



Town of Johnstown

Streets and Stormwater Design Standards Update

January 26, 2024

Dear Participant,

The Town of Johnstown's Public Works Department invites you to contribute to the review process of the proposed update to the Town's Design Standards. Your insights are crucial to ensuring the successful update and adoption of the following sections:

- Chapter 3: Land Disturbance
- Chapter 4: Streets
- Chapter 6: Storm Drain
- Chapter 9: Standard Details (Streets and Storm Drain)
- Appendix A (for reference only)

To access the documents, kindly visit the Town's website using the following link:

<https://johnstown.colorado.gov/sites/johnstown/files/documents/Street%20and%20Stormwater%20Design%20Standards%20Draft.pdf>.

We encourage you to provide your comments preferably in Bluebeam or Adobe Acrobat format on the PDFs of the designated chapters. Alternatively, comments in MSWord or MSEXcel format are acceptable, ensuring comprehensive references to the specific chapter and section.

If there are multiple contributors from your company or agency, we kindly request consolidating comments into a single summary to minimize duplication. Please forward your comments, or a link for downloading comments, to shelley.e.cobau@imegcorp.com. If you prefer to opt-out of the review process, kindly inform either Shelley Cobau with IMEG or myself.

The deadline for submitting comments is March 15th, 2024. Should you require additional time for review, please request an extension from Shelley Cobau or myself.

While reviewing, be mindful of cross-references to chapters not yet released. All comments will be considered, though final incorporation is at the discretion of the Public Works Department. Appendix A is for reference only, and feedback on this section is not currently sought. The Town's TIA Guidelines have already been adopted for use.

We appreciate your valuable participation and eagerly await your insights.

Thank you,

Jason Elkins, PE
Public Works Director

CHAPTER THREE

LAND DISTURBANCE STANDARDS

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CHAPTER THREE - LAND DISTURBANCE STANDARDS

Section 3.01 Grading and Earthwork

A. General

1. Any grading, stripping, excavating, filling, or otherwise disturbing of land within the Town's limits shall comply with Federal and State law, the Town's Land Development Code, the DESIGN STANDARDS herein, and shall meet the specifications and materials outlined in Volume II, Technical Specifications.

B. Permitting Before Grading and Earthwork Activities

1. The Town of Johnstown requires a Grading Permit before the commencement of grading activity as defined by the Town's Land Development Code. Additionally, if any work falls within or directly impacts a regulatory 1.0% probability (100-yr) floodplain or floodway, a Town of Johnstown Floodplain Development Permit is also required.
2. The State of Colorado requires permits for construction-related activities which are in addition to the permitting requirement of the Town of Johnstown. The Design Professional shall contact the State of Colorado Department of Public Health & Environment (CDPHE) Water Quality control Division (WQCD) for specific State permitting information for their project(s).
3. Applicant and Design Professionals are also responsible for complying with all applicable Federal permitting. This may include, but is not limited to the FEMA map revision process, the Department of the Army Corps of Engineers Section 404 Permit and US Fish and Wildlife Service, Endangered Species Action, Section 10, and Section 7 Permits. Information on some of the Federal programs and permits that may be applicable include the following (this is not to be considered an exhaustive list; therefore, Design Professionals are advised to confirm the Federal requirements that may apply).
 - i. FEMA Map Revisions: Projects that impact the regulatory floodplain may need to obtain a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) from FEMA. In this case, proper documentation needs to be submitted to FEMA for review and approval by the Design Professional, after review and concurrence by the Town's Floodplain Administrator.
 - ii. Section 404 Permitting: Excavation/grading activity in, or impacting "Waters of the United States" (including streams, open water lakes, ponds, wetlands, etc.) may require a Section 404 Permit. The level of permitting is dependent on the extent of disturbance along/within the water body of interest. It should be reviewed with the U.S. Army Corps of Engineers as to whether a Nationwide Permit or an Individual Permit is required. Individual Permits will require more detailed information about the project and preparation of exhibits specific to the project site.
 - iii. U.S. Fish and Wildlife Service Threatened and Endangered Species Clearance: The U.S. Fish and Wildlife Service has established guidelines for surveys to determine the presence or absence of threatened and endangered species within a project's limits. The most prominent of these species in the Town of Johnstown is the Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*). Clearance of this and other threatened and endangered species from a project site is dependent on spatial and regional requirements as determined by the U.S. Fish and Wildlife Service.

C. Grading and Drainage Plans

1. The Town of Johnstown requires the submittal of a detailed Grading and Drainage Plan as part of the Construction Improvement Drawings, as required by the Town's Land Development Code. A Construction Improvement Drawing Checklist is available on the Town's website.
2. Grading and Drainage Plans must be representative of the existing and proposed site conditions and as a minimum must include (as applicable to the specific development):
 - i. The clear depiction of the property and construction limits and designation of trees, shrubs plants, and other objects to remain.

- ii. Existing and proposed finished contours shall be shown at 2-foot intervals and shall be accurate to within 0.5 feet. USGS Quadrangle Maps will not be accepted as evidence for topographic contours. Existing contours must extend a minimum of 100' beyond the boundary of the subject property, and appropriate blending between proposed and existing finished contours (the point of daylight) must be clearly shown. All contours must be legibly labeled.
- iii. The boundary of the existing and proposed one percent probability (100-year) floodplain limits and base flood elevations must be shown. Identification of property proposed to be removed from the Special Flood Hazard Area must be included.
- iv. All proposed improvements must be shown, including proposed lot layout, stormwater improvements, and street improvements (curb, gutter, and sidewalk) with street names. Water, sewer, irrigation ditches, streetlights, and other utilities must be depicted to assure conflicts are not present.
- v. Grade breaks on proposed streets shall be indicated with a high point spot elevation and directional arrows indicating slope.
- vi. Elevations of curbs and street centerlines must be provided at 100-foot intervals, and all points of grade breaks and grade transitions must include spot elevations in addition to finished contours.
- vii. All existing and proposed easements must be shown graphically and dimensioned.
- viii. Retaining walls must be shown, with elevation at the top and toe of wall provided. (Retaining walls will require a separate permit-refer to the Town's Land Development Code and website for additional information).
- ix. Side slopes shall be represented as a ratio (e.g., 4H:1V), and street grades shall be represented as a percentage (e.g., 2.0%).
- x. Finished floor elevations must be provided.
- xi. All swales and drainage features must be shown and must be referenced with an alpha-numeric identifier that ties back to the swale capacity calculations provided in the required Drainage Report.

D. Construction Dewatering Permits

- 1. The State issues a permit for Discharges Associated with Construction Activities to manage dewatering discharges from construction projects. The permit establishes water quality standards and BMPs for dewatering discharges.
- 2. A State-issued Construction Dewatering Wastewater Discharge Permit is required if Dewatering is required to install utilities or water is discharged into a storm sewer, channel, irrigation ditch, or any "Waters of the United States".

E. Air Quality Plans/Permits

- 1. Fugitive dust should not leave construction projects. The Town of Johnstown lies in a non-ozone attainment area, and land development activity must comply with State standards.
- 2. The Air Pollution Control Division of the Colorado Department of Public Health and Environment (CDPHE) has passed air quality regulations consistent with Federal legislation. Regulation No. 3 requires submittal of an Air Pollutant Emission Notice (APEN) for sources of fugitive dust from construction sites, as well as other sources. Regulation No. 1 defines particulate emission control regulations for haul roads and streets. Additional controls, such as road watering, may be necessary to fully comply with these regulations at a construction site. The CDPHE should be contacted about APENs and other air quality permitting requirements.
- 3. As described in the Mile High Flood District's Urban Storm Drainage Criteria Manual - Volume 3, , as amended, the surface stabilization measures identified for control of precipitation-induced erosion generally inhibit soils from becoming windborne.
- 4. Construction water use must be coordinated with the Town's Utility Department. Contact information can be found on the Town's website.

F. Erosion Control Measures

1. No person shall clear or grade land for new development without implementing soil erosion and sediment controls in accordance with the requirements of these DESIGN STANDARDS, the Town of Johnstown's Municipal Code, and State Law.
2. Erosion control measures required for compliance with State and Federal law shall be designed, installed, and maintained in conformance with the DESIGN STANDARDS and the MHFD USDCM (Volume 3), as amended. Refer to Chapter 6, Section 6.16 for additional information and requirements. In addition, Colorado requires construction projects exceeding one (1) acre of disturbance to obtain a Construction Stormwater Discharge Permit, and also requires the preparation of Stormwater Management Plan(s) (SWMP).
3. Detailed erosion control measures shall be provided to protect the following:
 - i. Inlets, gutters, and culverts
 - ii. Drainageways
 - iii. Streams or other water bodies immediately adjacent to land disturbed by construction activity
 - iv. Cut and fill areas
 - v. Properties and improved streets adjacent to construction activity
 - vi. Areas achieving final stabilization through vegetative cover
 - vii. Other areas as required by the Town of Johnstown based on site conditions.
4. A Stormwater Management Plan must be submitted as outlined in Chapter 6, Section 6.10.

G. General Land Disturbance Standards

1. Land disturbance includes all earthwork and excavation involved with moving earth, soil, rock, or other materials with the use of tools, equipment, or explosives.
2. Embankment construction shall consist of construction building sites, street/road embankments and drainage structures.
3. All earthwork and excavations shall be adequately guarded with barricades and lights to protect the public from hazards. Streets, sidewalks, parkways, and other public or private property disturbed in the course of the work shall be restored in a manner satisfactory to the Town and as described in the Town's Municipal Code and these DESIGN STANDARDS.
4. All excavations must meet the criteria outlined in Chapter II, Article II of the Municipal Code, and as outlined in Section 3.02 herein.
5. All excavations required for the installation of utilities shall be open trench work unless otherwise approved by the Town.
6. All overlot grading in the right-of-way or within an easement shall be completed before installing potable water, sanitary sewer, storm drain, and non-potable irrigation lines. This requirement shall be indicated on the project's Phasing Plan, and in the projects' general construction notes.
7. Fill shall not be placed over existing utilities to a depth that forces the existing asset out of compliance with the DESIGN STANDARDS. In no case shall fill be placed over any utility without written approval of the utility owner.

H. Grading in the Public Right-of-Way:

1. Slopes:
 - i. The maximum slope for all areas within the right-of-way or outside the right-of-way that can affect public improvements shall be 4H:1V unless designed with retaining walls.
 - ii. Any slopes proposed to exceed 4H:1V must be proven to be stable by a Geotechnical Report and testing per the Town's Standard Specifications and must be approved via the Design Standard Exception Process outlined in Chapter 2, Section 2.05.
 - iii. The minimum slope in non-roadway areas of the public right-of-way shall be 2.0%.

2. Fill Material:

- i. Any fill material to be used in the right-of-way, or within the influence areas of the right-of-way must be tested and discussed in the submitted Geotechnical Report.
- ii. Refer to Chapter 2, Section 2.03 for Geotechnical Report requirements.

I. Trench Excavations

1. Trench excavation includes the removal of all materials and obstructions and the control of groundwater and surface inflow water necessary to construct the project as shown on the approved Construction Drawings, and for construction of or repairs to any wet or dry utility, signage, or lighting, and open ditches.
2. A Right-of-Way Permit (see Section 3.01) must be obtained from the Town prior to any trenching or construction activity within street rights-of-way or other public easements.
3. Excavations made within the paved surface must be permanently restored per Section 3.03 and Standard Detail 225.
4. The Town does not allow excavation or trenching in newly surfaced streets. Should an exigent utility repair require excavation/trenching, a full-width patch back will be required. Streets are considered newly surfaced if new pavement or a mill/overlay has occurred within the preceding 24 months. Refer to Chapter 4, Section 4.05.
5. All trench activity in the Town shall be compliant with OSHA and other overarching trench safety standards.
 - i. Where the proposed trench depth exceeds 10 feet the Town may require submittal of an excavation plan to show stockpile area(s), trench width, trench benching, and shoring.
6. The use of trench digging equipment will be permitted in places where its operation will not cause damage to existing structures or features, in which case hand methods shall be employed. The Design Professional/Contractor shall proceed with caution in the excavation of trenches.
7. All utility installations shall follow the criteria outlined in Chapter 5 of these DESIGN STANDARDS, and in Volume II, Technical Specifications.

J. Stockpiling of Materials

1. Stockpiling of Materials shall not occur in the public right-of-way unless specifically permitted by the Public Works Director.
2. Stockpile location(s) shall be indicated on the project SWMP and Sediment and Erosion Control Plans in the Project Construction Improvement Drawings and shall comply with the regulations for stockpiles established in the Town's Municipal Code.

K. Site Work

1. All site work shall comply with the criteria established by these DESIGN STANDARDS and Section 3.01 herein. Site work may include demolition, removal, and abandonment of existing improvements; clearing and grubbing; overlot grading; removal of topsoil; site preparation; installation and maintenance of erosion and sedimentation control measures; embankment subgrade preparation; embankment fill; excavation, trenching, bedding and backfill of pipelines and service lines; excess excavation; structure backfill; street excavation, backfill, and compaction; borrow; dredging; and restoration and cleanup.
2. All site work and earthwork shall comply with the requirements of these DESIGN STANDARDS and any special criteria established by the Town based on specific site conditions.
3. Site work shall be completed as shown on the approved Construction Improvement Drawings. All workmanship and materials shall meet the requirements outlined in the DESIGN STANDARDS Volumes I and II, and shall conform to the lines, grades, quantities, and the typical cross-sections shown on the approved Construction Improvement Drawings.

L. Hauling

1. Where the hauling of material, such as fill material, is anticipated to exceed a volume of 500 CY, the Town may require that a designated haul route is established to minimize the presence of heavy equipment on the Town's streets.

Section 3.02 Pavement Cut and Repair Standards

A. Street Excavations and Installation

1. The removal and replacement of portions of existing concrete pavement, drives, slabs, sidewalks, etc., shall require breakout lines to be sawed by the use of an approved power-driven concrete saw per the specifications and details shown on the plans or as directed by the Public Works Director.
 - i. Areas to be removed or removed and replaced, must be shown on the Construction Improvement Drawings
 - ii. Removal and replacement of sidewalks shall be to the nearest existing joint not damaged by the construction.
2. All pipe, conduit, line, or other conveyance of utility service shall have at least three (3) feet of cover below the street.
3. All lines, pipes, conduits, etc. shall be marked with standard marker tape for future locating.
4. Pipe, conduit, line, or other conveyance of utility service shall have at least three (3) feet of cover below the street. All lines, pipes, conduits, etc. shall be marked with standard marker tape for future locating.
5. Where it is necessary to place a temporary surface on any cut opening, the temporary surface shall be composed of hot-mix asphalt or cold-mix paving materials. Gravel or aggregate surface course material shall not be used as a temporary surface on any excavation unless the preexisting street surface was gravel or aggregate surface course.
 - i. Temporary surfaces shall be adequately compacted to prevent deterioration of repair during the temporary period. The temporary surface shall be replaced with permanent repair within 14 calendar days.
 - ii. If the excavation is to be covered, the contractor shall use steel plates of sufficient strength and thickness to support all traffic. Plates must be sufficiently secured in place to prevent them from dislodging or in any way creating a hazard to traffic. Asphalt transitions must be placed as needed to provide an acceptably smooth riding surface.

B. Backfill

1. Backfill operations shall commence as rapidly as is consistent with high-quality workmanship and materials. If the excavation cannot be backfilled to create a temporary surface by the end of the working day, the excavation shall be covered with steel plates of sufficient strength and thickness to support all traffic.
2. Backfill shall be completed to the elevation of the bottom of the pavement section in accordance with the "Pavement Repairs" section of these DESIGN STANDARDS.
3. The Public Works Director shall have the authority to direct any entity or contractor to use excavatable flowable fill to backfill an excavation in the Town's public right-of-way in the interest of preserving the public convenience or safety.
4. All excess water and mud must be removed from the excavation prior to backfilling. Any backfill placed during a rainy period or at other times where excess water cannot be prevented from entering the excavation shall be considered temporary and must be removed as soon as weather permits.
5. Following the removal of any excess water and mud from the excavation, the excavation shall then be backfilled with select materials from the excavation or with excavatable flowable backfill material as follows:
 - i. For all excavations and pavement cuts exceeding width and length of five (5) feet, backfill shall use select materials from the excavation. Excavated material used in backfilling shall be select soil free of organic or other deleterious materials and have a maximum particle size of less than three (3) inches.

- ii. Excavated material may not be used if it is water saturated. If excavation materials are not acceptable, then import borrow material or excavatable flowable backfill material shall be used for backfill.
- iii. During freezing weather where repairs must be made to restore or maintain service, crushed stone may be used when approved by the Public Works Director.
- iv. That portion of backfill, which will not support any portion of any sidewalk, driveway, or street, shall be placed in maximum loose lift heights of eight (8) inches and compacted to at least 90% of the Standard Proctor (ASTM D-698) maximum dry density.
- v. That portion of the backfill that lies below any portion of sidewalk, driveway, alley, street, or other pavement shall be placed in maximum loose lift heights of 8 inches and compacted to at least 95% of the Standard Proctor (ASTM D-698) maximum dry density.
- vi. All pavement excavations equal to or less than five (5) feet in length or width shall be backfilled with excavatable flowable backfill material unless the Town Engineer authorizes an alternate backfill method and material.
- vii. Excavatable flowable backfill material shall be a controlled density material consisting of cement and fly ash, fine aggregate, water, entrained air, and appropriate admixtures. Excavatable flowable backfill material shall be in accordance with the Technical Specifications.
- viii. The use of flooding as a means of obtaining compaction of backfill shall not be allowed on existing public streets, alleys, or sidewalks.

C. Testing

- 1. A certified construction materials testing lab acceptable to the Town of Johnstown must perform the appropriate tests to ensure quality control for all backfill and pavement replacement phases.
- 2. The results from compaction tests must be supplied to the Town within three (3) days of the backfill work completion and before pavement construction begins.
 - i. Compaction testing will not be required if flowable fill is used and accepted for the excavation backfill.

Section 3.03 Pavement Repairs

A. Workmanship

- 1. Pavement repairs are to be made as rapidly as is consistent with high-quality workmanship and materials. The use of high early-strength concrete and similar techniques is encouraged insofar as possible without sacrificing the quality of the repair.
- 2. Unless otherwise allowed by the Public Works Director, excavations in arterials, collectors, and in the Town's Downtown Business District must be backfilled and compacted or properly plated within 24 hours. All materials used to replace pavement base and pavement shall be in accordance with the requirements of this manual, the Standard Specifications for Infrastructure Improvements, and the Town Standard Plans for Infrastructure Improvements.
- 3. All permanent patches and repairs shall be appropriate to the surface course. For example, concrete pavement repairs shall be required for streets with concrete surfaces, asphalt surface course over concrete base shall have an asphaltic surface course, etc. In no case shall there be an asphalt repair in a concrete street or a concrete repair in an asphalt street.

B. Replacement of Curb and Gutter, Sidewalk, and Alleys

- 1. Construction and or replacement of curb and gutter, sidewalk, and alley pavement and its related base support shall be in accordance with Chapter 4, Section 4.05.
- 2. Alley pavements shall be restored using like materials per the pavement details provided in these DESIGN STANDARDS.
- 3. Any joints shall be sealed per the Technical Specifications.

C. Core Holes and Utility Potholing Repairs

1. For core holes in concrete pavement, the hole shall be filled with non-shrink grout having a compressive strength of 4,500 psi after 28 days. The grout material used shall be compatible with the existing surface in color and texture and shall seal the hole to prevent the intrusion of moisture into the subgrade. If the core hole passes into the subgrade, the subgrade shall be tamped to provide pavement support before filling with grout.
2. For core holes in asphalt pavement, hot mix fine graded surface course asphaltic concrete tamped in place shall be used in place of the non-shrink grout.
3. Excavations for potholing to expose underground utilities shall be backfilled with excavatable flowable fill prior to completing surface repairs.
4. The surface of the completed repair shall have no indentions, pockets, or recesses that may trap and hold water, nor have bumps or high places. The completed surface shall match the grade of the existing pavement surface.
5. The permittee will be required to provide, at their expense, a certified construction materials testing lab acceptable to the Town of Johnstown to perform the appropriate tests to ensure quality control for the pavement repairs. The results from pavement tests shall be supplied to the Town within one week of project completion.

D. Replacement Pavement Testing

1. Specifications for pavement testing shall meet the requirements contained in the applicable provisions of the Town's Technical Specifications, found in Volume II of these DESIGN STANDARDS.

END OF CHAPTER

CHAPTER FOUR

STREET DESIGN STANDARDS

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CHAPTER FOUR: STREET DESIGN STANDARDS

Section 4.01 Adopted Standards

A. Larimer County Urban Area Street Standards

1. Policies and Technical Criteria in this document closely follow the provisions of the Larimer County "Urban Area Street Standards" (hereafter called "LCUASS") as currently published. With the clarifications and exclusions noted below, LCUASS is hereby adopted by reference as part of these DESIGN STANDARDS.
2. The following Chapters or Appendices of LCUASS are adopted in their entirety:
 - i. LCUASS Chapter 5: Soils Investigation and Report (available on Larimer County website)
 - ii. LCUASS Chapter 11: Structures (available on Larimer County website)
 - iii. LCUASS Chapter 17: Bicycle Facilities and Technical Design Criteria (available on Larimer County website)
 - iv. LCUASS Appendix I: Roundabout Design Manual (available on Larimer County website)
3. All facilities for public streets and for private streets within the jurisdictional boundary of the Town of Johnstown shall be designed and constructed in accordance with the DESIGN STANDARDS. Where specific standards/guidance are not contained herein, the Design Professional is encouraged to utilize LCUASS.
4. In the case of a conflict between LCUASS and the criteria and procedures in these DESIGN STANDARDS, the supplemental criteria and procedures provided in these DESIGN STANDARDS shall take precedence over LCUASS.

B. Use of LCUASS Drawings, Figures and Details

1. See Chapter 9 for specific Town adopted LCUASS Standard Drawings and Figures.
2. LCUASS Standard Figures and Details not included herein as part of Chapter 9 are not approved for use in the Town.
3. LCUASS criteria and details specific to the City of Fort Collins shall not be used in the Town of Johnstown.

C. LCUASS Exclusions

1. The following sections of LCUASS are not approved for use or reference for design of projects within the Town of Johnstown. The procedures and criterion covered in these excluded sections are addressed as needed herein in the Town's DESIGN STANDARDS.
 - i. LCUASS Chapter 2: Submittal and Review Procedures
 - ii. LCUASS Chapter 6: Permits
 - iii. LCUASS Chapter 12: Utility Locations
 - iv. LCUASS Chapter 13: Street Naming and Addressing
 - v. LCUASS Chapter 18: Neighborhood Traffic Safety
 - vi. LCUASS Chapter 19: Parking
 - vii. LCUASS Chapter 20: Public Improvements Opinion of Costs
 - viii. Appendix A—Standard Drawings (See Chapter 9, as previously noted)
 - ix. Appendix B—Forms: Reimbursement, Permits, Licensing
 - x. Appendix C—Fort Collins Streetscape Design
 - xi. Appendix D—Master Street Plans
 - xii. Appendix E—Standard Notes, Approval Blocks, Checklists

- xiii. Appendix F through Appendix H—Fort Collins Manuals and Requirements
- xiv. Appendix L—Loveland Thermoplastic Standards
- xv. Appendix M—ADA Curb Ramps (Loveland Only)

D. Standards Not Addressed

1. At the Town's discretion, where applicable to street construction, for any standard not addressed in these DESIGN STANDARDS or in the adopted LCUASS sections the Design Professional should defer to Colorado Department of Transportation (CDOT) and/or AASHTO Standards, or to the list of references provided in LCUASS.
2. Use of additional or alternate standards as noted above must be clearly and specifically noted on the submitted documents. Approval by the Public Works Director through the Design Standard Exception Process outlined in Chapter 2, Section 2.05 may be required.

Section 4.02 Development Procedures and Policy

A. Street Construction Responsibility

1. Street Construction Responsibility
 - i. The responsibility for the design and construction of all new streets and the widening of existing streets necessary to provide adequate transportation service to, or within, a development rests exclusively with the Applicant.
 - a. Construction includes all associated work, including but not limited to items such as pavement design, construction materials testing costs, required striping and signing. If required, signalization and/or street lighting must also be addressed.
 - ii. This responsibility applies to on-site streets as well as off-site connections to the adjacent public street system streets, required transition sections, and provision of any required landscape tracts and associated landscaping along streets in and/or bordering the site.
 - a. This responsibility includes the acquisition and/or dedication of all necessary rights-of-way and easements. Right-of-way and easements as needed for street improvements must be dedicated to the Town prior to, or concurrent with, approval of the development. Easement requirements are outlined in Chapter 2, Section 2.02 of the DESIGN STANDARDS.
 - b. Pavement design section(s) shall be based on a 20-year design life including both projected site generated and background traffic growth. Refer to Section 4.06 for Pavement Report Requirements.
 - c. When required by the Town, the developer shall extend internal streets to property lines for access (current and/or future) to or with adjacent properties.
 - d. Certain portions of the required improvements may be eligible for reimbursement, and if deemed reimbursable by the appropriate Town Department, the process for reimbursement will be outlined in the Development Agreement.
2. Off-Site:
 - i. The Applicant is responsible for improvements adjacent to the site boundaries. Where street upgrades are needed offsite to comply with these DESIGN STANDARDS, the Applicant shall be responsible for the design and construction of street improvements adjacent to the exterior boundary of the subject property.
 - a. At a minimum, the Applicant shall be responsible for full half street improvements, to Town Standards, of any abutting Collector or Arterial roadway across the "frontage" of the development site (e.g., added lane(s), curb & gutter, sidewalk, etc.).

