Guidance on Erosion Control at Pipe Utility Crossings

TO:	Carl Singleton Environment and Development Planner North Central Texas Council of Governments	**DATE:**	October 28th, 2025
FROM:	Saumya (Sam) Sarkar, PE Project Manager Halff Associates, Inc.	**AVO:**	45347.001
EMAIL:	ssarkar@halff.com		
SUBJECT:	Guidance on Erosion Control at Pipe Utility Crossings		

1.0 Introduction

The North Central Texas Council of Governments (NCTCOG) integrated Stormwater Management (iSWM) Implementation Subcommittee prepared the following summary guidance on stream utility crossings for municipalities with support from Halff. Stream utility crossings are water lines, sanitary sewer lines, gas pipelines, and other utilities that traverse creeks or rivers. Erosion control measures to protect utility crossings from exposure are crucial to maintaining the integrity of the infrastructure. The iSWM Hydraulics Technical Manual contains detailed information on erosion control design for rip rap, gabions, and other erosion control measures – however, there are other best practices for erosion control at pipe utilize crossings that should be considered. This memorandum will discuss both pre- and post-construction erosion control best practices at pipe utility crossings. The findings of this memo are all based on information found in the sources included in the references section below.

2.0 Best Practices for Erosion Control Pre-Construction

Site selection, cover depth, and permitting should all be considered before the construction of a pipe utility crossing begins.

2.0.1 Site Selection and Planning

One way to reduce erosion at pipe utility crossings is to be mindful when deciding where to build them. For example, designing utility crossings away from locations on streams that show signs of erosive conditions, such as meandering outer bends of streams, can prevent future issues. If a flow constriction is present at a bridge or transition from natural channel to concrete channel, the crossing should be placed upstream of that point. It is also ideal to minimize the number of unique tributary crossings and to combine crossings of multiple utilities into one location or one conduit where

possible. Designing crossings perpendicular to flow in the stream to minimize the total length of crossing is a good practice.

2.0.2 Designing Cover Depth

A design cover depth will need to be determined if a pipeline is designed to cross under a stream. Factors to consider in this process include protection against channel bed erosion and pipe flotation. Frost penetration should also be considered, depending on the underlying climate of the project location.

The following **Table 1** summarizes recommendations for minimum pipe cover depths in different scenarios. This information was taken from the Washington Suburban Sanitary Commission's (WSSC's) 2017 Pipeline Design Manual.

Table 1: Minimum Cover Requirements

Type of Channel Crossing	Minimum Cover	
	Water Supply Line	Sanitary Sewer Lines
Concrete Channel/Dry Ditch	4-feet	3-feet
Perennial Stream	5-feet	Greater of 3-feet or 1.5x pipe outside diameter

Equations to evaluate the possibility of flotation should also be checked and may require greater cover depths than the minimum values described in **Table 1**. These minimum required cover depths are generally sufficient to prevent against channel bed erosion for pipelines 12-inches in diameter and smaller; however, for pipes larger than 12-inches in diameter, the Tractive Force Method or the Permissible Velocity Method should also be used to determine a stable channel depth under which a pipe could be built. Examples of these calculations are in the WSSC's 2017 Pipeline Design Manual.

If the cover depth required for the project is shallower than the minimum acceptable values recommended, armoring the channel bed above and downstream of the pipeline crossing is recommended.

2.0.3 Stream Crossing Permits

All pipelines that cross streams and other waterbodies must comply with both federal and state regulations to assess and mitigate environmental impacts. The Federal Energy Regulatory Commission (FERC) authorizes the construction of pipelines that cross state lines by issuing a Certificate of Public Convenience and Necessity. Additionally, pipelines often require a permit from the U.S. Army Corps of Engineers (USACE) to cross streams and wetlands.

3.0 Best Practices for Erosion Control Post - Construction

Taking immediate action after construction and making mindful decision about selecting an erosion control measure can both contribute to the long-term stability of a pipe utility crossing.

3.0.1 Post Construction Recommendations

Existing conditions contours should be restored as quickly as possible after utility crossings are constructed. The USACE recommends restoration be finalized within 14 days of construction completion for an average project. The following is a checklist of activities that should be completed within that time frame:

1. Consider leaving temporary interceptor dikes in place or constructing new ones to minimize erosion due to runoff.
2. Fertilize and lime slopes
3. Mix several seed types acceptable for season and geographic location.
4. Use mulching or other non-vegetative stabilization if vegetation stabilization is not sufficient.
5. Use fabric fences, hay bales, or other sediment barriers to prevent sediment from entering sensitive areas.
6. Stabilize stream banks with permanent measures as needed.
7. Remove temporary structures that are not designed for long term use and are not biodegradable, like silt fences.

3.0.2 Selecting an Erosion Control Measure

Erosion control measures like bank stabilization can be necessary when pipe utilities that were previously buried have been exposed or to prevent imminent exposure due to erosion. Permanent restoration includes measures like riprap, concrete structures, and permanent vegetation to stabilize the site long-term. The iSWM Hydraulics Technical Manual contains detailed information on erosion control design that is applicable for any rip rap, gabion, or other erosion control measure design at a utility crossing.

Other manuals such as the WSSC's 2017 Pipeline Design Manual offer suggested thresholds for maximum velocity - 10-feet per second - before rip rap stabilization is necessary. However, these recommendations are likely based more on regional hydrologic conditions such as soil types than hydraulic calculations that are unique to pipe utility crossing locations. An alternative solution that could have universal applicability is simply redirecting flow paths away from banks to reduce velocities, as is discussed in the case study below.

Some erosion control measures like interception ditches, geotextile blankets, and energy dissipators can be used for both temporary and permanent erosion control. Wattles, brush barriers, and silt fences should only be used as temporary measures. Many other permanent erosion control measures can be used at pipe utility crossings depending on site conditions, including but not limited to gabion mattresses, seeding, sodding, ditch plugs, rock flumes, check dams, rock barriers, and terracing.

References

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