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CHAPTER THIRTY-SEVEN

TEMPORARY EROSION AND SEDIMENT CONTROL

37-1.0 GENERAL INFORMATION

An erosion- and sediment-control plan is required to be submitted to the applicable local Soil and Water Conservation District (SWCD) to comply with 327 IAC 15-5 (Rule 5) as required by Section 9-2.05(06). INDOT *Standard Specifications* and *Standard Drawings* have been developed for erosion and sediment control to formalize and expand on existing measures available to the designer. These guidelines will aid the designer in choosing the appropriate measures and frequency of their use. Although Rule 5 requires erosion- and sediment-control measures for a specified minimum disturbed area, these measures should be applied to each project if land is disturbed. Formal submittal to comply with Rule 5 is not required where less than the minimum specified area is disturbed. However, where soil is disturbed, an erosion- and sediment-control plan must be developed. This applies particularly where sediment can enter a waterway.

The goal of the erosion- and sediment control plan is to minimize the amount of sediment generated by construction operations leaving the construction site. Water flowing through a construction-disturbed area is to be filtered of sediment before it mixes with water which is not affected by construction operations. These guidelines concentrate on temporary erosion and sediment control measures. It is the designer's responsibility to include permanent measures where warranted. Temporary erosion-control measures should be in compliance with the construction-zone clear-zone criteria shown in Chapter Eighty-two. The erosion- and sediment-control plan should address erosion and sediment control during the entire construction process. This may mean that different measures will be used during different phases of construction. Allowance should be made for changes in the field to fit existing conditions or the use of different measures where they are more appropriate. The erosion- and sediment-control measures have been listed in groups according to their use. Some of the measures may be used in multiple applications.

A copy of Rule 5 is available via the Indiana Department of Environmental Management (IDEM) website, at http://www.in.gov/idem/4221.htm. It lists items that should be submitted with the erosion- and sediment-control plan to the applicable SWCD. A checklist of items that should be considered in complying with Rule 5 is shown in Figure 37-1A. The erosion- and

sediment-control plan should be prepared and submitted to the appropriate SWCD. The Notice of Intent letter should be filed with IDEM. The submittals are as follows.

1. Plans developed for a Central-Office project will be filed by the Production Management Division's Permit Coordinator.

2. Plans developed by a district office will be filed by district personnel.

3. Plans developed for a local public agency project will be filed by the local agency.

37-2.0 SITE ANALYSIS

The erosion- and sediment-control plan should identify control measures that will be used to minimize erosion and off-site sedimentation. It serves as a blueprint for the location, installation, and maintenance of these measures.

In preparing the erosion- and sediment-control plan, the designer should start by looking at local drainage patterns and topography. The volume of water entering and leaving the construction site at various locations should be taken into consideration. Where reasonable, off-site waters should be isolated and allowed to pass through the project site. Sediments from on-site sources should be captured prior to leaving the site. The method of treatment depends upon the drainage area.

Providing a vegetated ground cover is the most important factor in terms of preventing erosion. If the existing vegetation is to be disturbed, appropriate erosion- and sediment-control measures should be utilized. If utility features traverse the site, their relocation should be taken into consideration in designing these measures.

The following principles of erosion and sediment control should be utilized.

1. The physical characteristics of the site should be assessed, including topography, soils, and drainage to determine how to best minimize erosion and sedimentation.

2. The erosion- and sediment-control plan should be designed to include measures that will keep sediment on the construction site as much as possible.

3. Where reasonable, a perimeter dike or waterway should be used to divert or intercept off-site runoff.

4. Measures to slow runoff and allow deposition of sediment should be designed using grading and sediment barriers to break up long, steep slopes.

5. Temporary seeding should be utilized where applicable.

6. Runoff velocity should be reduced by maintaining existing vegetative cover, preserving a natural buffer strip around the lower perimeter of the disturbed land, and installing a perimeter control such as a sediment barrier, silt fence, filter, dike, or sediment basin or trap.

7. The contractor should be provided adequate working space to construct, repair, and maintain erosion-control features.

The construction-zone clear zone should be determined in order to select the appropriate erosion-control measures. Chapter Eighty-two includes the information necessary to determine the construction-zone clear zone. Straw bales should be used instead of riprap for a ditch check in the construction-zone clear zone.

Temporary entrance points will likely be required for the contractor's use from off-road locations on to public roads. The INDOT *Standard Specifications* require the contractor to install stable construction entrances at these points in order to control movement of sediment off the project site by construction traffic. If the designer determines that such entrances are required, an undistributed quantity of 100 Mg of No. 2 stone should be included in the preliminary estimate of quantities and cost estimate. This minimum quantity should be sufficient to provide two stable construction entrances. If the designer anticipates that additional entrances will be required, the quantity should be adjusted accordingly. The locations of such entrances should not be shown on the plans.

37-3.0 TEMPORARY EROSION- AND SEDIMENT-CONTROL MEASURES

37-3.01 Protection of Adjacent Area

These measures are used to minimize sediment to an area adjacent to the disturbed area. These measures include silt fence, vegetative filter strip, sediment trap, and sediment basin.

37-3.01(01) Silt Fence

A silt fence is a fabric barrier used to retain sediment from a small, sloping, disturbed area by reducing the velocity of sheet flow. See the INDOT *Standard Drawings* for details. A silt fence requires a trench for proper installation and should not be used on a fill slope. A silt fence captures sediment by ponding water to allow deposition, not by filtration. Although the practice works best in conjunction with other erosion-control measures, it can be effective when used

alone under the proper field conditions. A silt fence is not recommended to divert water; nor is it to be used across a stream, channel, or where concentrated flow is anticipated.

Use of a silt fence is limited to a disturbed site in a drainage area. The use of a silt fence is further restricted by the slope (grade), as indicated in Figure 37-3A. A silt fence should be installed nearly level, approximately following the land contour. Ideally, a silt fence should be installed at least 3 m from the toe of slope to provide a broad, shallow sediment pool with increased storage capacity.

The length of silt fence should be sufficient to encompass the boundaries of the toe of the slope with the ends of the fence terminated upslope. The silt fence should terminate at adjacent erosion control measures or at a stabilized area.

For an area greater or a slope steeper than provided in Figure 37-3A, additional erosion-control measures should be utilized such as a slope drain, sediment trap or basin, temporary or permanent stabilization, etc.

Where site conditions exceed the limits shown in Figure 37-3A, other appropriate erosion- and sediment-control measures should be implemented in conjunction with the silt fence.

37-3.01(02) Vegetative Filter Strip

Leaving existing grassy vegetation in place is the most effective method for erosion control. It may not practical or possible to leave all existing vegetation in place. It is still best to maintain as much existing vegetation as possible, which will reduce erosion, and will act as a filter trap for sediment from an upslope area. A vegetative filter strip is an area where the ground cover is to be left undisturbed to filter runoff from a drainage area. A filter strip is located between a sediment-producing site and a downslope site or watercourse. The locations which are not to be disturbed by the contractor should be shown in the erosion- and sediment-control plan.

Applications for this sediment-control measure include an area adjacent to right-of-way limits, roadside ditch, relocated or existing waterway, or wetlands.

The vegetative filter strip’s effectiveness is increased when it is used in conjunction with other measures such as a silt fence, inlet protection, or sediment trap or basin, etc.

The effectiveness of a vegetative filter strip is dependent upon the slope of the undisturbed area. The designer should evaluate and identify all potential areas for use of this control measure.

