Appendix B

Clean Water Nashville Overflow Abatement Program

# GUIDANCE FOR DESIGN

# CONVEYANCE PIPELINES

Version 6.0

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cleanwater NASHVILLE
OVERFLOW ABATEMENT PROGRAM

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# Section 1
# General Information

These guidelines have been developed to help the Designer prepare plans and specifications for conveyance systems for the Clean Water Nashville Overflow Abatement Program (Program). The guidelines are applicable to the majority of situations defined herein and may be modified for an individual project. More project-specific guidance may be identified by the Program in the Project Summary. Construction approach aspects for Program conveyance projects are also presented to help the Designer develop project documents.

These guidelines are intended to suggest specific parameters for design. The Program Management Team will evaluate the plans and specifications based on this guidance and establish, as far as practicable, uniform practices for the conveyance systems designed as stand-alone projects or as a portion of other projects to be constructed under the Program.

Users should also be cognizant of and follow Metro Water Services' (MWS) adopted water and sewer standards, the Tennessee Department of Environment and Conservation (TDEC) Design Criteria for Sewage Works, the International Building Code, and applicable federal requirements. Recommendations from the Designer regarding any proposed deviations or issues are to be presented in the *Preliminary Engineering Report*.

Designers are specifically directed to the TDEC Design Criteria which have been updated to emphasize the prevention of trench water migration and stream capture by establishing additional requirements for early discussions with TDEC when constructing sewers in proximity to streams.

# Section 2

# Gravity and Pressure Pipe and Fittings

## 2.1 Corrosion Resistant Construction Materials

### 2.1.1 General

Corrosion resistant construction materials for pipe and fittings are to be used in the Program's projects because of anticipated system conditions with greater sulfide potential. The Designer is to evaluate project conditions to determine if corrosion impervious material(s) are further warranted for the application. Gravity conveyance systems will use corrosion impervious materials for a minimum 2,000-linear feet LF downstream distance following a force main discharge into the system.

For pipe construction materials not naturally corrosion resistant the following shall apply:

### 2.1.2 Standard Ductile Iron Pipe Interior Protection

The standard interior protection for ductile iron pipe for wastewater installations is to be a ceramic-epoxy coating (quality standard is Protecto 401). Ductile iron pipe for potable water installations is to have a standard cement mortar lining in accordance with MWS standard specifications. Ductile iron pipe fittings are to have the same lining as the associated pipe.

### 2.1.3 Standard Ductile Iron Pipe Exterior Protection

Standard ductile iron pipe exterior protection is to be an asphaltic coating approximately 1-mil thick per AWWA C151 for ductile iron pipe and AWWA C110 and C153 for fittings.

### 2.1.4 Corrosion Resistant Ductile Iron Pipe Exterior Protection

Polywrap is to be used as the standard for exterior protection for ductile iron pipe installed in corrosive environments such as aggressive soils, crossings, in proximity to cathodically-protected pipes or facilities, or other corrosive conditions encountered in the project. The Designer is to consider each application on a case-by-case basis and institute appropriate protection.

### 2.1.5 Corrosion Resistant Reinforced Concrete Pipe Protection

Reinforced concrete pipe is to have Xypex C1000 or pre-approved equal admixture as a design standard to be corrosion resistant.

## 2.2 Gravity Sewer Pipe Material and Size Usage Preferences

### 2.2.1 General

The Designer is to select pipe material and wall thickness based on these guidelines:

- The project-specific criteria, including cover depth
- Vehicular traffic loading
- Native soil characteristics
- Bedding conditions

- Other pertinent factors
- In accordance with the pipe manufacturer's recommendations

### 2.2.2 Corrosion Resistant Construction Materials

The Designer is to use corrosion resistant construction materials for gravity sewer design (see Section 2.1 Corrosion Resistant Construction Materials).

### 2.2.3 6-through 15-inch Diameter Pipe

The design minimum for 6-through 15-inch diameter pipe material is to be solid wall ASTM D3034, SDR 35 polyvinyl chloride (PVC), or pressure class 250 ductile iron pipe.

### 2.2.4 18-through 30-inch Diameter Pipe

The design minimum for 18-through 30-inch diameter pipe material is to be solid wall ASTM F679, SDR 35 PVC or pressure class 150 ductile iron pipe.

