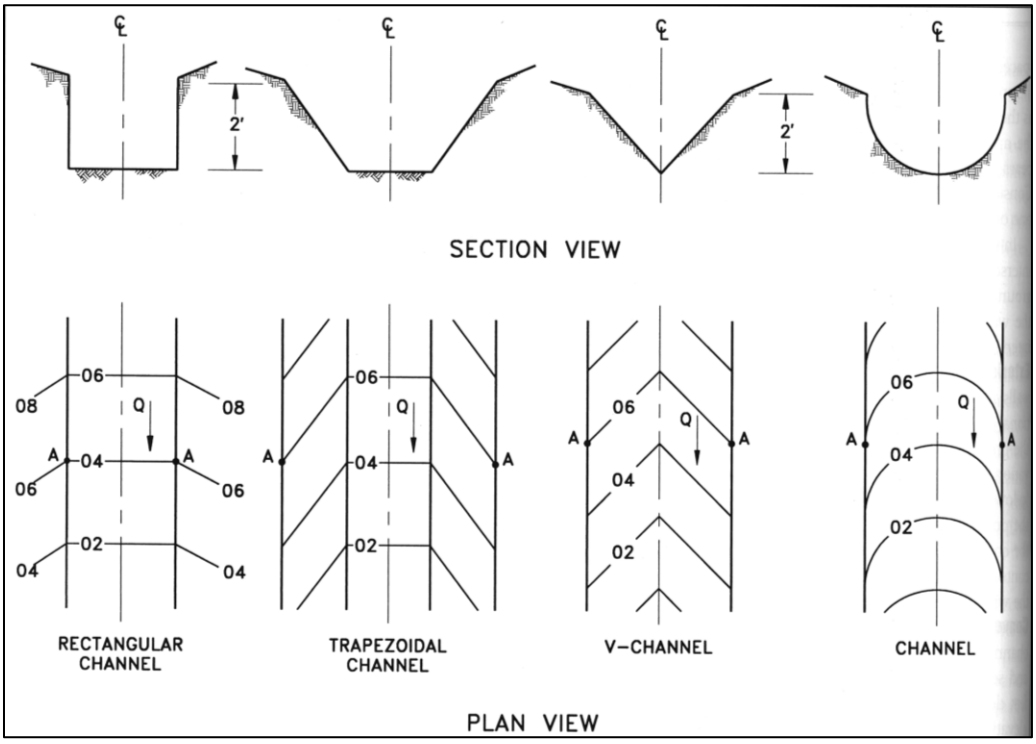


Stormwater runoff and, therefore, sediment leave sites through drainage ways in valleys or swales.

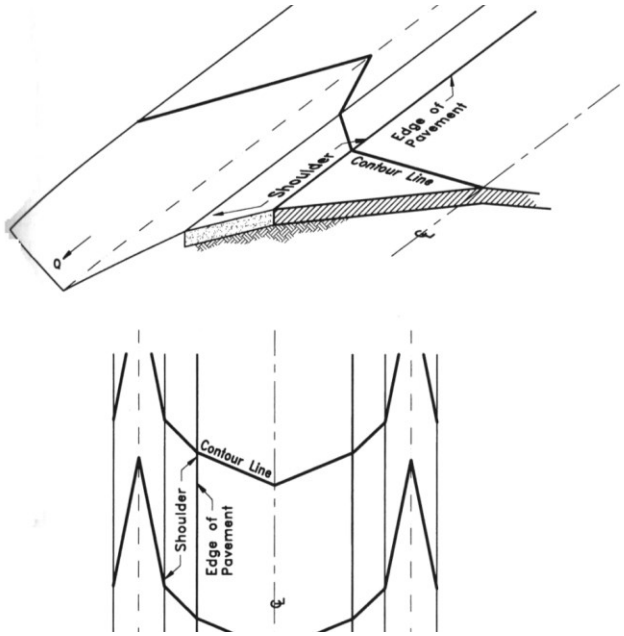


A valley or swale is represented by contours that point toward higher elevations.