It is preferable that the vegetative strip is on the flatter area beyond the toe of slope. This does not preclude leaving as much vegetation on the slope as possible. If site conditions exist that do not allow for locating a filter strip on the flatter ground, the designer should preserve vegetation on the slope. The vegetative filter strip may be considered for an undisturbed area within the construction limits.

Where a vegetative filter strip is to be used independent of other measures, the strip should be in accordance with or exceed the requirements shown in Figure 37-3C.

Where existing vegetation cannot be in accordance with the minimum requirements shown in Figure 37-3C, there are still advantages to leaving the vegetation in place. However, the vegetative strip should be used in conjunction with other appropriate practices. If a silt fence is to be used in conjunction with a filter strip, the fence should be installed 3 m from the toe of the slope on the flatter ground.

37-3.01(03) Sediment Trap

A sediment trap is an area located in a ditch line that is used to temporarily pond runoff, which allows the sediment to be contained. It is the last measure used in a ditch to filter water before it enters another legal drainage body. If the ditch grade is 5% or steeper, or if the ditch is 1000 m or longer, the last two measures in the ditch should be sediment traps. Revetment riprap should be used in construction of a sediment trap.

If used independent of other sediment-control measures, the sediment trap should be designed for up to a maximum drainage area of 2 ha. Where right of way is limited, the sediment trap should be designed considering the space rather than the drainage area. In this situation, other sediment-control measures should be specified in conjunction with the sediment trap. Ideally, the trap should be designed to store sediment for a minimum disturbed volume of 125 m^3/ha. In order to determine the volume of the trap; the watershed that is tributary to the sediment trap should be calculated.

Figures 37-3E, 37-3F, and 37-3G indicate the minimum spillway design for a sediment trap.

The sediment-trap design depends on the geometric characteristics of the proposed ditch as follows:

1. ditch grade;
2. ditch shape (flat bottom or V-ditch); and
3. sideslopes (fore- and backslope).

Figure 37-3G indicates the minimum spacing for sediment traps, based on the flood pool length, so that the next measure would not encroach into the pool of the previous one. The procedure is as follows.

1. Select the largest sediment trap, by spillway height, which can physically fit in the proposed ditch cross section

2. Check the proposed ditch grade directly upstream of the approximate location of the sediment trap. The grade should be continuous.

3. From the table for the appropriate ditch, find the required sediment-traps spacing. The provided spacing should be at least that shown in Figure 37-3G.

37-3.01(04) Sediment Basin

A sediment basin is a water-impoundment structure formed with an embankment or by excavating a basin. It is used to prevent offsite sedimentation by retaining sediment on the construction site. A sediment basin should be a primary consideration for a new-construction project where there is adequate right of way. It should be used within an interchange, rest area, weigh station, or replacement wetlands. Where right of way is limited, the sediment basin should be designed considering available space rather than drainage area. In this situation, other control measures should be specified in conjunction with the sediment basin depending on site conditions.

A sediment basin is the last control measure encountered by runoff before it leaves the construction site. It is about twice as long as it is wide, but it must be shaped to fit the area it will be used in. It should therefore be designed and detailed for each specific site, as no standard details have been developed. However, a schematic detail is shown in Figure 37-3H. If used independent of other sediment-control measures, the basin should be designed for a drainage range of 2 to 12 ha. The basin should be designed to store a minimum water volume of 125 m^3/ha for the watershed. If the watershed area is greater than 12 ha, additional consideration should be given.

A wetland-replacement site or detention pond may be used temporarily as a sediment basin. For guidance in the use of a wetland-replacement site as a sediment basin, contact the Production Management Division's Hydraulics Team. If the permanent control structure of the wetland-replacement site or detention pond is a pipe, a temporary perforated riser should be used to dewater the basin allowing for adequate residence time in the basin.

This sediment-control measure should not be used where failure of the embankment can endanger life or property. Temporary right of way may be provided where possible.

37-3.02 Slope

The following measures are used to temporarily control erosion on a slope. These measures include interceptor ditch and slope drain, vegetative strip in a cut section, temporary seeding and temporary mulching, erosion control blanket, and surface roughening.

37-3.02(01) Interceptor Ditch and Slope Drain

An interceptor ditch, in combination with temporary or permanent seeding, protects a work area from runoff and diverts water to a sediment trap or a protected-flow area. An interceptor ditch is constructed to protect a work area, fill slope, or cut slope. It should be constructed and graded to drain to provide positive drainage. A slope drain is a pipe drain used in conjunction with an interceptor ditch to convey runoff down a slope without causing erosion. An interceptor ditch with a slope drain should be specified at the top of a fill slope to divert runoff from the top of the embankment, and control where the runoff is discharged. Where cut or fill height exceeds 3 m, a slope drain should be used. The INDOT *Standard Drawings* specify the pipe diameter and its drainage area. This information is useful in determining the spacing of slope drains.

The contractor should be permitted to use a temporary-pipe slope drain or an open slope drain. The slope drain should be lengthened as the embankment is extended upward. A slope drain should not be outlet directly into a stream due to the possible conveyance of sediment from the top of the embankment. Instead, it should be outlet onto a riprap splash pad and into another sediment-control measure.

37-3.02(02) Interceptor Ditch or Vegetative Strip in Cut Section

An interceptor ditch in accordance with Section 37-3.02(01) may be warranted in a cut section at the right-of-way line to divert runoff from the construction site to adjacent properties. Another method for addressing this situation is to specify that a vegetative strip be left at the right-of-way line to filter runoff from the construction site. The strip should be shown on the erosion- and sediment-control plan, to indicate that the contractor should not clear the area.

37-3.02(03) Temporary Seeding and Temporary Mulching

Temporary seeding and mulching are used to reduce erosion and sedimentation damage by stabilizing a disturbed area where additional work is not scheduled for at least 15 calendar days. Temporary seeding reduces problems associated with mud or dust from a bare-soil surface

during construction, and also reduces sediment runoff downstream by providing temporary stabilization. Mulching protects the soil from the impact of wind and water, prevents the soil from crusting, conserves moisture, and promotes seed germination and growth. Temporary seeding and mulching are often used in concert, although temporary mulching should be used where temporary seeding is not reasonable, such as during the winter months. The seasonal requirements for the use of temporary seeding and mulching are shown in the INDOT *Standard Specifications*.

The pay quantity for temporary seeding should be determined based on the contract type as follows:

1. Bridge Contract. Based on the same area as the permanent seeding.

2. Road Contract. Based on one-half the area of the permanent seeding.

3. Maintenance, Traffic, or Resurfacing Contract. A pay quantity should not be included unless an analysis of the project shows it to be necessary.

A different pay quantity for temporary seeding may be shown if an analysis of the project shows it to be warranted.

When mulch is used during certain periods of the year instead of temporary seed, a pay quantity for mulch should also be included in a road or bridge contract. The quantity specified should be doubled, to cover the areas to be temporarily and permanently seeded. An additional quantity of mulch should not be shown if a quantity is already included.

37-3.02(04) Erosion-Control Blanket and Surface Roughening

If an erosion-control blanket is required as a permanent measure, and the special provisions require their early installation, it may be used as a temporary erosion-control measure. Surface roughening is required by the INDOT *Standard Specifications* for construction of erosion-control methods. The designer should not consider the measure as part of the temporary erosion- and sediment-control plan.