### 2.2.5 Greater than 30-inch Diameter Pipe

The design minimum for pipe material greater than 30-inch diameter is to be ductile iron pipe; C-76 reinforced concrete; ASTM D3262 centrifugally cast fiberglass reinforced polymer mortar; ASTM D3262 filament-wound fiberglass reinforced polymer mortar pipe materials; or ASTM F2764 polypropylene triple wall pipe (limited MWS approval).

### 2.2.6 Reinforced Concrete Pipe Joints

The joint type for reinforced concrete pipe is to be concrete bell and spigot with rubber "Reka" type profile gaskets conforming to ASTM C443 or ASTM C361.

### 2.2.7 Specified Maximum Leakage

The specified maximum leakage rate for pipe materials is to be zero gallons per inch per diameter mile for the test section and installed pipe. Every joint is to be tested in the factory prior to shipment and tested in the field following installation. Full segment air pressure testing is to be conducted for all pipe diameters 18-inches and smaller. Individual joint testing is to be conducted for larger sizes and may require man-entry in larger diameters.

### 2.2.8 Service Connections to Less than 15-inch Diameter Pipe

New service and/or existing service reconnections on less than 15-inch diameter pipe are to be accomplished with manufactured standard tees. A standard cleanout assembly is to be provided for all new or reconnected services at the edge of the permanent easement or right-of-way.

### 2.2.9 Service Connections to Greater than or Equal to 15-inch Diameter Pipe

New service connections and/or existing service reconnections on greater than or equal to 15-inch diameter pipe are to be accomplished with Romac or equivalent saddles. Insert-a-tees of the "Fatboy" type may be used for solid wall pipes having a wall thickness of 0.36 inches or greater. A standard cleanout assembly is to be provided for all new or reconnected services at the edge of the permanent easement or right-of-way.

# 2.3 Pressure Pipe Material and Fittings

## 2.3.1 General

The Designer shall select pipe material and wall thickness based on these guidelines:

- Project-specific criteria, including cover depth
- Vehicular traffic loading
- Native soil characteristics
- Bedding conditions
- Other pertinent factors
- In accordance with the pipe manufacturer's recommendations

## 2.3.2 Corrosion Resistant Construction Materials

The Designer is to use corrosion resistant construction materials for pressure sewer design. The Designer is to evaluate project conditions to determine if corrosion impervious material(s) are further warranted for the application. Corrosion impervious materials should be used at the terminus of the force main and any location with the potential for trapped air, such as locations of air release valves. (see Section 2.1 Corrosion Resistant Construction Materials).

## 2.3.3 Force Main

### 2.3.3.1 Pipe

The design minimum for force main pipe is to be minimum pressure class 150 ductile iron pipe or minimum pressure class 150 C900 PVC. The Designer shall pay special attention to cyclic design guidance for plastic pipe if PVC pipe is proposed. High-density polyethylene pipe may be considered in special cases to facilitate directional drilling installations. In these cases, the specified high-density polyethylene pipe must be able to accept standard ductile iron restrained-joint fittings. No heat fusing is to be required to facilitate future repairs.

### 2.3.3.2 Fittings

The design minimum for force main fittings for 4-through 24-inch diameter sizes is to be pressure class 350. The design minimum for force main fittings for 30-inch diameter and larger sizes are to be pressure class 250 mechanical restrained joints. Compact fittings may be used.

## 2.3.4 Potable Water

### 2.3.4.1 Pipe

The design minimum for potable water pipe is to be pressure class 250 ductile iron pipe with restrained joints. Lock type gaskets may be used.

### 2.3.4.2 Fittings

The design minimum for potable water fittings for 4-through 24-inch diameter sizes is to be pressure class 350. The design minimum for 30-inch diameter and larger sizes are to be pressure class 250 mechanical restrained joints. Compact fittings may be used for pipe sizes smaller than 18-inch diameter.

# Section 3

# Tunnel/Casing Pipe Sizing, Material, Joints, Pipe Supports, and Coatings

Tunnel/casing pipe material, joints, and coatings are to conform to railroad, Tennessee Department of Transportation or other jurisdictional standards as applicable for crossings. The Designer is to select carrier pipe and pipe supports that will facilitate full carrier pipe extraction from the host pipe in steel casing pipes with less than 33-inch diameters. All larger casing pipes and pipes in tunnels are to be installed with a concrete invert, guide rails for pipe installation, floatation restraints/blocking, and annular space pneumatically filled to full depth with pea gravel or cementitious grout. Consideration is to be given for sizing the casing or tunnel for future upsizing.