- b. The Applicant may also be responsible for curb, gutter, and sidewalk, as well as all or part of the remaining pavement on the opposite half of the adjacent street, including correction of any non-compliant ADA access ramps at intersections.
 - c. On a case specific basis, the Applicant also may be responsible for required improvements on the opposite half of the adjacent street. Such improvements may include (but not be limited to) required turn lanes, additional curb, gutter, and sidewalk and/or addition of, or correction of any non-compliant, ADA access ramps at intersections necessary to match up with ramps for the new development.
- 3. Transition Areas
 - i. Where an improved or new street connects to an existing street, appropriate lane transitions must be provided to safely provide required traffic shift(s).
 - ii. Connection with existing streets shall be made with smooth transitions to match existing horizontal and vertical alignment and grade of the existing improvements, in accordance with these DESIGN STANDARDS.
 - iii. Existing grades shall be shown for at least 150 feet on all sides of the connection. The proposed grade and ground lines of all streets that dead-end, except cul-de-sacs, shall be designed to blend (to DESIGN STANDARDS) for 500 feet beyond the proposed construction. The grade and ground lines of all arterials shall be designed to continue 1,000 feet beyond the end of proposed construction.
 - iv. Transitions shall typically be designed as a permanent street improvement (i.e., ultimate pavement thickness and location).
 - v. Temporary improvements (i.e., interim thickness and location) will be considered on a case-by-case basis using the Town's Design Standard Exception Request process as outlined in Chapter 2, Section 2.05.
 - vi. Transitions adjacent to the Development may be approved by the Town in situations where the long-range improvements are constructed adjacent to the Property and traffic safety, or operational concerns warrant a waiver of the off-site transition requirement.
- 4. Right-of-way and easements as needed for street improvements must be dedicated to the Town prior to, or concurrent with, approval of the development.
 - i. Easement requirements are outlined in Chapter 2, Section 2.02 of the DESIGN STANDARDS.

B. Street Connection Policy

- 1. Any new development which does not have direct access to an improved arterial street may be required to improve certain off-site streets to provide adequate access to the nearest improved arterial street.
 - i. Improved access must be provided along the most reasonable and/or most heavily traveled route, as determined by the Public Works Director.
 - ii. In some cases, more than one off-site street may need to be added or improved.
 - iii. Routing traffic through nearby existing residential areas to provide required connections generally will not be allowed. Where allowed by the Town, if the increased traffic volume(s) would cause the existing street's Average Daily Traffic (ADT) based functional classification to increase, the new development may be required to address the necessary improvements to the existing street.

C. Maintenance of Private Improvements

- 1. The Town will not accept maintenance responsibility for new private street improvements associated with land development activities, unless outlined in the Development Agreement.
- 2. When a request is made for the Town of Johnstown to assume maintenance of and/or take over any existing private streets, it shall be the responsibility of the Applicant to satisfactorily demonstrate that the subject private streets are constructed in accordance with these DESIGN STANDARDS.
- 3. Private improvements that were not constructed in accordance with these DESIGN STANDARDS, or that are not first improved up to these DESIGN STANDARDS, shall not be accepted for maintenance.

Section 4.03 Transportation Impact Analysis

A. General

1. Refer to the Town's Transportation Impact Analysis Guidelines provided herein as Appendix A for Traffic Impact Analysis preparation and content requirements.

Section 4.04 Street Construction Improvement Drawings

A. Construction Improvement Drawings—Streets

1. See Chapter 2, Section 2.06 for Construction Improvement Plan set overall content and general requirements.
2. Street Construction Improvement Drawings are required as a condition of a development's application in order to adequately assess the design of the proposed street network.
3. Minimum Plan Content:
 - i. The Construction Improvement Drawings shall include an overall Street Improvement Plan, with cross references to the specific Plan and Profile sheets for each planned street both onsite and offsite of the subject property.
 - ii. This overall plan should include the location of all proposed utilities.
 - iii. Plan and Profile views must be provided for each street proposed in the development.
 - iv. Storm Drain design may be included on the Street Construction Improvement Drawings as long as all information needed to verify the design and to complete construction of the stormdrain system as outlined in Chapter 2 is included, and the design criteria outlined in Chapter 6 is met.
 - v. Cross-section sheets (with 50-foot section intervals) are required for all Arterial and Collector streets.
 - vi. In addition to the requirements set forth elsewhere in these DESIGN STANDARDS, the following information shall be shown on all street improvement drawings submitted for review and approval.
4. Plan View Minimum Content:
 - i. Existing and proposed property and/or right-of-way lines, easements, and/or tracts.
 - ii. Type and dimension of easement or tract is to be clearly labeled.
 - iii. Dimensions of property and right-of-way lines are to be marked.
 - iv. Survey lines and stationing lines shall normally be based on centerline of street; other profiles may be included but shall be referenced to centerline stationing.
 - v. Stationing in cul-de-sacs shall be on the centerline to the center of the bulb with flowlines dimensioned within the bulb.
 - vi. Survey lines and stationing lines shall deviate from centerline of street to parallel the street for situations where two sides of a divided street are not parallel.
 - vii. Stationing shall read in ascending order in the direction of the north arrow or to the right.
 - viii. Streets and street names—with clear distinction between public and private streets.
 - ix. Stationing shall read in ascending order in the direction of the north arrow or to the right.
 - x. Streets and street names—with clear distinction between public and private streets.
 - xi. Existing and proposed location of utilities shall be identified with horizontal and vertical dimensions as measured from street centerline profile grade and shall conform to local, state, and federal requirements including SB18-167. Utilities must be shown as phantom lines, including, but not limited to:
 - a. Storm sewer and appurtenances.
 - b. Fence lines and gates.
 - c. Water lines and appurtenances including hydrants.
 - d. Ditches or swales.

- e. Storm sewer and appurtenances.
 - f. Fence lines and gates.
 - g. Water lines and appurtenances including hydrants.
 - h. Ditches or swales.
 - i. Electric lines and appurtenances.
 - j. Curbs and gutters (with inlet length and type indicated).
 - k. Sewer lines and appurtenances.
 - l. Pavement limits.
 - m. Telephone lines and appurtenances.
 - n. Bridges or culverts.
 - o. CATV lines and appurtenances.
 - p. Guardrails.
 - q. Signs
 - r. Gas lines and appurtenances, etc:
 - xii. Contour lines, existing and proposed.
 - a. Station and critical elevation (flowline, invert of pipe, etc.) of all existing and proposed utility or drainage structures.
 - xiii. Storm drainage surface flow direction arrows, particularly at intersections and all high and low points.
 - xiv. Match lines, stations and consecutive sheet numbers, beginning with cover sheet.
 - xv. Station and elevation of all horizontal curves including PI, PC's, PT's, etc.; high or low point and PI of all vertical curves; existing and proposed, centerline bearings, distances, and complete curve data.
 - xvi. Curb return radii, existing and proposed.
 - xvii. Stations and elevations of all curb returns; mid-point elevations and additional locations necessary, flowline-flowline intersection elevations, and percent of grade from the P.C.R. to flowline-flowline intersections of all cross pans.
 - xviii. Curb ramp spot elevations.
 - xix. Mid-block pedestrian ramp locations at "T" intersections.
 - xx. Centerline stations of all proposed driveways and all intersecting streets.
 - xxi. Survey tie lines to section corners or quarter corners, consistent with that shown on the plat.
 - xxii. Typical street cross-section for all streets, existing or proposed, within and adjacent to the proposed development. These cross-sections shall appear on a Typical Street Section detail sheet, or if no Typical Street Section detail sheet has been used, on the Cover Sheet of the submittal showing street design.
 - xxiii. Intersections:
 - a. Any street intersections shall include detailed construction and lane details for the new construction and existing facilities for a minimum of 150 feet beyond the limits of construction.
 - b. Intersection CL/CL Station Equations, with CL elevation, shall be labeled at each intersection (in both Plan and Profile views).
 - c. Intersection details, including detailed grading (spot elevations, drainage flow arrows with percent grade) and reference(s) listed to the applicable street Plan & Profile sheets shall be provided for all intersections. A key map showing the intersection location(s) in the overall development should be included on each intersection detail sheet. Multiple intersections may be included on a sheet, provided adequate scale is accommodated for clear presentation of all information.
 - d. Where necessary to clearly show details, the Town may require that collector/collector, collector/arterial, and arterial/arterial intersections be the subject of their own plan sheet(s) with the intersection in question centered on the plan sheet.
 - xxiv. Basis of plan view and profile elevations shall be the same, i.e., flowline and flowline, top of curb etc
 - xxv. Cul-de-sac high point and grades shown with directional arrows at critical points (cross-slope and flow line).
5. Street Profile Content
- i. Show profile of street center lines and flow lines.

- a. This requirement may be waived by the Public Works Director when profile grades exceed 1.0% for flow lines and standard cross sections and cross slopes are used. In such cases, additional vertical data may be required at intersections and on curves.
- ii. Profile and Plan shall be orientated in same direction (increasing stationing to right).
- iii. Original ground (dashed) and proposed design grade (heavy, solid). Both grades are to be plainly labeled for all centerline and flowline profiles.
- iv. Design elevations shall be provided for the centerline and for curb and gutter flowlines. The basis of Record Drawing information shall be the same as the design and grade (flowline and centerline, etc.).
- v. Stationing shall be depicted as a continuous line for the entire portion of the Street shown in the plan view, with the centerline station of all proposed driveways and all intersecting streets clearly labeled.
- vi. All existing curbs, gutters, sidewalks, and pavement adjacent to the proposed design. The existing profile grades shall be measured by survey. Previously approved designs or Record Drawings are not an acceptable means of establishing existing grades.
- vii. Existing and New Utilities.
- viii. Elevation and location of all utilities in the immediate vicinity of the construction shall be shown on the plans and shall conform to local, state, and federal requirements including SB18-167
- ix. Station and elevation of all vertical grade breaks, existing (as built) and proposed.
- x. Distance and grade between VPI's.
- xi. Vertical curves, when necessary, with VPI, VPC, and VPT, high or low point (if applicable) stations and elevations.
 - a. All vertical curves shall be labeled with length of curve (L) and $K=L/A$ where A is the algebraic difference in slopes, in percent.
- xii. Profiles for all curb returns (except medians) and intersection details.

B. Typical Street Section(s)

1. Provide any applicable horizontal or vertical dimensions, in addition to providing a section of all improvements within the right-of-way.
2. A section should be provided for each street type planned within the project.

C. Cross-Sections

1. Street cross-sections shall be provided as necessary (typically at 50-foot increments) to effectively evaluate connection with the existing facilities and must extend a minimum of 100-foot past the proposed construction.
2. Cross-sections shall be required on arterials, collectors, and any other streets (typically at 50-foot increments) as deemed necessary by the Town of Johnstown.
3. The cross-sections shall indicate the following:
 - i. Profile grade design point (centerline, flowline, top of curb, lip of gutter, etc.).
 - ii. Street width.
 - iii. Right-of-way.
 - iv. Pavement cross slope.
 - v. Structural material components of the pavement, base and subbase, together with specifications for treatment of subgrade and installation of pavement structural members.
 - vi. Tie in of proposed improvements with existing ground.
 - vii. Slopes of the street, landscape areas, sidewalks, and slopes of open space within 50' of the street right-of-way

D. Key Map

1. The key map should be oriented consistent with north up (to top of sheet).
2. Minimum scale is 1 inch = 500 feet. Scale should be indicated on the Key Map via graphic scale.
3. Clearly depict each sheet's relative position compared to the overall project. The street or area that the design pertains to will be shaded or outlined to clearly convey location in the overall project.
4. Showing the location and name of all existing streets within and adjacent to the proposed construction and all show all future streets.

E. Typical Street Section(s)

1. Provide any applicable horizontal or vertical dimensions, in addition to providing a section of all improvements within the right-of-way.
2. A section should be provided for each street type planned within the project.

F. Cross-Sections

1. Street cross-sections shall be provided as necessary (typically at 50-foot increments) to effectively evaluate connection with the existing facilities and must extend a minimum of 100-foot past the proposed construction.
2. Cross-sections shall be required on arterials, collectors, and any other streets (typically at 50-foot increments) as deemed necessary by the Town of Johnstown.
3. The cross-sections shall indicate:
 - i. Profile grade design point (centerline, flowline, top of curb, lip of gutter, etc.).
 - ii. Street width.
 - iii. Right-of-way location and width.
 - iv. Pavement cross slope.
 - v. Structural material components of the pavement, base and subbase, together with specifications for treatment of subgrade and installation of pavement structural members.
 - vi. Tie in of proposed improvements with existing ground.
 - vii. Slopes of the parkway/median.
 - viii. Slopes of ground behind sidewalk.

G. Street Improvements Details

1. All pertinent details related to street improvements shall be shown on a detail sheet (or sheets).
2. Refer to Chapter 9 for Standard Details.

H. Traffic Signing and Pavement Marking Plans

1. All permanent and temporary traffic signing and pavement markings shall be shown on the Signing and Striping Plan, with the existing and proposed street system used as the base layout. Unnecessary layers should be shown in half tone or removed.
2. Signage and Pavement Marking Plans are to include:
 - i. Cover Sheet with the following:
 - a. Area Map
 - 1) *Area map must note all specific use areas, such as schools, parks, recreation centers, library, commercial, industrial, etc. in proximity to the project.*
 - 2) *Any construction or application notes, (e.g., application temperatures, surface cleaning methods to be used prior to application, etc.).*

b. Road Segment Key Map

3. Overall Signage and Striping Plan (depicting signage layout for the development) must include:
 - i. Sign locations.
 - ii. Sign types.
 - iii. Pavement marking locations and type.
4. Signing Plan:
 - i. Show the location of each sign (horizontal offset and station), or other specific dimensions indicating exact location of the proposed sign.
 - ii. Specify the sign legend and sign type (from MUTCD).
 - iii. Specify the sign size.
 - iv. Provide the installation dimensions (height, distance from curb, etc).
 - v. Detail post and base dimensions and installation plan, see Standard Detail 221.
5. Striping Plan:
 - i. Show street lane widths, taper lengths, storage lengths, etc.
 - ii. Show striping/skip intervals and provide standard skip dimension and stripe length.
 - iii. Show typical treatments for acceleration/deceleration lanes, turning lanes, and crosswalks.
 - iv. Indicate type of pavement marking material with cross reference to the Town's DESIGN STANDARDS Volume II, Specifications and Approved Materials list.
 - v. Provide station/offset, or other specific dimensions indicating exact locations to all angle points, symbol locations, and line terminations.

I. Street Lighting Plan

1. All proposed street lighting shall be shown on an overall Street Lighting Plan.
2. Provide station/offset or other specific dimensions indicating exact locations.
3. Show new and existing luminaries, their stations, installation details, contactor cabinet or the connections to an existing contactor cabinet, conduit, wire, and any adjacent existing luminaires as necessary to complete the electrical system.
4. Show in half tone all relevant proposed and existing features, including but not limited to above and below ground utilities, building awnings/overhangs, street trees, crosswalks and driveways.
5. Provide cut sheets, and fixture details.
6. Include signature line for the utility company.
7. Refer to Section 4.13 and Standard Detail 200.13.

J. Landscape Plan

1. Landscape Plan sheets shall show all plan views and details necessary for construction of plantings in the street right-of-way.
2. The Landscape Plan sheets shall include all existing and all proposed utilities, plantings, shrubbery, trees, and all irrigation systems and appurtenances.
3. All landscaping shall be designed in accordance with the Town's Standards.
4. Sight Distance Triangles (See Standard Detail 200.01) shall be shown/labeled at all street intersections and/or at all commercial drive/street intersections.
 - i. Sight Triangle must fall within public right-of-way, or a dedicated Sight Triangle Easement must be provided to the Town (shown on Plat, or if not then by separate document).

- ii. Evergreen Trees shall not be placed within Sight Triangle. Deciduous Trees may be allowed on a case-by-case basis within Sight Triangle but shall be maintained such that lowest canopy is seven (7) feet minimum above adjacent grade.
- iii. No shrubs and/or other plantings that will (or may) attain a height greater than 24 inches nor fences over 24 inches in height shall be placed within sight triangle.
- 5. Distance from wet utilities shall be shown if trees/shrubs are proposed within proximity (less than 10') from any wet utility.

Section 4.05 General Guidelines

A. Work Schedule

- 1. Allowable work hours shall be as per published Town Municipal Code.
- 2. Work activity done at times other than during normal working hours (8 a.m. to 5 p.m. Monday through Friday) may require reimbursement to the Town for the overtime cost of public employees called in to respond on weekends or holidays. Work requests beyond normal working hours must be submitted to the Town a minimum of five (5) working days prior to the requested date.

B. Pavement Cut Policy

- 1. Construction work that requires removal of existing paved surfaces will require replacement with similar new pavement materials within a period of 48 hours, unless otherwise approved by the Town. Traffic control devices may not be removed until after the paved surface has been replaced.
- 2. Pavement cuts in public streets:
 - i. When an existing asphalt street must be cut, the street must be restored to a condition equal to or better than its original condition.
 - ii. The Contractor/Design Professional shall document the existing street condition before any cuts are made. The documented pavement condition must be provided to and verified by the Town's Inspector as outlined in Volume II, Technical Specifications.
 - iii. Improper construction of pavement patches is a problem in the Town of Johnstown. Poor construction methods may result in dangerous bumps or dips in the traveled street. If such conditions are identified by the appropriate Town Department within two (2) years after construction, the contractor will be notified in writing to reconstruct the pavement patch properly.
 - iv. Failure to meet the conditions described in the written notice from the appropriate Town Department can result in emergency repairs being performed by Town crews. In such cases, the contractor will be invoiced to reimburse the Town for all costs associated with the road repairs.
- 3. New Pavement
 - i. Pavement cuts shall be prohibited in streets where asphalt is new (24 months old).
 - ii. Where pavement cuts for utilities or other connections must be made in these areas, a full width mill/overlay and restriping will be required.
- 4. Pavement cuts in Public Streets
 - i. When an existing asphalt street must be cut, the street must be restored to a condition equal to or better than its original condition.
 - ii. The Contractor/Design Professional shall document the existing street condition before any cuts are made. The documented pavement condition must be provided to and verified by the Town's Inspector.
- 5. Pavement Patch Backs
 - i. Pavement patching shall be done in conformance with the Town of Johnstown Technical Specifications and Standard Detail 224.
 - ii. All pavement removals will be saw-cut a minimum of one (1) foot wider than the patching area. The new pavement patch material will be placed and compacted to a thickness at least one (1) inch greater than the adjacent in-place pavement.

- iii. The minimum dimension of both length and width of any pavement patch will be at least four (4) feet to ensure adequate compaction can be obtained.
- iv. The finished patch shall blend smoothly into the existing surface. All large patches shall be paved with an asphalt lay-down machine.
- v. In streets where more than one cut is made within an area, a full width mill/overlay and restriping including the patched area(s) may be required. The Town shall make a case-by-case determination of need for a complete mill and overlay.
- vi. Pavement cuts in winter months:
 - a. Construction in the winter will require temporary asphalt patching using cold-mix materials, then returning to the site to reconstruct with permanent patching using hot-mix materials when weather conditions allow.

C. Interim Pavement Edge

- 1. In situations where curb and gutter are not installed along the roadway edge and/or in situations where the full street widening in accordance with the street's functional classification is not being constructed, an asphalt shoulder shall be provided that is the same width as existed prior to construction or four (4) feet, whichever is greater.
- 2. A minimum two (2) foot gravel shoulder shall be provided beyond the edge of asphalt.

D. Mailbox clusters

- 1. Location of the proposed cluster mail facilities must be shown on the Construction Drawings.
- 2. The proposed placement and details must be approved by the United States Postal Service (USPS).
- 3. USPS approval is the Applicant's responsibility and will not be verified by the Town as part of the Development Review Process.
- 4. The Postal Cluster facilities must provide ADA complaint accessibility.
- 5. Mailbox clusters must be installed a minimum of two (2) feet from back of walk and not cause any sight obstruction. Mailboxes must not pose a fixed object hazard for vehicles and pedestrians. See Section 4.09 for additional information.

E. Concrete Curb and Gutter

- 1. All streets in the Town of Johnstown shall be constructed with Type II Vertical Curb and Gutter. Refer to the Town's Standard Details and to Table 4-7, Street elements Design Summary for type of curb required based on the functional classification of the street.
- 2. All median islands other than Town approved painted medians, must include concrete curb and gutter.
- 3. For stormwater conveyance design criteria in curb and gutter refer to Section 6.09.
- 4. The slope of curb and gutter at the flowline must be 0.50% minimum.

F. Concrete Sidewalks

- 1. Street (public) Sidewalks shall be constructed of six (6) inch minimum thick concrete and sited inside the public right-of-way (with back of walk at least 0.5-feet inset from ROW line) or within a dedicated public access easement (that extends a minimum 1.0-feet beyond the concrete walk edges).
 - i. Meandering of sidewalks must occur inside the public right-of-way or must be contained in a public access easement.
 - ii. In no case shall a public sidewalk be outside the ROW unless a Design Standard Exception Request is granted by the Town.

2. The Town of Johnstown requires detached concrete sidewalks, placed as shown on the Standard Details for each street classification per the Town's Standard Detail.
3. Sidewalks shall be designed with uniform, continuous profile grade including at driveway access points. On a case-by-case basis, where required by specific design constraints and/or to construct appropriate ADA compliant ramps at intersections, attached walks may be approved through the Town's Design Standard Exception Request process.
4. Sidewalk widths shall be as outlined on Table 4-7.
5. All sidewalks and curb ramps placed in the public right-of-way must meet the U.S. Access Board's Public Right of Way Access Guidelines (PROWAG). See Section 4.08 for additional information
6. Utility covers, other than manhole covers needed to access storm drain inlets, shall not be placed in sidewalks. In those cases, the covers must be traffic rated, with pedestrian friendly covers. No manholes, meters, inlets, or other stormdrain facilities are allowed within ADA curb ramps
7. Utility covers, other than manhole covers needed to access storm drain inlets, shall not be placed in sidewalks. In those cases, the covers must be pedestrian rated. No manholes, meters, inlets, or other stormdrain facilities are allowed within ADA curb ramps
8. Sheet flow from surface areas greater than 750 square feet, and concentrated flow from roof drainage, sump-pump drainage, landscape swales, etc., is not allowed to flow across public sidewalks. These flows must be directed elsewhere or conveyed under the sidewalk in a sidewalk chase. For sidewalk chase design requirements refer to Chapter 6, Section 6.09 and Standard Detail 303.
9. Safety railing will be required where steep side slopes (steeper than 4:1-within 4' of sidewalk), vertical walls (height exceeding 2'-within 4' of sidewalk), steep longitudinal slopes, bends, and/or areas where cross drainages create hazard are present. The safety railing must be placed no closer than 2' from edge of sidewalk where bicycles are expected to be present. See also Chapter 6, Section 6.13.

G. Driveways

1. For driveway access spacing and required driveway approach design refer to Section 4.10.
2. In rural areas of the Town of Johnstown where a single existing lot is to be served by a single driveway the following standards shall apply:
 - i. New driveway accesses from private property to existing pavement shall be paved within the right-of-way.
 - ii. Hot bituminous pavement or concrete pavement shall be installed from the right-of-way line to the edge of the traveled roadway.
 - iii. The width of the driveway within the right-of-way shall be 12 to 22 feet.
3. A culvert with flared end sections, shall be installed at the established roadside ditch flowline elevation beneath the private drive access.
 - i. Roadside ditch grade and conveyance capacity shall be maintained with an appropriately design/ sized culvert. Minimum culvert diameter shall be 18 inches. In no case shall CMP pipe be allowed.
 - ii. Culvert conveyance capacity shall be determined using the methodology outlined in Chapter 6 of these DESIGN STANDARDS and a larger culvert may be required.
4. Minimum cover over driveway culverts is one (1) foot.
5. All portions of the driveway improvements, including piping, ditches, curb, gutter, and/or sidewalk are the responsibility of the property owner. The Town of Johnstown will not provide maintenance on these facilities.
6. Refer to Chapter 2 for Right-of-Way Permit Application requirements.

H. Street Re-Construction

1. Street modifications, such as widening and overlays, must consider drainage impacts and must comply with the criteria outlined in Chapter 6 of these DESIGN STANDARDS.

Section 4.06 Pavement Design

A. General Requirements

1. The following information includes the Street Design criteria for use on all streets in the Town of Johnstown.
2. General Soils Investigations and Report requirements are outlined in Appendix A, Soils Investigations and Report
3. The Technical Specifications (DESIGN STANDARDS Volume II) defines requirements for soil testing and backfill requirements for all cut and fill areas within the right-of-way or public easements.
4. The Final Pavement Design Report shall include follow-up testing for subgrade soil expansion, subsurface water, and R-value, in accordance with Table 4-3.
5. The Public Works Director may require deflection tests or other testing of the existing pavement and base structure to determine if area(s) of proposed overlay is/are feasible, or if full reconstruction is needed.
6. The DESIGN CRITERIA and procedures presented shall comply with the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) guide for the Design of Pavement Structures.
 - i. Mechanistic Empirical (M.E.) design procedures may be substituted, if approved in advance. The designer shall review the M.E. design criteria with the Town prior to submitting the final pavement design.
7. Collector and Local Streets are to be constructed of either asphaltic concrete pavement or Portland cement concrete, base course material, and subbase material (where required), placed on compacted subgrade.
 - i. The subgrade shall have a minimum one (1) foot layer of R=20 material.
 - ii. Refer to the Technical Specifications for subgrade, subbase, and base course information.
 - iii. The Town of Johnstown does not allow full depth asphalt sections.
 - iv. The Town may require Portland cement concrete or chemically treated base or subgrade in locations where traffic, utilities, type of construction, subsurface drainage, or time of construction would make asphalt on aggregate base impractical

B. Treated Subgrade

1. The Town of Johnstown does not allow full depth asphalt. Treated subgrade or treated base is required under all asphalt surfaced streets.
2. Subgrade must be at within six (6) inches of final grade prior to soil sampling and testing for final pavement design. Subgrade testing shall be conducted in accordance with the Technical Specifications (Design Standards Volume II).

C. Pavement Thickness

1. Arterial Streets and Arterial Street intersections must be constructed of portland cement concrete pavement, in accordance with Table 4-7: Street Design Elements Summary.
2. The pavement thickness design must be based on the combined 20-year design for both directions for shared use areas and intersections of Arterial Streets and Collector Streets. A separate intersection design analysis is required.

3. Pavement Thickness at roundabouts shall be based on the sum of the 20-year design volumes from all legs. A separate roundabout pavement design analysis is required.

D. Approval

1. As noted in Section 4.06, and Chapter 2, a preliminary pavement design must be submitted in a Pavement Report and included with the submittal of the final Construction Improvement Drawings (CD's).
2. Approval of the final Pavement Report is required prior to subgrade treatment, placement of base or pavement (including curb and gutter).
3. A new, revised Pavement Design Report will be required if the following conditions occur:
 - i. Phasing— If a street is to be built in phases, (i.e., the center two lanes are built first, then at some later date more lanes are added), and it has been at least two years since the original design was completed.
 - ii. Importing of Fill— If any new fill material that does not match the properties of the subgrade soil is imported, the Town may require a new pavement design report or additional testing to verify the acceptability of this material for roadway fill.

