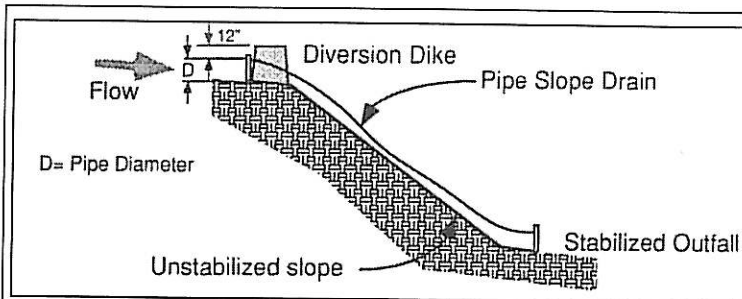


## 2.6 Pipe Slope Drain

Erosion Control



**Description:** A pipe slope drain is a temporary or permanent pipeline, typically utilizing flexible pipe that conveys runoff down steep or unstabilized slopes without causing erosion. The drain is anchored on the upstream end with some form of headwall to limit erosion and secure the pipe.

### KEY CONSIDERATIONS

#### DESIGN CRITERIA:

- Maximum entrance grade of 3 percent
- Anchor upstream end with a headwall or similar device
- Secure pipe with hold down anchors spaced 10 feet on center
- Stabilize outlet and provide velocity dissipation so that released flow has a velocity less than 3 feet per second

#### ADVANTAGES / BENEFITS:

- Protects slopes from erosion caused by overland flow
- A series of pipes may be used to control drainage areas greater than 5 acres in size

#### DISADVANTAGES / LIMITATIONS:

- Drain can easily be damaged by construction traffic
- Difficult to secure pipe to the slope
- Can become clogged during large rain events causing water to overflow and create a serious erosion condition

#### MAINTENANCE REQUIREMENTS:

- Inspect regularly
- Repair damage to pipe joints
- Unclog pipe

### TARGETED POLLUTANTS

- Sediment
- Nutrients & Toxic Materials
- Oil & Grease
- Floatable Materials
- Other Construction Wastes

### APPLICATIONS

Perimeter Control

**Slope Protection**

Sediment Barrier

Channel Protection

Temporary Stabilization

Final Stabilization

Waste Management

Housekeeping Practices

**Fe=0.95**

### IMPLEMENTATION CONSIDERATIONS

- Capital Costs
- Maintenance
- Training
- Suitability for Slopes > 5%

#### Other Considerations:

- *Normally used in combination with interceptor swales or diversion dikes to direct flow*
- *Additional measures needed to remove sediment from runoff*

### 2.6.1 Primary Use

Pipe slope drains are used to protect graded slopes during establishment of temporary and final vegetation. They are used on sites with a long, unstabilized, steep slope area that is subject to erosion from overland flow. Drains are normally used in combination with interceptor swales or diversion dikes to direct the flow into the pipe. The pipe slope drain can provide service for a relatively large area. It does not treat the runoff; therefore if the runoff contains sediment from a disturbed area, treatment through a sediment control is required before the flow is released offsite.

### 2.6.2 Applications

Sites with large berms or grade changes, such as roadway embankments, are candidates for a pipe slope drain. Since provisions must be made to direct the flow into the pipe drain, some grading is normally required upstream of the pipe slope drain. Installed properly, slope erosion can be greatly reduced (but not entirely eliminated) through the use of the drain.

Pipe slope drains also require a stabilized outlet. This is critical since the velocities at the outfall are normally high. Velocity dissipators such as stone or concrete riprap are typically required to reduce the velocity and spread the flow, reducing erosion.

### 2.6.3 Design Criteria

- Design calculations and information are required for the use of this control. The designer shall provide drainage computations, pipe material, pipe size, and stone apron size for each application.
- The entrance to the pipe slope drain may be a standard corrugated, metal pre-fabricated, flared end section with an integral toe plate extending a minimum of 6 inches from the bottom of the end section.
- The grade of the entrance shall be 3 percent maximum.
- The diversion dike at the entrance shall have a minimum height of the pipe diameter plus 12 inches and a minimum width of 3 times the pipe diameter. Additional criteria are in *Section 2.2 Diversion Dike*.
- The drain pipe shall be made of any material, rigid or flexible, capable of conveying runoff. Regardless of material, the drain pipe shall be completely water-tight so that no water leaks onto the slope being protected.
- All sections of the pipe slope drain shall be connected using watertight collars or gasketed watertight fittings.
- If the upslope drainage area contributing flow to the pipe drain is disturbed or the collection swale/dike for the drain is not stabilized, flow from a pipe slope drain must be routed to a sediment control to remove suspended soil collected in these areas before being discharged from the site.
- The pipe shall be secured with hold down anchors spaced 10 feet on center.
- Temporary pipe slope drains are to be sized to accommodate runoff flows equivalent to a 10-year storm as calculated using the Rational Method and Manning's equation, but in no case shall pipes be sized smaller than shown on the following table.

<i>Minimum Pipe Size</i>	<i>Maximum Contributing Drainage Area</i>
12 inches	0.5 Acres
18 inches	1.5 Acres
21 inches	2.5 Acres
24 inches	3.5 Acres
30 inches	5.0 Acres

- Maximum drainage areas for individual pipe slope drains shall be 5 acres. For areas larger than 5 acres, additional drains shall be added.
- Both the entrance and outfall of the pipe slope drain should be properly stabilized. Grass can normally be used at the entrance, but armor type stabilization such as stone or concrete riprap is normally required to address the high velocities of the outfall.
- A riprap lined apron shall be excavated to accept the discharge from the pipe and dissipate the energy of the flow. The width of the bottom of the apron shall be 3 times the pipe diameter, and the length shall be a minimum of 6 times the pipe diameter of the drain pipe.
- The riprap apron shall be a minimum of 12 inches in depth and shall be lined with well graded stone weighing between 50 and 150 pounds per stone at a minimum thickness of 12 inches. The top of the riprap apron shall be relatively flat (no slope) and flush with the surrounding ground.
- The apron shall be designed so that the released flow has a velocity less than 3 feet per second.