The Designer is to locate soil borings on the plan and obtain from the geotechnical engineer a preliminary *Geotechnical Report* based on a minimum of four soil/rock borings to refusal per non-open-cut crossing or as identified in the Designer's scope of work. Based on known site and soil characteristics, the Designer determines if additional borings are required and submit a recommendation for the method of non-open-cut crossing. The *Geotechnical Report* will be included as an appendix to the bidders for information.

# Section 4

# Manholes and Appurtenances

## 4.1 General

The Designer is to select manhole material and appurtenances based on these guidelines and the project-specific criteria. The Designer is to specify manholes that accommodate site-specific load bearing requirements and comply with manufacturers' recommendations.

## 4.2 Corrosion Resistant Construction Materials

The Designer is to consider corrosion resistant construction materials for manhole and appurtenance design. All concrete manholes, precast or cast-in-place, are to have Xypex or pre-approved equal admixture. Fiberglass manholes may be considered for corrosive conditions requiring impervious materials.

## 4.3 Maximum Pipe Size and Angles for Manholes

The Designer is to use MWS standard specifications and details for maximum pipe size and angles for manholes (see excerpt below) for pipe diameters less than or equal to 42 inches.

**Table 4-1 Maximum Pipe Size Outside Diameters (Excerpt from MWS Specifications)**

| | Maximum Pipe Size Outside Diameter | |
|---|---|---|
| Manhole Diameter | From Straight through to 45 Degree Deflection | If 90 Degree Deflection |
| 4-foot (48-inch) | 31.5-inch | 25-inch |
| 5-foot (60-inch) | 42-inch | 32-inch |
| 6-foot (72-inch) | 51-inch | 38-inch |
| 7-foot (84-inch) | 59-inch | 44-inch |
| 8-foot (96-inch) | 73.5-inch | 50-inch |

The Designer is to select manhole diameters on a case by case basis for pipe diameters greater than 42 inches. The Designer is to avoid 90 degree connections for pipe diameters greater than 42 inches and consider using two closely spaced manholes to improve hydraulics.

## 4.4 Casting Minimum Opening Size by Pipe Diameter

For pipe diameters less than 36 inches, the Designer is to use standard 24-inch minimum casting openings. For pipe diameters greater than or equal to 36 inches, the Designer is to use 30-inch minimum casting openings. Opening size is to be determined on a case-by-case basis to facilitate inspection, maintenance, and cleaning.

## 4.5 Frame Adjustment Components

Frame adjustment components are to be 1-piece concrete or composite rings.

## 4.6 Distance Between Manholes

The standard maximum distance between manholes in linear pipe runs is to be 400 LF. The maximum distance for pipes greater than 20-inches in diameter is to be 600 LF. Large diameter conveyance pipes constructed in tunnels may exceed this distance; however, longer distances should provide adequate access for maintenance and should be discussed with MWS during design.

## 4.7 Protection in Open Areas

Manholes in open, non-paved areas such as pastures, farms, woods, etc., and not in a regularly mowed yard are to have a raised flattop to enhance their visibility and minimize the potential for damage. The top-of-casting elevation is to be 24 inches above the finished grade.

## 4.8 Alternative Structures for Large Diameter Pipes in Lieu of Manholes

The Designer may consider using tees in lieu of manholes (where applicable) for pipes with greater than or equal to 48-inch diameters.

## 4.9 Bends for Large Diameter Pipes in Lieu of Manholes

The Designer may consider using bends in conjunction with manholes or tees to facilitate maintenance access and alignment changes for pipes with greater than or equal to 48-inch diameters.

## 4.10 Minimum Drop

The design standard for the minimum drop through a manhole is to be 0.2 feet. For manholes with varying diameter pipe connections, the Designer is to match the pipe crowns or maintain the 0.2 feet drop, whichever is greater. The minimum drop may be altered for larger diameter sewers (greater than or equal to 48-inch diameter) on a case-by-case basis. The Designer is to perform calculations to determine losses through manholes for larger diameter sewers.

## 4.11 Steps

Co-polymer polypropylene steel-reinforced manhole steps are to be provided for all new manholes or diversion structures on 12-inch center-to-center spacing.