E. Pavement Design Procedures

1. Timing of Soil Borings
 - i. Soil borings shall be taken in the existing or proposed street right-of-way.
 - ii. Subgrade samples shall be taken upon the material that will be subgrade after the installation of the sanitary sewer, waterline, other utilities. Final pavement design should testing should occur after placement and compaction of all utilities and trenching within the street.
 - iii. The subgrade shall be at or near its final elevation, generally within six (6) inches of final subgrade elevation, see Section 4.06.
 - iv. Any required fill material shall be placed to the subgrade elevation prior to sampling.
2. Frequency of Testing
 - i. A minimum of one boring shall be obtained for any roadway segment.
 - ii. A second boring shall be required in the trench of any installed utilities.
 - iii. The distance between borings shall not exceed 500 feet, two borings per location where utility trenches exist (one boring in the trench and one in compacted subgrade).
 - iv. Multiple samples shall be taken alternately among lanes and shall be evenly spaced.
3. Depth of Borings
 - i. In utility trenches, samples shall be taken to a minimum depth of five (5) feet below the proposed utility subgrade elevation.
 - ii. Outside of trenches, samples shall be taken to a minimum depth of 10 feet below the proposed subgrade elevation.
 - iii. Extra Depth Borings shall extend deeper if bedrock or high groundwater are a design concern identified in the Geotechnical Report.
 - iv. Required Tests are as outlined on Table 4-1: Final Pavement Design Testing.
4. Classification Testing
 - i. Soils shall be classified visually and tested to determine the properties listed in Appendix A. Sands and gravel samples shall be analyzed for gradation where needed to comply with classification requirements.
5. Subgrade Support Testing
 - i. Individual subgrade or composite samples shall be tested for subgrade support value. The subgrade Soils Investigation Report shall clearly state whether or not the subgrade soil is capable of supporting the proposed construction and design traffic loads.
 - ii. Recommendation for subgrade stabilization, if required, shall also be provided. The Final Pavement Report shall contain specific mitigation measures to be taken.

iii. The following subgrade tests shall be conducted:

- a. The subgrade support value shall be determined using Hveem Stabilometer (R-Value). The design R-value shall be for 300 psi (2070 kPa) exudation pressure. Reported data shall include the following:
 - 1) *Test procedure reference.*
 - 2) *Dry density and moisture content for each sample.*
 - 3) *Expansion pressure for each sample.*
 - 4) *Exudation Pressure:*
 - i. *Corrected R-value curve showing the 300 psi (2070 kPa) design R-value.*
- b. Swell tests shall be conducted for samples with probable expansion (volume change estimate) greater than 2 percent based on actual test results. Table 4-2: Expansion Potential of Subgrade Soils provides a guideline for expansion potential of subgrade soils.
 - 1) *Surcharge pressure shall be 150 psf minimum, or as specified by the Public Works Director. Refer to Appendix A Soils Investigations and Reports for mitigation requirements.*
 - 2) *At least two samples shall be required per soils report, with one test sample within trench backfill and one outside of trench backfill. Thereafter continue with one swell test every fourth sample unless waived (or otherwise directed) by the Public Works Director.*

Table 4-1: Final Pavement Design Testing			
TEST	FINAL PAVEMENT DESIGN REPORT	SWELL	MITIGATION AND DETAILED ANALYSIS
Visual	X	Percentage of soluble sulfates	X
Liquid Limit	X	Standard Penetration Test	X
Plastic Limit	X	Groundwater	X
Moisture	X	Bedrock Level	X
Percent Passing 200	X		
Gradation	X		
AASHTO or USC Classification	X		
Subgrade Support R-Value	X		

Table 4-2: Expansion Potential of Subgrade Soils				
% Passing No. 2 Sieve	Liquid Limit (%)	Standard Penetration Resistance (Blows/Ft)	Volume Change Estimate (% of Total)	Expansion Classification
>95	>60	>30	>10	Very High
60-95	40-60	20-30	3-10	High
30-60	30-40	10-20	1-5	Medium
<30	<30	<10	<1	Low

F. Pavement Thickness Design Criteria

1. Pavement thickness design procedures shall provide for a 20-year service life of pavement when normal maintenance is provided to keep the roadway surface in an acceptable condition.
2. Equivalent Daily Load Applications (EDLA) and Equivalent Single Axle Loads (ESAL) units are based on 18 kip (80 kN) axle loading on each design lane. All data and design procedures in this section shall use EDLA or ESAL units for pavement loading repetitions.
 - i. Minimum EDLA and ESAL criteria for each roadway classification are provided on Table 4-3: Flexible Pavement Design Criteria.
 - ii. The values provided shall be increased for roadways with a traffic study showing higher traffic number projections.
3. The Serviceability Index to be used for all Town of Johnstown streets is provided on Table 4-3: Flexible Pavement Design Criteria.
4. Minimum Pavement Section parameters by street classification, based on assumed subgrade support and traffic values, are provided on Table 4-3: Flexible Pavement Design Criteria .
 - i. These pavement thicknesses may be used for preliminary planning purposes and cost estimates. All pavement thickness designs must be based on actual subgrade support test results (refer to Appendix A, Soils Investigations and Report) and traffic projections (refer to Section 4.03, Transportation Impact Study) for the specific project.
 - ii. In specifying minimum layer thickness, the Design Professional shall consider how the pavement section will be physically constructed (e.g. specify how to construct 2' of treated subgrade or the number of lifts and the grade for each lift of the asphalt section.)
 - iii. In no case will the Town accept pavement thickness and subgrade thickness less than the minimums provided on Table 4-3.
5. Standard Flexible Pavement Strength Coefficients are provided on Table 4-4: Pavement Strength Coefficients. Non-standard coefficients may be used, but only if approved in advance by the Town's Public Works Director, via the Design Standard Exception Request process outlined in Section 2.05. The design values must be verified by pre-design mix test data and supported by daily construction tests, refer to DESIGN STANDARDS Volume II for Testing Procedures.

G. Special Considerations for Staged Construction

1. Alternative Processes
 - i. Final Top Coarse Paving Following Construction – before Warranty Period Starts
 - a. The Town of Johnstown, on a case-by-case basis by special request, may allow staged asphalt street paving, as follows: The Developer would provide a minimum thickness pavement during construction, generally consisting of all but the top wear course. After completion of all construction, the final top lift of asphalt would then be placed, providing for a new finished pavement surface once the majority of construction is completed.
 - b. If the entire pavement section is not to be placed immediately, the pavement design for staged construction must be provided in the Pavement Design Report, and approved by the Public Works Director. The staged construction design must include asphalt thickness for each proposed stage. Calculations, traffic numbers, and construction truck traffic number supporting the staged design must be included in the Pavement Report. The surface must drain at all times, no standing water should be left on the pavement surface.
 - ii. Final Surface Course/Overlay at End of Warranty Period.
 - a. After the end of the two-year warranty period, (and after all Punch list repairs have been made), the Contractor shall pave with a 1.5inch SX overlay.
 - b. The report shall instruct the Contractor to pave 0.5 inch less than required pavement section at initial construction, leaving the finish asphalt 0.5 inch below the design crown elevation. After two years, (and after all warranty repairs have been made), the Contractor shall perform a tapered milling (0 to 1-inch depth) of the outside 4 feet of pavement along the gutters prior to placing the 1.5 inch SX overlay. This shall be accomplished before the Town accepts the streets for full-term maintenance.

- iii. Manhole and Valve Settings.
 - a. All manholes and valve boxes shall be set at grade for the interim paving surface.
 - b. Manholes and valve boxes must be adjusted to final grade prior to placement of the final overlay.
 - c. Riser rings shall not be used.
- iv. Rehabilitating Existing Asphalt
 - a. Prior to overlaying existing asphalt, the Town may accept nondestructive testing to determine the amount of overlay necessary to bring the street to current standards. The method of nondestructive testing and the data obtained must be in a form compatible with the pavement management system for the Town of Johnstown
- v. All backfill shall be maintained in a satisfactory condition and all places showing signs of settlement shall be filled and maintained during construction pursuant to warranty period requirements outlined in Chapter 2, Section 2.06.K.4.

H. Flexible Pavement Design Procedures

1. General Flexible pavements are those pavements that have sufficiently low bending resistance to maintain continuous contact with the underlying structure, yet have sufficient stability to support a given traffic loading condition. An example is asphaltic concrete pavement.
2. Computer generated printouts and/or other design calculations must be included with the design submittal.
3. The following procedure should be used in determining the structural number and thickness of the pavement being designed:
 - i. Confirm the roadway classification and corresponding EDLA. The predicted volumes in the Traffic Impact Analysis must be used whenever they exceed the minimum EDLA values given on Table 4-3.
 - ii. Determine the serviceability index (SI) and reliability for the roadway classification (Table 4-4).
 - iii. Convert the R-value to a Resilient Modulus for each soil subgrade type identified in the exploration using the CDOT equations 2.1 and 2.2 as detailed in the latest edition of the CDOT Pavement Design Manual.
 - iv. Determine the required structural numbers using AASHTO pavement design software or nomographs from AASHTO along with soil support test results and EDLA values previously determined. If used, copies of the nomograph determinations must be included with the design submittal.
 - v. Once the required structural number (SN) has been determined, the design thickness of the pavement structure can also be determined by the software that uses the general parameters provided in Equation 4-1.
 - vi. The standard deviation for design of asphalt pavements shall be 0.44.
 - vii. The design must reference any mitigation measures required when the subgrade contains swelling soils. Refer to Appendix A, Soils Investigations and Report.
 - viii. Design reports recommending permeable layers in the pavement system must present the measures to be used to ensure adequate drainage of such layers and to maintain separation of the layers from the swelling soils.

Table 4-3: Flexible Pavement Design Criteria

ROAD CLASSIFICATION	20-YEAR DESIGN INFORMATION		SERVICEABILITY INDEX (psi)				Wearing Surface Course Grading	Reliability (%)	MINIMUM ASPHALT Composite Section	DEFAULT AGGREGATE BASE COUSE SECTION	MINIMUM STRUCTURE NUMBER
	EDLA (Min)	ESAL	S _i (initial)	S _t (final)	D	Layer (Min)			Layer (Min)	(Based on subgrade R-Value of 5, and on CDOT calcs where: M _r =3.025, Std Deviation = 0.44)	
						HMA			ABC		
Local: Residential Two-Lane	5	36,500	4.5	2.0	2.5	S or SX	75	6"	6"	3.30	
Local: Residential Cul-de-sac	10	73,000		2.0	2.5	S or SX	80	6"	8"	3.52	
Local: Alley	10	73,000		2.0	2.5	S or SX	80	6"	8"	3.52	
Local: Low Volume (Commercial/Industrial)	50	365,000		2.3	2.2	S	75	6"	10"	3.74	
Minor Collector	25	182,500		2.3	2.2	S	75	6"	8"	3.36	
Major Collector	50	365,000		2.3	2.2	S	85	6"	11"	3.85	
Collector (Commercial/Ind)	100	730,000		2.3	2.2	S	85	7"	12"	4.40	
Arterial: 2-lane	100	730,000		2.5	2.0	S	90	7"	12"	4.40	
Arterial: 4-lane	200	1,460,000		2.5	2.0	S	90	8"	16"	5.28	
Arterial: 6-lane	300	2,190,000		2.5	2.0	S	90	9"	17"	5.83	
NOTES:											
1. Minimum and Maximum Lift Thickness: GRADE SX 1-1/2" min., 2-1/2" max. ; GRADE S 2" min., 3.5" max. ; Grade SG 3" min/5" max (2' min surface course).											
2. EDLA for roundabouts shall include the cumulative EDLA for each entry leg.											
3. Design calculation shall be used for resilient modulus calculations for all roads.											

EQUATION 4-1

$$SN = A1D1M1 + A2D2M2 + A3D3M3 + \dots$$

Where: A1 = Hot Mix Asphalt (HMA) Strength Coefficients

A2, A3, . . . = Strength Coefficients of Additional Pavement Components The strength coefficients for various components of the pavement structure are given in Table 4-4: Pavement Strength Coefficients.

D1 = Thickness of Hot Mix Asphalt (HMA)

D2, D3, . . . = Thickness of Additional Pavement Component Sections

M1, M2, . . . = Drainage Coefficient Total HMA thickness selected shall not be less than the minimum specified in Table 4-3: Flexible Pavement Design and the aggregate base course thickness selected shall not exceed 2.0 times the total HMA thickness selected.

Table 4-4: Pavement Strength Coefficients			
Pavement Component	Structure	Design Strength Coefficients (per inch of material)*	Limiting Test Criteria
CONVENTIONAL MATERIALS			
Plant Mix Seal Coat		0.25	N/A
Hot Bituminous Pavement		0.44	R 90+
Existing Bituminous Pavement		0.24	**
Aggregate Base Course		0.11	R>72
Existing Aggregate Base Course		0.10	R>69
Granular Subbase Course		0.07	R>50
Recycled Asphalt/Concrete Pavement Subbase Course		0.07	R>50
CHEMICALLY TREATED SUBGRADES***			Compressive Strength of Field Specimen
Cement Treated		0.23	7 day, 650-1000 psi
Fly Ash Treated		0.10	7 day, 150 psi @70 ⁰ ±
Lime Treated		0.14	7 day, 160 psi, PI <6
Kiln Dust Treated		0.10	7 day, 150 psi, PI <6
NOTES: *The credited thickness of chemically treated subgrade shall be 2-inches less than the maximum specified tilling depth (e.g. 12-inches of fly ash stabilization will get a 10-inch strength credit. Chemical soil stabilization shall not proceed between October 31 and April 1 without Public Works Director approval, due to freeze thaw issues with frozen subgrade. Minimum tilling depth shall be 12-inches to meet subgrade scarifying requirements. **Greater strength coefficient may be considered if derived from deflection data collected on the existing street in compliance with procedures outlined in the Asphalt Institute Manual MS-17. ***Strength coefficient is only acceptable if material is properly mixed and field tests correlate with laboratory results. Strength Coefficient shall be reduced by 50 percent if field test correlations are not performed			

I. Rigid Pavement Design Procedures

1. Rigid pavements are those that possess a high bending resistance and distribute loads over a large area of foundation soil. Examples include Portland cement concrete pavement or Portland cement concrete surfaced with asphalt.
2. Computer generated printouts and/or other design calculations must be included with the design submittal.
3. The design of rigid pavements is a function of structural quality of the subgrade soil (R-value), traffic (EDLA), and the strength of the concrete (working stress). In comparison to the strength of the concrete slab, the structural contributions of underlying layers to the capacity of the pavement are relatively insignificant. Therefore, the use of thick bases or subbases under concrete pavement to achieve greater structural capacity is considered to be uneconomical and is not recommended.
 - i. Street sections with landscape medians may require a drainage layer section to provide positive drainage from the median to an acceptable outlet.
4. In all cases, the subgrade shall be stable as determined by proof-rolling requirements outlined in DESIGN STANDARDS Volume II, Construction Specifications, concerning final proof-rolling.
5. The following procedure should be used in determining the structural number and thickness of the pavement being designed:
 - i. Confirm roadway classification and corresponding EDLA. The predicted volumes in the Traffic Impact Analysis must be used whenever they exceed the minimum EDLA values on Table 4-3: Flexible Pavement Design.
 - ii. Determine the serviceability index of the roadway classification from Table 4-3.
 - iii. The reliability factor for design of all concrete pavements shall be 90 percent.
 - iv. The working stress of the concrete is to be obtained from laboratory tests.
 - v. The standard deviation for design of concrete pavements shall be between 0.30 and 0.40.
 - vi. Determine the structural numbers using AASHTO pavement design software. Nomographs of the AASHTO parameters may be used instead. If used, copies of the nomograph determinations must be included with the design submittal.
 - vii. Determine the slab thickness. A minimum thickness of 6 inches must be provided.
 - viii. Design must reference any mitigation measures required when the subgrade contains sulfates. Refer to Appendix A, Soils Investigations.
6. The construction plans for rigid pavement areas shall include a joint pattern layout for each street or alley.
 - i. All joints and joint filling in rigid pavement shall be designed and detailed in accordance with the current Colorado Department of Transportation Standard Plans (M&S Standards).

Section 4.07 Pavement Design Report

A. Preparation Requirements

1. The Town of Johnstown requires that a Pavement Design Report prepared by or under the supervision of and signed and stamped by a Professional Engineer registered in the State of Colorado is submitted for all projects.
2. The Pavement Design Report shall make a recommendation for a typical pavement structural section based on known site soil conditions and the valid Traffic Impact Analysis (refer to Appendix A Transportation Impact Analysis requirements).

B. Submittal Content Requirements

1. Vicinity Map to locate the investigated area
2. Scaled drawings showing the location of final borings.
3. Final Plat with street names scaled drawings showing the estimated extent of subgrade soil types and EDLA for each street classification.
4. Pavement design alternatives for each street classification.
5. Tabular listing of sample designation, sample depth, Group Number, liquid limit, plasticity index, percent passing the No. 200 sieve, AASHTO Classification, Group Index and soil description. Refer to Appendix A, Soils Investigations.
6. R-value test results of each soil type used in the design. Refer to Appendix A, Soils Investigations.
7. Swell/consolidation tests. Refer to Appendix A, Soils Investigations.
8. Identification of any samples that were consolidated to create composite samples for testing purposes. Refer to Appendix A, Soils Investigations.
9. Borrow source identification.
10. Pavement design computer printouts or nomographs properly drawn to show Soil Support - EDLA - SN.
11. Design calculations for all phases of Soil Report.
12. Design coefficient used for asphalt, base course, etc.
13. Mix design test results
14. A discussion of potential subgrade soil problems including, but not limited to:
15. Heave or settlement prone soils.
16. Frost susceptible soils.
17. Ground water.
18. Drainage considerations (surface and subsurface).
19. Cold weather construction (if appropriate). Soluble sulfates in subgrade.
20. Other factors or properties that could affect the design or performance of the pavement system.
21. Recommendations to alleviate or mitigate the impact of problems in subgrade soil.
22. Professional Engineer Stamp.

Section 4.08 Accessible Pedestrian Design

A. ADA Accessibility Guidelines for Public Rights-of-Way

1. PROWAG Guidelines: The U.S. Access Board provides guidelines under the Americans with Disabilities Act (ADA) that addresses access to sidewalks and streets, crosswalks, curb ramps, pedestrian signals, on-street parking, and other components of public rights-of-way.
 - i. As federally mandated by the Americans with Disabilities Act, design and construction of new pedestrian facilities in the Town shall be compliant with current ADA standards, and shall follow the recommended best practices not fully addressed by current ADA standards as outlined in PROWAG (the 2011 draft PROWAG has been identified by the FHWA as the current best practice in pedestrian design).
 - ii. The Access Guidelines (ADAAG) and the PROWAG are not requirements of the ADA but serve as the standards and guidelines by which compliance of the law is measured, however the Town mandates use of these guidelines for all new construction, and when bringing existing Improvements into compliance.
2. ADA law:
 - i. New construction is required to be ADA accessible, this requirement became mandatory for newly constructed and altered facilities as of March 15, 2012. DOJ's ADA Standards apply to all facilities covered by the ADA except public transit facilities.

- ii. Alterations to existing facilities that are within the scope of a project to provide accessibility to the maximum extent feasible.
- iii. Existing facilities that have not been altered shall not deny access to persons with disabilities.
- iv. All new construction projects where a pedestrian demand is exhibited shall incorporate appropriate pedestrian facilities that are accessible to persons with disabilities.

B. ADA Compliance Responsibility:

- 1. All new Projects should comply with applicable ADA requirements. The Project Development Team (Developer, Development Engineer and/or Architect of Record) shall assume responsibility for ADA design compliance.
- 2. While the Town/Town representatives may review and offer ADA related comments on Project plans and submittals, the Town/Town representatives specifically do NOT imply nor accept ADA compliance responsibility for the Project through such review and comments.

C. ADA Compliance New Development

- 1. All construction projects shall mitigate constraints through good planning and design practices.
 - i. Project budget or limited scopes are not an acceptable reason to fail to provide compliant accessible facilities during new construction.
- 2. The Town may require the preparation of an ADA Access Plan for more complex projects as part of the Construction Improvement Drawing Set. This ADA Access Plan will be required to indicate the location of the pedestrian access route (PAR).
- 3. The continuous width of the PAR shall be five (5) feet minimum, exclusive of the curb. Where a pedestrian access route makes a 90-degree turn, it should be widened if/as necessary to ensure five (5) feet clear space to accommodate the continuous passage of a wheelchair (i.e., pedestrian design vehicle).
- 4. Pedestrian facilities shall have a maximum running slope of eight percent (8 %).
- 5. Sidewalk cross slope must be a minimum of one percent (1%) and shall not exceed two percent (2%).
- 6. ADA compliant ramps at intersections must be directional, see Standard Detail 213.
- 7. Diagonal ramps are not permitted, and where present adjacent to the site (including on opposite corners of existing intersections), they must be removed and replaced with directional ramps at the time roadway and/or ramp construction or modifications associated with the new development are made.
- 8. All sidewalks shall be detached and must comply with the Town's Standard Details.

D. Curb Ramp Types

- 1. Curb ramps in the public right-of way shall be directional, with separate ramps for each crossing direction, see Standard Detail 200.19.
- 2. The standard detectable warning must be included, see the Town's Approved Material List for approved types.
- 3. Landings and turning spaces allow users to maneuver on and off the curb ramp and are required at the top or bottom of a curb ramp. Turning spaces are required at the top of a perpendicular curb ramp and at the bottom of a parallel curb ramp.
- 4. The maximum running slope and cross slope of landings and turning spaces shall be 2.0%.

5. At mid-block crossings or locations without yield or stop control, the cross slope of the turning space can equal the street or highway grade.
6. Turning spaces shall be 4 feet by 4 feet minimum. If the turning space is constrained by a vertical element on one or more sides, provide 5 feet in the direction of the street crossing.

E. ADA Curb Ramp Exception Process

1. There are circumstances where it can be impractical to make facilities fully compliant with the standards due to existing site constraints. Improvements at locations can be deemed “Technically Infeasible” when sound engineering judgement is exercised. When full compliance is deemed technically infeasible, facilities being altered should be made accessible to the maximum extent practicable. If a site cannot meet accessibility standards, the proper documentation procedures should be followed. Examples of site constraints that may make it technically infeasible to make a facility fully compliant include:
 - i. Adjacent development or buildings that would need to be moved or altered to make a facility fully compliant.
 - ii. Required improvements that would alter the status of a Historic property.
 - iii. Drainage that could not be maintained if an area is made fully accessible.
 - iv. Underlying terrain that would require significant expansion of the project scope to achieve full compliance.
 - a. An example would be altering a street profile to make the cross slope of a crosswalk fully compliant.
 - b. Project scope, not cost, shall determine when existing constraints make an item technically infeasible.
2. To submit a curb ramp specific exception, the Town’s Design Standard Exception Process as outlined in Chapter 2, Section 2.05 of these DESIGN STANDARDS must be followed. The attached explanation must be signed by a licensed professional engineer documenting why the curb ramp was deemed technically infeasible and must demonstrate that reasonable effort was made to design the curb ramp to meet ADA compliance. The request will be reviewed by the Public Works Director and if approved, will be filed with by Town in the applicable project file.

F. Pedestrian Crossing at Controlled Intersections

1. Signalized Intersection Crossing Controls
 - i. If an intersection under signal control has sidewalks, then marked crosswalks should be provided. Pedestrian signals are recommended at all intersections where sidewalks are provided on the approaches to a signalized intersection.
 - ii. STOP lines shall be placed a minimum of 4-feet in advance of the crosswalks.
 - a. Consideration must be given to providing advance right turn STOP lines to improve the visibility of pedestrians coming from the motorist’s left.
 - iii. Pedestrian push buttons shall be accessible to pedestrians via an accessible pedestrian route in compliance with the ADA.
 - iv. Pedestrian Signals
 - a. The draft PROWAG requires that whenever pedestrian signals are installed, accessible pedestrian push buttons be installed. Push buttons shall be connected to a fully accessible pedestrian signal that complies with the MUTCD as amended, with the ability to enable or disable accessible features.
 - b. The Public Works Director will decide on which functions to activate at each accessible pedestrian crossing on a case-by-case basis.
 - v. At intersections with high volumes of pedestrians, consideration should be given to restricting the right turn on red movement.

2. Stop and Yield Crossing Controls.
 - i. Marked crosswalks shall be provided wherever a sidewalk crosses a major collector or arterial street under stop or yield control.
 - ii. Crosswalk striping will not be required on local streets with the following exceptions, which will be evaluated by the appropriate Town staff on a case by case basis:
 - a. A school site is nearby
 - b. A trail crossing needs access
 - c. Residents need access
3. Roundabout Crossing Controls
 - i. Requirements for roundabout crossings shall reference the latest version of NCHRP Report 672 – Roundabouts: An Informational Guide and the PROWAG. If there is a conflict between the adopted LCUASS Standards and NCHRP, the NCHRP standard shall apply.

G. Uncontrolled or Mid-Block Pedestrian Crossings

1. A specific section must be added in the required Traffic Impact Analysis, or a separate engineering study (for placement on existing streets) shall be performed before a crosswalk is installed at a location away from a traffic signal or an approach controlled by a STOP or YIELD sign, even if the development generates fewer than 100 vehicular peak hour trips, see Section 4.03.
2. The engineering study shall be stamped by a professional engineer, licensed in the State of Colorado.
3. A minimum distance of 300 feet is required from the nearest intersection or existing pedestrian crossing for a location to be considered for a proposed uncontrolled or mid-block crosswalk.

Section 4.09 Street Design Technical Criteria

A. General

1. Street design and layout shall conform to these DESIGN STANDARDS and with the Town's Transportation Master Plan (as amended).
2. Roads located on/along Township section lines generally should be classified and designed as Arterial classification streets, unless otherwise identified in a Town adopted transportation master plan.
 - i. All other streets shall be classified and designed in accordance with applicable street layout requirements outlined herein, and in accordance with the required site-specific Traffic Improvement Study/Analysis.
3. All public streets shall have concrete sidewalk, curb and gutter. See Standard Details 207 and 208.
4. New development, including commercial development and subdivisions are required to have two points of access to a public street.

B. Street Layout Requirements

1. Streets shall be placed with a logical relations to the existing topography and to the location of existing or platted streets within adjacent properties.
2. Circumstances may exist where streets within the project may need to be extended in order to provide for the future logical extension of the street network through adjacent properties.
3. Where possible, street categories and placement should be consistent with information identified in the Town's most current adopted Transportation Master Plan.
4. Streets intersecting on opposite sides of collectors or local streets must intersect directly across from each other (e.g., center lines match), or a minimum offset of 200' must be provided.
5. Street layout shall address the needs of the proposed development and satisfy all other specific requirements in the DESIGN STANDARDS.

