

Headwalls and Endwalls:

A wall built at a pipe opening to support the road and protect it from the erosive forces of flowing water. A wall at a pipe inlet is called a headwall. A wall at a pipe outlet is an endwall.

Purposes

Headwalls and endwalls support the road and protect the ends of the pipe. Properly constructed headwalls and endwalls improve pipe capacity and efficiency while reducing erosion around pipe installations.

Benefits of Headwalls and Endwalls

- Provide a low-cost, long-lasting solution to erosion problems at pipe openings.
- Prevent flowing water from damaging the road structure.
- Provide structural support for the road and prevent crushing of the pipe.
- Increase the flow capacity of pipes by reducing turbulence and directing flow.
- Visually identify pipe openings and protect them from traffic and maintenance equipment.

Necessity for Protection at Pipe Openings

It is necessary to protect pipe openings for several reasons:

- Water is turbulent when it changes shape or direction, increasing its erosive potential.
- Water accelerates as it passes through a pipe creating the need for armor to prevent erosion.
- High flows erode unprotected areas directly causing soil erosion, sediment pollution, and maintenance costs.
- Physical support for the road may be necessary at pipe openings, depending on road width and pipe length.

Materials

Headwalls and endwalls can be built with many different materials. Several factors influence the choice of materials including local availability, skill and time required for construction, durability, cost, and volume and velocity of water to be handled. Materials commonly used in Pennsylvania include*:

- Native stone or boulders collected on-site
- Pre-cast concrete and cast-in-place concrete
- Molded plastic (Hartman Endwall System)
- Modular masonry products

* Construction techniques using the materials listed will be covered in future technical bulletins.



Walls can be made with a variety of materials including native stone (a), boulders (b), or molded plastic (c).

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Shape

The shape of headwalls and endwalls is important to direct water flow, to protect the road and banks from turbulent water, and improve drainage efficiency.

Headwalls and endwalls built in a rough trapezoidal/parabolic shape act to collect and funnel fast-moving water while protecting the ends of the pipe from erosion (Figure 1). At the pipe inlet, the headwall reduces turbulence, directs flow, and maximizes the flow capacity of the pipe during high flows. At the outlet, the endwall prevents erosive back eddy currents from undermining the pipe placement and the road structure.

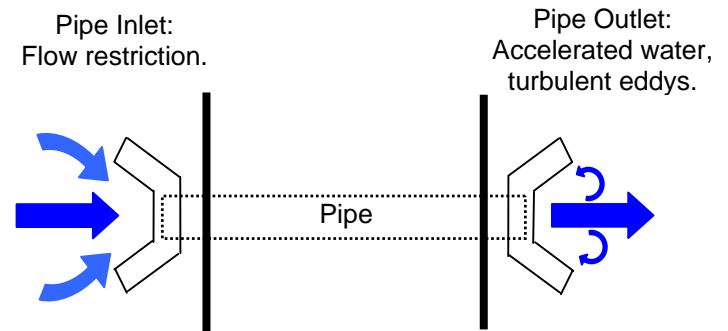


Figure 1: Plan or Bird's Eye View
Figure not drawn to scale.

Water that must change direction to enter a pipe can be very erosive. Erosion and sediment deposition cause maintenance and pollution. An angle-shaped headwall directs flow and reduces turbulence, improving pipe capacity (Figure 2).

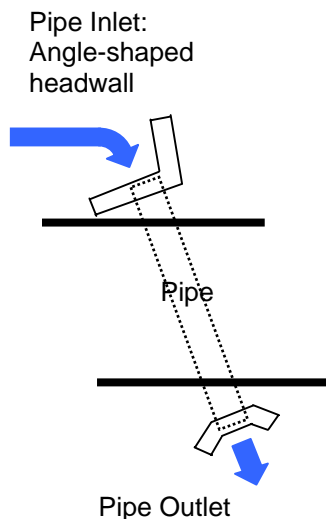


Figure 2: Plan or Bird's Eye View
Figure not drawn to scale.



Important Considerations

- Headwalls and endwalls should be built high enough to support the full depth of pipe cover recommended by the manufacturer: 12" of cover for plastic and corrugated steel pipe 24" in diameter and smaller (Figure 3).
- It is critically important to anticipate the forces of drainage water under heavy storm high flow conditions. Drainage structures should be built to conduct massive flows and provision for safe over flow should be provided. Headwalls and end walls built to the proper height not only improve pipe capacity during extremely high flows but also help prevent pipe blockage, road washouts and the resulting catastrophic effects.

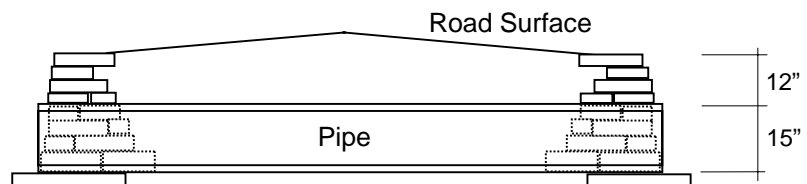


Figure 3: Longitudinal Section of Pipe Installation.
The head- and endwalls are built 12" above the pipe to ensure proper cover, support the road, and improve pipe capacity.

Figure not drawn to scale.