## 4.12 Requirements for using Watertight Frames and Covers

The Designer is to use watertight frames and covers in the following areas with consideration given to the following elevations:

- Below the local FEMA 100-year flood elevation
- Areas within the 75-foot creek buffer

## 4.13 Vent Pipe Assemblies

For gravity sewer sections with watertight frames and covers on manholes, vent pipe assemblies are to be spaced at a maximum of 1,000 LF or at every major bend greater than or equal to 50 degrees, whichever is less. Vent pipe assemblies are to incorporate corrosion resistant construction materials.

Vent pipe assemblies are to be located as unobtrusively as possible to minimize the visual impact to the surroundings. Top of vent pipe elevations are to be above the 100 year flood elevation.

## 4.14 Manhole Channels and Benches

Manhole channels and benches shall be designed to match the full height to the crown of the pipes to minimize turbulence in high flows and to inhibit hydraulic losses in the manhole.

# Section 5
# Installation

## 5.1 Typical

### 5.1.1 Minimum Slope

The minimum slope for gravity sewers must comply with TDEC's Design Criteria for Sewage Works and MWS' Guidance based upon 10-States Standards as design standards. The "Tractive Force Method" of ASCE and WEF may be used as set forth in TDEC 2013 revised criteria for design. The Designer is to consider project-specific conditions in determining the actual slope to be used. Decreased slopes will be considered where the depth of flow will be 0.3 or greater of the diameter for the design average flow.

The following table of MWS may be utilized in determining the minimum slope.

**Table 5-1 Slope Determination Criteria**

| Slope Determination Criteria | |
|---|---|
| Sewer Diameter (inches) | Minimum Slope in Feet (Per 100 Feet) |
| 8 | 0.40 |
| 10 | 0.28 |
| 12 | 0.22 |
| 14 | 0.17 |
| 15 | 0.15 |
| 16 | 0.14 |
| 18 | 0.12 |
| 21 | 0.10 |
| 24 | 0.08 |
| 27 | 0.067 |
| 30 | 0.058 |
| 36 | 0.046 |
| 42 | 0.037 |

### 5.1.2 Check Dams

Check dams are to be installed in the bedding and backfill for all new or replaced sewer lines to limit the drainage area subject to the French-drain effect of gravel bedding in accordance with TDEC's Design Criteria for Sewage Works. Dams are to consist of concrete bedding, pipe envelope, and backfill at least 3-feet thick to the top of the trench and keyed 2-feet into the trench walls. If in rock, the rock is to be sound. Dams are to be placed no more than 500 LF apart. The required location is upstream of each manhole.

## 5.1.3 Creek Crossings

### 5.1.3.1 Concrete Encasement

Creek crossings are to incorporate concrete encasement for pipe protection. The crossing should include cobbling in the upper six inches to restore habitat if vertical clearance is available. The encasement is to extend a minimum of 6 LF past the vertical plane projected down from each top-of-bank and is to terminate with a concrete check dam.

### 5.1.3.2 Minimum Cover

The following is the minimum cover at crossings:

- 8-to 15-inch diameter pipe..... 2'-0"
- Greater than 15-to 27-inch diameter pipe..... 2'-6"
- Greater than or equal to 30-inch diameter pipe..... 3'-0"

The stipulated cover is to be considered a design minimum. In all cases, the Designer is to design the crossing to offset buoyant forces considering an empty pipe and to accommodate project-specific variables.

## 5.1.4 Bedding and Backfill

Bedding and backfill are to be accomplished in accordance with MWS standard specifications and details. Backfill is to be performed in consolidated lifts with mechanical compaction in accordance with MWS and jurisdictional roadway authority requirements. All pipe bedding and backfill envelopes are to be a crushed stone material. All in-roadway pipe trench backfill is to be crushed stone and/or flowable fill concrete in accordance with the situation and with details.

## 5.1.5 Flowable Fill Trench Cap for Crossings and/or Longitudinal Installations under Public Roadway Pavement

Trench cap with flowable concrete fill in accordance with the standard detail is to be placed 18 inches below finished grade unless a project-specific variance is obtained from MWS and Metro Public Works.

## 5.1.6 Unclassified Excavation

All excavation is to be unclassified. A certification from an appropriate spoil material disposal site is required as a submittal from the contractor. The grading permit for the spoil disposal site, if in Davidson County, is required to be submitted by the contractor to the Construction Manager.