37-3.03 Side Ditch

The measures used to control sediment in a side ditch include check dam, sediment trap, and grass- or riprap-lined channel. Figure 37-3L shows the measures to be used with a disturbed ditch. Figure 37-3M shows the measures to be used with an undisturbed ditch.

37-3.03(01) Check Dam

A check dam is used to reduce erosion in a drainage channel by slowing the velocity of the flow. A check dam is used in a channel that is degrading but where permanent stabilization measures are impractical due to their short period of usefulness, or in an eroding channel where construction delays or weather conditions prevent timely installation of erosion-resistant linings. A check dam should not be used in an intermittent or perennial stream. A check dam should be used only a drainage area less than or equal to 0.8 ha. A revetment-riprap check dam should be specified for use if it is outside the construction clear zone and is not exposed to public traffic. A straw-bales check dam should be specified for use only if it inside the construction clear zone and is exposed to public traffic. See the INDOT *Standard Drawings* for details.

A check dam should be wide enough to traverse the ditch section to force water to flow over the check dam instead of around the ends.

Figures 37-3J and 37-3K provide guidance in developing quantities based on the spacing of revetment-riprap check dams. The spacing dimensions listed below were determined based on a 1.2-m bottom ditch with 4:1 fore- and backslopes. For another ditch cross section, the spacing should be recalculated. It is not necessary to show the spacing on the plans. The check dams should be spaced such that the top of the downstream check is at the same elevation as the toe of the adjacent upstream check dam.

The check-dam mass, M_{RR}, in megagrams, should be determined by using either of the formulas as follows:

For 0.6-m depth, $M_{RR} = 1.8\left[0.81a + 0.3645(b + c)\right]$
For 0.9-m depth, $M_{RR} = 1.8\left[1.22a + 0.732(b + c)\right]$

The coarse aggregate No. 5 and geotextile fabric required with this work are not separate pay items, therefore, quantities need not be determined.

Geotextile is required under the riprap and as an apron as shown on the INDOT *Standard Drawings.* The area to be covered with geotextile is as follows:

$$\text{Area (m}^2\text{)} = 3.7a + 1.94\,(b + c)$$

37-3.03(02) Sediment Trap in Side Ditch

A sediment trap is used in a side ditch in lieu of, or in conjunction with, a check dam. It allows sediment to settle out of the water instead of damming the sediments as with a check dam.

Riprap quantities are shown in Figures 37-3N, 37-3 O, and 37-3P. See Section 37-3.01(03) for details.

37-3.03(03) Grass- or Riprap-Lined Channel

Grass seed or riprap should be placed in a channel early in the construction process. This measure may be used as a temporary erosion- and sediment-control measure, and then retained as a permanent feature.

37-3.04 Stream

A sediment basin and silt fence is used to control sediment at a stream. Although all of the measures contribute to the reduction of sediment that could enter a stream, the measures described below apply adjacent to the stream.

37-3.04(01) Sediment Basin Alongside Stream

A sediment basin is used as a last sediment-control measure, in a line of several measures, before runoff is allowed to enter a waterway. This measure may not be necessary on a project with a small disturbed area. A sediment basin allows sediments to settle out of the water. See Section 37-3.01(04) for information concerning this measure.

37-3.04(02) Silt Fence Alongside Stream

Where a stream is adjacent to an exposed fill slope, the stream should be protected from sediment by use of a silt fence alongside the stream as described in Section 37-3.01(01).

37-3.05 Inlet

Prevention of sedimentation of a stream includes protection of each stormwater inlet. The inlet-protection measures described below have been established to handle a maximum drainage area of 0.4 ha. If the drainage area is greater than 0.4 ha per inlet, additional measures should be used in conjunction with the inlet-specific protection measures.

37-3.05(01) Ditch-Inlet Protection

Ditch-inlet protection is used to keep sediment from entering an inlet. Ditch-inlet protection is needed only where there is likelihood that sediment will enter the inlet. The designer should include ditch-inlet protection in the erosion- and sediment-control plan only where such plan calls for disturbing the area around the inlet. The contractor should be given the option of using silt-fence, slotted-barrel, or aggregate-ring inlet protection. Each measure captures sediment at the approach to a storm-drain inlet, allowing full use of the storm-drain system during the construction period. See the INDOT *Standard Drawings* for details.

37-3.05(02) Curb-Inlet Protection

Curb-inlet protection should be provided where a road is still closed to traffic, or is being used by the contractor as a haul road, and there is a reasonable potential for sediment to wash onto the road from surrounding areas or be tracked by construction equipment. There are no sediment-control measures that the designer may consider regarding this situation. Measures which the contractor must consider are described in the INDOT *Standard Specifications.*

The following is a check for the following items to be adequately addressed on the plans. *(The plans must include appropriate legends, scales, and north arrow.)*

PROJECT INFORMATION

Yes	No		
☐	☐	1A	Project location map *(Show project in relation to other areas of the county.)*
☐	☐	1B	Narrative describing the nature and purpose of the project
☐	☐	1C	Location of planned and/or existing roads, utilities[1], structures, highways, etc.
☐	☐	1D	Building locations[2]
____	____	1E	Land use of adjacent areas *(Show the entire upstream watershed and adjacent areas within 150 m of the property lines.)*[3]

TOPOGRAPHIC, DRAINAGE, AND GENERAL SITE FEATURES

Yes	No		
☐	☐	2A	Existing vegetation *(Identify and delineate.)*
☐	☐	2B	Location/name of all wetlands, lakes, and water courses on and adjacent to site
☐	☐	2C	100-year floodplains, floodway fringes, and floodways *(not applicable if none.)*[4]
☐	☐	2D	Soils information *(If hydric soils are present, it is the responsibility of the owner to investigate the existence of wetlands and obtain appropriate permits.)*[5]
☐	☐	2E	Existing/planned contours[6] at intervals appropriate to indicate drainage patterns
☐	☐	2F	Locations of specific points where stormwater discharge will leave the site
☐	☐	2G	Identify all receiving waters *(If discharge is to a separate municipal storm sewer, identify the name of the municipal operator and the ultimate receiving water.)*
☐	☐	2H	Potential areas where storm water may enter groundwater *(note if none.)*
☐	☐	2 I	Location of stormwater system *(Include culverts, storm sewers, channels, and swales.)*

[1] Use best available information.
[2] Within project area.
[3] Attach the appropriate United States Geological Survey topographic map.
[4] This item is satisfied by showing the 100-year flood elevation on the plans.
[5] No formal submittal from the designer is necessary for this item.
[6] Profiles or contours where available.

