

Technical Bulletin

Headwalls & Endwalls

HEADWALLS AND ENDWALLS – A wall built at a pipe opening to support the road, protect the pipe, and guard against erosion. 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 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 shoulder.
- Increase the efficiency of pipes by directing flow and reducing turbulence.
- Headwalls can reduce flow by-pass of the pipe, or “piping.”
- Visually identify pipe openings and protect them from damage by 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 direction or velocity, increasing its erosive potential.
- Water accelerates as it passes through a pipe, creating the need to stabilize surrounding soil to prevent erosion.
- Erosion of unprotected areas increases sediment pollution and maintenance costs.
- Physical support for the road and banks may be necessary at pipe openings.
- Headwalls and endwalls help guard against crushed pipes.

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, and cost. Materials used in Pennsylvania include *:

- Dimensional stone, either collected or purchased
- Non-dimensional boulders
- Pre-cast concrete and cast-in-place concrete
- Modular masonry products (various sized blocks)
- Modular plastic products (fillable)

*Construction techniques using dimensional stone is detailed in the *Natural Stone Headwalls technical bulletin*.

Headwalls and Endwalls can be made with a variety of materials including native stone (a), boulders (b), poured concrete (c), or pre-cast concrete (d).



SHAPE

The shape of a headwall or endwall is important to direct water flow, to support and protect the road and banks from erosive flow, and improve drainage efficiency.

Headwalls can be built with wing walls and bank walls to direct flow into a pipe and to protect the road and banks (see pictures). At the pipe inlet, the headwall reduces erosion, directs flow, and increases the flow efficiency of the pipe. At the outlet, the endwall supports the road and prevents erosion that could undermine the pipe placement and the road structure.

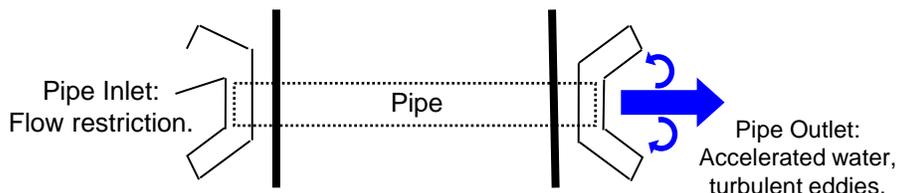
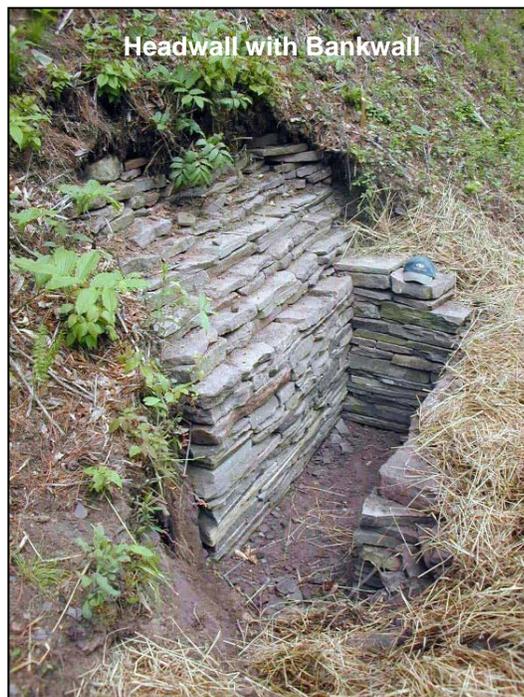


Figure 1: Plan or Bird's Eye View
Figure not drawn to scale.



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).

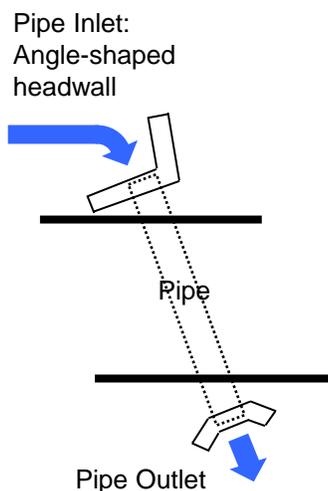


Figure 2: Plan or Bird's Eye View
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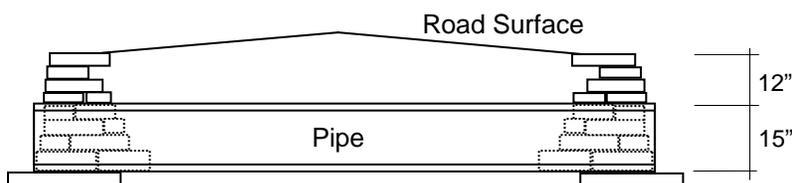


Figure 3: Longitudinal Section of Pipe Installation.
The headwall and endwall are built 12" above the pipe to ensure proper cover, to support the road, and to improve pipe capacity.
Figure not drawn to scale.

IMPORTANT CONSIDERATIONS:

- Headwalls and endwalls should be built high enough to support the full depth of pipe cover recommended by the manufacture, typically 12" for both plastic and corrugated steel pipe 48" in diameter and smaller (Figure 3).
- It is critically important to anticipate the forces of drainage water under high flow conditions. Drainage structures should be built to protect the road and banks during large storm events. Headwalls and endwalls built to the proper height improve pipe capacity during extremely high flows and help prevent pipe blockage, road washouts, and compounding damage caused by pipe failure.