C. Major and Minor Arterial Streets

1. Dedication of minimum 120' right-of-way for Major Arterials and minimum 110' right-of-way for Minor Arterials is required, see Standard Detail 206 and Standard Detail 207. Additional ROW width may be required as required by the TIA or the Town.
2. Intersections between Arterial Streets and Local Streets and/or Minor Residential Streets must be minimized as much as possible, and will be considered on a case-by-case basis, through the Town's Design Standard Exception Request process.

D. Collector Streets

1. General:
 - i. Collectors (both Major and Minor) are not permitted to have residential driveway access. The Town requires that residential driveways must access from Local Streets internal to the proposed development.
 - ii. Intersections of Collectors and Arterials should be located no closer than 660 foot spacing.
2. Major Collectors
 - i. Dedication of an 80' right-of-way is required, see Standard Detail 202.
 - ii. Intersections of Collector Streets with Arterial Streets should be located no closer than 1/3 mile intervals along the Arterial Street.
3. Minor Collectors
 - i. The Town of Johnstown retains the authority to designate required Minor Collectors and to approve the overall street layout, see Standard Detail 202.
 - ii. Dedication of an 80' right-of-way is required for Minor Collector with flush median (primarily intended for industrial areas).
 - iii. Dedication of a 65' right-of-way is required for Minor Collector with on-street parking.
 - iv. The maximum continuous length for a Minor Collector is 2640 feet (1/2 mile).

E. Local Streets

1. Dedication of 60' right-of-way is required, see Standard Detail 203 and Standard Detail 204.
2. Local Streets should connect to Collector Streets and other local streets. Direct connection of local streets to Arterial Streets should be minimized and must be avoided where possible.
3. Local streets are intended as a low volume direct access to residences fronting on the street, and to provide a multi-modal system that can be shared by vehicular, bicycle and pedestrian traffic.
4. Local commercial roadways will have fewer multi-modal conflicts and are permitted to have longer continuity and less restrictive traffic calming requirements.
5. The maximum permitted length between 90-degree turns and controlled intersections is 660 feet.

F. Alleys

1. Dedication of 20' minimum right-of-way is required for an Alley, see Standard Detail 211.
2. Additional site specific right-of way width may be required by the Fire Department.

G. Private Streets

1. Private streets shall meet the same design standards as public streets. Private streets are not owned, maintained, or plowed by the Town. They are the sole responsibility of the applicable development, Metro District or Homeowner's Association.

H. Neighborhood Traffic Safety and Traffic Calming.

1. New Local Streets shall be laid out in a manner that:
 - i. Minimizes opportunities for cut-through traffic.
 - ii. Reduces opportunity for speeding on local residential streets.
 - iii. Provides protection for school zones.
 - iv. Incorporates traffic calming techniques and traffic safety in residential areas.
 - a. Local Streets should be low traffic volume roadways used for direct access to residences on the street.
 - b. Local Streets are also intended as a multi-modal system that is shared by vehicular, bicycle, and pedestrian traffic equally, in a manner that minimally impacts residents.
2. Roundabouts may be used in new streets if the appropriate criteria are met. Refer to Appendix D for roundabout design criteria.
3. Traffic calming measures typically are not intended for use on new streets.
 - i. See Standard Details 219 and 220 for Traffic Calming Measures that may be allowed and/or required on a case-by-case basis by the Town's Public Works Director.
 - ii. Proposed Traffic Calming Measures must be approved by both the Town and the appropriate Fire District.

I. Street Functional Classifications

1. One of the first steps in the design process is to define the function that the street is intended to provide. Lower order streets function primarily as access to individual lots, and higher order streets function primarily for the purpose of mobility (efficient movement of traffic).
2. Typically, the hierarchy of the functional highway classification system consists of the following:
 - i. Freeways – controlled access facilities (Interstate, Freeways, and Expressways).
 - ii. Major arterial – main movement (high mobility, limited access).
 - iii. Minor arterial – interconnects principal arterials (moderate mobility, limited access).
 - iv. Collectors – connects local roads to arterials (moderate mobility, moderate access); and
 - v. Local streets – permit access to abutting land with direct driveway connections (high access, limited mobility).
3. In the Town of Johnstown these classifications are further defined based on Table 4-5: Functional Classification.
 - i. Additional traffic volume created by new development must not result in increases that the change the functional classification of the existing streets, unless improvements are planned/provided to bring the existing street to the level of improvement required for the new functional classification.

Table 4-5: Functional Classifications			
Functional Classification	Traffic Volume (VPD)	Number of Lanes	Design Speed/ Posted Speed
Major Arterial	16,001-48,000	6	50/45
Minor Arterial	7,001-16,000	4	45/40
Major Collector	3,001 to 7,000	4	40/35
Minor Collector	1,001 to 3,000	2-3*	40/35
Local Street	201 to 1,000	2	30/25
Local Street (Commercial and Industrial)	201 to 1,000	2	30/25
Alley	Maximum of 200	1	20/15
* Three lanes for commercial zones, with center two-way left turn lane.			

J. Design Elements

1. Horizontal Alignment
 - i. As noted in Section 4.02 all abutting streets shall be extended to the property lines and along the full frontage of the property to be developed.
 - ii. All streets should intersect at right angles (90-degrees). In no case shall street intersect with angles exceeding 10° from perpendicular.
2. Minimum Radius Curves
 - i. Curves along a street must be designed with adjacent radii that are approximately equal to provide consistency for drivers and speed. Minimum centerline arc lengths have been established based on functional street classifications and associated posted/design speeds.
 - ii. On Arterial and Major Collector roadways, curve radii shall be as large as possible using the minimum allowed radii only when necessary due to terrain or other site constraints.
 - iii. On Minor Collectors and other low volume Town streets, the minimum radius curve may be used.
 - iv. The Town requires Local Street widening (knuckles) at turns on where total radius angle is 60-degrees or greater), see Standard Detail 200.03.
 - v. Angle point direction changes are not permitted. All changes in direction shall be made using appropriate radii curves.
 - vi. Horizontal Curves shall not begin near the top of a crest vertical curve nor at or near the bottom of a sag vertical curve.
3. Reverse and Compound Curves
 - i. Reverse and Compound curves should be used only when a single radius curve will not work.
 - ii. For driver safety, compound curves must have a ratio no greater than 1.5 where the value of the larger radius is divided by the smaller radius.
 - iii. Two curves in the same direction (broken back curves) shall be separated by a tangent with a length of at least 2 times the minimum tangent length shown in Table 4-7: Street Design Element Summary.
4. Tangent Lengths
 - i. Minimum Intersection Approach Tangents:
 - a. On Arterial and Major Collector streets the tangent distances between curves and at intersections shall be as large as possible, using minimum tangent lengths only when necessary due to terrain or other site constraints.
 - b. Distance may be measured along the arc of a curve, so long as the angle of departure does not exceed 10 degrees for the length of tangent.
 - ii. Tangent lengths between reverse curves must meet the minimum distance outlined on Table 4-7: Street Design Element Summary.
5. Vertical Alignment
 - i. Street Grade minimum and maximum slopes are provided on Table 4-7: Street Design Element Summary with the following clarifications and/specific requirements in addition to those listed in the Table:
 - ii. Cross slope is required on public streets in the Town of Johnstown. Crown or cross slope shall be not more than 4% nor less than 2%, with slope measured from the crown to the lip of the gutter.
 - a. Maximum cross slope on all new construction shall be 3%. The 4% maximum will be permitted only on minor reconstruction or overlays of existing streets.
 - iii. When widening an existing street, or adding turn lanes to an existing street:
 - a. The cross slope of the widened portion should blend smoothly with the existing cross slope.
 - b. The resulting cross slope should be within the limits stated above and the new cross slope shall be no less than the existing cross slope.
 - c. If the cross slope of the existing street is outside of the slope permitted in these DESIGN STANDARDS and/or will not allow the added pavement within these limits, then the new addition, including new curb and gutter if required, must be designed and constructed such that the existing pavement, when overlaid, will result in a straight line cross slope that meets these DESIGN STANDARDS.
 - d. Alternatively, existing pavement may be removed and reprofiled to bring the street into compliance.
 - iv. Flowline grade in the bulb of a cul-de-sac shall be a minimum of 1%.
 - v. Centerline grade in the bulb of a cul-de-sac shall not exceed 3%.

- vi. Flowline grade along the gutter flowline on the central islands of roundabouts shall be a minimum of 1%.
- vii. Approach grades at intersections are outlined on Table 4-7: Street Design Element Summary and are provided on Standard Detail 215.
- viii. Minimum grade on cross-pans at the flowline shall be 0.75%.
- ix. Curb returns shall be designed to meet these standards.
- x. Refer to Section 4.9 for additional information for cross slope limitations specific to widening on existing streets.
- xi. Refer to Standard Detail 221 for minimum and maximum cross slope grades on cul-de-sacs.
- 6. Grade Breaks/Grade Changes must be clearly depicted on the Construction Improvement Drawings on both the plan and the profile view, and must meet the following criteria:
 - i. Grade breaks shall be spaced with a minimum of 25' of separation.
 - ii. Grade breaks larger than 0.50% require use of a vertical curve (sag or crest).
 - iii. Other than at stop-controlled intersections, no single point grade break shall exceed 0.50%.
- 7. Vertical Curves:
 - i. Minimum length of vertical curves must be in accordance with Standard Detail 216 and 217.
 - ii. For crest curves the street centerline and curb and gutter must be constructed with vertical curves in accordance with Standard Detail 216.
 - iii. For sag curves the street centerlines must include a vertical curve with the minimum length as shown on Table 4-7: Street Design Elements Summary for grade changes exceeding 0.50%/0.75%.
 - iv. K-Values for design must meet the minimum values shown on Table 4-7: Street Design Element Summary.
 - v. Grade breaks in series may be used in lieu of a specified vertical curve as long as the series of breaks meet the vertical curve criteria in these DESIGN STANDARDS for the design speed.
 - vi. No grade changes are allowed at the beginning or end of a vertical curve; the curve information shall be based on the curve going into or out of the vertical curve.
- 8. Vertical Clearance above a roadway is a minimum of 16.5 feet.

K. Sight Distance

- 1. The sight distance shall be measured to the centerline of the closest through-lane in both directions.
- 2. The sight distance design procedure shall assume a 6-foot-high fence (as measured from actual finished grade) exists at all property lines except in the sight distance easements that may be required to preserve the needed sight distance. Stopping sight distances based on design speed are summarized on Table 4-6: Stopping and Passing Sight Distance*.
- 3. Stopping Sight Distance for Vehicle Crest Curves is to be calculated as follows:
 - i. Object height is 2.00 feet above road surface and viewer's height is 3.50 feet above road surface.
 - ii. Stopping Sight Distance on Horizontal Curves is based upon lateral clearance from the inner edge of pavement to sight obstruction, for various radii of inner edge of pavement and design speeds. Where an object off the pavement restricts sight distance, the minimum radius of curvature is determined by the stopping site distance.
 - iii. The position of the driver's eye and the object sighted shall be assumed to be 6 ft. from the inner edge of pavement, with the sight distance being measured along this line.

4. Passing Sight Distance is provided for reference, and is typically applicable to rural applications only. Passing zones may be required on two lane roadways, with the required passing sight distance as shown on Table 4-7.
5. Corner Sight Distance provides for vehicles to enter traffic and accelerate to the average running speed.
 - i. Corner Sight distance shall be measured as shown on Standard Detail 200.01.
6. Sight Distance Triangles and Easements
 - i. Sight Distance Triangles must be depicted on the Construction Improvement Drawings (CDs) on both the Landscape Plans and on the Street Plan and Profile Drawings.
 - ii. All sight distance triangles must occur within the street right-of-way (public or private) or a sight distance easement (for any/all portions of the sight distance triangle falling outside of public right-of-way) will be required.
 - iii. If the sight distance triangle falls outside the street right-of-way, a site distance easement must be shown on the plat and dedicated to the Town of Johnstown. A plat note must be included mandating that maintenance is the responsibility of the property owner, but that the Town can enter the property if needed to maintain the sight distance triangle at the property owner's expense. The Town will not maintain private property.
7. Sight Obstructions
 - i. Any object within the sight distance easement more than 30 inches above the flowline elevation of the adjacent street shall constitute a sight obstruction, and shall be removed or lowered. Such objects include but are not limited to:
 - a. Berms,
 - b. Buildings,
 - c. Parked vehicles on private property,
 - d. Cut of fill slopes,
 - e. Hedges ,trees, bushes, tall crops,
 - f. Utility cabinets,
 - g. Mailbox clusters.
 - ii. Parked vehicles generally shall not be considered an obstruction for design purposes; however, the Town reserves the right to limit parking at intersections to protect visibility.
 - iii. In no case shall any permanent object encroach into the line-of-sight or any part of the sight-distance triangle.
 - iv. On horizontal curves line of site shall be provided as noted on Standard Detail 200.18.
 - v. Street trees as required by the Town of Johnstown are excepted from this requirement if pruned up to a height of 8 feet.
 - vi. In addition to the sight distance triangle requirements, a clear space zone is required within all curb returns (measured from point of curb return to point of curb return) where no trees, shrubs, aesthetic structures/features, monument signs, or objects that have the potential to hinder driver visibility, and/or pedestrian and bicycle safety, are allowed. See Standard Detail 200.06.

Table 4-6: Stopping and Passing Sight Distance*		
DESIGN SPEED (MPH)	STOPPING SIGHT DISTANCE (Ft)	PASSING SIGHT DISTANCE (Ft)
20	115	400
25	155	450
30	200	500
35	250	550
40	305	600
45	360	700
50	425	800
<i>*All data derived from AASHTO's Green Book, Tables 3-1 and 3-5</i>		

L. Superelevation on Horizontal Curves

1. Superelevation may only be utilized with other means of design will not work due to topography or other constraints. Where necessary, the following criteria must be followed:
 - i. Superelevation may be allowed for curve on Arterial and Major Collector streets to reduce the minimum centerline radius. In no case shall superelevation exceed a 4.0 % cross slope.
 - ii. Superelevation shall not be used to reduce minimum radii on Local or Minor Collector Streets.
 - iii. Where superelevation is utilized, a minimum 100-foot run-out shall be used entering and existing the superelevated portion.
2. Superelevated sections:
 - i. Gutter shall be inflow type.
 - ii. Water must enter the storm drain system or another acceptable outlet from the street rather than crossing as sheet flow across the street.
 - iii. Crosspans are not allowed across the superelevation section.

M. Design Speed

1. For design speed standards, refer to Table 4-7: Street Design Elements Summary.

N. Curb Return Radii

1. For curb radii standards, refer to Table 4-7: Street Design Elements Summary.

O. Streetscape Design

1. Refer to the Town's Landscape Design Standards, available on the Town's website for streetscape design criteria.

P. Medians

1. In the Town of Johnstown, painted or raised medians are required on all Arterial Streets. Refer to Standard Detail 205. Raised medians may be applicable and may be considered on a case-by-case basis on other category streets.
 - i. Raised medians shall be a minimum of 4 feet (4') in width and shall have an 6-inch (6") curb w/attached gutter to convey drainage, or with an 6" barrier curb where drainage is not being conveyed along the curb.
 - ii. The nose of medians shall be tapered to two inches (2") above finished grade for a minimum of 4 feet (4') from the face of the curb on the nose, and the curb radius on the nose shall be a minimum of 2 feet (2') to the flowline.
 - iii. Appropriate signage at the nose of medians shall be provided.
 - iv. Where requested as part of new development, developer requested raised medians may be accepted by the Town's Public Works Director so long as additional right-of-way is dedicated, and all landscape and irrigation maintenance is conducted by viable private parties.
 - v. All non-landscaped areas of medians shall be paved with stamped concrete, brick pavers, concrete, or exposed aggregate concrete in accordance with streetscape standards of the Town of Johnstown. The ends of medians shall transition into turn lanes with a minimum radius of 100'. A change of directions must be accomplished with the use of radii. Angle points shall not be allowed. No permanent structures, including light poles, fire hydrants, trees, etc. shall be placed within five feet (5') of the travel lane.
 - vi. Where streetlights are placed in the median, if placed within five feet (5') of the travel lane, the light pole standard must be breakaway. See Section 4.13 for street light requirements.

Q. Cul-de-Sacs, Eyebrows and Knuckles

1. Cul-de-sacs:
 - i. Placement and use of cul-de-sacs must be in accordance with these DESIGN STANDARDS, and with the Town's Land Development Code.
 - ii. Cul-de-sacs must be designed with maximum lengths that are compliant with the local Fire District's standards.
 - iii. Refer to Standard Detail 221 for minimum and maximum slopes and radii.
 - iv. Snow storage is required on cul-de-sacs per Standard Detail 222 and Standard Detail 223.
 - v. Surface drainage shall be directed toward the intersecting street, or if this is not reasonably practical, to a drainage structure and easement provided at the end of the cul-de-sac. Rear draining cul-de-sacs are discouraged. The Design Professional is referred to Chapter 6, Section 6.09 for storm drain inlet placement considerations on cul-de-sacs.
2. Eyebrows:
 - i. Eyebrows as described in LCUASS are not permitted in the Town of Johnstown.
3. Knuckles:
 - i. Street widening is required at locations where two Local Streets are intersecting at a radius corner as shown on Standard Detail 200.03.

R. Dead-End Streets

1. New permanent dead-end streets are not allowed in the Town of Johnstown.
2. Temporary dead-end streets are permitted only on streets that have no direct access from adjoining property and are planned to be extended for connectivity into neighboring property during a later development phase or project.
3. The dead-end street must be fully constructed to the property line using the permanent street section configuration, and if longer than 150' a temporary turnaround will be required.
 - i. Temporary turnarounds shall have a minimum radius of 50', and curb and gutter is not required. See Standard Detail 221.
 - ii. Temporary turnarounds must be inside an Access Easement, which may be vacated when the permanent street is extended (e.g., ceases to be a "dead-end" segment).
 - iii. Access Easement negotiations with adjacent property owners and all exhibits and legal descriptions for the Access Easement must be initiated and paid for by the Applicant proposing the temporary dead-end/turnaround.
4. Dead-End signage and street termination barricades will be required, refer to Standard Detail 226.

Table 4-7: Street Design Elements Summary												
		FUNCTIONAL CLASSIFICATION										
		ARTERIAL				COLLECTOR		LOCAL		ALLEY		
		Major Arterial	Minor Arterial		Major Collector	Minor Collector	Local Street (Residential)	Local Street (Industrial and Commercial)	Alley			
Overall Design Parameters	Number of Dwelling Units Served		N/A		N/A		>251	100-250		<100	N/A	N/A
	ADT at Build-Out or 20-year design horizon, whichever is greater		16,001-48,000		7,001-16,000		3,001-7,000	1,001-3,000		201-1000	201-1000	
	Right-of-Way Width		120'		110'		80'	65'		60'	60'	20'
	Total Through Lanes		4 to 6		2 to 4		2	2		2	2	1
	Minimum Travel Lane Width		12'		12'		12'	11'/12'		12'	10'	
	Minimum Bike Lane Width (exclusive of gutter)		5'		5'		5'	5'		Share Street	Share Street	
	Minimum Sidewalk Width (detached required)		10'		10'		6'	6'		5'	5'	N/A
	Parking Lane Width		None allowed		None Allowed		None Allowed	6'		6'	6'	
	Curb Type		Vertical		Vertical		Vertical	Vertical or Roll		Vertical or Roll	Vertical or Roll	
	Raised Median (width includes curb and 1' gutter pan)		18'		14'		16' flush	N/A		N/A	N/A	N/A
Horizontal and Vertical Alignment	Speed-Maximum (Design/Posted)		50/45		45/40		35/35	35/35		25/25	25/25	15/15
	Minimum Tangent Length		200'		200'		150'	100'		100'	100'	20'
	Minimum Centerline Radius (no superelevation)		995'/830' w/SE		775'		475'	475'		175'	175'	60'
	Minimum Centerline Arc Length		400'/6°		400'/8.8°		300'/14.3°	300'/14.3°		100'/32.7°	200'/32.7°	N/A
	Cross Slope Standards		Maximum 3% new construction; 4% for reconstruction- Minimum 2% no superelevation is allowed on local or collector streets.									
	Minimum Flowline Curb Radius	Arterial	50'		50'		30'	30'		25'	25'	N/A
		Collector	30'		30'		25'	25'		20'	20'	15'
		Local	25'		25'		20'	20'		15'	15'	15'
	Maximum Street Grade		5%		5%		6%	6%		6%	6%	6%
	Minimum Street Grade		0.75%									
Maximum Grade at Intersection		See Standard Detail 215										
Minimum K-Values for Vertical Curves	Crest	84		84		44	44		19	19	12	
	Sag	96		96		64	64		37	37	26	
Access Control	Minimum Sight Distance at Driveways and Intersections		500'		450'		350'	350'		250'	250'	210'
	Minimum Distance Between Intersections	Raised Median	No	Yes	No	Yes						
		Unsignalized	1320'	660'	1320'	660'	330'	250'	200'	200'	N/A	
		Signalized	2640'					N/A	N/A	N/A	N/A	N/A
	Distance Between Driveway Edges/Entrance Type		660'/radial			330'/radial	75'/radial	30'/curb cut	30'/curb cut	12'/curb cut	12'/curb cut	
	Minimum Corner Clearance Between Driveways/alleys and Intersections (as measured from flowline to flowline)		1320' (>45MPH)		660'		175'	100'	80'	80'		
	Driveway Access Restrictions (1 single access for commercial off arterial or major collector only if lower classification access is not available)	Commercial	SEE ALSO Driveway Approach Design Requirements.					Single (1) per Frontage ¹	Two (2) per Frontage max.	No Limit	No Limit	N/A
		Residential	No access allowed							One	One	One

S. Crossspans and Drainage Systems

1. Drainage from new development cannot adversely impact the function of the Town's streets upstream or downstream of the development. Refer to Chapter 6 – Stormdrain Design Standards for additional information regarding offsite stormwater impacts.
2. The Town's design requirements for the placement of inlets and storm drain in proposed streets, to safely convey stormwater runoff, can be found in Chapter 6, Section 6.09.
3. Underdrain standards and design requirements can be found in Chapter 8, Section 8.09.
4. Crossspans for passing storm drainage flow across roadways shall be constructed as shown on Standard Detail 209 and must meet the following criteria:
 - i. Crossspans shall be constructed of fiber reinforced concrete, at the thicknesses indicated on Standard Detail 209 based on the functional classification of the street.
 - ii. Crossspans shall be a minimum of 6' wide on Local and Collector Streets, and 8' wide on Arterial Streets.
 - iii. Midblock crossspans are discouraged in all locations and will not be allowed on Arterial or Collector Streets.
 - a. Where proposed on local streets, midblock crossspans must be a minimum of 12' wide.
5. Crossspans shall not be placed on through streets, and shall only be placed on the branch of the intersection on the Local Street that has the designated full stop.

T. Major Structures

1. Major structures, such as retaining walls, box culverts and bridges, that are appurtenant to the proposed street and/or parking lot construction, must conform to the structural design and loading requirements of the Colorado Department of Transportation Standard Specifications for Road Bridge Construction and the Town's geometric and drainage requirements outlined in Chapter 6, Section 6.12.
2. Plans and supporting calculations must be prepared and sealed by a qualified structural engineer who is a Registered Professional Engineer licensed to practice in Colorado.
3. Retaining Walls:
 - i. Retaining walls and abutments are prohibited within the publicly maintained right-of-way.

U. Emergency Access Requirements

1. Refer to the specific regulations of the fire authority serving the property.

V. Bus Bays and Bus Shelters

1. Bus bay locations must be approved on a case-by-case basis by the Town's Public Works Director.
2. Bus shelters may not impede sidewalk access, and must be setback from the back of curb.

Section 4.10 Access Requirements

A. Access to Public Streets

1. This section contains criteria for the two types of access commonly allowed in the Town of Johnstown:
 - i. Access for Land Use (Driveways) and,
 - ii. Public Street Intersections

2. Placement of new or modified access requires a permit. Access is granted through approval of the Final Plat, Final Construction Improvement Plans, or Site Development Plan. See Chapter 2, Standard Submittal Procedures for permit and plan submittal requirements.
 - i. The Design Professional is advised that access to State or County roadways will require additional permitting from the affected agency (CDOT, Weld or Larimer County).
 - ii. An Access Control Plan may be required, or may have been adopted for specific areas in the Town. In this case, the proposed access must conform with the applicable Access Control Plan.

B. Designing Placement of Access Points

1. Direct access to individual lots from Johnstown's Arterial and Collector streets is restricted, see Table 4-7: Street Design Element Summary.
2. Proposed access connections on streets intersecting an arterial roadway shall not be less than 200' from the centerline of an arterial roadway. Minimum access distances from other intersections and/or street types are specified on Table 4-7. If special circumstances are present to necessitate lesser minimum spacing, the Design Professional shall use the Town's Design Standard Exception process outlined in Chapter 2, Section 2.05.
3. Offset access points should be avoided, (e.g., access points across the street from each other should line up). The Design Professional is encouraged to review driveway and/or intersection placement of adjacent development to ensure offsets do not occur. For required separation distances of access points, refer to Table 4-7 for specific spacing criterion based on the street's functional classification.
 - i. Where offset access is unavoidable, the left turn movement into these accesses cannot conflict or compete for the simultaneous use of a center left turn lane, or right-in/right-out only access(es) may be required.

C. Street and Roadway Access Criteria

1. State Highways and Frontage Roads
 - i. Access to state highways is governed by the State Highway Access Code, state highway access plans and these DESIGN STANDARDS. All access issues on state highways within the Town of Johnstown shall be submitted to the Colorado Department of Transportation and approved before access permits will be issued by CDOT. The proposed access points to a state highway shall be in accordance with Table 4-7: Street Design Elements Summary and:
 - a. Access to Freeways
 - 1) *All new freeway access in the Town of Johnstown shall meet the requirements of the Colorado Department of Transportation and must meet CDOT Standards.*
 - b. Existing Frontage Roads
 - 1) *Proposed access to all frontage roads shall comply with the requirements of the Colorado Department of Transportation State Highway Access Code, any applicable access control plan and the requirements of these DESIGN STANDARDS.*
2. Major Arterials
 - i. Access to Major Arterials must be obtained through the Town's development review process, based on the following:
 - a. For any driveway or street access to a four (4) lane or six (6) lane Major Arterial, an Access Management Plan and a Signal Progression Plan will be required. Refer to Section 4.03 Transportation Impact Studies to determine content requirements for these plans. Note that Traffic Impact Analysis requirements can be found in a separate document included herein as Appendix A.