LAND-DISTURBING ACTIVITIES

Yes	No		
☐	☐	3A	Location and approximate dimensions of all disturbed areas *[i.e., construction limits] (Areas where vegetation cover will be preserved should clearly be designated.)*
☐	☐	3B	Soil stockpiles and borrow areas[7] *(Show location or note if none.)*

EROSION AND SEDIMENT CONTROL MEASURES

Yes	No		
☐	☐	4A	Sequence of each measure to be implemented[7] *(Relative to earth-disturbing activities.)*
☐	☐	4B	Monitoring and maintenance guidelines for each measure[8]
☐	☐	4C	Perimeter sediment control measures *(Location, construction detail, dimensions, specifications.)*
☐	☐	4D	Temporary seeding *(Specifications including seed mix, fertilizer, lime, and mulch rates.)*[8]
☐	☐	4E	Temporary erosion and sediment control measures *(Location, construction details dimensions, specifications.)*
☐	☐	4F	Permanent erosion and sediment control measures *(Location, construction details, dimensions, specifications.)*
☐	☐	4G	Storm drain inlet protection *(Location, construction details, dimensions, specifications.)*
☐	☐	4H	Storm drain outlet protection *(Location, construction details, dimensions, specifications.)*
☐	☐	4 I	Stable construction entrance *(Location, construction details, dimensions, specifications.)*[7]
☐	☐	4J	Permanent seeding *(Specifications including seed mix, fertilizer, lime, and mulch rates.)*[8]

EROSION AND SEDIMENT CONTROL PLAN
TECHNICAL REVIEW CHECKLIST

[7]To be submitted by the contractor following contract award.
[8]This item addressed in Indiana Department of Transportation *Standard Specifications*.

Slope, *a*:1 (Grade, %)*	Maximum Slope Length, *B***
Flatter than 50:1 (< 2%)	30 m
50:1 ≤ Slope < 20:1 (2% ≤ Grade < 5%)	23m
20:1 ≤ Slope < 10:1 (5% ≤ Grade < 10%)	15 m
10:1 ≤ Slope < 5:1 (10% ≤ Grade < 20%)	8 m
5:1 or Steeper (≥ 20%)	5 m

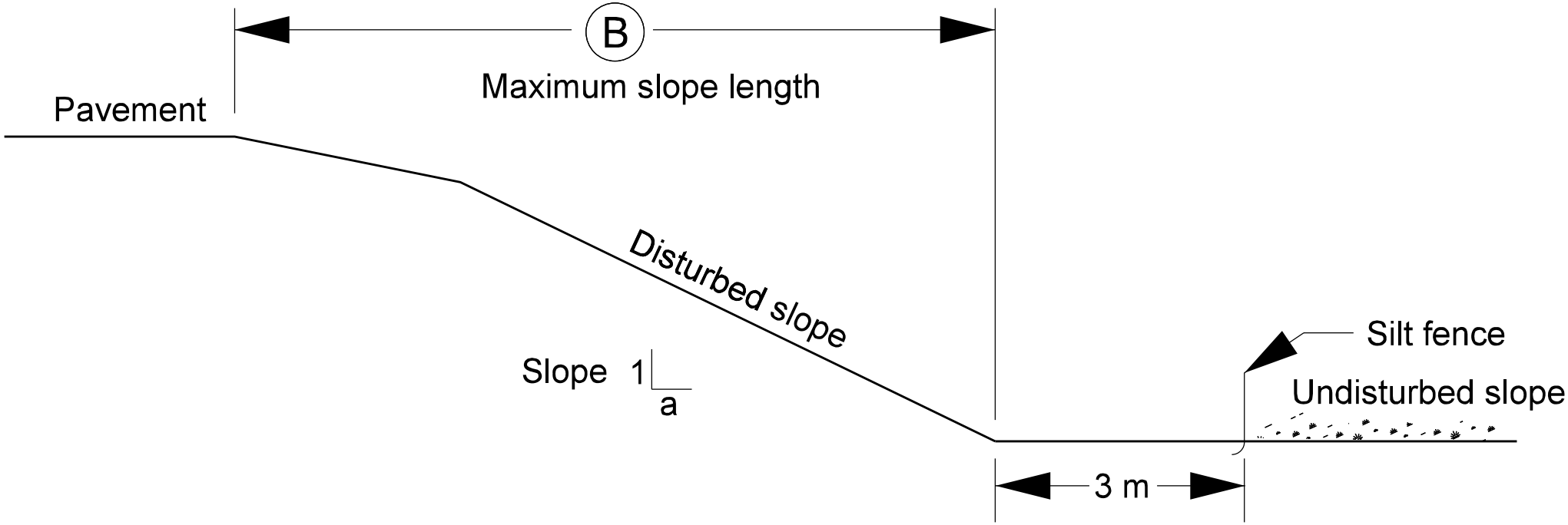
* *Steepest portion of the slope.*

** *The length of the slope above the fence that will be contributing runoff. This is not to be interpreted as a spacing distance between multiple rows of fence down a slope. Multiple or terraced rows of silt fence are not an approved application of this sediment-control measure.*

Figure 37-3B should be used with this figure.

SLOPE LENGTH FOR SILT FENCE

Figure 37-3A



SILT FENCE APPLICATION

Figure 37-3B

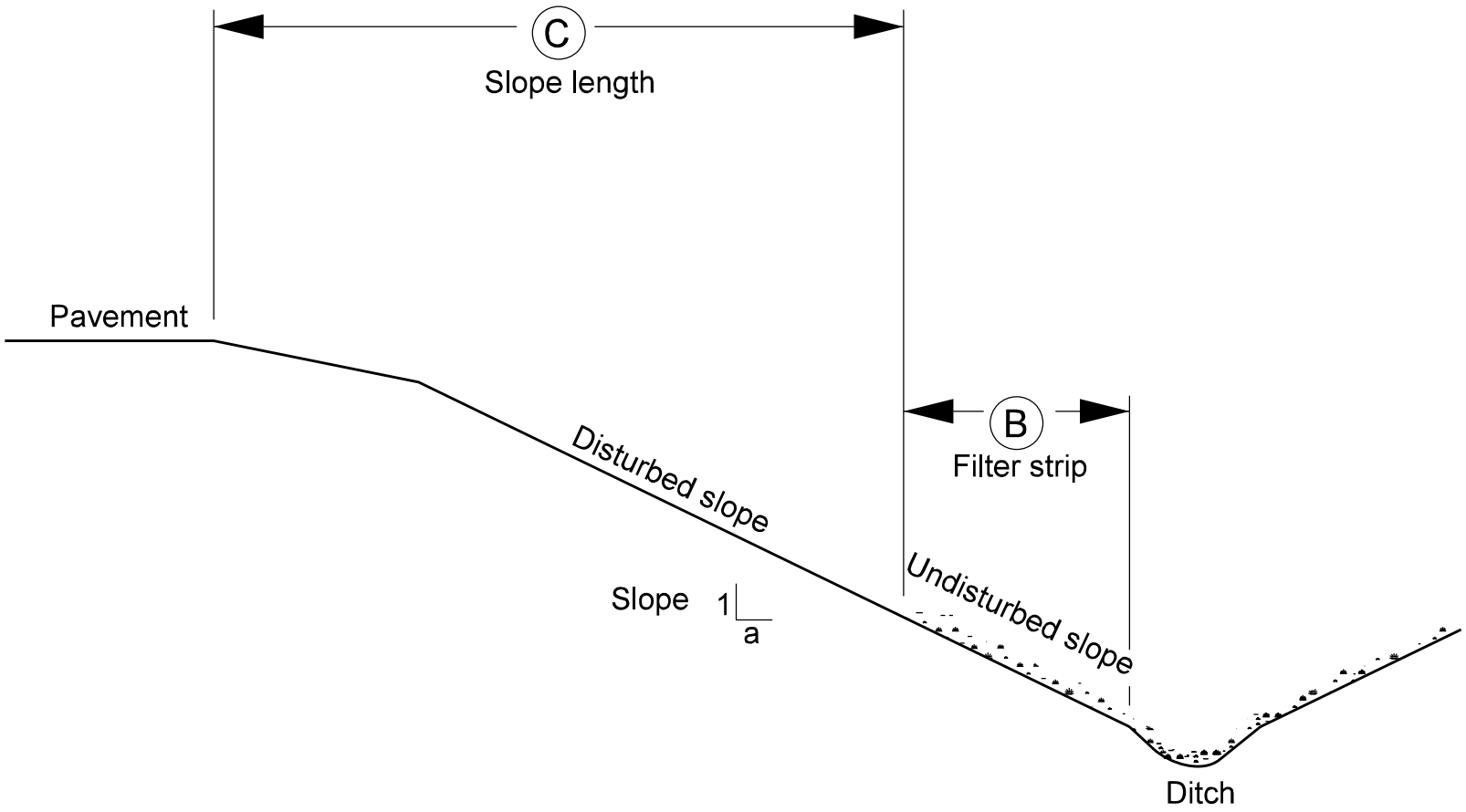
Slope, *a*:1 (Grade, %) *	Minimum Recommended Filter Width, *B*	Maximum Slope Length, *C* **
Flatter than 20:1 (< 5%)	6 m	23 m ≤ *C* < 30 m
20:1 ≤ Slope < 10:1 (5% ≤ Grade < 10%)	12 m	15 m ≤ *C* < 23 m
10:1 ≤ Slope < 5:1 (10% ≤ Grade < 20%)	18 m	8 m ≤ *C* < 15 m
5:1 or Steeper (≥ 20%)	23 m	5 m ≤ *C* < 8 m

