11. **Vertical Alignment (Profiles).**

**a. Cover Over Pipeline.**

1) **Minimum cover over the top of the pipe:** four (4) feet from the lowest profile grade or ground line.

2) **Pipelines crossing under a stream, ditch, etc.**

   a) Provide minimum four (4) feet cover over the top of the pipe. If the design requires less than four (4) feet of cover, submit the design along with calculations for special pipe and trench protection, see Part One, Section 4 (Selection of Pipe Material).

   b) Show invert/bottom elevation of the crossing stream, ditch, etc on the profile.

   c) For additional requirements for stream crossings, see Part Three, Section 9 (Pipeline Stream Crossings).

3) **Pipeline clearances with other pipelines and utilities;** see Part Three, Section 3 (Pipeline Crossings and Clearances).

**b. Labeling Pipeline in Profile.**

1) Label all pipe sizes, fittings and appurtenances, and provide stations and invert elevations as required in this section.

2) Indicate the class of DIP or PVC as required under Part One, Section 2 (Pipeline Materials and Fittings) and Section 4 (Selection of Pipe Material). Provide stations on the profile to show the limits and class of DIP or PVC for all areas, including those which require a pipe class higher than the minimum class.

3) Show the direction of thrust for all thrust collar blocks and show the concrete thrust block location, see Standard Details B/3.1 and B/3.3, and Part Three, Section 27 (Thrust Restraint Design for Buried Piping). If the design has restrained joints, provide stationing showing the limits of the restrained joints.

**c. Change in Vertical Alignment.**

1) Except for vertical bends, design the pipeline using vertical joint deflections. Provide stations and elevations, based on twenty (20) foot lay lengths. Do not exceed the maximum allowable joint deflections as shown in the tables under Part One, Section 12 (Allowable Joint Deflections).

2) When joint deflections used in the horizontal plane are at the maximum allowable, no vertical deflection may be used. When joint deflections are used in both the horizontal and vertical plane, do not exceed the maximum allowable joint deflection; see requirements in Part One, Section 12 (Allowable Joint Deflections) and Section 15 (Deflection of Pipe Joints).

**d. Stations and Elevations.**

1) **Pipelines smaller than 24-inch diameter,** the pipeline can be shown in profiles with curves. Show the stations and elevations at fifty (50) foot intervals.
2) **Pipelines 24-inch diameter and larger**, do not show the pipeline on profile with curved lines, only show a series of straight lines with deflections. Base the deflections on twenty (20) foot intervals of pipe with stations and elevations given at each deflection. When the pipeline has no deflections, give stations and elevations at fifty (50) foot intervals.

3) Provide stations and elevations at every pipeline/utility crossing and at every high/low point.

4) At fitting locations provide the type of fitting, station and elevation.

**e. Design of Structures on Profile.**

1) Verify that the vertical depth (invert) of the pipeline is set at the proper depth of the structure.

**f. Profile Grade Lines.**

1) Pipelines within or adjacent to a roadway.

   a) **Existing roadway** show the following:

      (1) **Centerline of Existing Paving** from field surveys.

      (2) **Existing Ground over Centerline of Pipeline**, from field surveys. If the ground elevation differs by one (1) foot or more, show both the centerline of existing paving and the existing ground over centerline of pipeline.

      (3) **Existing Established Centerline Roadway Grade** from approved street grade drawing.

      (4) If the roadway does not have an established roadway grade, provide the following:

         (a) Contact the agencies having jurisdiction over the existing roadway and submit for approval all necessary designs and drawings. Show the established roadway grade on profile, labeling it, **Established Centerline Roadway Grade**.

         (b) At the option of WSSC, show only the design of the roadway improvements on profile and labeling it, **Possible Future Centerline of Roadway** or **Possible Future Grade**.

   b) **New or proposed roadways** show the following:

      (1) **Centerline of Finished Roadway Grade**.

      (2) **Finished Grade over Centerline of Pipeline**, if the grade elevation differs by one (1) foot or more show both the centerline of finished roadway grade and the finished grade over centerline of pipeline.

      (3) **Finished Grade**, is the proposed elevation over the pipeline during or after pipeline construction.

2) Pipelines not within or adjacent to a roadway (across property), show **Existing Ground over Centerline of Pipeline** and **Finished Grade over Centerline of Pipeline**.
3) Pipelines running parallel to an existing or proposed ditch, streams, etc. and within ten (10) feet of the bank or slope, show the invert (bottom) elevation of the ditch, stream, etc. on the profile.

4) Indicate the grade/ground lines on the profile as follows:
   a) Centerline of existing roadway - solid line.
   b) Established or possible future centerline of roadway - dashed line.
   c) Existing ground or grade over centerline of pipeline - solid "freehand" line.
   d) Proposed grade over centerline of pipeline - dashed "freehand" line.

\textbf{g. Length of Profile.}

1) Show the grade or ground lines for the entire length of the pipeline.

2) When connecting to existing mains or ending the pipeline, show an additional two hundred (200) feet of the following:
   a) Existing and proposed grade or ground lines and the existing pipeline extending from the new pipeline or past the limits of the new pipeline when ending with a cap/plug.
   b) Sufficient future extensions of the pipeline design must be shown to assure proper depth of the alignment. The amount of additional length will be determined on a case by case basis.

3) When beginning or ending the pipeline with a tee, show approximately one hundred (100) feet of the grade/ground line past the limits of the branch connection.

\textbf{h. Pipeline Stationing.}

1) Measure the pipeline stations along centerline of the pipeline in the horizontal plane.

2) Pipelines within or adjacent to a roadway.
   a) \textbf{Pipelines 12-inch and smaller}, horizontal stations on the baseline of the profile represent the centerline of the roadway with the location of the pipeline stationing projected on to the centerline of the roadway. This means that the horizontal distances on the pipeline alignment cannot be scaled accurately on the profiles where they are not entirely parallel and straight with the centerline of the roadway. However, show the pipeline stations as they are actually measured horizontally along the pipeline on the profile.
   b) \textbf{Pipelines 16-inch and larger}, horizontal stations on the profile represent the centerline stationing along the pipeline with the centerline of the roadway projected on the pipeline centerline. In cases where other utilities will be shown on the profile, the location shall be projected on the water pipeline centerline.

3) Pipelines not within or adjacent to roadway (across property); the horizontal stations on the profile represent the centerline stationing along the pipeline.