- ii. Private direct access shall not be allowed onto a four (4) or six (6) lane Arterial Streets in the Town of Johnstown. Private direct access may be permitted only when the property in question has no other reasonable access to the general street system. Auxiliary turn lanes are required to be provided.
 - a. Access may be permitted when the alternative direct access to another roadway would cause unacceptable traffic operation and/or safety problems to the overall traffic flow of the general street system.
 - b. Private access points must be compliant with the applicable Access Management Plan.
 - c. When private access must be provided, the following shall be considered:
 - 1) *Temporary Nature. Such access shall continue only until such time that some other reasonable access to a lower function category street is available and permitted. The Access Permit shall specify the future reasonable alternative access location(s), if known, and what changes will be required to accommodate the access relocation.*
 - 2) *Limitations. No more than one access shall be provided to an individual parcel or to contiguous parcels under the same ownership unless it can be shown that:*
 - 3) *Allowing only one access conflicts with safety regulations (e.g., fire access), or*
 - 4) *Additional access would significantly benefit safety and operation of the highway or street and is necessary to the safe and efficient use of the property.*
- iii. Access from Major Arterials shall be limited to right turns only (right-in/right-out) through signage and a raised median unless:
 - a. The access has the potential for signalization, in accordance with the general spacing requirements in Table 4-7: Street Design Element Summary.
 - b. Left turns would not create unreasonable congestion or safety problems and not lower the level of service, and
 - c. Alternatives to the left turns would cause unacceptable traffic operation and safety problems to the general street system.
- iv. Offset from Opposite Streets.
 - a. Intersections of streets with Arterial Streets where a traffic signal or roundabout will be permitted and must align with streets intersecting on the opposite side of the Arterial Street.
 - 1) *Unless a raised median exists within the arterial roadway that restricts the access at the intersections to right-in and right-out turns only.*
 - 2) *All other private access intersections must be offset by the distances given in Table 4-7: Street Design Element Summary.*
- v. Public Street Direct Access Requirements
 - a. Public street direct access to a 4- or 6-lane Arterial Street, where left turns are to be permitted, must meet the signal spacing criteria and the conditions established in the Access Management Plan.
 - b. Those that do not meet these requirements shall be limited to right turns only, unless they meet the requirements above.
 - c. Local streets should not intersect 4- or 6-lane Arterial Streets
 - d. Spacing and Signalization Criteria
 - 1) *Full access to 4-lane or 6-lane Arterials shall be limited to one-half mile intervals to achieve good speed, capacity, and optimal signal progression.*
 - 2) *If additional access locations are desired and/or needed to provide flexibility for both existing and future conditions, the Design Professional shall propose these access points using the Town's Design Standard Exception Process.*
 - 3) *An approved engineering analysis of signal progression shall be prepared. The required content of this analysis is detailed in Section 4.03.*

3. Minor Arterial

- i. Minor Arterial access must be approved through the Town's development review process, based on the following:
 - a. 4-Lane Minor Arterials:
 - 1) *Access requirements and restrictions for 4-lane Minor Arterials shall be the same and for Major Arterials.*

- ii. 2-Lane Minor Arterials:
 - a. Private Direct Access shall not be allowed onto a 2-lane Arterial Street except where no alternative access is available. Private direct access onto a 2-lane Arterial Street may be permitted under the following conditions:
 - 1) *No Signalization Potential (the access does not have the potential for signalization as per the requirements of Section 4.03) or,*
 - 2) *The access has the potential for signalization, by meeting the signal spacing requirements for intersecting public streets and does not interfere with the location, planning, and operation of the general street system and access to nearby properties in accordance with the Access Management Plan.*
 - b. Left turns may be prohibited, allowing right turns only. If left turns are restricted, raised medians will be required to prevent the left turn movements.
 - c. Public Direct Access Requirements
 - 1) *Public direct access to a 2-lane Arterial Street, where left turns are to be permitted, must meet the signal spacing criteria in Table 4-7: Street Design Elements Summary.*
 - 2) *Those that do not meet these requirements shall be limited to right turns only-unless meeting the requirements of Section 4.09(C).*
 - 3) *No local streets should intersect 2-lane Arterial Streets.*
 - d. Spacing and Signalization Criteria
 - 1) *Non-signalized full access to 2-lane Arterials shall be limited to one-quarter mile intervals, plus or minus approximately 100 feet, to achieve good speed, capacity, and optimal signal progression.*
 - 2) *Signalized intersections shall still be spaced at one-half mile spacing.*
 - 3) *To provide flexibility for both existing and future conditions, an approved engineering analysis of signal progression shall be made to properly locate any proposed access that may require signalization.*
 - 4) *The specifics of this analysis are detailed in Section 4.03, Transportation Impact Studies.*
4. Major and Minor Collectors
- i. Major and Minor Collector access must be obtained through the Town's development review process, based on the following:
 - a. Private Direct Access to Collector Streets
 - 1) *Private access to Collector Streets and intersection spacing requirements, shall be governed by the criteria established on Table 4-7: Street Design Element Summary.*
 - 2) *Individual single-family residential dwelling driveway access to Collector Streets is not permitted unless access to a lower function category street is not available.*
 - b. Offset from Opposite Streets
 - 1) *Streets intersecting on opposite side of Collector Streets shall be directly across from each other or offset based on the distances provided on Table 4-7: Street Design Element Summary.*
 - c. Local Streets and Alleys access must be obtained through the Town's development review process, based on the following:
 - d. Private (driveway) access to local streets shall be determined based on the curb opening criteria outlined in Section 4.10(E) and must be spaced in accordance with Table 4-7: Street Design Element Summary. Alleys shall be centered at half the distance between two intersections or not less than 150 feet from the nearest Local Street intersection.
 - e. Shared driveways shall meet the same spacing criteria as alleys.

D. Curb Openings and Driveways

1. Driveways which serve properties adjoining the right-of-way, shall be served through a curb cut. The portion of the driveway within the right-of-way is called the driveway approach.
2. Layout Criteria
 - i. The opening or driveway approach width shall be adequate to properly handle the anticipated traffic volume and character of traffic, as well as being within the limits specified for the type of property development.
 - ii. High Volume Driveway Access
 - a. A High Volume Driveway Access must be a Radial Access Type (aka Return Type Opening) in accordance with Table 4-7: Street Design Element Summary, Table 4-8 Driveway Approach Design Requirements and Standard Detail 214, and whenever any of the following conditions occur:
 - 1) *Access onto an arterial or major collector street.*
 - 2) *The driveway is for an adjoining commercial land use.*
 - 3) *The driveway has a volume of 350 or more trip ends per day and enters directly onto a Collector Street, Local Commercial or Industrial Street.*
 - b. High Volume Driveways must have a minimum width of 28 feet and a maximum width of 36 feet.
 - 1) *If additional maximum width is necessary and warranted, a median (designed to a minimum width of 6 feet) may be required in order to divide the inbound from the outbound traffic. See Chapter 4, Section 4.09 for median design requirements.*
 - 2) *The need for turn lanes must be evaluated in accordance with Chapter 4, Section 4.09, with the submitted Transportation Impact Study as required in Chapter 4, Section 4.03, and in accordance with the requirements of Chapter 4, Section 4.10.*
 - iii. Low Volume Driveway Access
 - a. Any driveway not determined to be built with a radial access opening in accordance with the requirements set forth for High Volume Driveway Access, shall be designed and constructed as a standard driveway (aka Wing Type Opening) in accordance Table 4-8 and Standard Detail 214 (as applicable).
 - 1) *Multi-Family dwelling unit driveways (3 or more units) are acceptable with a minimum width of 24 feet and a maximum width of 36'.*
 - 2) *Driveways that serve 12 units or more shall have a minimum width of 28 feet (this width may be reduced to 24 feet on low traffic volume streets) and a maximum width of 36 feet. Individual Single-Family lot driveways shall have a minimum width of 12' and a maximum width of 24" in accordance with Standard Detail 214.*

E. Layout Requirements

1. Sight Distance –Driveways
 - i. All openings for driveways shall be located at the point of adequate sight distance along the street. Accesses to commercial, office and multifamily residential establishments shall have sufficient space reasonably clear of any obstructions to provide drivers entering the property sufficient sight distance for proper and safe movements. All design must provide minimum safe stopping sight distance in accordance with Section 4.09(K) and AASHTO requirements.
 - a. The profile of a driveway approach and the grading of the adjacent area shall be such that when a vehicle is located on the driveway outside the traveled portion of the street the driver can see a sufficient distance in both directions to enter the street without creating a hazardous traffic situation.
 - ii. The Town of Johnstown does not allow driveway access points to serve as a pedestrian accessible route alternative. Appropriate pedestrian access points (Curb cuts/ramps/etc.) must be provided.
 - iii. Adjustments for Existing Structures
 - a. Any adjustments made to utility poles, street light standards, fire hydrants, catch basins or inlets, traffic signs and signals, or other public improvements or installations that are necessary for new curb openings or driveways shall be accomplished without cost to the Town of Johnstown.

- iv. Entrance-Only and Exit-Only Approaches
 - a. Driveway approaches, where the driveway is to serve as an entrance only or as an exit only, shall be appropriately signed by, and at the expense of, the property owner.
 - b. The property owner shall provide means to ensure that motorists will use the driveway as only an entrance or an exit only. All such required signage shall be installed and maintained by the property owner.
 - c. In the event such signage is not maintained adequately, the Town may perform the required maintenance at the Property Owners expense.
- v. Access to rural roadways
 - a. Refer to Chapter 4, Section 4.05(G) for the Town's criteria related to private single driveway access from rural lots to rural roadways.
- vi. Maintenance of the access and drainage improvements within the right-of-way described in Chapter 4, Section 4.02(C) shall be the responsibility of the adjacent property owner or other designated private entity, including all improvements to driveways within right-of-way.
- vii. Driveway Approaches All driveway approaches must comply with Table 4-7: Street Design Elements Summary and Table 4-8: Driveway Approach Design Requirements.

F. Unpermitted access

- 1. Any access, driveway, or curb-cut which is constructed within public right-of-way without a right-of-way or access permit issued by the Town shall be subject to removal.
- 2. Failure to remove the unpermitted access may result in the removal of said access by the Town of Johnstown. The cost for removal and restoration shall be charged to the property owner from which the access originates.

G. Removal/Abandonment of Access

- 1. Any curb opening or driveway that has been abandoned shall be removed and the curb profile and right-of-way restored by the property owner except where such abandonment has been made at the request of the Town.

Table 4-8: Driveway Approach Design Requirements						
Type of Access:	Single Family Residential	Shared Residential	Multi-Family Residential	Commercial	Commercial with less than 150' lot frontage	Industrial
Number of Openings (Opening locations must meet spacing criteria, and TIA may be required see refer to TIA requirements on the Town's Website)	One Access	One-Access for use by two adjacent properties—access easement required	Two	Two	One (unless building in centered w/parking on each side)	Two
Width of Opening	Min 12' Max 24' (if 3-car garage: Max 30')	Min 12' Max 24'	Min 24' (3 or more units) Min 28' (12 or more units) Max 36'	Min 24' Min 28' (if ADT exceeds 350) Max 36'	Min 24' Min 28' (if ADT exceeds 350) Max 36	
Frontage on Lot	No more than 50% of frontage can be driveway access, unless on a cul-de-sac or flag lot	Cannot exceed 40% of Frontage	Cannot exceed 40% of Frontage	Cannot exceed 40% of Frontage	Cannot exceed 40% of Frontage	Cannot exceed 40% of Frontage
Surface Type	Portland Cement Concrete only	Portland Cement Concrete only	PCC/Asphalt	PCC/Asphalt	PCC/Asphalt	PCC/Asphalt
Opening Type	Curb Cut	Curb Cut	Radial	Radial	Radial	Radial
Intersecting Angle (Entrance Angle)	90 ⁰ for all driveway approaches preferred. Minimum angle permitted 80 ⁰ to 100 ⁰ for a minimum of 25' measured perpendicular to the street from the curb or edge of pavement toward the private property served.					
Corner Clearance	Refer to Table 4-7: Street Design Elements Summary					

Section 4.11 Traffic Control Devices

A. General

1. On December 15, 2011, the Transportation Commission of Colorado adopted the Federal Manual on Uniform Traffic Control Devices 2009, (MUTCD) for use in Colorado. The MUTCD is a national publication that outlines the proper usage of traffic control devices. It contains national standards for the design, application, and placement of signs, signals, pavement markings and other types of traffic control devices. It describes how traffic control devices are to be used in a variety of situations such as local street operations, bicycle and pedestrian crossings, school zones, and work zones. Use of the MUTCD is mandatory on all public highways, roads and streets in Colorado. This is pursuant to section 42-4-104 and 42-4-105 of the Colorado Revised Statutes.
2. Signing and Striping Plans, demonstrating compliance with the MUTCD requirements, and Colorado Revised Statutes, and with these DESIGN STANDARDS, must be submitted as part of the Construction Improvement Drawings, see Chapter 2, Section 2.06.
3. Traffic signal, regulatory signage and pavement marking placement on streets and/or roadways managed and maintained by Larimer County, Weld County or the Colorado Department of Transportation will require that the Design Professional secure the approval and any required permits from the affected agency. Copies of such approved permits shall be submitted to the Town of Johnstown for Town records.
4. Placement of any proposed Traffic Signals and/or stop or yield signs must meet one or more appropriate warrants under the MUTCD. Appropriate warrant documentation must be provided in the Construction Plans or associated Traffic Impact Analysis.
5. Materials used for traffic signals, regulatory signage, and pavement markings must comply with the Town's Approved Materials List and placement and fabrication must comply with the Town's Standard Specifications (See Design Standards Volume II).
6. All permanent signage and striping, unless otherwise approved by the Public Works Director shall be completely in place before any new street is opened to the public.
7. Street name designations shall be obtained from the approved Plat.
8. Signals, signage, and pavement markings must be placed inside the public right-of-way, and once final acceptance is issued by the Town, will be maintained by the Town of Johnstown. Prior to issuance of final acceptance, maintenance will be the responsibility of the developer and/or property owner.
 - i. Placement of any improvements, including traffic signals, regulatory signage, and pavement markings in right-of-way held by the Town may require a Right-of-Way Permit. Refer to Chapter 2, Section 2.04 for additional information.
 - ii. Extensions must be requested in writing, and submitted to the Public Works Director. If weather or other conditions outside the Developer's control prevents installation of required permanent signage and striping prior to requested conditional project acceptance by the Town.

B. General

1. On December 15, 2011, the Transportation Commission of Colorado adopted the Federal Manual on Uniform Traffic Control Devices 2009, (MUTCD) for use in Colorado. The MUTCD is a national publication that outlines the proper usage of traffic control devices. It contains national standards for the design, application, and placement of signs, signals, pavement markings and other types of traffic control devices. It describes how traffic control devices are to be used in a variety of situations such as local street operations, bicycle and pedestrian crossings, school zones, and work zones. Use of the MUTCD is mandatory on all public highways, roads and streets in Colorado. This is pursuant to section 42-4-104 and 42-4-105 of the Colorado Revised Statutes.
2. Signing and Striping Plans, demonstrating compliance with the MUTCD requirements, and Colorado Revised Statutes, and with these DESIGN STANDARDS, must be submitted as part of the Construction Improvement Drawings, see Chapter 2, Section 2.06.
3. Traffic signal, regulatory signage and pavement marking placement on streets and/or roadways managed and maintained by Larimer County, Weld County or the Colorado Department of Transportation will require that the Design Professional secure the approval and any required permits from the affected agency. Copies of such approved permits shall be submitted to the Town of Johnstown for Town records.
4. Placement of any proposed Traffic Signals and/or stop or yield signs must meet one or more appropriate warrants under the MUTCD. Appropriate warrant documentation must be provided in the Construction Plans or associated Traffic Impact Analysis.
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6. All permanent signage and striping, unless otherwise approved by the Public Works Director shall be completely in place before any new street is opened to the public.
7. Street name designations shall be obtained from the approved Plat.
8. Signals, signage, and pavement markings must be placed inside the public right-of-way, and once final acceptance is issued by the Town, will be maintained by the Town of Johnstown. Prior to issuance of final acceptance, maintenance will be the responsibility of the developer and/or property owner.
 - i. Placement of any improvements, including traffic signals, regulatory signage, and pavement markings in right-of-way held by the Town may require a Right-of-Way Permit. Refer to Chapter 2, Section 2.04 for additional information.
 - ii. Extensions must be requested in writing, and submitted to the Public Works Director. If weather or other conditions outside the Developer's control prevents installation of required permanent signage and striping prior to requested conditional project acceptance by the Town.
9. Private streets must provide regulatory signage and pavement markings as required by the MUTCD to assure public safety.
 - i. Signage, pavement markings, and traffic signals (including signalized pedestrian crossings) that are placed on private streets or within a private access easement must be maintained by the Metropolitan District, Homeowner's Association or other entity as described on the Subdivision Plat and in the Development Agreement.
10. The need for and placement of traffic signals and regulatory signage will be determined and described in the required Traffic Impact Analysis, as described in Chapter 4, Section 4.03 of these DESIGN STANDARDS, refer also to Appendix A.
 - i. Where traffic signals and/or regulatory signage is determined to be necessary in the Traffic Impact Analysis the following shall apply:

- a. Traffic signals, regulatory signage, and striping must be shown on the required Construction Improvement Drawings (CD's), and should have all other layers screened so that the information presented is clear and concise. Refer to Chapter 2, Section 2.06 for additional CD requirements.
 - b. The placement of required traffic signals shall adhere to the Development Agreement as required as part of the project's submittal and entitlement process.
 - c. The Design Professional must include the cost associated with traffic signalization and signage in the Engineer's opinion of Probable Cost for the project. Refer to Chapter 2, Section 2.03 for additional information. The Applicant is responsible for the installation of all traffic control devices, street name signs and pavement markings prior to opening or reopening a public street.
 - d. All cavities required for cable pulling purposes shall be constructed as load bearing manholes or handholes. Handholes shall not be placed in any traveled lane including road shoulders, sidewalks, multi-use paths, or bike lanes.
- ii. Trenching in roadways and landscape areas shall comply with the Town's Land Disturbance Standards, outlined in Chapter 3.

C. Traffic Signals

- 1. All intersections requiring a traffic signal shall include Opticom sensors for emergency vehicles. Configuration and placement should be verified with the appropriate emergency response agency.
- 2. Conduit Placement:
 - i. All primary circuits (greater than 600 volts) located under concrete road surfaces, where circuit density is high, and in all arterial streets or collector streets, shall be installed in a 4" minimum diameter conduit. Minimum depth of cover shall be 42".
 - ii. All secondary circuits (less than 600 volts) supply services greater than 800 amperes shall be installed in a 2" minimum diameter conduit. Minimum depth of cover shall be 30".
 - iii. All primary and secondary conduits shall be encased in 4" minimum thickness concrete with a minimum strength of 2000 psi.
 - iv. All Conduit joints shall be solvent welded.
 - v. A cable warning tape shall be placed 12"-18" above the conduit or cable in the trench.
 - vi. All aboveground facilities shall be protected from damage by vehicular traffic impacts or similar causes either by being located a safe distance from traffic or by structural barricades. These facilities may not cause an obstruction to pedestrian or vehicular traffic.
 - vii. Minimum clearance from highest finished surface of the road shall not be less than 18 feet (18') to the bottom of any aerial cables over the street. Such cables must conform to all National Electric Safety Code Standards and Institute of Traffic Engineers (ITE) Guidelines.

D. Traffic Control Signage

- 1. Sign specifications and diagrams must be compliant with the MUTCD, and Colorado supplement and as detailed in the latest revision of the Federal "Standard Highway Signs and Markings," latest version. This publication is available from the U.S. Department of Transportation, Federal Highway Administration. These DESIGN STANDARDS offer additional criteria specific to the Town of Johnstown.
- 2. All regulatory signage, for both public and private streets must be mounted on breakaway posts as shown on Standard Detail 227.
- 3. Signs shall not be mounted on existing street lights or power poles without approval by utility owner.
- 4. All street name signage must be fabricated and installed according to the Specification and Details provided in these DESIGN STANDARDS.
- 5. Internally luminated street name signs are not permitted.

6. The Design Professional must notate on the CD's the color and lettering distinctions between public and privately maintained streets. Signs shall be fabricated as follows:
 - i. Public Street: signage shall have green letters on a white background.
 - ii. Private Street: signage shall have white letters on a green background. All cul-de-sacs, temporary or permanent dead-end streets, and any other street with only one access point will be required to have a "No Outlet" sign.
 - iii. Bicycle signs for bike lanes shall be provided for all proposed bike lanes in the Town of Johnstown.
 - iv. If the approved design allows no parking along bike lanes located adjacent to the curb, standard symbol signs for "No Parking" shall be used.
 - v. Other signs for the beginning and ending points of bike lanes shall be used according to the MUTCD and *AASHTO Guide for Development of Bicycle Facilities* and shall be shown on the signing and striping plans.

E. Signage at Intersections

1. If the intersection has a signal, street name signs should be designed as part of the signal, and should be integral to the signal rather than having a separate post.
2. The location of all stop signs shall be determined by the Traffic Impact Analysis, and placed generally at the point of curvature (PC) a minimum of 2' from the back of curb.
3. The Public Works Director may allow Yield signs in lieu of Stop signs at some intersections. If Yield Signs are proposed, this should be clearly noted on the Construction Improvement Drawings for consideration on a case-by-case basis.
4. Intersection advance warning signs are required on 4-lane and 6-lane arterials in advance of major intersections. Refer to the MUTCD for placement distance and spacing in advance of the intersection.

F. Pavement Markings

1. It is the Town's policy (and CDOT's) to require the use of durable pavement marking (such as thermoplastic and cold plastic) on all Major Arterial, Minor Arterial, and Major Collector streets.
2. All pavement markings must installed according to the Specifications and Details provided in these DESIGN STANDARDS.
3. Pavement marking designs shall be in accordance with these DESIGN STANDARDS and the latest revision of the MUTCD and Colorado supplement to the MUTCD.
4. The Town of Johnstown's Public Works Director shall make the final determination for the required type and location of pavement striping and marking within the right-of-way during the review of the project Signing and Striping Plans.
5. Paint type requirements can be found in DESIGN STANDARDS Volume II, Technical Specifications.
6. All temporary striping shall conform to "Standard Specifications for Road and Bridge Construction," published by CDOT, the latest revision except as herein amended. When approved, temporary striping shall be required prior to the opening of a Roadway for travel where pavement and/or permanent striping cannot be completed due to weather and/or time constraints.
7. All crosswalks, arrows, sharrows (for bike lanes), and legends shall use pre-formed thermoplastics. Refer to Volume II for specifications.
8. Prefabricated legends and designs shall conform to the applicable shapes and sized as outlined in the MUTCD.
9. Lane Line markings:
 - i. Center line and lane line markings should be placed on Arterials and Collectors that have a traveled way of 20 feet or more in width and an ADT of 4,000 vehicles per day or greater.
 - ii. Center line markings and edge of pavement lines should also be placed on all Arterials and Collectors that have a traveled way of 18 feet or more in width and an ADT of 3,000 vehicles per day or greater.

- iii. Center line, lane line and edge of pavement line markings should also be placed on other traveled streets where the approved Traffic Impact Analysis indicates such a need.
- 10. Stop Bars
 - i. A stop bar shall be placed perpendicular to the center of the intersection.
 - ii. All stop bars shall be white and a minimum of 18 inches wide.
 - iii. Stop bars are required at all intersections with arterial and collector streets, and other locations specified by the Public Works Director and the approved Traffic Impact Analysis.
- 11. Crosswalks
 - i. Refer to Section 4.08 Accessible Pedestrian Design, for crosswalk requirements and associated signage placement requirements.

Section 4.12 Traffic Calming (Neighborhood Traffic Safety)

A. General

- 1. The traffic calming measure devices presented on Standard Details 219 through 220, are generally not intended for use on new streets.
 - i. New street design is addressed in Section 4.09. New (local streets and minor collectors) are to be designed to minimize cut through traffic, high volumes, and high speed operation and to maximize the efficiency of the street to provide vehicular access and bicycle and pedestrian traffic.
 - ii. Traffic calming measures are intended to minimize speeding issues on existing residential streets, and to return the quality of life to the neighborhood. Care must be taken by the designer so that the installation of traffic calming devices does not create unintended hazards that delay emergency response or jeopardize the safety of bicyclists, pedestrians or motorists.

Section 4.13 Street Lights

A. General

- 1. All street lighting of public streets in the Town of Johnstown will be designed in accordance with these DESIGN STANDARDS.
 - i. The Developer will be responsible for all costs of the design, material, and installation of street lights.
 - ii. The Developer is responsible for coordinating with the appropriate utility company relative to all aspects of design and installation.
- 2. A Street Light Plan will be required for placement of street lights in the public right of way. Refer to Section 4.04 for plan content requirement.
- 3. Street lighting shall be installed with underground electric service on all newly developed dedicated public streets in the Town.
- 4. Curb returns shall be installed after the installation of the electrical system, including underground vaults.

B. Purpose

- 1. The purpose of streetlight installations shall be to illuminate the public traveled ways to a level that provides for the safe passage of multi-modal traffic, both vehicle and pedestrian.
- 2. All lighting in commercial and residential areas shall be installed to minimize light pollution and light trespass, and shall follow criteria established in the Municipal Code specific to lighting.

C. Design Requirements

1. Uniform lighting will be used on new projects involving Arterial and Collector streets. The guidelines shall be the most recent editions of the American National Standard Practice for Roadway Lighting (ANSI/IES RP-8), the Colorado Department of Transportation Lighting Design Guidelines and supplemental guidelines provided herein. In the case of conflict, the more restrictive standard shall apply.
2. Streetlight poles, attachments to poles (mast arms, luminaires, banners, etc.) and pole foundations shall withstand loading due to forces from wind and ice loading as specified in the most recent American Society of Civil Engineers ASCE/SEI 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
 - i. Interpretation of exposure and risk categories used to determine ultimate wind speeds specified in ASCE/SEI 7 shall be reviewed and approved by the Public Works Director.
3. All fixtures, poles, and designs must be reviewed and approved by the power provider.
4. All fixtures must use downward directed LED lights, and must be Dark Sky compliant.
5. If integrating a Small Cell Wireless Communication Facility, pole must contain all wiring and electronics internal to the pole, and be as compatible as possible with other street lighting in the vicinity.
6. Non-standard replacements are the sole responsibility of the applicable Metro District or Homeowners' Association. Minimum replacement extent is one full block, between intersections, to ensure consistency and gradual upgrades over time.
7. If replacing existing custom fixtures for which sourcing has become difficult or impossible, the Town highly encourages replacement of fixtures using current DESIGN STANDARDS and Specifications.