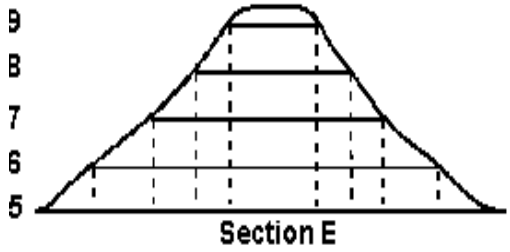
Channel shapes and contours:



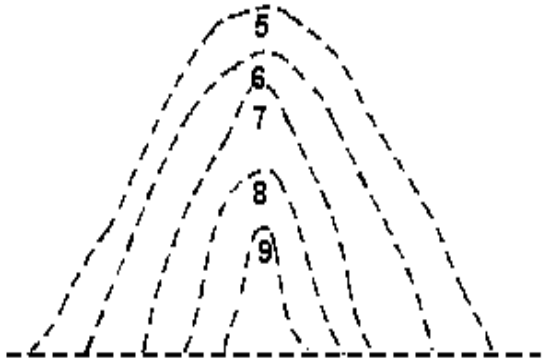
Road drainage: crowned at centerline to sheet flow water off pavement and send it into roadside ditches or valley gutters along shoulders



Ridge: a long, narrow hilltop or range of hills. Follow ridge lines to denote drainage areas.



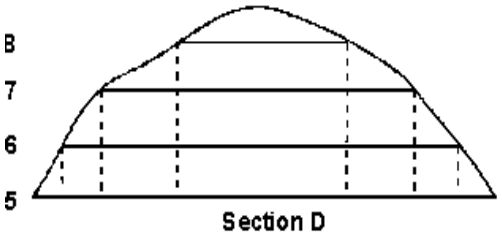
Section E

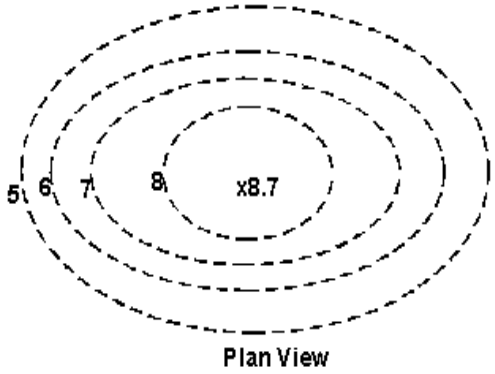


Plan View

A ridge is represented by contours that point toward lower elevations.

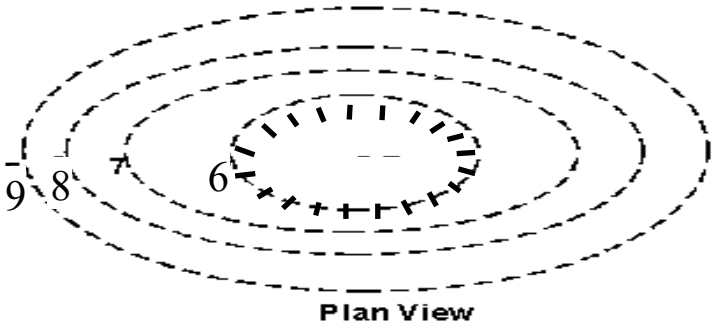
Summit: the highest point or top of something, typically a mountain





Summits usually have a spot elevation for the highest point; depressions may not have a spot elevation.

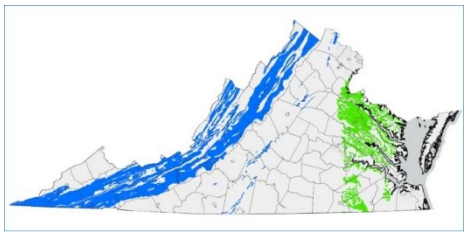
Depression/Sinkhole: a low area in a landscape without a clear drainage way. Sinkholes may drain through an underground system (karst topography).