#### *2.6.4 Design Guidance and Specifications*

Specifications for construction of this item may be found in the Standard Specifications for Public Works Construction – North Central Texas Council of Governments, Section 201.14 Pipe Slope Drain and in the Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (TxDOT 2004) Item 506.2.B and 506.4.C.2.

#### *2.6.5 Inspection and Maintenance Requirements*

Pipe slope drains should be inspected regularly (at least as often as required by the TPDES Construction General Permit) to locate and repair any damage to joints or clogging of the pipe. In cases where the diversion dike has deteriorated around the entrance of the pipe, it may be necessary to reinforce the dike with sandbags or to install a concrete collar to prevent failure. Signs of erosion around the pipe drain should be addressed in a timely manner by stabilizing the area with erosion control blanket, turf reinforcement mats, riprap, concrete, or other acceptable methods.

#### *2.6.6 Example Schematics*

The following schematics are example applications of the construction control. They are intended to assist in understanding the control's design and function.

The schematics are **not for construction**. They may serve as a starting point for creating a construction detail, but they must be site adapted by the designer. In addition, dimensions and notes appropriate for the application must be added by the designer.

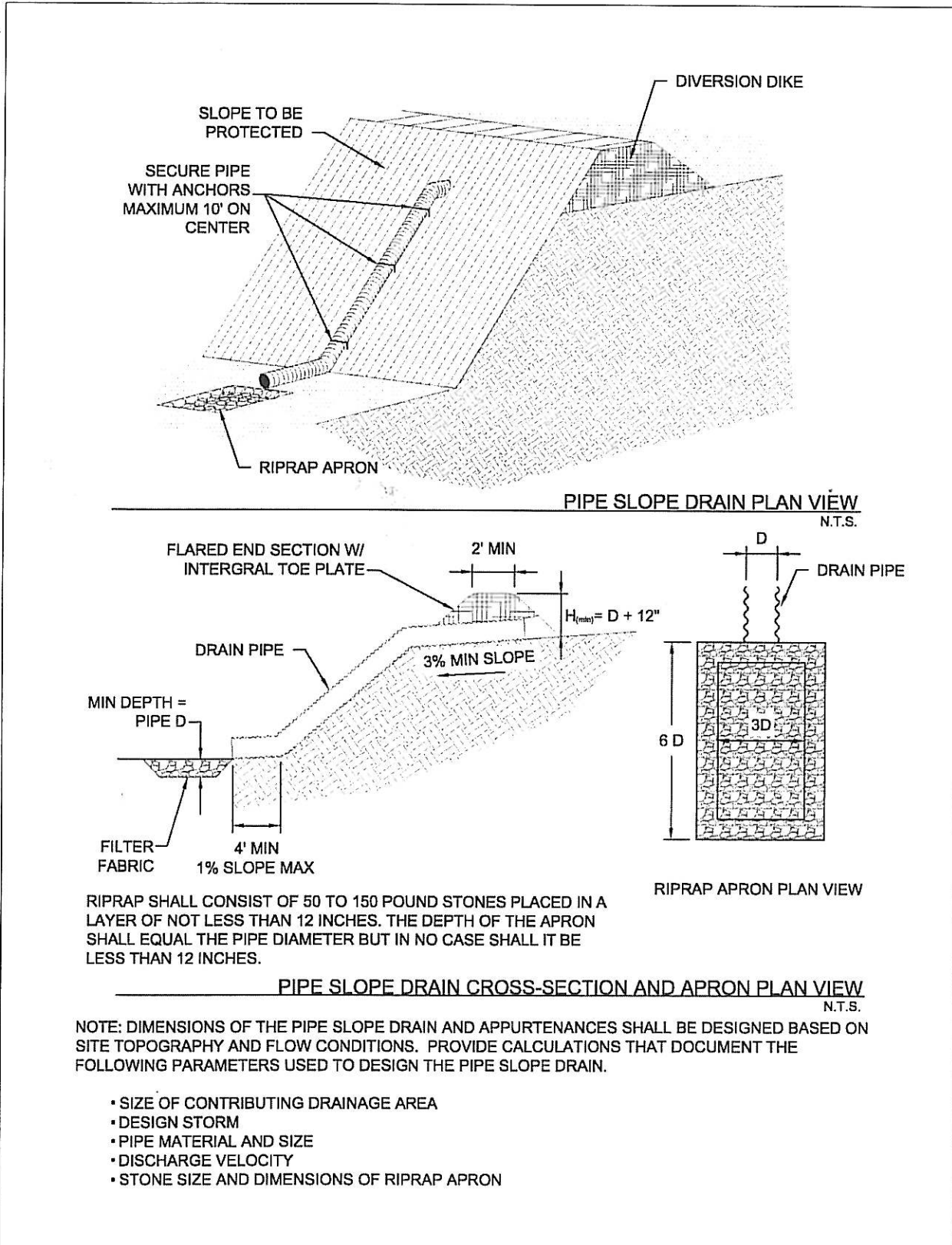


Figure 2.10 Schematics of Pipe Slope Drain