D. Street Lights at Intersections

1. Arterials/Arterials: 4 lights required, one on each corner
2. Major Collector/Arterials: 4 lights required, one on each corner
3. Collector/Collector: 2 lights required, on opposite corners
4. Local/Collector: 2 lights required, on diagonally opposite corners
5. Local/Local: 1 light on one corner
6. End of Cul-de-sac and mid-block pedestrian crossings: 1 light required

Table 4-9: Street Light Design Elements

Street Classification	Spacing	Final Height (maximum)	Layout	Luminaries (LED REQ'D)	Illumination Levels		Uniformity Ratio (Avg. to Min) ¹	Pole Type	Pole Color
Major Arterial	120-175 feet	38' (6-lane) 32' (4-lane)	Staggered, and: At intersections On significant curves At pedestrian/trail crossings At end of cul-de-sacs • • • • •	400-W Cobra	High	17lx (1.7fc)	3:1	Galvanized Aluminum	Gray or Silver
Minor Arterial	150-175 feet	32'			Med	13lx (1.3 fc)			
					Low	9lx (0.9fc)			
				250-W Cobra	High	17lx (1.7fc)		Galvanized Aluminum	Gray or Silver
Med	13lx (1.3 fc)								
Low	9lx (0.9fc)								
Major Collector	150 feet	27'		150-W Cobra	High	12lx (1.2fc)	4:1	Galvanized Aluminum	Gray or Silver
					Med	9lx (0.9 fc)			
					Low	6lx (0.6fc)			
Minor Collector	150-200 feet	18'		70-W Acorn	High	12lx (1.2fc)		Fiberglass	Black
					Med	9lx (0.9 fc)			
					Low	6lx (0.6fc)			
Local Street	150-200 feet	18'		70-W Acorn	High	9lx (0.9fc)	6:1	Fiberglass	Black
					Med	7lx (0.9 fc)			
					Low	4lx (0.4fc)			
Pedestrian Walks, Trails, and Park Areas	50-100 feet	15'	Single light	70-W Acorn	Use Local Street Standard			Fiberglass	Black, Bronze, Green
Downtown Historic District	150-200 feet	18'	Staggered	70-W Acorn				Decorative	Dark Green

END OF CHAPTER

¹ Refer to LCUASS Table 15-1 for additional information if needed.

CHAPTER SIX

STORMDRAIN DESIGN STANDARDS

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CHAPTER SIX- Stormdrain Design Standards Adopted Standards

A. Mile High Flood Control District Standards

1. Policies and technical criteria for stormwater collection and conveyance not specifically addressed in these DESIGN STANDARDS shall follow the provisions of the Mile High Flood Control District (hereafter called "MHFD") "Urban Storm Drainage Criteria Manual" (hereafter abbreviated to USDCM).
2. The USDCM Volume 1, Volume 2, and Volume 3 as currently published or hereafter amended, are adopted by reference, with amendments and additions which are set forth herein.
3. A link to the USDCM is provided on the Town's website and copies can be obtained from the Mile High Flood District.

B. Additional Town of Johnstown Design Standards

1. The criteria and procedures contained in this Chapter are intended to supplement the USDCM Manual in ways specific to the Town of Johnstown.
2. In the case of a conflict between the USDCM and this Chapter, the supplemental criteria provided in these DESIGN STANDARDS shall take precedence over the USDCM.

Section 6.02 Drainage Enforcement

A. Enforcement Responsibility

1. It shall be the responsibility of the Public Works Director to enforce the provision of this Chapter, as the Public Works Department is the responsible department for reviewing drainage compliance for public projects and/or for private projects that are seeking entitlement through the Town's process as required by the Municipal Code (as amended) and through compliance with the process outlined herein.

Section 6.03 Drainage Report Submittal Contents

A. Submittal Requirements

1. Drainage reports and plans, construction drawings, specifications, and as-built information shall be submitted and approved as described in Chapter Two, and must contain the information outlined herein.
2. Additional submittals may be required, including ACOE Section 404 Permits, Floodplain Development Permits, and Environmental Permits based on the project scope and location. Requirements for these submittals will follow the guidelines set forth by the DESIGN STANDARDS and/or the State or Federal Agency that provides oversight.
3. The development specific Grading and Drainage Plan and Erosion and Sediment Control Plan must coincide with and support the findings and recommendations of the Drainage Report and Drainage Plan.
4. An Operations and Maintenance (O&M) Report for stormwater facilities and associated infrastructure must be included concurrent with the final drainage report.
 - i. The O&M Report shall include a copy of the applicable stormwater system construction plans, instructions on safe and correct operations, repair and maintenance of all installed stormwater system equipment and facilities, and recommended inspection schedules.
 - ii. The O&M Report is to be distributed to any applicable homeowners' association Metropolitan District and/or or business association (or equivalent) for their use in facility management.

B. Drainage Report Content

1. The Drainage Report shall contain the information as outlined in this Section, and must summarize and demonstrate compliance with the criteria set forth in these DESIGN STANDARDS.
 - i. The Drainage Report must fully document all assumptions and methodologies and shall contain copies of all applicable tables and reference materials in an appendix.
 - ii. A Drainage Basin Map shall be included showing basin delineations based on provided topography extending 100' past project boundaries, flow arrows, design points, pond volume, pond Qin, pond Qout, maintenance access locations, swale locations, stormdrain system location, emergency overflow location and flow paths, easement locations, location of any regulatory floodplain, and any other information pertinent to the required design.
 - iii. The Drainage Report and Drainage Plan Checklist, available on the Town's website, provides a framework of the Town's requirements for the drainage report, construction drawings and Operations and Maintenance (O&M) Report.
 - a. The Design Professional shall include this checklist with the preliminary and final submittals for the project as noted in Chapter 2, Section 2.03.

C. Preliminary Drainage Report

1. The Preliminary Drainage Report shall define the proposed development site, describe existing conditions, and propose needed stormwater facilities to meet the requirements of these DESIGN STANDARDS.
2. The Preliminary Drainage Report shall include, at a minimum, the following:
 - i. Certification Page.
 - ii. Executive Summary.
 - iii. General Project Location Map depicting drainage patterns and flows entering and leaving site.
 - iv. Scale 1"=1000' to 1"=8000'.
 - v. Location of all existing improvements.
 - vi. General description of proposed development in the Drainage Report Narrative shall include:
 - a. Area in Acres.
 - b. Location of Project, including Township, Section, Range and ¼ Section.
 - c. Local Streets (existing and proposed) within and adjacent to project.
 - d. Existing and proposed ground cover (types of trees, shrubs, and vegetation).
 - e. General topography.
 - f. General soil conditions and soil hydrologic types.
 - g. Existing and proposed drainage ways.
 - h. Exhibit and overview discussion of the existing or proposed system for transmission of the stormwater from the development site to final outlet to the either of the following:
 - 1) *An existing approved regional detention system, or*
 - 2) *To the Little Thompson River of the Big Thompson River (as applicable).*
 - v. Description of Basin and Sub-basins, including:
 - a. References to planning studies, FIS studies, Master Drainage Basin Planning Studies.
 - b. Reference to the most current applicable Stormwater Master Plan(s) for Town of Johnstown.
 - c. Discussion of major basin drainage characteristics.
 - d. Identification of all nearby irrigation ditches, laterals, streams, rivers, or wetlands which will be/may be influenced by the development's drainage and/or will/may influence the development.
 - e. Discussion of offsite historic drainage pattern(s).
 - f. Discussion of historic drainage patterns of proposed property.
 - vi. Drainage Design
 - a. Tabulated peak runoff for 5-year, 10-year and 100-year recurrence interval events.
 - b. Discussion of runoff calculation method and explanation of assumptions made in determining:
 - 1) *Runoff coefficients.*

- 2) *Time of concentration.*
 - 3) *CN values.*
- vii. Preliminary projection of necessary detention facility(ies) and its/their storage requirements and release rates
- viii. Drainage Facility Design
 - a. Discussion of compliance with off-site runoff allowances and considerations. (All development's post development stormwater release rates must be at or below the lesser of the historical rate or the applicable master plan defined allowable release rates).
 - b. Discussion of anticipated and proposed drainage patterns.
 - c. Discussion of tables, charts, figures, or drawings presented in report.
 - d. Approach to accommodate or remediate drainage impacts on existing or proposed improvements and facilities
 - e. Presentation of proposed facilities, including:
 - 1) *Alignment*
 - 2) *Material*
 - 3) *Structure type*
 - 4) *Preliminary detention pond sizing*
- ix. Discussion of long-term maintenance and drainage facility(ies) access relative to preliminary design.
- x. All criteria, master plans and technical information used in support of the preliminary drainage design concept has been referenced
- xi. All calculations in organized appendix, separate appendix for:
 - a. Undeveloped/historic hydrology
 - b. Developed hydrology
 - c. Preliminary detention pond sizing

D. Final Drainage Report

1. The purpose of the Final Drainage Report is to provide a detailed study and analysis of the proposed development. It shall include calculations for all runoff and for all drainage structures or facilities within the development. Also, any change to the Preliminary concept shall be presented.
2. The Final Drainage Report shall be submitted with the Construction Improvement Drawings for the site. The Final Report (which updates the Preliminary Drainage Study) shall be reviewed with the submittal of the CD's and approved by the appropriate Town Department(s) prior to issuance of construction permits.

E. Drainage Plan

1. A Drainage Plan must be submitted to accompany Drainage Report. The Drainage Plan must comply with and/or include the following:
 - i. Scale no more than 1"=200' on 24"x36" sheet.
 - ii. Large offsite basins may be shown on smaller sheets and in the appropriate appendix of the report.
 - iii. Existing contours (2' maximum interval), streets, roads, ditches, fence lines, streams, rivers, building, trees, utilities, wetlands, etc.
 - iv. Proposed spot elevations or contours, and spot flow arrows (with % grade) on streets and across planned lots and tracts.
 - v. Existing and Proposed streets, lots, tracts, etc.
 - a. Existing and proposed basin delineations and basin areas.
 - vi. Location and volume(s) of off-site runoff entering site.
 - vii. Location and volume(s) of runoff leaving site.
 - viii. Locations existing and proposed storm inlets, storm sewers, and drainage swales serving the site.

- ix. Documentation of existing regulatory 1% probability (100-yr) floodplain boundaries on or adjacent to the site.
- 2. The Drainage Plan must accurately reflect the proposed design depicted on the Construction Improvement Drawings (CD's).

Section 6.04 Statement of Policy and Purpose

A. Drainage System Design

- 1. The provision for adequate drainage in urban areas is necessary to preserve and promote the general health, welfare, and economic well-being of the region.
- 2. The Town of Johnstown recognizes drainage as a sub-system of all development; and as such, the planning and design of drainage facilities shall be included in the development process.
- 3. The purpose of the criteria set forth DESIGN STANDARDS is to prevent and/or mitigate loss or damage of property due to increased storm water runoff from proposed development.
- 4. The scope of all submitted reports and designs shall consider both property within the development and property adjacent to, upstream and downstream of the development.
- 5. Release rates and regional drainage information should be analyzed where available to assist in the storm drainage design for proposed developments.
 - i. The Town's Stormwater Master Plan(s) (as amended) and/or applicable regional stormwater detention system design reports (to which the development is tributary) should be referenced for proposed developments located within the basin boundaries of such Plan(s).
 - ii. It is the policy of the Town of Johnstown that that the maximum allowed release rate(s) from proposed development(s) be restricted to at or below the lesser of the historical rate(s) or the allowable rate(s) identified in the applicable regional system design or in Town's Stormwater Master Plan(s).

B. Use of Streets for Stormwater Collection and Conveyance

- 1. Streets are a significant component of the urban drainage system, and use of streets for storm runoff should be made within reasonable limits, recognizing that the primary purpose of streets is for traffic.
- 2. Reasonable limits of the use of streets for conveyance of stormwater are governed by design criteria provided in these DESIGN STANDARDS.
 - i. When maximum allowable street encroachment by stormwater will be exceeded, a storm drain system based on the 5-year recurrence interval event storm must be designed and constructed in accordance with these DESIGN STANDARDS.
 - ii. Drainage design objectives for streets as outline in these DESIGN STANDARDS include measures that effectively reduce street repair and maintenance costs, minimize nuisance to the public, and minimize disruption of traffic flow.

C. Use of Irrigation Facilities

1. Utilization of existing irrigation ditches as stormwater collection/conveyance elements in the drainage design and/or discharge of developed runoff into the irrigation ditch system will not be allowed in general within the Town of Johnstown.
2. Where required by decreed water rights, where such discharge is in conformance with the Town's Stormwater Master Plan (as amended), and/or with the express written permission of the affected Ditch Company. Some exceptions may occur but only at the discretion of the Town.¹
 - i. In no event shall discharge of developed runoff be allowed into an irrigation ditch that would carry the runoff into another local basin resulting in a basin transfer.
 - ii. Where irrigation ditches cross major drainage channels in developing areas, the Applicant must separate stormwater runoff flows from normal ditch flows. Whenever development occurs where an irrigation ditch or reservoir or other facility is present, the Applicant must provide adequate easements or other interests for ditch and reservoir operations, maintenance and repair, as required by the owner(s) of the ditch or reservoir.

D. Sump Areas

1. In the case of a naturally occurring sump area, the Design Professional shall show that the sump can be provided with a gravity outfall to an existing conveyance.
2. If an outfall cannot be provided the Design Professional is referred to Chapter 2, Section 2.05 Design Standard Exception Requests.

E. Cross-lot drainage

1. New subdivisions shall be designed to avoid cross-lot drainage and/or rear yard swales by directing stormwater flow to streets, to separate outlots created for drainage conveyance, to open space areas platted for drainage and/or to detention ponds.
 - i. Where stormwater is directed to areas other than the public right-of-way, the easement requirements established in Chapter 2, and on Table 2-1: Minimum Easement Design Criteria shall be satisfied.

F. Major Drainage Ways

1. Major Drainage Ways have been and/or may be identified in the Town's Stormwater Master Plan(s). These drainage ways provide the opportunity for the preservation of natural corridors.
 - i. The width of the Major Drainage Way will be determined by the requirement to convey the computed 100-year flow, with freeboard per the requirements outlined in these DESIGN STANDARDS, and for appropriate maintenance access.
 - a. Typically, a corridor of 100 feet minimum is herein mandated, but can be greater if warranted by existing topography, expected storm water flows, or other considerations
 - b. Development directly adjacent to a major drainage way(s) shall incorporate trail systems and other amenities to facilitate the drainage way to act as wildlife corridors and to add to the quality of life in Johnstown.
 - c. Major Drainage Ways will remain as open channels and shall not be changed into an enclosed drainage transmission unless otherwise approved by the Town.

¹ Refer irrigation case law as cited in the MHFD Criteria for additional information.

G. Multi-Use Opportunity/Good Neighbor Policy

1. The Town of Johnstown recognizes the natural and beneficial function of the floodplain, including their use as trail corridors, parks, recreational sites, wildlife habitat and for flood storage and groundwater recharge. However, the Good Neighbor Policy adopted by the MHFD is not specifically applicable to the Town of Johnstown.
 - i. The MHFD's Good Neighbor Policy as described in Volume 1, Section 5.0 of the MHFD standards will not be adopted by the Town of Johnstown.

Section 6.05 Drainage Law

A. Drainage Law Reference

1. Refer to the Drainage Law chapter of the USDCM, Volume 1, for more information on Drainage law as it relates to stormwater runoff and floodplain management.

B. Drainage Law as it applies to the Town of Johnstown²:

1. The owner of upstream property possesses a natural easement on land downstream for drainage of surface water flowing in its natural course. The upstream property owner may alter drainage conditions so long as the water is not sent downstream in a manner or quantity to do more harm to the downstream land than formerly. *Bittersweet Farms, Inc. v. Zimbelman*, 976 P.2d 326 (Colo. App. 1998).
 - i. A natural watercourse may be used as a conduit or outlet for the drainage of lands so long as the augmented flow will not tax the stream beyond its capacity and cause flooding of adjacent lands. *Ambrosio v. Pearl-Mack Construction Co.*, 351 P.2d 803 (Colo. 1960).
 - ii. Ditch corporations that own ditches owe a duty to those property owners through which their ditches pass to maintain their ditches using ordinary care so as to prevent damage to adjoining real property. *Oliver v. Amity Mut. Irrigation Co.*, 994 P.2d 495 (Colo. App. 1999).
 - iii. A "dangerous condition" constitutes an unreasonable risk to the health or safety of the public, which is known to exist or which in the exercise of reasonable care should have been known to exist and which condition is proximately caused by the negligent act or omission of the public entity in constructing or maintaining such facility. 24-10-103 C.R.S.
 - iv. A Professional Engineer is required not only to serve the interests of his or her employer/client but also is required—as his or her primary obligation—to protect the safety, health, property, and welfare of the public in compliance with Rule 3.1.1 of the Bylaws and Rules of The State Board of Licensure for Architects, Professional Engineers, and Professional Land Surveyors.
 - v. When drainage easements are required, the development is required to dedicate said easements to the Town. Developments that affect or have an impact upon existing drainage easements must preserve and maintain those easements.

Section 6.06 Stormwater Conveyance System Planning

A. System Function

1. All planned public or private improvements, or any other proposed construction or development activities regulated by the Town are required to include an adequate plan for storm drainage.

² Drainage Law excerpt directly from Weld County Engineering and Construction Criteria Section 5.2.1

2. This plan must be based on an analysis and design in compliance with all the applicable requirements set forth in the DESIGN STANDARDS. The Town requires the planning and construction of all private local stormwater conveyance and treatment facilities be performed in a manner that ensures that such facilities are compatible with the Town's Storm Water Master Plan(s) (as amended), applicable regional system(s) to which a development is tributary, and the design requirements set forth in these DESIGN STANDARDS.
 - i. As noted in Section 6.02 of the DESIGN STANDARDS, detention of stormwater runoff is required by the MHFD Standards and by the Town of Johnstown to reduce the impact of development on downstream properties and stormwater conveyances. Detention of stormwater has beneficial aspects and can reduce the drainage conveyance capacity requirement immediately downstream. Reservation of open space adjacent to streams provides areas where storm runoff can spread out for attenuation of flow and to reduce downstream impacts. The Town of Johnstown's Detention and Storage of Stormwater requirements can be found in Section 6.12 and the MHFD's Stream Access and Recreational Channel Requirements can be found on the MHFD website.
 - ii. Federal and State regulatory constraints should also be considered during the planning process. The Design Professional should be aware of how those requirements can affect the feasibility of planned improvements. Applicable regulatory requirements established by Federal and State agencies must be followed when planning development projects.
 - iii. To provide for orderly urban growth, reduce costs to future generations and avoid loss of life and major property damage, both the initial (minor) drainage and the major drainage system must be properly planned, engineered, and maintained.

B. System Capacity

1. The initial drainage system is intended to collect storm water from the minor storm (5-year recurrence interval storm event). The initial drainage system should be able to collect and convey storm water, without allowing excessive depth of water in streets, and without causing property damage. Runoff from small, frequently occurring storms should be managed to reduce runoff peak flows, volumes (where feasible and pursuant to legal requirements) and pollutant loading to streams.
2. Management of these frequently occurring events helps to protect beneficial uses of streams and promotes channel stability.
 - i. The allowable depth of water in streets during the minor and major storms will depend on the street geometry and street classification. During the major storm (100-year recurrence interval storm event):
 - a. Arterial streets must still be able to pass one lane of traffic each way on unsubmerged pavement.
 - b. Collector streets must be able to have one lane width in the center of unsubmerged pavement.
 - c. Local residential streets may have water over the crown but must be able to allow access to emergency vehicles.
 - ii. In all cases, the major storm street conveyance must be full contained within the public street ROW and/or adjacent platted drainage easements.
 - iii. Street, inlet and storm drain system design criteria is established by Section 6.09 of the DESIGN STANDARDS.

C. Drainage System Planning Process

1. **Major Drainage Planning:** As stated in Volume 1 of the MHFD standards, a well-planned major system protects the urban area from extensive property damage, injury, and loss of life from flooding.
 - i. Local and regional planning should consider the major drainage system necessary to manage the 100-year runoff; that is the runoff having a one percent (1 %) probability of occurrence in any given year.
 - ii. Major drainage systems may include storm sewers, curb, gutter and streets, open channels, drainage ways, ponds, rivers, streams and detention facilities.
 - iii. The Design Professional shall follow the Town's specific requirements regarding street conveyance capacity and stormdrain system design in the planning and design of major drainage systems.
2. **Outfall System Planning:** Outfall system planning efforts identify detention, water quality and conveyance practices within a watershed that ultimately discharges to a receiving stream. Outfall system plans typically address storm drain improvements, stream crossing improvements, stream enlargement, stabilization, and floodplain preservation.
3. **Initial Drainage System Planning:** The Initial (minor) drainage system is needed to convey flows from the initial design storm to reduce inconvenience, frequently recurring damages, and street maintenance costs, and to help create an orderly urban system with a multi-functional drainage system at a reasonable cost.
 - i. Generally, the initial drainage system drains a tributary no larger than 90 acres, as the runoff from this area would be more than the typical capacity of features within a street section.
 - ii. The initial system may include a variety of features such as swales, curbs and gutters, storm drain pipes, on-site detention, runoff reduction (e.g., minimized directly connected impervious areas) practices, and water quality BMPs.
 - iii. All planning and design in the Town of Johnstown should consider the initial drainage system to transport the runoff from the Minor (5-year/ 20% annual probability) storm).
 - iv. The DESIGN STANDARDS requirements regarding street conveyance capacity (see Section 6.06 and 6.09) and storm drain system design presented in this Chapter must be followed in the planning of initial drainage systems.
4. **Water Quality and Environmental Design:**
 - i. Consider opportunities to mimic natural hydrology, to preserve natural features, to enhance habitat, and to evaluate impacts of proposed new facilities. When convened early in the planning and design process, a multi-disciplinary design team can help to ensure that the benefits to total urban systems are considered in the drainage planning effort.
 - ii. For large-scale, multi-phase developments, Design Professionals should incorporate space for water quality treatments in the initial, overall design plans and plan ahead for addressing the water quality requirements, whether meeting all the requirements in the first phase or each phase meeting the requirements individually.
5. All planning efforts should address stormwater quality treatment requirements and Transfer of problems associated with stormwater runoff:
6. Planning and design of stormwater drainage systems should not be based on the premise that problems can be transferred downstream from one location to another.
7. Both intra-watershed and inter-watershed transfers should be avoided, and appropriate assumptions should be made during site planning to avoid transfer of problems.

D. Downstream Impacts and Basin Transfers

1. Drainage modifications that create unnecessary problems downstream should be avoided, both for the benefit of the public and to avoid damage to private downstream parties.
 - i. Problems to avoid include land and channel erosion due to increased stormwater discharge velocity, downstream sediment deposition, increase of runoff peaks, debris transport, etc.
2. Downstream impacts must be discussed in the Preliminary and Final Drainage Reports. The overflow path to the nearest major conveyance (Little Thompson or Big Thompson River) must be discussed and schematically depicted in the Drainage Report.
3. If the downstream area does not have the capacity to receive flow from the proposed development, additional improvements may be required.
4. Diversion of storm runoff from one watershed basin to another may introduce significant legal and social problems.
5. If the development significantly increases the drainage area tributary to the subdivision outfall, then inter-basin transfer may be occurring. Inter-basin transfers should be avoided, unless specific and prudent reasons justify and dictate such a transfer. In such case(s), it must be clearly documented using the Town's Design Standard Exception Process, outlined in Chapter 2, Section 2.05 that:
 - i. No measurable damages will occur to the natural receiving water or urban systems or to the public.
 - ii. All applicable laws are complied with and permissions from affected property(ies) is secured and legally documented.

E. Drainage System Maintenance

1. The Town of Johnstown requires adequate maintenance of all systems associated with the conveyance of stormwater runoff. The Town requires that maintenance access be provided to all storm drainage facilities to assure continuous operational capability of the system.
2. The property owner shall be responsible for the maintenance of all privately owned drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures, and detention basins located on their land unless modified by the Development Agreement. Should the property owner fail to adequately maintain said facilities, the Town shall have the right to enter said land for the purposes of operations and maintenance. All such maintenance costs shall be assessed to the property owner.
3. To assure adequate maintenance occurs, a detailed Operations and Maintenance Report is required. Refer to Chapter 2, Section 2.03 for report content requirements.

F. Flood Risk Management

1. Compliance with Federal, State and Local Floodplain Regulations
 - i. All work within a regulatory 100-year (1% probability) floodplain as designated by the Federal Emergency Management Agency (FEMA) on the Town of Johnstown's Flood Insurance Rate Maps (FIRM) shall comply with 44 CFR §60.3, the State of Colorado's Floodplain Development Standards, and the Town's Floodplain Ordinance. The Town's Floodplain Ordinance can be found in the Town's Municipal Code, on the Town's website.
 - ii. Any work (trenching, construction, paving, wall building, grading, filling, etc.) inside the limits of the FEMA designated Special Flood Hazard Area (SFHA) requires a Floodplain Development Permit. This Floodplain Development Permit must be acquired from the Town's designated Floodplain Administrator prior to commencement of construction activity.
 - iii. Floodplain Modifications
 - a. When development modifications include significant changes to the regulatory floodplain, a Conditional Letter of Map Revision (CLOMR) and/or a Letter of Map Revision (LOMR) will be required as outlined in federal and state criteria, and as outlined in the Town's Floodplain Ordinance.

- b. The engineering calculations and scientific models, as well as the CLOMR and/or LOMR applications and all supporting documentation, shall be submitted to the appropriate Town Department for review, prior to attaining the required Community Official Acknowledgement from the Town's Floodplain Administrator.
- c. This review is required in an effort to determine that the proposed changes do not adversely impact Town or private stormwater conveyance facilities and that the proposed modifications do not adversely impact downstream or upstream parcels whether publicly or privately held.

Section 6.07 Rainfall

A. Design Storm Recurrence Interval

- 1. All new public and private improvements must plan, design, and construct drainage systems that account for the 5-year minor storm event as well as the 100-year major storm event.
- 2. The 100-year major storm event is the standard level of protection in the Town of Johnstown.