* *Steepest portion of the slope*
** *Length of the slope above the filter strip that will contribute runoff.*

Note: Figure 37-3D should be used with this figure.

MINIMUM FILTER-STRIP APPLICATION

Figure 37-3C



VEGETATIVE FILTER STRIP APPLICATION

Figure 37-3D

Spillway Height (m)	STORAGE CAPACITY, m^3 / SPACING, m														
	2:1 Foreslope, 2:1 Backslope Ditch Grade, up to:					3:1 Foreslope, 2:1 Backslope Ditch Grade, up to:					3:1 Foreslope, 3:1 Backslope Ditch Grade, up to:				
	2%	3%	4%	5%	6%	2%	3%	4%	5%	6%	2%	3%	4%	5%	6%
0.60	11 20*	7 13*	5 10*	4 8*	4 6*	13 25*	9 16*	7 12*	5 10*	5 8*	16 30	11 20	8 15	6 12	5 10
0.75	21 38	14 26	11 19	8 15	7 13	26 48	18 32	13 24	11 19	9 16	32 58	21 38	16 29	13 23	11 19
0.90	36 66	24 44	18 33	15 27	12 22	46 83	30 55	23 41	18 33	15 28	55 100	36 66	27 50	22 40	18 33
1.05	58 105	39 70	29 53	23 42	19 35	72 132	48 88	36 66	29 53	24 44	87 158	58 106	43 80	35 63	29 52

** This spacing is for information only. Use the minimum spacing from Figure 37-3G instead.*

SEDIMENT TRAP IN V-DITCH

Figure 37-3E

Spillway Height (m)	STORAGE CAPACITY, m^3 / SPACING, m														
	31 Foreslope, 31 Backslope Ditch Grade, up to:					41 Foreslope, 31 Backslope Ditch Grade, up to:					41 Foreslope, 41 Backslope Ditch Grade, up to:				
	2%	3%	4%	5%	6%	2%	3%	4%	5%	6%	2%	3%	4%	5%	6%
0.60	24/34	16/23	12/17	10/14	8/11	27/39	18/26	13/19	11/16	9/13	30/44	20/29	15/22	12/18	10/14
0.75	44/65	30/43	22/33	18/26	15/22	50/74	33/49	25/37	20/30	17/25	55/84	37/56	27/42	22/34	18/28
0.90	73/110	49/73	36/55	29/44	24/37	86/126	55/84	41/63	33/50	27/42	91/143	61/95	46/71	35/57	30/48
1.05	112/172	74/115	56/86	45/69	37/57	126/198	84/132	63/100	50/79	42/66	141/224	94/150	70/113	56/90	47/74

Note: The values are calculated for a 0.9-m width flat-bottom ditch. They are also suitable for use for a 1.2-m width ditch, due to the proximity of the values.