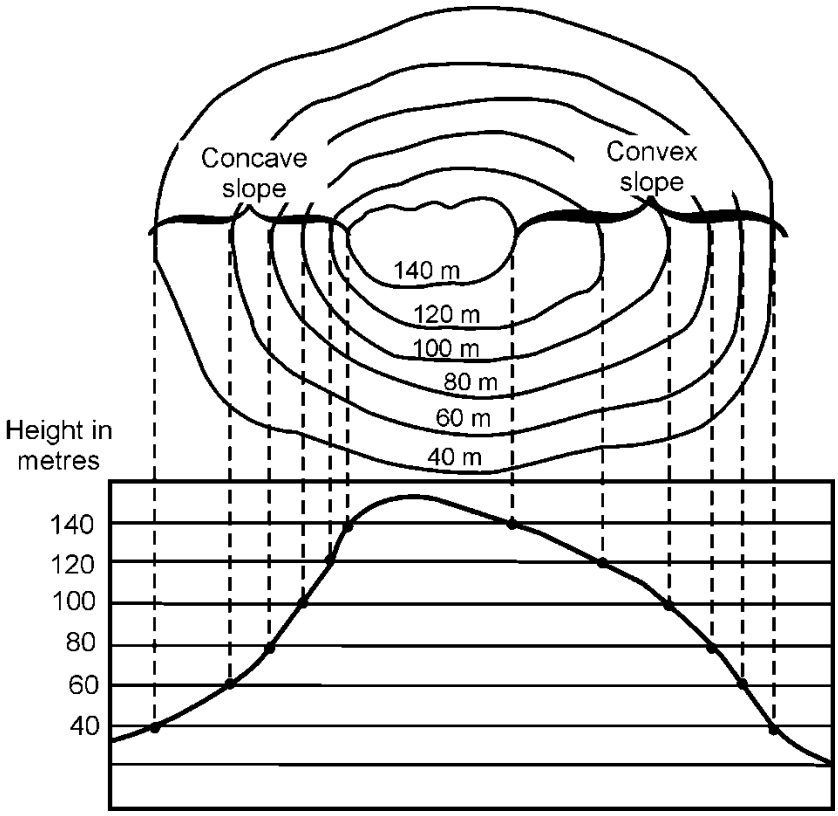
Hachure lines are used to indicate depressions.

KARST SYSTEMS

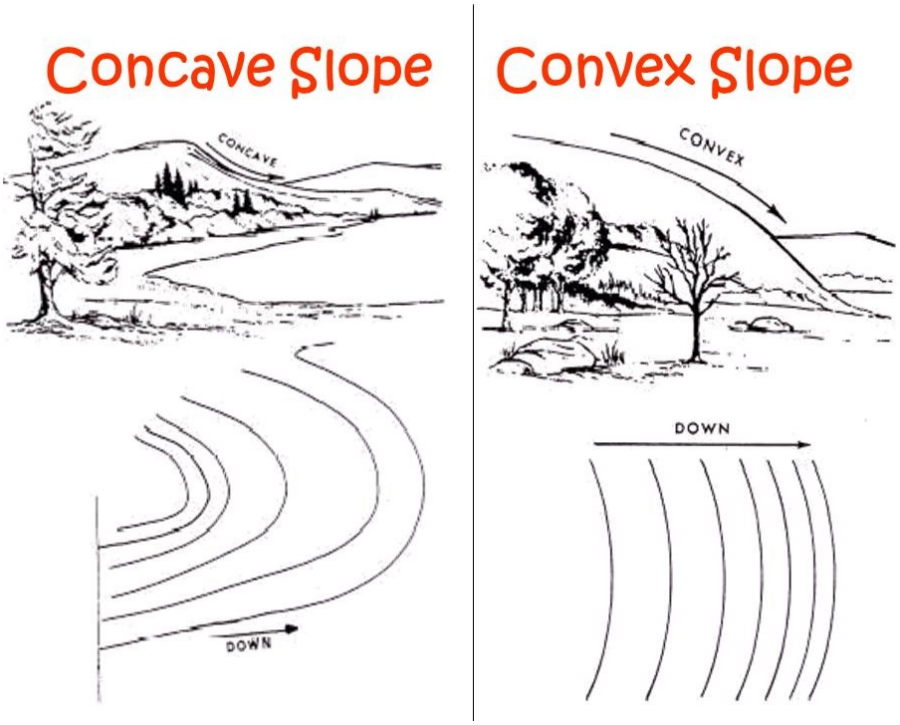
Prevalent in the Valley and Ridge province of Virginia, karst systems form from soluble limestone bedrock eroded over time by acidic rainwater. As this limestone dissolves, sinkholes, caves, and disappearing springs can form through the cracks in the limestone and contribute more challenges to controlling stormwater from developed sites. An extensive geologic and hydrologic investigation by a geotechnical engineer is required before stormwater facilities can be placed in these areas and the appropriate modifications made to ensure structural integrity is maintained. Karst systems also occur in the poorly consolidated sediments of the coastal plain (represented in green in the image below). Chapter 6 of the Virginia Stormwater Management Handbook (VSWHB) contains more information about karst and the considerations a designer and plan reviewer should be aware of.