## 5.1.7 General Location

Preference is to be given to locating conveyance systems in rights-of-way and existing sewer easements over private easements. Preference is also to be given to locating conveyance systems in non-paved areas over paved areas. The Designer is to consider surface features and existing utilities conflicts/preservation when locating conveyance systems.

## 5.1.8 Location in Streets and Roads

If a conveyance system is to be located within a roadway, the Designer is to locate the pipe in the center of a driving lane if possible. The Designer is to take care to avoid encroachment on bike and pedestrian lanes if possible.

### 5.1.9 Depth of Cover in Streets and Roads

If a conveyance system is to be located within a roadway, the minimum depth of cover will be four feet. In situations where the depth of cover achievable is less than four feet or exceeds 15 feet, use ductile iron pipe for pipe diameters less than or equal to 30 inches. For depths of cover less than four feet or greater than 15 feet for pipe diameters greater than 30 inches, the Designer shall carefully select pipe material and strength based on site specific criteria.

### 5.1.10 Diversion Pumping Plan

The Designer is to ensure that a detailed *Diversion Pumping Plan* is prepared and submitted by the contractor. The plan is to be strictly enforced in construction.

### 5.1.11 Force Main Valves and Drains

The Designer is to provide isolation plug valves to allow facilitative maintenance of the force main(s). Their location is to be on approximately 2,000 LF spacing and/or as the profile determines. If possible, the Designer is to provide valved drains in manholes from the force main to adjacent gravity sewers to facilitate drainage of the force main in segments.

## 5.2 Atypical Installations

### 5.2.1 Horizontal Parallel Installation

The Designer may consider a horizontal parallel sewer installation when project-specific conditions make this option viable. In these instances, the existing gravity sewer may be renewed to restore capacity and service life if pipe conditions warrant it. The Designer may also consider using diversion manholes and/or structures to facilitate ongoing parallel sewer maintenance as long as the manholes/structures use simple, user-friendly, minimal maintenance options such as slide gates to achieve flow diversion. Approval of this option is to be on a case-by-case basis.

### 5.2.2 Vertical (Stacked) Parallel Installation

The Designer may consider vertical (stacked) parallel sewer installation for short pipe runs when project-specific conditions constrain installation options so that this alternative would be the only viable option. In these instances, the existing gravity sewer is to be renewed by trenchless methods to restore capacity and service life. This option is to be approved on a case-by-case basis.

## 5.3 Stormwater Control

The Designer is to ensure that detailed Erosion Control and Stormwater Mitigation Plans are prepared as part of the design documents and submitted in accordance with TDEC and MWS standards. Review and approval of the project by MWS Stormwater and TDEC if applicable is required prior to plan finalization and the construction period issuance of a grading permit.

## 5.4 Stormwater Piping Reviews

When open-cut excavation is required in pavement areas, the area's stormwater/drainage systems should be evaluated. Geographic information system (GIS) data and limited field investigations should be used to identify storm drains/piping that cross or closely parallel the open cut area, and the Designer should present this information to the Project Manager. MWS Stormwater will handle these situations on a case-by-case basis; however, it is anticipated that deteriorated storm drains/piping replacement will be included as part of the sewer conveyance upgrade project where public roadway

paving is anticipated. MWS Stormwater will determine the need for stormwater pipe replacement and replacement flow/sizing. The Designer shall design replacement pipes and include them on the drawings.

## 5.5 Abandoned Sewers

The 12-inch and larger sewer diameters and any size pipe/structure in state rights-of-way are to be abandoned in place. The annular space is to be filled with an inert material (flowable fill or similar), and the open ends are to be grouted closed. Manhole castings are to be removed and returned to MWS. Manholes will be demolished and removed to a depth of 36 inches below finished grade, and the remaining structure will be filled with #57 crushed stone. Abandoned manholes will be backfilled to within 18 inches of finished grade with #57 stone, and the remaining 18 inches will be filled with compacted soil if out-of-roadway. The top six inches are to be topsoil in out-of-roadway areas. Exceptions to this process are to be made on a case-by-case basis. The Designer shall consider the potential for differing and elevated hydrostatic heads on plugs and structure connections for abandoning sewers and design such accordingly.

## 5.6 Traffic Control

The Designer is to ensure that detailed Traffic Control Plans are prepared for major roadways and arterial streets that may be closed or constrained to facilitate conveyance system construction. The Traffic Control Plan is to be prepared as part of the design documents and submitted in accordance with Nashville Department of Transportation and Multimodal Infrastructure(NDOT) and Tennessee Department of Transportation standards. NDOT is to be consulted about the project's traffic control requirements during the 60/90% design stage for conditions to be presented in the 100% documents and in order to be positioned for the construction issuance of a road closure permit.