B. Methodology

- 1. The National Oceanic and Atmospheric Association (NOAA) has published (2013) point rainfall data based on statistical analysis of rain gage data for different regions across the United States. Rainfall data provided in NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 8 Midwestern States shall be used to determine depth duration frequency values related to analysis using the Rational Method and the Colorado Urban Hydrograph Procedure (CUHP). The data can be found tabulated by NOAA at: <https://hdsc.nws.noaa.gov>
 - i. Local rainfall data from NOAA Atlas 14 shall be used for projects/developments in Johnstown, unless otherwise approved by the Department of Public Works, or unless otherwise specified in existing master plans. The Town's current Stormwater Master Plan recommends use of the City of Loveland's rainfall depth and distribution. Use of the City of Loveland's rainfall depth and distribution is acceptable within the portions of Johnstown contained within or immediately adjacent to the City of Loveland's basin limits. Special approval from the Town Engineer and/or the Department of Public Works shall be obtained for use of the City of Loveland rainfall depth and distribution data in other areas of Johnstown
 - ii. The Rational Method and the Colorado Urban Hydrograph Procedure (CUHP) are reliable methods used in the northern front range and are applicable for use in the Town of Johnstown.. Rainfall intensity for a certain event and time of concentration can be calculated using the following equation for analysis with the Rational Method:

$$I = (28.5 P_1) / (10 + T_d)^{0.786}$$

Where:

I = rainfall intensity (inches/hour)

P_1 = 1-hour point rainfall depth (inches)

T_d = storm duration or time of concentration (minutes)

C. Point Precipitation Frequency Estimates for the CUHP Method

- 1. Point Precipitation Frequency Estimates can be obtained from NOAA's Hydrometeorological Design Studies Center, Precipitation Frequency Data Server on the NOAA website.
 - i. The Figures and Tables provided are based on data at 40.3361 LAT; -104.9073 LONG at the intersection of County Road 17, and State Highway 60 (e.g. approximate center of downtown Johnstown).

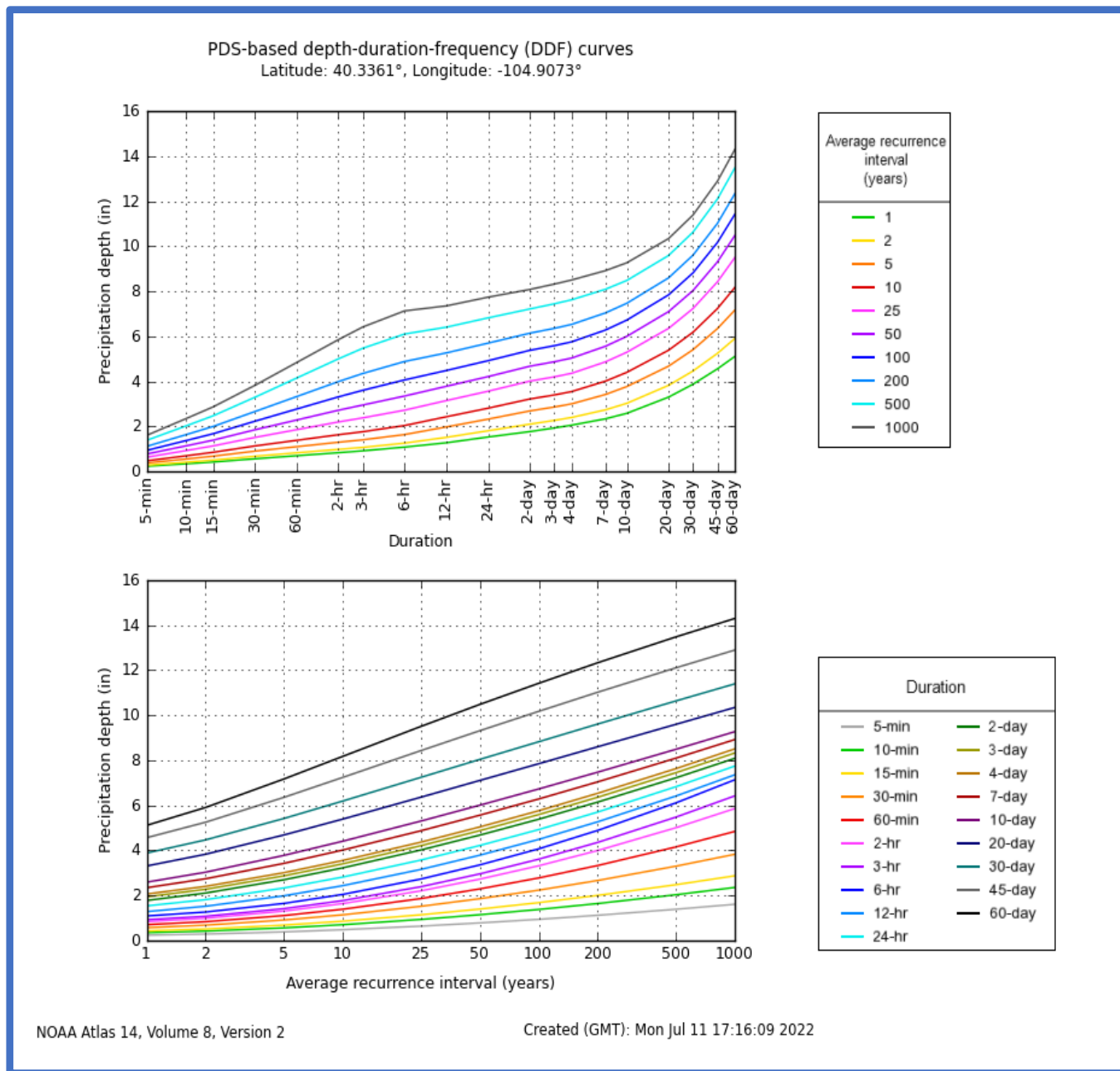
FIGURE 6-1: PDS-BASED DDF CURVES FROM NOAA 14

Table 6-1: PRECIPITATION FREQUENCY ESTIMATES										
Storm Duration	Average Recurrence Interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min:	0.239	0.287	0.383	0.48	0.639	0.782	0.941	1.12	1.39	1.61
10-min:	0.35	0.42	0.561	0.703	0.936	1.15	1.38	1.64	2.03	2.36
15-min:	0.427	0.513	0.685	0.858	1.14	1.4	1.68	2	2.48	2.87
30-min:	0.57	0.683	0.91	1.14	1.52	1.86	2.24	2.67	3.3	3.83
60-min:	0.706	0.836	1.11	1.39	1.86	2.29	2.78	3.33	4.15	4.84
2-hr:	0.841	0.988	1.3	1.64	2.2	2.72	3.32	3.99	5	5.85
3-hr:	0.924	1.08	1.41	1.77	2.39	2.96	3.61	4.36	5.47	6.42
6-hr:	1.09	1.27	1.65	2.05	2.73	3.35	4.07	4.89	6.11	7.13
12-hr:	1.28	1.52	1.98	2.43	3.15	3.79	4.49	5.27	6.41	7.35
24-hr:	1.54	1.81	2.33	2.82	3.57	4.22	4.92	5.7	6.82	7.74
2-day:	1.78	2.11	2.69	3.22	4.02	4.68	5.38	6.14	7.22	8.08
3-day:	1.94	2.27	2.87	3.4	4.21	4.87	5.59	6.36	7.45	8.32
4-day:	2.06	2.4	3.01	3.55	4.36	5.04	5.76	6.53	7.62	8.5
7-day:	2.34	2.74	3.42	4.01	4.87	5.56	6.28	7.04	8.09	8.92
10-day:	2.59	3.03	3.78	4.41	5.3	6	6.72	7.47	8.48	9.27
20-day:	3.31	3.83	4.68	5.39	6.36	7.1	7.84	8.6	9.59	10.3
30-day:	3.88	4.47	5.41	6.19	7.24	8.03	8.82	9.61	10.6	11.4
45-day:	4.56	5.25	6.35	7.24	8.42	9.31	10.2	11	12.1	12.9
60-day:	5.11	5.9	7.16	8.17	9.5	10.5	11.4	12.3	13.5	14.3
5-min:	0.239	0.287	0.383	0.48	0.639	0.782	0.941	1.12	1.39	1.61
10-min:	0.35	0.42	0.561	0.703	0.936	1.15	1.38	1.64	2.03	2.36
15-min:	0.427	0.513	0.685	0.858	1.14	1.4	1.68	2	2.48	2.87
30-min:	0.57	0.683	0.91	1.14	1.52	1.86	2.24	2.67	3.3	3.83
60-min:	0.706	0.836	1.11	1.39	1.86	2.29	2.78	3.33	4.15	4.84

D. Intensity Duration Curves for the Rational Method

1. The two-hour incremental rainfall depths for basins less than 5 square miles are provided in Table 6-2: Intensity-Duration Curves for the Rational Method.
 - i. These values are based on City of Loveland values. Note that the use of the values provided in the Town's Stormwater Master Plan are also acceptable.

Table 6-2: INTENSITY-DURATION CURVES FOR THE RATIONAL METHOD						
DURATION (Minutes)	INTENSITY 5-YEAR (inches/hour)	INTENSITY 100-YEAR (inches/hour)	INTENSITY 2-YEAR (inches/hour)	INTENSITY 10-YEAR (inches/hour)	INTENSITY 25-YEAR (inches/hour)	INTENSITY 50-YEAR (inches/hour)
5	0.05	0.02	0.04	0.06	0.01	0.01
10	0.07	0.07	0.04	0.08	0.06	0.07
15	0.13	0.09	0.09	0.16	0.08	0.10
20	0.23	0.26	0.16	0.27	0.20	0.20
25	0.41	0.43	0.29	0.49	0.33	0.38
30	0.17	0.77	0.12	0.20	0.59	0.68
35	0.10	0.32	0.07	0.12	0.24	0.28
40	0.08	0.20	0.06	0.09	0.14	0.17
45	0.06	0.18	0.04	0.07	0.11	0.15
50	0.04	0.14	0.03	0.06	0.09	0.14
55	0.04	0.08	0.03	0.05	0.07	0.08
60	0.03	0.06	0.03	0.04	0.06	0.06
65	0.03	0.06	0.03	0.04	0.06	0.05
70	0.03	0.05	0.03	0.03	0.05	0.04
75	0.03	0.04	0.02	0.03	0.04	0.04
80	0.02	0.04	0.02	0.02	0.04	0.04
85	0.02	0.03	0.01	0.02	0.03	0.04
90	0.01	0.03	0.01	0.02	0.03	0.03
95	0.01	0.03	0.01	0.02	0.03	0.03
100	0.01	0.03	0.01	0.02	0.02	0.02
105	0.01	0.02	0.01	0.02	0.02	0.01
110	0.01	0.02	0.01	0.01	0.01	0.01
115	0.01	0.02	0.01	0.01	0.01	0.01
120	0.01	0.02	0.01	0.01	0.01	0.01
TOTAL:	1.61	3.01	1.18	1.94	2.33	2.65

For informational purposes, the 2-year, 10-year, 25-year and 50-year events are also provided

Section 6.08 Runoff

A. Determination of Peak Flows

1. The criteria and methodology for determining the storm runoff design peaks and volumes to be used in the Town of Johnstown in the preparation of Drainage Reports, Drainage Plans, and for all stormwater conveyance and stormwater facility design shall follow the procedures outlined in these DESIGN STANDARDS and in the MHFD's USDCM.
 - i. Undeveloped 100-year event runoff rates in the Johnstown area tend to fall between 0.50 cfs/acre and 1.0 cfs/acre depending on the basin size, slope and hydrologic soil group. Soils tend to be silty for most of the Johnstown area and it is important to not overestimate the undeveloped runoff rates that will be used for detention pond release rates.
 - ii. Further details and discussion for each of the acceptable rainfall/runoff models is presented in the MHFD's Urban Storm Drainage Criteria Manual (USDCM), and are provided in the following paragraphs.

B. Approved Methodology

1. Estimates of peak rate of runoff, runoff volume, and the time distribution of flow provide the basis for all planning, design, and construction of drainage facilities.
2. Five methods of hydrologic analysis are described in the Urban Storm Drainage Criteria Manual (USDCM):
 - i. The Rational Method,
 - ii. The Colorado Urban Hydrograph Procedure (CUHP) for generating hydrographs from watersheds,
 - iii. The EPA's Storm Water Management Model (SWMM), mostly for combining and routing the hydrographs generated using CUHP,
 - iv. Use of published runoff information, and
 - v. Statistical analyses.
 - vi. Table 6-3: Applicability of Hydrologic Methods, provides guidance on the selection of methodology per the MHFD.

Table 6-3: APPLICABILITY OF HYDROLOGIC METHODS		
WATERSHED SIZE (Acres)	IS THE RATIONAL METHOD APPLICABLE?	IS CUHP APPLICABLE?
0 to 90	Yes	Yes
90-160	No	Yes
160 to 3,000	No	Yes*
Greater than 3,000	No	Yes*
* Subdividing the contributing drainage basin into smaller sub basins and routing the resultant hydrographs using SWMM may be needed to accurately model a drainage basin with areas of different soil types or percentages of imperviousness. See Section 6.08.C for maximum drainage basin size.		

1. Rational Method:
 - i. The Rational Method shall be used to determine runoff rates for all drainage basins 90 acres or less in size and the calculations shall be summarized in the submitted drainage report. Calculations for the Rational Method can be carried out by hand or using the UD-Rational Excel workbook available at www.udfcd.org.

- ii. Runoff coefficient calculations and rainfall data specific to the Town of Johnstown shall be used. Time of Concentration shall be computed using the methodology outlined in the MHFD's Volume 1.
 - a. Runoff Coefficients shall be determined based on either overall land use or surface type across the drainage area. The design professional is advised that:
 - 1) *More intense rainfall events can lead to a higher percentage runoff as the surface becomes saturated while the storm is ongoing.*
 - 2) *For storm events exceeding the 10-year recurrence interval, higher values should be used.*
 - 3) *Slope will also impact the runoff coefficient. The steeper the gradient, the more water will run off the surface.*
 - b. When using Table 6-4: Rational Method Runoff Coefficients, it is required that flat areas use the lower coefficient values, while areas with a slope greater than 6% use the higher values. Areas with intermediate slopes should use values interpolated from the two extremes. Developing the Runoff coefficient involves engineering judgment, and the surface Types-Runoff Coefficients used for Rational Method computations in the Town shall be as shown on Table 6-4.

Table 6-4: RATIONAL METHOD RUNOFF COEFFICIENTS		
SURFACE TYPE	RUNOFF COEFFICIENTS*	
	Lower value—use for flatter slopes	Upper value—use for slopes greater than 6%
Manmade or Impervious Surfaces		
Asphalt or concrete	0.85	0.95
Pervious Asphalt or concrete	0.60	0.80
Rooftop (larger rooftops should use upper value)	0.90	0.95
Recycled Asphalt	0.80	0.85
Gravel	0.50	0.60
Pavers	0.50	0.85
Landscape or Pervious Surface		
Lawns	0.21	0.62
Turf Block	0.15	0.30
Parks	0.10	0.25
Sports Fields	0.20	0.35
Cultivated Lands HSG A or B	0.25	0.52
Cultivated Lands HSG C or D	0.40	0.82
* In simple cases for new developments, it is often appropriate to assume 100% runoff from man-made or impermeable surfaces rather than spend a long time getting a value in the 90s which includes a lot of assumptions, simplifications and guesswork. (REFERENCE: <i>Civil WEB</i>)		

Table 6-5: IMPERVIOUS VALUES	
LAND USE OR SURFACE CHARACTERISTIC	PERCENTAGE IMPERVIOUSNESS
Central Business District	95%
Industrial PUD's	80%
Business PUD's	80%
Single Family Residential Lot Size:	
¼ acre or less	45%
¼ acre to ¾ acre	30%
¾ acre to 2.5 acres	20%
2.5 acres or greater	12%
Multifamily attached (condo's, townhomes, apartments)	75%
Multifamily detached	60%
Academic	55%
Playgrounds	25%
Detention Pond Areas	50%
Park and Open Space Areas	10%
Paved Streets	100%
Recycled Asphalt Pavement	75%
Gravel Roads	40%
Driveways and sidewalks	90%
Roof Areas	90%
Railyards	50%
Solar Facilities	25%

2. Colorado Unit Hydrograph Procedure (CUHP):

- i. The Colorado Urban Hydrograph Procedure (CUHP) shall be used for basins greater than 90 acres in area.
- ii. The procedures for the CUHP, as explained in the USDCM, Volume 1, Chapter "Runoff", shall be followed in the preparation of drainage reports and storm drainage facility designs in the Town.
- iii. The design storm events to be used with the CUHP method are presented in Section 3 of these DESIGN STANDARDS.
- iv. Applicable infiltration depths are outlined in Section 3.2 of the USDCM, Volume 1, Chapter "Runoff".
- v. The CUHP computer program was modified to provide the capability of estimating hydrographs for small drainage basins greater than 5 acres. The resulting flood peaks in many cases are generally comparable, but not identical to those estimated by the Rational Formula as specified in the MHFD USDCM Volume 1.
- vi. To estimate a hydrograph for small basins requires the input of the time of concentration as computed by the Rational Method described in the MHFD USDCM Volume 1.

- vii. It is required that the Design Professional generate a storm hydrograph to facilitate the routing of flows through detention facilities or channels.
- viii. Imperviousness:
 - a. The percentage of imperviousness is the primary variable that affects the volumes and rates of runoff calculated using CUHP.
 - b. When analyzing a watershed for design purposes, the probable future percent of impervious area must first be estimated.
 - c. Table 6-5: Impervious Values the DESIGN STANDARDS provide the percentage of imperviousness to be used in analysis in the Town of Johnstown.
- 3. Stormwater Management Model (SWMM):
 - i. The Storm Water Management Model (SWMM) provided by Mile High Flood District (UD-SWMM) or the US Environmental Protection Agency (EPA-SWMM) may be used for combining and routing hydrographs produced through the CUHP methodology.
 - ii. When SWMM is utilized for the analysis of projects in the Town of Johnstown, the most recent version must be used.

C. Drainage Basin Delineation Criteria

- 1. As noted in the MHFD's UDFCM, the average drainage basin area size typically shall not exceed 90-acres.
 - i. The delineation of drainage basins and the requirement of the methodology selected should be logically considered, and carefully thought out by the design professional.
 - ii. Basins shall be subdivided into homogenous areas to improve results.
 - a. When modeling large watersheds, the drainage basin size can influence results.
 - b. If heterogeneous land uses are "lumped" together into large sub-areas, the models may not accurately account for the "flashy" nature of runoff from impervious surfaces and peak rates of runoff may be underestimated.
 - c. Defining very small drainage subareas can lead to complicated and unrealistic routing that can overestimate peak rates of runoff—the Design Professional should not excessively create small subareas for this reason.
- 2. The Design Professional shall follow the detailed process outlined in the MHFD's USDCM.

D. Time of Concentration

- 1. Time of concentration calculations must be submitted for review, and all computations used must be explained and included in the required Drainage Report
 - i. The UD-Rational spreadsheet by Mile High Flood District is an acceptable means of calculating flow rates from small urban areas, and is typically used for drainage basins (sub-basins) up to 90 acres in size.
 - ii. Inputs needed include:
 - a. Drainage Basin or Sub-Basin area,
 - b. Runoff coefficient,
 - c. 1-hour point rainfall depth, and
 - d. Flow reach characteristics (length, slope, and type of ground surface).

Section 6.09 Streets, Inlets and Stormdrains

A. Street Conveyance

1. Streets are a significant component of the urban drainage system, and use of streets for storm runoff in the Town of Johnstown should be made within reasonable limits, recognizing that the primary purpose of streets is for traffic.
 - i. These DESIGN CRITERIA are consistent with the intent that storm runoff (both Minor and Major) will be removed from public streets at frequent and regular intervals and routed into inlets and storm sewers, as well as the recognition that runoff tends to follow streets; therefore, streets and associated storm systems may be aligned to provide a specific runoff conveyance function.
 - ii. Storm runoff within streets from Minor (5-yr event) storms should be fully contained within the street and should not exceed the curb & gutter full capacity and/or exceed the allowable street spread (based on street classification – See Table 6-6) prior to interception by appropriate inlets and storm sewer system.
 - iii. Storm runoff within streets from Major (100-yr event) storms must be fully contained within the public street ROW and/or recorded drainage easement(s) and should not exceed the allowable street spread (based on street classification – See Table 6-6) prior to interception by appropriate inlets and storm sewer system.
 - iv. The Design Professional shall ensure that any storm flooding or surcharge of the street system maintains public safety, minimizes flood damages, and allows for emergency vehicle access as required by the Town of Johnstown.

B. Inlets and Stormdrain Systems

1. Sizing and spacing of inlets, pipe systems, culverts or other drainage collection systems for development sites should be designed to safely convey flows through the site, in a manner that will protect the site's users and/or the public from harm and will not cause damage on-site or off-site.
2. The Design Professional for the project shall provide calculations for pipe sizes, overtopping of roads, ditches, etc., such that the Town's Public Works Department can verify that the drainage on-site is safe for users. The Town reserves the right to comment on and require modification of private drainage systems that the Public Work's Department believes may be unsafe or inadequate for the intended site use.
3. The 100-year developed flows must be conveyed safely to the site's detention pond for a controlled release.

C. Stormdrain System Capacity

1. In the Town of Johnstown, the public and private stormdrain system shall be designed to convey the 5-year recurrence interval storm event inside the pipe, and to convey the 100-year recurrence interval storm event with the hydraulic grade line a minimum of 1' below the ground surface to avoid surcharge.

D. Public vs. Private Storm Drainage Systems

1. Public Drainage Systems
 - i. The public storm sewer system generally consists of inlets and pipes within the public right-of-way and/or within a public easement and that conveys flows from public property and/or from multiple private sites.
 - ii. Unless otherwise identified in a site-specific Private Development Agreement, the public storm sewer system shall be owned and maintained by the Town.
2. Private Drainage Systems:
 - i. Unless otherwise identified in a site-specific Private Development Agreement, all storm drainage systems within private developments and/or within private streets (such as, but not limited to: curb & gutters, inlets, storm piping, culverts, swales, hydraulic structures, storm detention facilities) shall be considered private.
 - ii. Pipe connections from the private system to the public system and/or outfall pipes from private detention basins shall be private.
 - iii. All private storm drainage systems shall be maintained by the associated Developer, Metro District, or Home-Owner's Association. The property Owner and/or maintenance entity shall be responsible for the maintenance of all drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures, and detention basins located on their land unless modified by the development agreement. Should the Owner/Maintenance Entity fail to adequately maintain said facilities, the Town of Johnstown shall have the right to enter said land for the purposes of operations and maintenance. All such maintenance costs will be assessed to the property Owner/Maintenance Entity.
 - iv. Refer to Chapter 2 for additional information specific to Maintenance Agreements and Operations and Maintenance Report content and requirements that are required for private systems.

E. Approved Software

1. The Town allows the use of the following software to determine the hydraulic characteristics of storm networks/culverts:
 - i. HydroFLOW
 - ii. CivilStorm
 - iii. HY-8
 - iv. FlowMaster
 - v. StormCAD
2. Inlet spread calculations and street capacities with curb and gutter are to be analyzed using the most recent version of MHFD's UD-Inlet spreadsheets as provided on the MHFD's website. Alternative modeling software may be used upon approval by the Public Works Department.

F. Street Drainage

1. Street Function and Classification for Drainage Purposes shall match the classifications assigned by the Town of Johnstown's Municipal Code and as described in Chapter 4 of these DESIGN STANDARDS. Maximum depth of flow in streets shall not exceed the parameters shown on Table 6-6: **MAXIMUM STREET FLOW DEPTHS**

Table 6-6: MAXIMUM STREET FLOW DEPTHS

Street Classification	Maximum Encroachment and Inundated Area*		Allowable Cross Flow	
	Minor Storm (5-yr)	Major Storm (100-yr)	Minor Storm (5-yr)	Major Storm (100-yr)
Major Arterial	No curb overtopping, flow spread must leave one dry lane in each direction, minimum width 12' each lane. Flow shall not exceed 12" at gutter and cannot overtop the street crown.	The depth of water over the gutter flow line should not exceed 12 inches. Flow must remain in the platted street right-of-way.	None	None
Minor Arterial				
Major Residential Collector	Flow spread must leave one dry lane, min. 10' wide. No curb overtopping. Flow shall not exceed the street crown.		Flow depth shall not exceed 6 inches or adjacent curb height (whichever is less) of depth in cross pan. Flow must remain in platted street right-of-way.	Flow depth shall not exceed 12 inches above gutter flow line. Flow must remain in platted street right-of-way.
Minor Residential Collector				
Local Street	No curb overtopping, flow may spread to or overtop the crown of the street. Flow must remain in the platted street right-of-way.			
Low Volume Local Street				
Alleys	Flow depth shall not exceed 12", and residential dwellings and commercial buildings must be no less than 12" above the computed flow depth.	Not Applicable		
*Based on standard 6" vertical curb, mountable curb will reduce conveyance capacity NOTE: Residential dwellings and commercial buildings should be no less than 12 inches above the water surface elevation of 100-year flood at the ground line or lowest entry of the dwelling or building.				

G. Foundation Drains and Sump Pumps

1. Discharge from privately held foundation sump pumps may be tied to the Town's stormdrain system upon approval from the Public Works Director, but may not discharge directly to a street surface.
 - i. All tie-in points must be installed at approved locations such as at a manhole or at an inlet. No direct (blind) tie-in to a storm drain pipe will be allowed.
 - ii. Tie-ins shall be per Section 6.10, and perforated subdrains or underdrains are not allowed within any public right-of-way or easement. See Chapter 8 for underdrain standards

H. Inlet Design Standards

1. Inlets can be classified as being on a "continuous grade" or in a "sump" condition. The term continuous grade refers to an inlet located so that the grade of the street has a continuous slope past the inlet and, therefore, ponding does not occur at the inlet. The sump condition refers to the low point(s) in the street network where water ponds.
 - i. Presented in this section is the criteria and methodology for design and evaluation of stormwater inlets in the Town of Johnstown.
 - ii. Except as modified herein, all stormwater inlet criteria shall be in accordance with the MHFD's USDCM, and the UD-Inlet design workbook shall be used to present inlet capacity calculations.

2. Inlet Types Permitted based on Location

- i. Location in Streets or Alleys:
 - a. Curb Opening Inlets (CDOT Type R) must be provided on public streets within the Town of Johnstown, refer to CDOT Detail M-604-12.
 - b. Where possible, street design and inlet spacing should provide for maximum 15' length Type R inlets. (With Town Public Works approval, larger Type R Inlets may be approved on a case-by-case basis.)
 - c. CDOT/Denver Type 13 Valley Grate or CDOT Type 13 Combination inlets may be allowed on a case-by-case basis where applicable and must be traffic rated.
 - d. Bicycle friendly grates must be used where inlets are placed in public right-of-way and should be used in all other locations where bicycles may be used.
- ii. Open Space Areas and Parking Lots:
 - a. Area Inlets are permitted in Open Space Areas and Parking Lots (CDOT Type 13 traffic rated for parking lots: CDOT Type C with concrete apron, or CDOT TYPE D).
 - b. Close mesh grates are required for all CDOT Type C and CDOT Type D inlets.