SLOPES



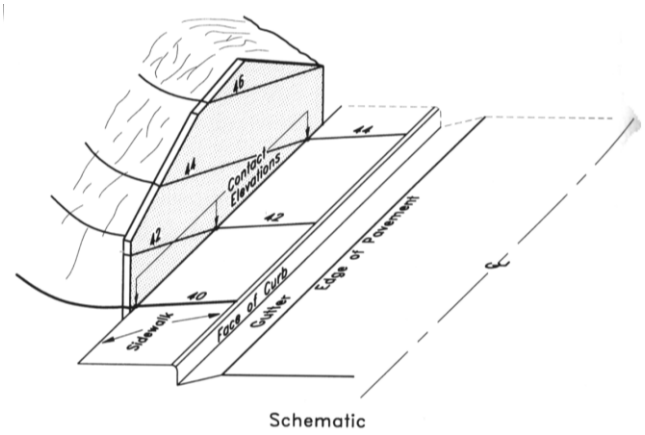
Contour profiles show a cross-section of a certain portion of a contour map, so you can envision what this portion looks like on the site.



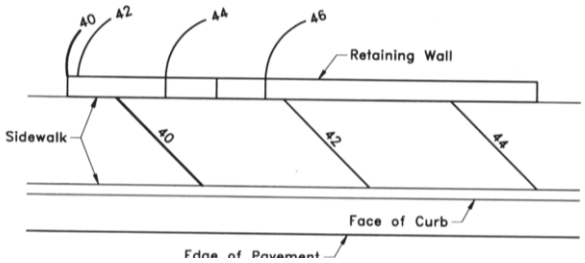
Remember, concave slopes are steeper at the top then flatten out. Convex slopes are steeper toward lower elevations.

Retaining Walls

Retaining walls may be used in lieu of creating extremely steep slopes on a site. When these are shown on plans, contour lines may appear as if they do not connect properly or simply disappear for a short period. Retaining walls should be noted clearly as such, as well as give top and bottom of wall elevations. As a plan reviewer, consider how water will flow around the wall at the bottom edge and be sure the wall tapers enough to prevent erosion.