## 5.7 Water Quality and Erosion Control

The Designer shall follow MWS' stormwater guidelines (latest version) when developing the project design and shall utilize best management practices (BMPs) for all water quality and water control aspects. On the site design drawings, the Designer shall indicate appropriate water quality and erosion control details. Designers are directed to the TDEC 2013 revised design criteria for prevention of stream capture for additional requirements for water quality.

The Designer shall consider the minimization of stream buffer disturbances and delineate construction limits to control such; consider limits of construction to reasonably define cost-effective, necessary primary and support construction operations; designate logistically convenient and ample material "laydown" areas, access roadways, concrete washdown areas; and provide erosion control BMPs.

# Section 6

# Property Restoration

## 6.1 General

The Designer should seek to route conveyance systems to avoid surface enhancements if reasonably possible. In the event that surface enhancements are impacted by the system, the enhancements are to be restored to a condition like or better than the condition that existed prior to commencing construction activities.

## 6.2 Seed and Straw

Seeding and strawing are to be used to establish vegetative cover as a short-term erosion control measure.

## 6.3 Hydroseed

Hydroseeding followed by strawing is to be used as the base restoration technique for long-term erosion control and enhanced property restoration on a timely basis.

## 6.4 Sod

As determined by the Designer, sodding is to be used where warranted on a case-by-case basis to achieve property restoration to a “like or better” condition.

# Section 7

# Risk Management

The Designer is to consider and/or institute the following items and other applicable rules and regulations to minimize risk in the design, construction, and ongoing conveyance system operations.

- The Designer is to consider parallel installation with pipe/manhole/structure asset renewal of the existing gravity sewer on lines greater than or equal to 48-inch diameters to minimize diversion pumping requirements.
- The Designer is to walk the system route with Program representatives (Project Manager and Construction Manager) as part of the 30% and 60% design reviews to evaluate a route's viability and identify potential areas of concern.
- The Designer shall be cognizant that the contractor is required to perform a preconstruction surface video inspection of the system route to document existing conditions. A separate pay item may be established for this task.
- The Designer shall be cognizant that the contractor is required to perform a pre-construction internal video inspection of adjacent existing parallel sewers within 50 feet of the proposed conveyance system to document existing conditions. The video is to be submitted in CUES GraniteNet format. A separate pay item may be established for this task.
- Blasting as a construction method is expected to facilitate excavation and is to be allowed only after the contractor completes a mandatory pre-blast survey.
- Mechanical trenching in rock as a construction method to facilitate excavation may be identified in vibration sensitive areas and/or as a contractor-elected method. Trenching may be allowed on a case-by-case basis only if a minimum spacing of 12 inches between pipe wall and vertical rock surfaces and six inches between pipe wall and horizontal rock surface can be achieved.
- The Designer shall be cognizant that the contractor is required to perform a post-construction internal video inspection of completed conveyance system prior to acceptance. The video is to be submitted in CUES GraniteNet format. A separate pay item is to be established for this task.
- The Designer shall be cognizant that the contractor is required to complete successful Pressure/Vacuum tests on the completed conveyance system prior to acceptance. A separate pay item is to be established for this task and could be merged with the above post-construction internal video inspection for acceptance.
- The Designer shall be cognizant that the contractor is required to complete successful mandrel testing on all flexible pipes following final back-fill and prior to acceptance. A separate pay item is to be established for this task and could be merged with the above tests and post-construction internal video inspection for acceptance.
- The Designer shall be cognizant that the contractor is not allowed to store any spoil in roadway areas. The contractor is to manage spoil in a manner to minimize impact to areas in close proximity to the construction.
- The Designer shall be cognizant that the contractor is not allowed to store any spoil in flood zone areas in excess of corresponding cut volumes. The contractor is to manage spoil in a

manner to minimize impact to areas in close proximity to the construction and not obstruct floodways.

- The Designer shall be cognizant that the contractor is required to develop a project-specific *Project Safety Plan*.

# Section 8

# Other Considerations

The Designer should consider sustainable principles in the design if there is a potential to reasonably incorporate recycled materials or reduce excess materials spoilage. For further sustainable information and design guidance see Appendix L.