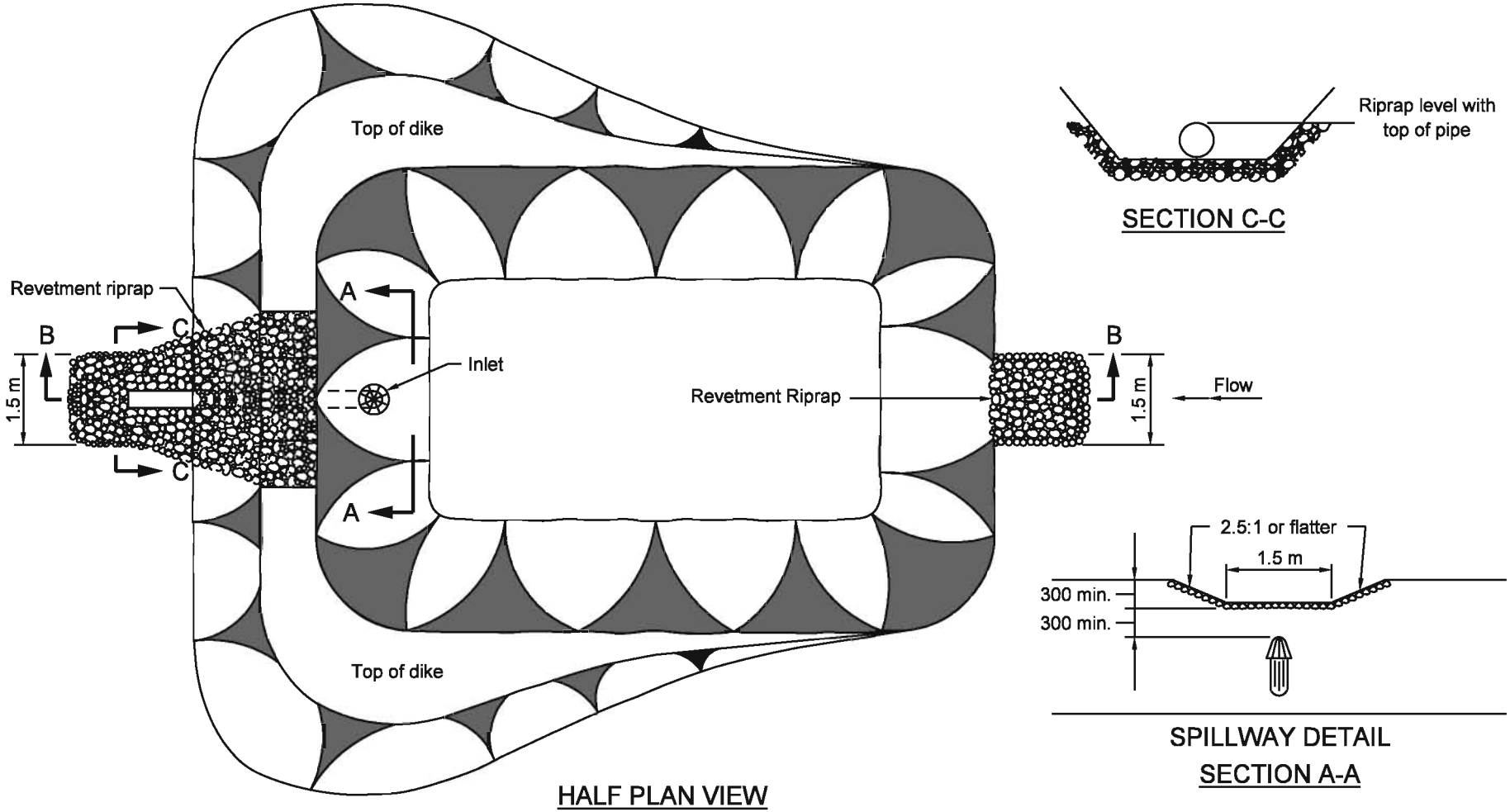
SEDIMENT TRAP IN FLAT-BOTTOM DITCH

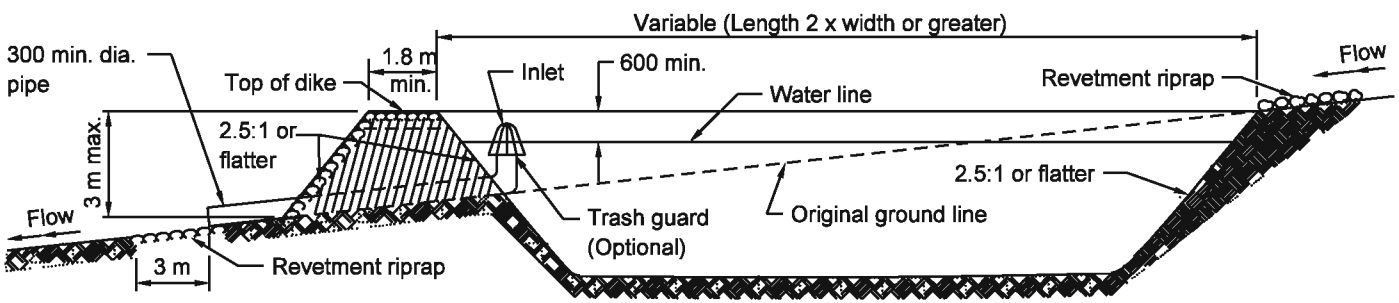
Figure 37-3E

Spillway Height, m	Ditch Grade, up to:				
	2%	3%	4%	5%	6%
0.60	30.0	20.0	15.0	12.0	10.0
0.75	37.5	25.0	18.8	15.0	12.5
0.90	45.0	30.0	22.5	18.0	15.0
1.05	52.5	35.0	26.3	21.0	17.5

FLOOD-POOL LENGTH (m)

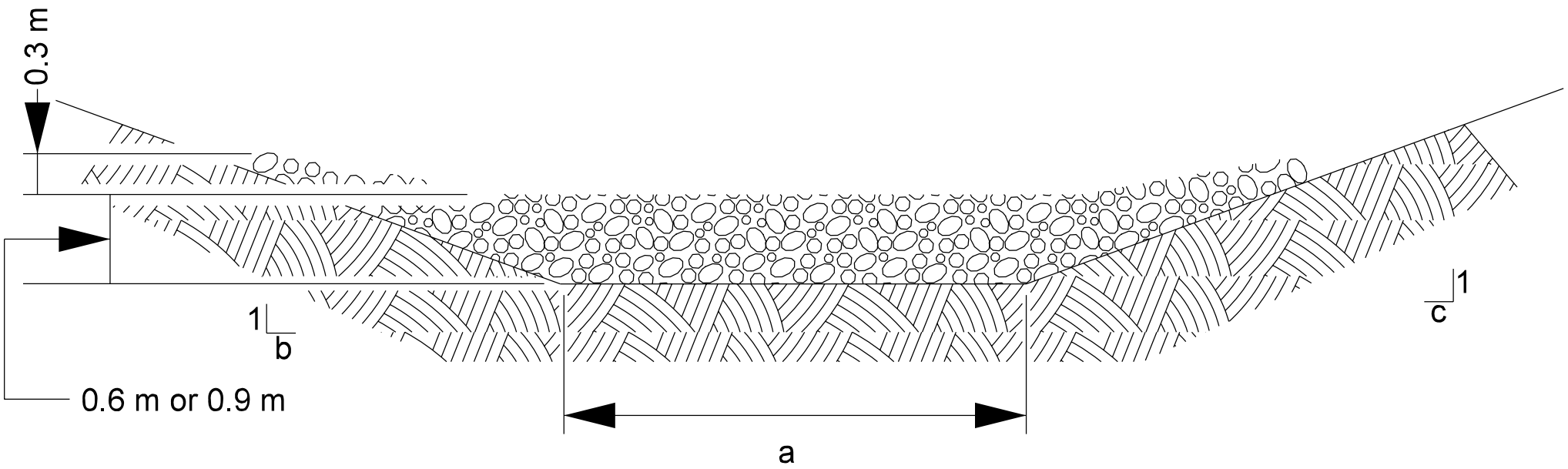
Figure 37-3G





SEDIMENT BASIN DETAILS

Figure 37-3H



CROSS SECTION FOR DETERMINING MASS
OF REVETMENT RIPRAP CHECK DAM

Figure 37-3 I

Sideslopes, F = Fore., B= Back.				Ditch Grade, *G*	Check-Dam Spacing
4:1 F; 4:1 B	4:1 F; 3:1 B	4:1 or 3:1 F; 2:1 B	3:1 or 2:1 F; 2:1 B		
X	X	X	X	$\leq 0.5\%$	120 m
X	X	X	X	$0.5\% < G \leq 0.75\%$	80 m
X	X	X	X	$0.75\% < G \leq 1\%$	60 m
X	X	X	X	$1\% < G \leq 1.25\%$	50 m
X	X	X	X	$1.25\% < G \leq 1.5\%$	40 m
X	X	X	X	$1.5\% < G \leq 1.75\%$	35 m
X	X	X	X	$1.75\% < G \leq 2\%$	30 m
X	X	X	X	$2\% < G \leq 3\%$	20 m
X	X	X	X	$3\% < G \leq 4\%$	15 m
*	X	X	X	$4\% < G \leq 5\%$	12 m
*	*	X	X	$5\% < G \leq 6\%$	10 m
*	*	*	X	$6\% < G \leq 7\%$	9 m
*	*	*	*	$> 7\%$	Establish Permanent Erosion Control Measure

** A permanent erosion-control measure should be specified. Permanent erosion-control measures are to be established immediately. These include turf-reinforcement material, a channel liner, or riprap. Temporary measures are to be specified in order to protect permanent measures until construction is complete in that area.*