Schematic



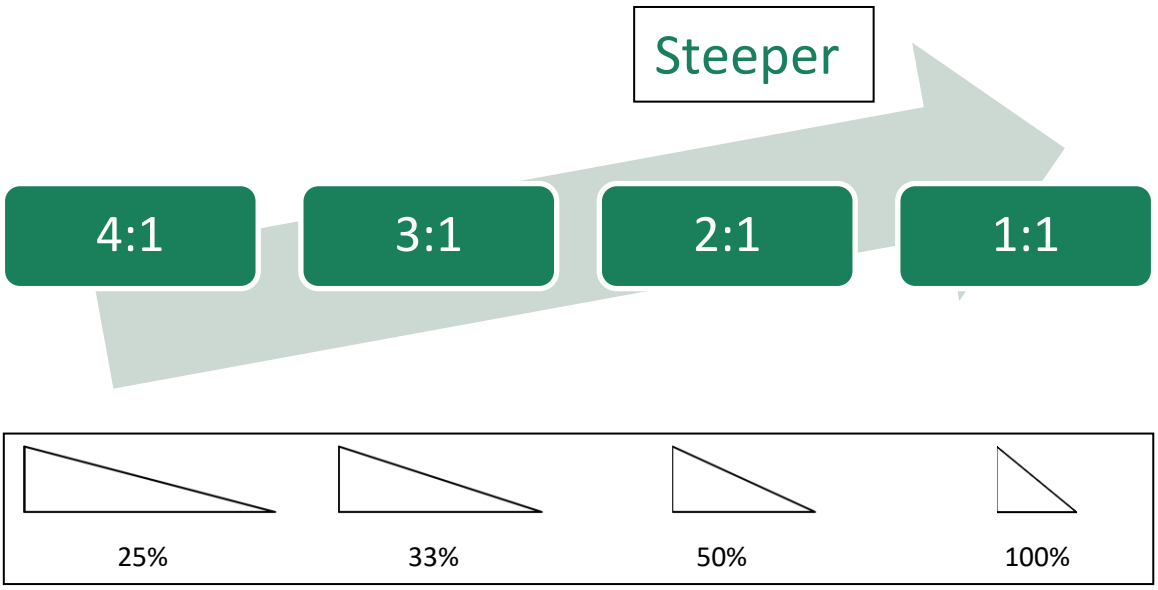
SLOPE CALCULATIONS

Slope angle is often described as a ratio (2:1, 3:1, 4:1, etc.) or as percent (%) slope. The closer the first number is to 0, or the higher the percentage is, the steeper the slope.

A 3:1 slope indicates that for every 3 horizontal feet, the slope has 1 foot of vertical rise, while a 5:1 slope means 5 horizontal feet for every 1 foot of rise. Thus, a 3:1 slope is steeper than a 5:1 slope.

Slope percent is calculated by dividing vertical distance by the horizontal distance in the ratio and multiplying this by 100.

- A 3:1 slope becomes a $\frac{1}{3} \times 100 = 33.3\%$ slope.
- A 4:1 slope becomes a $\frac{1}{4} \times 100 = 25\%$ slope.



A slope that is 40 feet long and goes from elevation 110 to 125 is a 40:15 or a 2.67:1 slope.

Expressed as a percentage, this is a $\frac{(125-110)}{40} \times 100 = 37.5\%$ slope.

13b. Plan Narrative

The narrative is a written statement that explains the erosion and sediment control decisions made for a particular project and the justification for those decisions. The narrative is especially important to the plan-approving authority because it contains concise information concerning existing site conditions, construction schedules, and other pertinent items that are not apparent on a typical site plan. Since a plan reviewer cannot always visit the site or discuss the project at length with the site planner, it is essential that the necessary information be provided for plan review.

The narrative is also important to the construction superintendent (RLD) and the inspector, who are responsible for seeing that the plan is implemented properly. It provides them with a single report that describes where and when the various Construction BMPs (C-BMPs) should be installed.

Narratives can either be stand-alone documents or printed on the larger plan sheets.

The narrative is commonly divided into the following sections, although these should be project-specific:

Table 13-1: Plan Narrative Components

Adequate	Incomplete	Not included	Not applicable	
☐	☐	☐	☐	Project description – briefly describe the nature and purpose of the LDA and the area (acres) to be disturbed **Comments:**
☐	☐	☐	☐	Existing site conditions – description of the existing topography, vegetation, and drainage of the site **Comments:**
☐	☐	☐	☐	Adjacent properties – description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the LDA **Comments:**
☐	☐	☐	☐	Off-site areas – describe any off-site LDAs that will occur (including borrow sites, stockpiles, etc.) **Comments:**
☐	☐	☐	☐	Soils – brief description of the soils on the site, giving such information as soil name, mapping unit, erodibility, permeability, depth, texture, and soil structure **Comments:**
☐	☐	☐	☐	Critical areas – description of areas on the site that have potentially serious problems (steep slopes, channels, wet weather/underground springs, etc.) **Comments:**