SPACING FOR CHECK DAM OF 0.6-m HEIGHT AT SPILLOVER

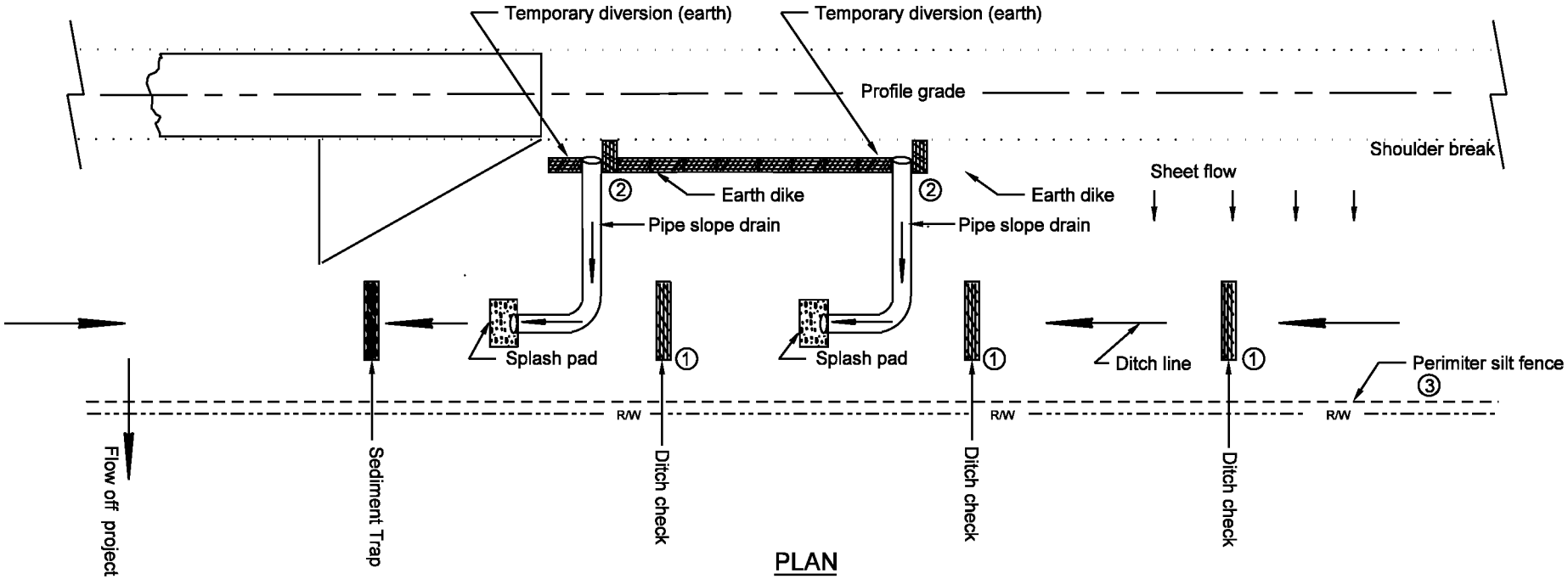
Figure 37-3J

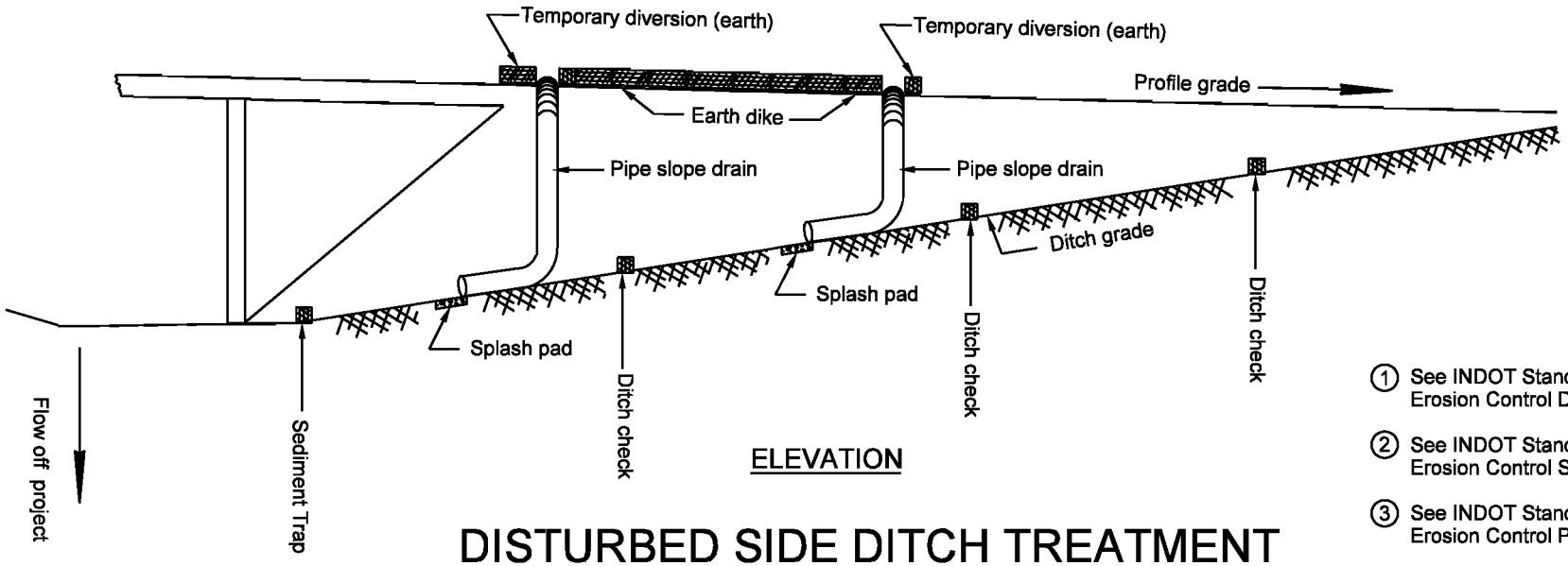
Sideslopes, F= Fore., B = Back.				Ditch Grade, *G*	Check-Dam Spacing
4:1 F; 4:1 B	4:1 F; 3:1 B	4:1 or 3:1 F; 2:1 B	3:1 or 2:1 F; 2:1 B		
X	X	X	X	$\leq 0.5\%$	180 m
X	X	X	X	$0.5\% < G \leq 0.75\%$	120 m
X	X	X	X	$0.75\% < G \leq 1\%$	90 m
X	X	X	X	$1\% < G \leq 1.25\%$	75 m
X	X	X	X	$1.25\% < G \leq 1.5\%$	60 m
X	X	X	X	$1.5\% < G \leq 1.75\%$	50 m
X	X	X	X	$1.75\% < G \leq 2\%$	45 m
X	X	X	X	$2\% < G \leq 3\%$	30 m
X	X	X	X	$3\% < G \leq 4\%$	25 m
*	X	X	X	$4\% < G \leq 5\%$	20 m
*	*	X	X	$5\% < G \leq 6\%$	15 m
*	*	*	X	$6\% < G \leq 7\%$	12 m
*	*	*	*	$> 7\%$	Establish Permanent Erosion Control Measure

** A permanent erosion-control measure should be specified. Permanent erosion-control measures are to be established immediately. These include turf-reinforcement material, a channel liner, or riprap. Temporary measures are to be specified in order to protect permanent measures until construction is complete in that area.*