Adequate	Incomplete	Not included	Not applicable	
☐	☐	☐	☐	ESC measures – description of the methods that will be used to control erosion and sedimentation on the site (from Chapter 3 of the Handbook) **Comments:**
☐	☐	☐	☐	Construction sequence – order of operations to build out the site. Installation of ESC measures should be one of the first steps. **Comments:**
☐	☐	☐	☐	Permanent stabilization – brief description, including specifications, of how the site will be stabilized after construction is completed **Comments:**
☐	☐	☐	☐	Stormwater runoff considerations – summarize water quantity compliance requirements and strategies used to achieve compliance for channel protection and flood protection. Any increases in sheet flow discharged from the site should also be addressed. Downstream capacity (flood protection) of channels and downstream stability (channel protection) of man-made channels must be addressed from each site discharge point to the limits of analysis, unless other requirements apply. **Comments:**
☐	☐	☐	☐	Calculations – provide detailed calculations for all water quantity evaluations, design of temporary sediment basins, permanent stormwater detention basins, diversions, channels, etc. Calculations for pre- and post-development runoff should be included. Often a separate booklet is included for all the detailed and summary calculations. **Comments:**

13c. Illustrative Portion of Plans

The illustrative portion of an ESC or ESM plan will be on full-sized map sheets. These usually include:

1. A cover sheet that generally has a small vicinity map showing the location of the project;
2. A soils map;
3. A map showing the drainage areas and general drainage directions on the site;
4. A site map showing the original conditions;
5. A plat showing the proposed development, including the ESC or ESM plans;
6. A sheet with details on the C-BMPs; and,
7. In some cases, a sheet that includes the narrative.

Some of these sheets may be omitted or combined, depending on the complexity of the project.

Also, see the Virginia Stormwater Management Handbook (VSWHB) for a thorough description of developing an ESC or ESM plan.

Table 13-2: Illustrative Plan Components

Adequate	Incomplete	Not included	Not applicable	
☐	☐	☐	☐	Vicinity map – small map that locates the site in relation to the surrounding area. It should include any landmarks that might assist in locating the site. **Comments:**
☐	☐	☐	☐	North arrows – allow the persons developing, reviewing, and implementing the plans to determine slope orientation and general position of the site **Comments:**
☐	☐	☐	☐	Limits of clearing and grading – areas of grading should match with areas of clearing. These limits need to be obviously noted on the plans and include a note to mark in the field. They also assist with tree and/or natural area protections. **Comments:**
☐	☐	☐	☐	Existing contours – represented in dashed or lighter gray lines and are used to examine pre-development conditions, drainage areas, critical areas, determine cut and fills, and, eventually, the proper use of the proposed ESC measures **Comments:**
☐	☐	☐	☐	Adjacent areas – areas upstream and downstream of the site should be shown. Include existing ponds, streams, ditches, etc. **Comments:**
☐	☐	☐	☐	Final contours – provide information on changes to the drainage patterns of the site, cut and fill, steep slopes, and allow for the determination of stormwater discharge from the site and channel transitions and adequacy **Comments:**

Adequate	Incomplete	Not included	Not applicable	
☐	☐	☐	☐	Existing vegetation – existing tree lines, grassed areas, or unique vegetation. Important to obviously note for water quality evaluations. **Comments:**
☐	☐	☐	☐	Soils – aligned with the soils' section in the narrative, showing the boundaries of the different soil types **Comments:**
☐	☐	☐	☐	Existing drainage patterns – dividing lines and direction of flow for drainage areas (in acres), to size structural controls **Comments:**
☐	☐	☐	☐	Critical areas – aligned with the critical area section in the narrative and include steep slopes, long slopes, state waters, threatened and endangered species areas, etc. **Comments:**
☐	☐	☐	☐	Site development – show all improvements, such as buildings, parking lots, access roads, utility construction, etc. **Comments:**
☐	☐	☐	☐	Location of practices – all proposed ESC (and SWM) practices used on the site **Comments:**

Adequate	Incomplete	Not included	Not applicable	
☐	☐	☐	☐	Off-site areas – identify any off-site LDAs (e.g., borrow sites, waste areas, etc.). Show location of erosion controls. (Is there sufficient info to assure adequate protection and stabilization?) **Comments:**
☐	☐	☐	☐	Detail drawings – any structural practices used should be explained and illustrated **Comments:**
☐	☐	☐	☐	Maintenance – schedule of regular inspections and repair of ESC structures and who is responsible for that maintenance **Comments:**

13d. Reviewing for Water Quantity

Summary

As a plan reviewer, it is important to be able to:

- Identify and educate the regulated community on the major components within an ESC plan.
- Read and properly evaluate an ESC plan for adequacy.