SPACING FOR CHECK DAM OF 0.9-m HEIGHT AT SPILLOVER

Figure 37-3K

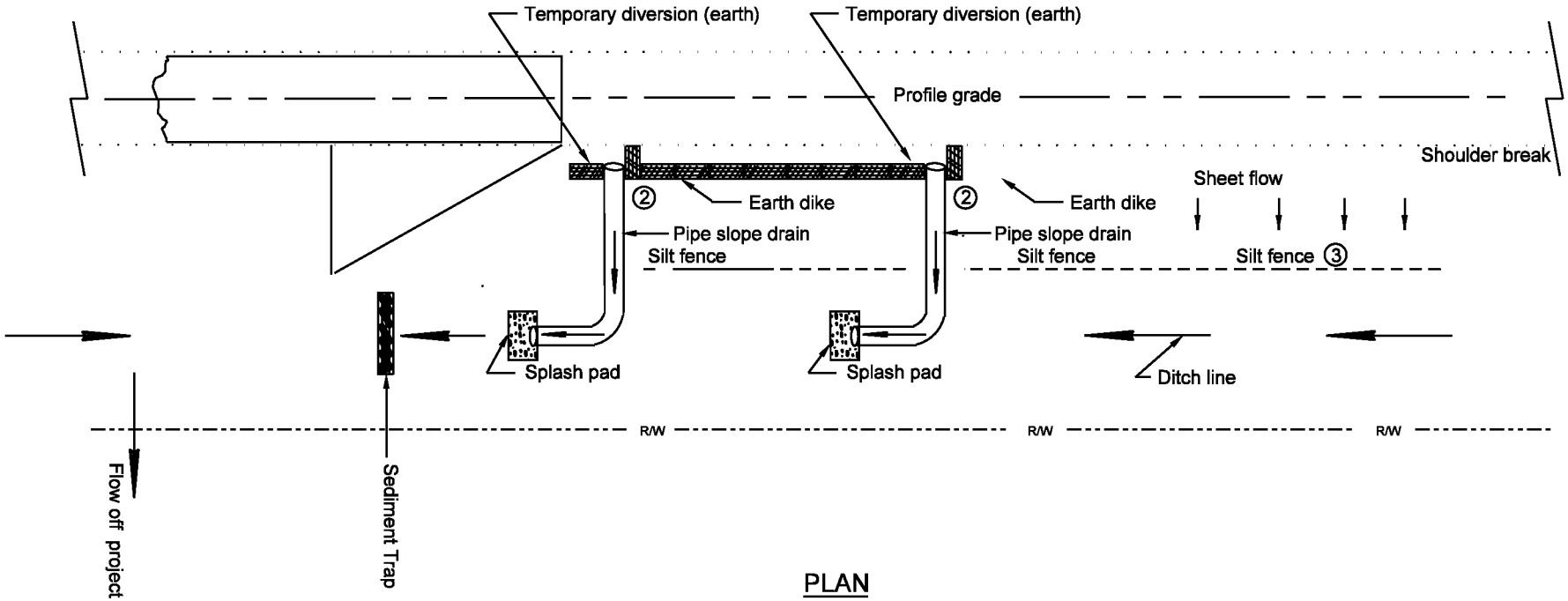




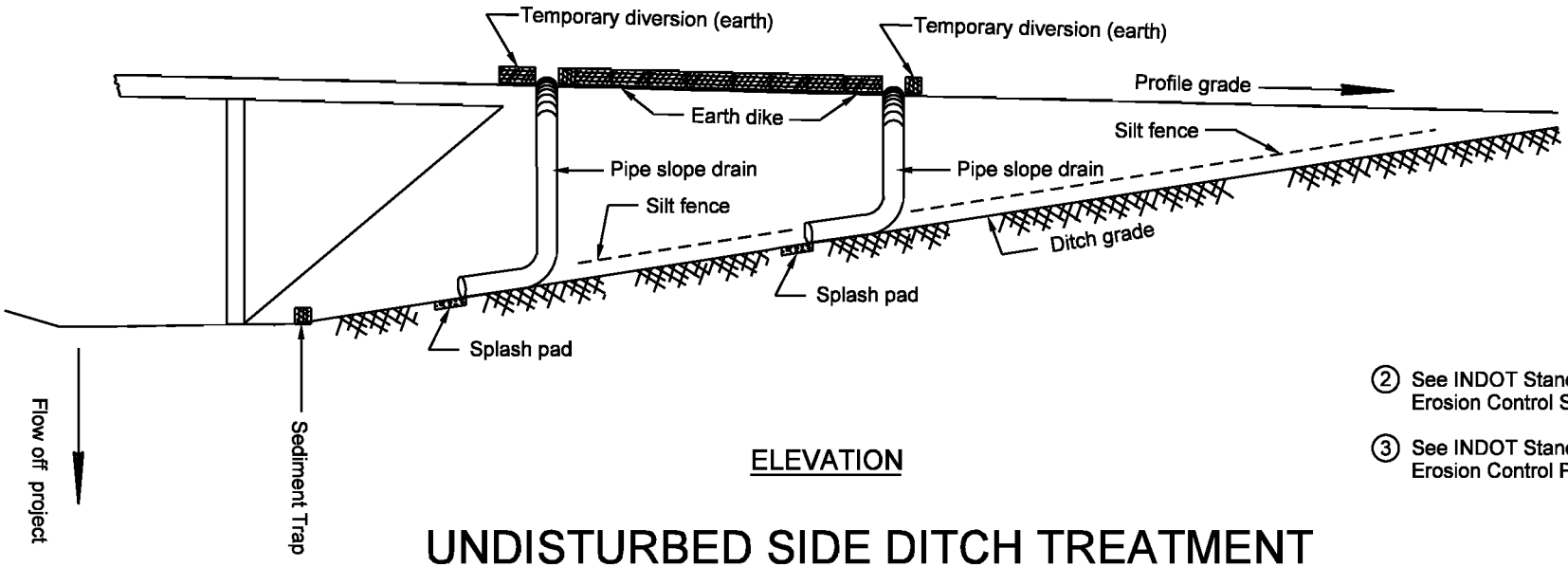
1. See INDOT Standard Drawings Temporary Erosion Control Ditch series.
2. See INDOT Standard Drawings Temporary Erosion Control Slope series.
3. See INDOT Standard Drawings Temporary Erosion Control Perimeter series.

DISTURBED SIDE DITCH TREATMENT

Figure 37-3L



PLAN



ELEVATION

② See INDOT Standard Drawings Temporary Erosion Control Slope series.

③ See INDOT Standard Drawings Temporary Erosion Control Perimeter series.

UNDISTURBED SIDE DITCH TREATMENT

Figure 37-3M

Spillway Height, m	Sideslope		
	2:1 F; 2:1 B	3:1 F; 2:1 B	3:1 F; 3:1 B
0.60	2.9	4.1	5.3
0.75	4.3	5.9	7.5
0.90	6.0	8.0	10.0
1.05	7.9	10.3	12.7

In Sideslopes columns, F = Foreslope, B = Backslope

RIPRAP VOLUME (m^3) IN V-DITCH

Figure 37-3N

Spillway Height, m	Sideslope		
	3:1 F; 3:1 B	4:1 F; 3:1 B	4:1 F; 4:1 B
0.60	8.7	9.9	11.1
0.75	11.7	13.2	14.8
0.90	15.0	17.0	19.0
1.05	18.8	21.2	23.7

In Sideslopes columns, F = Foreslope, B = Backslope

RIPRAP VOLUME (m^3) IN 0.9-m-BOTTOM DITCH

Figure 37-3 O

Spillway Height, m	Sideslope		
	3:1 F; 3:1 B	4:1 F; 3:1 B	4:1 F; 4:1 B
0.60	9.8	11.0	12.2
0.75	13.1	14.6	16.2
0.90	16.8	18.7	20.7
1.05	20.8	23.3	25.7

In Sideslopes columns, F = Foreslope, B = Backslope

RIPRAP VOLUME (m^3) IN 1.2-m-BOTTOM DITCH

Figure 37-3P