I. Inlet Spacing

1. In general, the allowable road capacity and maximum encroachment depth shall dictate the spacing and configuration of inlets.

J. Inlet Placement

1. Inlets should be placed at low points (sumps), median breaks, intersections, super-elevation transitions, and before cross walks and bridges, as required. In no case shall a 100-year design storm frequency cause inundation above allowable ponding depths or pose a hazard.
2. The Town prefers placement of inlets in sumps. Storm drainage inlets in sump conditions shall be designed to accept and convey the 100-year storm.
 - i. Refer to Figure 6-2: CDOT Type R Interception Capacity in a Sump and Figure 6-3: Sump Inlet Length for Type R inlet capacity in a sump condition for general sizing considerations.
 - ii. Final inlet design/spacing must be confirmed using the most current version of the MHFD UD-INLET software.
3. The use of continuous grade inlets should be limited to cases where providing a sump is not practical.
 - i. By-pass flow must be accounted for in street capacity calculations, accounted for at the receiving downstream inlet design and in the receiving underground storm sewer system to meet street design standards.
 - ii. On-grade inlets typically should capture all (>90%) of the minor event gutter flow. On a case-by-case basis, greater bypass may be acceptable, subject to other street capacity limitations being met.
 - iii. If a continuous on-grade inlet needs to be longer than 15 feet in length, the Town may require that the design is modified to provide a sump

K. Inlet Icing

1. As stated in the MHFD criteria for new development projects, locating inlets in areas where water can be intercepted before it accumulates or slows down and can freeze is the most effective way to minimize icing from the design perspective.
 - i. To the extent practical, locate inlets away from areas that will be heavily shaded during winter months, and do not place on cul-de-sacs in locations where the accumulation of plowed snow may cover the inlet and/or increase the likelihood of icing.
 - ii. For areas where shading is unavoidable, consider providing additional inlets at strategic locations. For example, if a street with a southern exposure will drain to an east-west street that is shaded, having additional inlets at the intersection may be advisable, especially if the flow is intended to turn and follow the east-west street.

FIGURE 6-2: CDOT TYPE R INTERCEPTION CAPACITY IN A SUMP

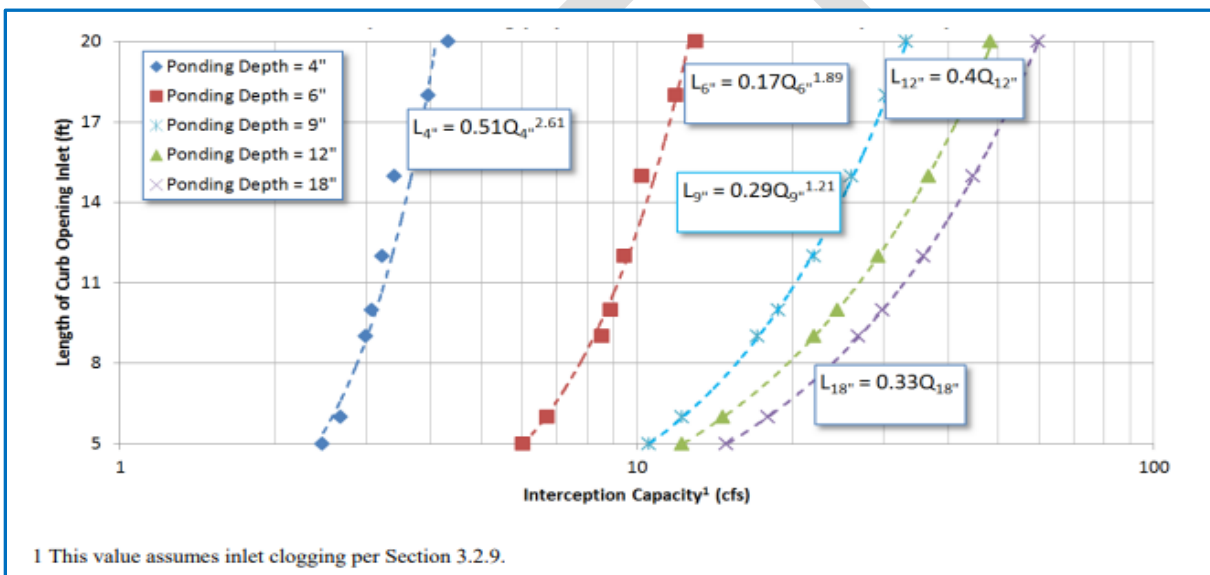
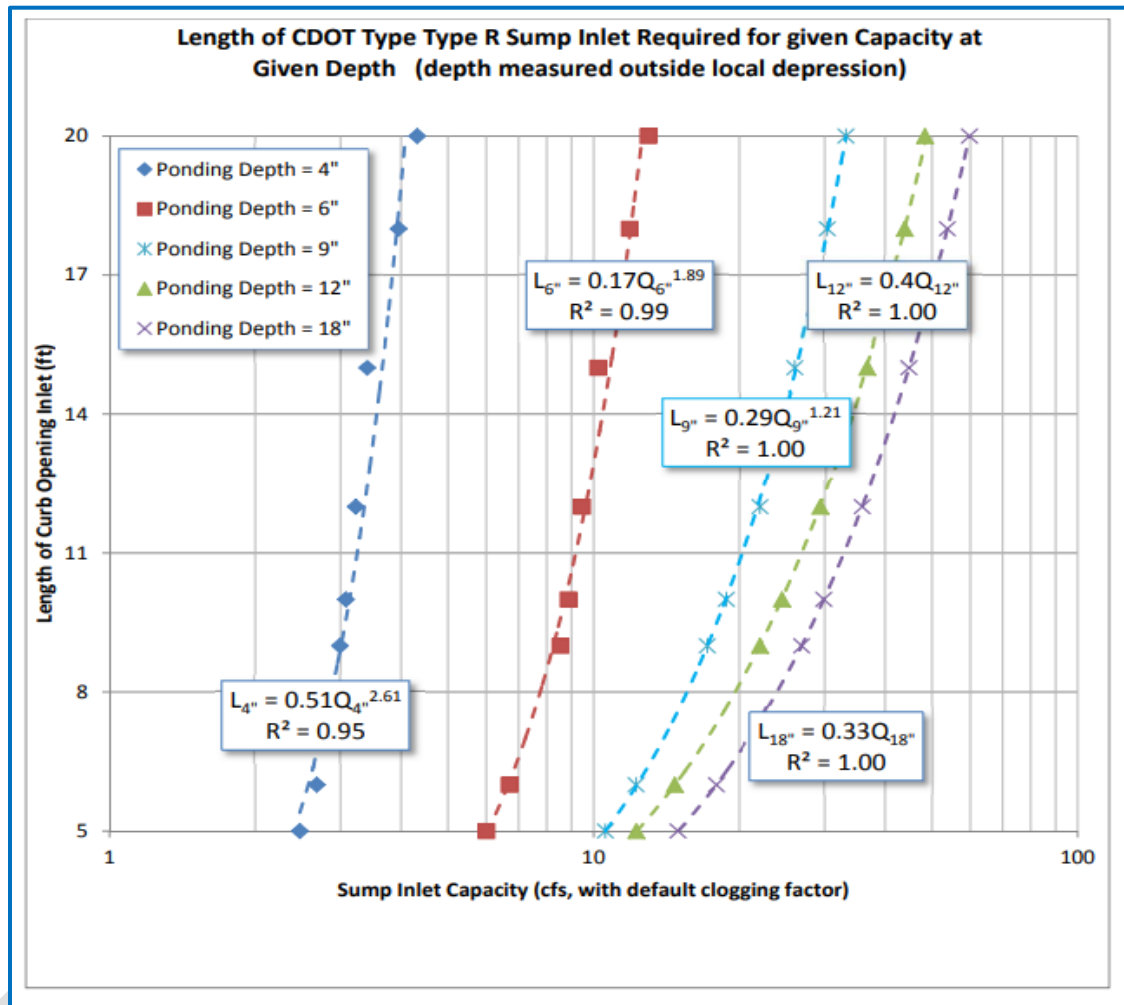


FIGURE 6-3: SUMP INLET LENGTH



L. Sidewalk Chase Drains

1. Sidewalk Chase Drains may be appropriate to aid in proper drainage of nuisance flows (for sump pump discharges, in particular); and to minimize sheet flow icing on walks. However, sidewalk chases can be problematic in terms of clogging and icing if located in areas with heavy loads of gross solids (leaves, grocery bags, restaurant litter, etc.) or if they are located in areas with poor solar exposure in winter months.
 - i. Sidewalk Chase Drains shall be capable of intercepting the minor storm (5-year event) flow volume with no sidewalk overtopping.
 - ii. Sidewalk Chase Drains shall not be located within a curb ramp, curb cut, or driveway.

M. Minimum Pipe and Culvert Diameter

1. Stormdrain systems within the public right-of-way shall not include pipe diameters of less than 18".
 - i. Stormdrain pipe diameter of less than 15" shall not be permitted for public or private use.
 - ii. Elliptical or arch pipe shall have a minimum vertical dimension of 12".

N. Alignment

1. Stormdrain systems in the public right-of-way shall be located a minimum of 5' from the gutter flowline in the street section.
2. Trench style drains are not allowed in the public right-of-way. They may be used, where appropriate, in private development sites, outside of the public right-of-way.
3. Whenever possible, match the pipe crown elevations (when the downstream pipe is larger) to minimize backwater effects on the upstream pipe.
4. Where placed outside the public right of way, storm sewers shall be centered in an easement. Easement width is based on bury depth as shown in Chapter 2, Table 2-1 and Table 6-7 below.

O. Materials

1. The Town of Johnstown allows the use of the following pipe for stormdrain installations:
 - i. RGRCP (Rubber Gasketed Reinforced Concrete Pipe).
 - a. As noted in the MHFD's Technical Memorandum "Pipe Material Technical Memorandum", RCP is generally limited by wall thickness requirements, pH, sulfate levels, and minimum bury depth.
 - b. Class V pipe shall be placed in all public streets.
 - ii. HDPE (High Density Polyethylene) is allowed in open space areas.
 - a. As noted in the MHFD's Technical Memorandum "Pipe Material Technical Memorandum", HDPE is limited by UV degradation, flotation, and maximum and minimum trench depth conditions.
 - iii. PVC pipe is not allowed in storm drain systems.
 - iv. Other materials will be considered on a case-by-case basis, through the process outlined in DESIGN STANDARDS, VOLUME II, Approved Materials List.

Table 6-7: SUPPLEMENTARY STORMDRAIN EASEMENT REQUIREMENTS	
Storm Sewer Pipe Diameter <36"	Minimum Easement Width
Depth to Invert: <5'	20' minimum
5' < Depth to Invert: >5' to ≤10'	30' minimum
Depth to Invert: >10'	30' minimum or [pipe I.D. + 6' + depth x 2] whichever is greater
Storm Sewer Pipe Diameter ≥ 36"	Minimum Easement Width
Depth to Invert: <5'	20' minimum or [pipe I.D. + 7' + depth x 2] whichever is greater
Depth to Invert: > 5' to ≤10'	30' minimum or [pipe I.D. + 7' + depth x 2] whichever is greater
Depth to Invert: >10'	

P. Maximum and Minimum Velocity

1. Maximum velocities in storm sewer conduits are important to minimize potential excessive erosion of the storm drain system.
 - i. Minimum velocities should be sufficient to prevent deposition of solid material. The controlling velocity is near the bottom of the conduit and is considerably less than the mean velocity.
 - a. Storm drains should be designed to have a minimum velocity of two and one half (2.5) feet per second (fps).
 - ii. Maximum velocity shall not be greater than 20 feet per second. Excessive velocities may result in hydraulic grade line problems and may increase the potential for erosion where the system outfalls.
 - a. Velocities shall be designed to be non-erosive at the re-entry into the natural stream or downstream channel.
 - b. An outlet velocity of six feet per second (6 fps) or less is generally considered to be non-erosive. The downstream receiving channel or stream may still need stabilization if site soil conditions require to prevent scour or erosion.
 - c. In cases where the outlet velocity is greater than six feet per second (6 fps), the downstream receiving channel or stream must receive adequate protection against erosion using erosion prevention practices or energy dissipation devices.
2. Design velocities for all pipes and structures shall be included in the drainage calculations for both public storm sewer systems and private storm sewer systems.
3. Table 6-8: MAXIMUM AND MINIMUM VELOCITY IN STORMDRAINS provides the allowed velocities.

Section 6.10 Stormdrain Manholes

A. Manhole Accessibility and Location

1. Manholes at Junctions Manholes provide an important access point for maintenance purposes, and the Town of Johnstown requires that all manholes are accessible for the purpose of maintenance. Refer to Chapter 2, Table 2-1: Minimum Easement Design Criteria for minimum access road and easement standards.
2. Manholes shall be located at street intersections whenever possible, or in locations where accessible with a standard vactor truck.
3. For manholes placed in the public right-of-way, manholes shall be located within asphalt or concrete paving, and shall not be located within concrete pans, sidewalks, or gutters.
4. For manholes placed in easements outside the public street right of way, adequate access must be provided for access (see Section 6.10.A for maintenance access requirements). This includes private systems.

TABLE 6-8: MAXIMUM AND MINIMUM VELOCITY IN STORMDRAINS		
TYPE	Maximum Permissible Velocity	Minimum Permissible Velocity
Storm Drain Inlet lateral	20 fps	2.5 fps
Storm Drain Trunk Line	20 fps	2.5 fps

B. Manholes at Junctions

1. The Town of Johnstown requires stormdrain manholes wherever a lateral pipe is located (e.g., blind connections are not allowed) and/or where a change occurs in pipe size, alignment, or slope.
2. Manholes are required at all pipe branch junctions.

C. Manhole Spacing

1. Manholes shall be placed at a maximum spacing of 500'.
2. Additional manholes may be necessary to "step down" steeper grades, allowing pipe slopes to be flatter than the slope of the street/grade above, to prevent velocities in storm drain pipes from exceeding the recommended maximum velocity of 20 fps.
 - i. Drop manholes will be evaluated on a case-by-case basis. If approved by the Public Works Director, the drop shall be designed in such:
 - a. To facilitate good hydraulic function.
 - b. To minimize erosive properties in/at the structure.
 - c. To protect personnel entering the manhole for maintenance and operation.

D. Manhole Depth and Manhole Inverts

1. Depth shall not exceed 15' unless an intermediate landing platform is provided per Standard Detail 407.
2. Manhole invert out shall be a minimum of 0.2 foot lower than the manhole invert in per the Town's Standard Detail 403. In the instances where flows enter and exit straight through the manhole without any bends or branches a one tenth (0.1) foot drop will be permissible.
3. When a tee invert is constructed, each invert coming into the manhole must be a minimum of two tenths (0.2) of a foot higher than the out invert.
4. If the hydraulic grade line of the major storm event is within one (1) foot of the manhole rim, a solid manhole cover, having an integral O-ring type gasket that can be bolted closed, must be used. Refer to Standard Detail 402.

E. Manhole Diameters

1. Manholes shall be at least forty eight (48) inches diameter for pipes up to thirty-six (36) inches in diameter.
2. Manholes shall be at least sixty (60) inches in diameter for pipes between forty two (42) inches to forty eight (48) inches in diameter.
3. Manholes shall be at least seventy-two (72) inches in diameter for pipes between fifty-four (54) inches and sixty (60) inches in diameter.
4. Manholes shall have a box base or precast tee for pipes larger than sixty (60) inches in diameter.
5. Structural design and details must be provided for box base manholes.
6. If elliptical pipe is to be used, the horizontal pipe dimension shall be used to determine MH sizing and spacing.
7. The above minimum manhole diameters shall be increased if/when required to ensure that a minimum of 1-foot clear wall space is maintained at the inside wall of the manhole between the outside to outside of all adjacent pipe penetrations.
 - i. Where this minimum clearance may be questionable, such as in manholes with multiple pipes entering and/or when one or more pipes are entering/exiting at oblique angles, detail must be provided in design plans to document adequate clearance.

F. Manhole Style (Flat Top Vs Eccentric Cones)

1. Use eccentric cones where manhole depth is 60 inches or greater on 48-inch diameter manholes and 72 inches or greater on 60-inch diameter manholes. Use flat top manholes when manhole depth is less than the above, and on all 72-inch diameter or larger manholes. The manway opening location on all manholes shall be placed to allow entry directly to manhole rungs placed on the clear vertical side of the manhole.

Section 6.11 Open Channels and Swales

A. General Information

1. This section of the DESIGN CRITERIA addresses the technical criteria for the hydraulic evaluation and hydraulic design of open channels in the Town. This information shall be considered a minimum standard.
2. Except as modified herein, all open channel criteria shall be in accordance with the most current edition and/or revisions of the MHFD's Urban Storm Drainage Criteria Manual (USDCM).
 - i. For the purpose of these DESIGN STANDARDS channels in the Town are defined as natural or artificial, and either Major Drainage Ways or Minor Drainage Ways.
 - ii. Channels conveying more than 20 cfs (>20) shall be considered a Major Drainage Way.
 - iii. Channel conveying flow less than or equal to 20 cfs (≤ 20) are considered a Minor Drainage Way.

B. Hydraulic Analysis

1. A hydraulic analysis is required for all channels conveying more than 5 cfs in the Town of Johnstown.
 - i. HECRAS models (or other step backwater computation software approved by the Public Works Director) shall be submitted digitally for review, including input and output files.
2. For channels and swales conveying less than 5 cfs normal depth calculations are acceptable. The Design Professional must provide detailed cross sections (representative of swale geometry) that include normal depth, velocity, and freeboard for the minor and major events demonstrating compliance with these DESIGN STANDARDS.
3. Uniform flow and critical flow computations will be in accordance with MHFD's USDCM.
4. Drop structure design shall be in accordance with the MHFD's USDCM. The Design Professional shall evaluate the forces of sheer stress, buoyancy, hydronic lift forces, etc. and provide calculations demonstrating a viable design in the required Drainage Report.

Table 6-9: STORMDRAIN MANHOLE SPACING		
Largest Storm Line In/Out⁽¹⁾	Minimum MH Diameter (in)⁽²⁾	Maximum MH Spacing (ft)
$\leq 36"$	48"	400 ft
$>36"$ to 48"	60"	400 ft
$>48"$ to $\leq 60"$	72"	400 ft
$>60"$	Box Base MH or TEE MH	400 ft
(1) If elliptical pipe is to be used, the horizontal pipe dimension shall be used to determine MH sizing and spacing. (2) As noted in Section 6.10 minimum manhole diameters shall be increased if/when required to ensure that a minimum of 1-foot clear wall space is maintained at the inside wall of the manhole between the outside to outside of all adjacent pipe penetrations.		

C. Channel Types, Major and Minor Drainage Ways

1. As previously noted, channels conveying more than 20 cfs shall be considered a major drainage way. Minor drainage ways will be conveyances of less than 20 cfs.
2. Natural channels include all watercourses that have occurred naturally, such as (but not limited to) the Big Thompson River, Little Thompson River or Big Hollow Gulch.
3. Artificial channels are those constructed or developed by human effort: large designated floodways, irrigation canals and flumes, roadside ditches, and grassed or lined channels.
4. The MHFD USDCM contains substantial information for use by the Design Professional for design and preservation of natural stream corridors. The Town of Johnstown defers to MHFD guidance on this topic.
5. This section of the DESIGN STANDARDS integrates specific criteria for the hydraulic design and analysis of naturalized and developed channels and swales from the MHFD.

D. Channels in floodplains

1. Where channels are in or impact Federal Emergency Management Agency (FEMA) regulatory floodplain, all regulations outlined in the Town's Municipal Code, Floodplain Ordinance, FEMA's 44CFR, and in these DESIGN STANDARDS must be followed.
2. Where a drainage channel is being modified or created by new development, the Design Professional is advised that a CLOMR/LOMR may be required by the Town to:
3. Include the project in the regulatory floodplain.
 - i. Or if the channel already is in a regulatory floodplain, for the Town to remain compliant with federal criteria governing floodplains.
4. Federal permitting requirements (USACOE Section 404 and EPA Endangered Species Act) must be adhered to for modifications to natural drainage ways.
 - i. These permits must be acquired by the Design Professional and referred to in the narrative of the required Drainage Report.
 - ii. Copies of applicable approved permits and associated documentation must be provided to the appropriate Town Department.

E. Natural Channels

1. The hydraulic properties of natural channels vary along a channel reach and can either be controlled to the extent desired or altered to meet given requirements.
2. An initial determination must be made regarding whether an impacted natural channel is (will be) adequately stable from degradation or aggradation due to erosion from high velocity flows and/or from excessive silt deposition due to low velocity flows. Many natural channels in urbanized and developing areas have mild slopes, and are reasonably stable.
 - i. If a natural channel is used for carrying storm runoff from new development, the altered nature of the runoff peaks and volumes from development may cause erosion.
 - ii. Detailed hydraulic analysis will be required for natural channels to identify the channel capacity and post development stability. Modifications to the pre-development natural channel may be required to ensure a stabilized post-development condition.
 - iii. Investigations necessary to ensure that the natural channel(s) are/will be adequate are different for every waterway. The Design Professional must prepare cross sections of the channel, define the water surface profile for the minor and major design flows/flood events, investigate the bed and bank material to determine erosion tendencies and study the bank slope stability of the channel under projected future (post development) conditions of flow. Calculations must be made to demonstrate that supercritical flows will not be anticipated for the major storm event.

3. Detailed hydraulic and channel stability analyses are required for natural channels to identify the erosion tendencies and the effect of the storm runoff on channel stability. Refer to Section 6.03 for required Drainage Report content. The design criteria and evaluation techniques for natural channels (major and minor drainage ways) are as follows:
 - i. The channel and over bank areas shall have adequate capacity for the 100-year storm runoff.
 - ii. Natural channel segments which have a calculated Froude Number greater than 0.6 for non-cohesive soils or with poor vegetation and a maximum Froude Number of 0.8 for vegetated cohesive soils for the 100-year flood peak.
 - iii. Roughness factors (Manning's n), which are representative of un-maintained channel conditions, must be used for the analysis of water surface profiles.
 - iv. Roughness factors (Manning's n), which are representative of maintained channel conditions, must be used to determine velocity limitations.
 - v. Erosion control structures, such as drop structures or check dams, may be required to control flow velocities.
 - vi. Maintenance access must be provided as outlined on Chapter 2, Table 2-1.
 - vii. Appropriate consideration/allowances for proposed future bridges or culverts, which can raise the water surface profile and cause the floodplain to be extended, shall be included in the analysis presented to support the existing or proposed channel evaluation/design improvements. The Design Professional shall contact the Town for information on future bridges, culverts or other planned improvements that might impact the project.
 - viii. The Drainage Report Narrative must include a summary of the impact of projected urbanization to show that stability and channel conveyance capacity is projected to remain adequate for the proposed existing and future post development conditions.
4. Bankfull Channels
 - i. The Town of Johnstown allows the design of bankfull channels as described in Volume 2 of the MHFD's USDCM based on the following:
 - a. The bankfull width, as depicted on Figure 6-5, must be based on the Minor (5-year) storm recurrence interval.
 - b. All proposed non-habitable appurtenant structures in the floodplain terrace (such as benches, signage, lighting, etc.) must be adequately protected from flood damage and anchored against floatation and the anchoring must be detailed in the Drainage Report and on the construction drawings.

F. Grass Lined Channels and Swales

1. Grass lined channels are the most desirable of the artificial channels. The grass will stabilize the body of the channel, consolidate the soil mass of the bed, check the erosion on the channel surface and control the movement of soil particles along the channel bottom. The channel storage, the lower velocities and the greenbelt multiple-use benefits obtained create significant advantages over other artificial channels.
 - i. Grass channels (includes naturalized channels as described in the MHFD USDCM criteria) shall be used in the Town of Johnstown.
 - a. Unless reasonable constraints on the hydraulic design from topography or space limitation and/or existing development preclude adequate space for the use of grass lined channel, only grass lined channel will be considered acceptable for major drainageways in the Town. In this case refer to the Town's Design Exception Process outlined in Chapter 2, Section 2.05.
 - ii. The presence of grass in channels creates turbulence which results in loss of energy and increased flow retardance. Therefore, the Design Professional consider sediment deposition and scour, as well as hydraulics.
2. The maximum channel depth of flow for grass lined channels shall be as outlined in the MHFD USDCM for major channels and 4' maximum depth for minor channels.
3. Critical depth shall be determined for the major and minor events to ensure that supercritical flow conditions do not occur.

4. Freeboard is required and shall be provided as outlined in Section 6.11.F.4.
5. Grass channel slopes shall be constructed so that flow velocities do not exceed 7 ft/s during the major storm. The minimum velocity must be greater than 2.0 feet per second for the minor storm runoff.
6. Grass lined channels having a Froude Number greater than 0.8 are not permitted.
7. Sideslopes of grass channels shall not exceed 4H:1V.
8. Minimum radius:
 - i. The minimum centerline radius curvature for major channels shall be the greater of twice the top width of the major storm design flow, or 50 feet. Superelevation calculations must be provided.
 - ii. The minimum centerline radius for minor channels (swales) shall be the greater of shall be the greater of twice the top width of the major storm design flow 25 feet.
9. As prescribed by the MHFD standards, an effective cross-sectional shape must be established for unlined channels. See Figure 6-5, for the Town's preferred cross section for unlined channels.
 - i. Construction Drawings must address seedbed preparation, installation of seed, blankets, and plugs.
 - a. Temporary irrigation must be provided until vegetation is established.
 - b. Reseeding and maintenance activity must be discussed in the required Operations and Maintenance Report.
10. Grass lined swales shall meet the minimum criteria for swales outlined in the MHFD's USDCM (as summarized in Table 6-10) and:
 - i. Flow rate of less than 40 cubic feet per second.
 - ii. Minimum bottom width of 2'.
 - iii. Sideslopes flatter than 5H:1V.
 - iv. Construction Drawings must address seedbed preparation, installation of seed, blankets, and plugs.
 - v. Temporary irrigation must be discussed.
 - vi. Reseeding and maintenance activity must be discussed in the required Operations and Maintenance Plan.

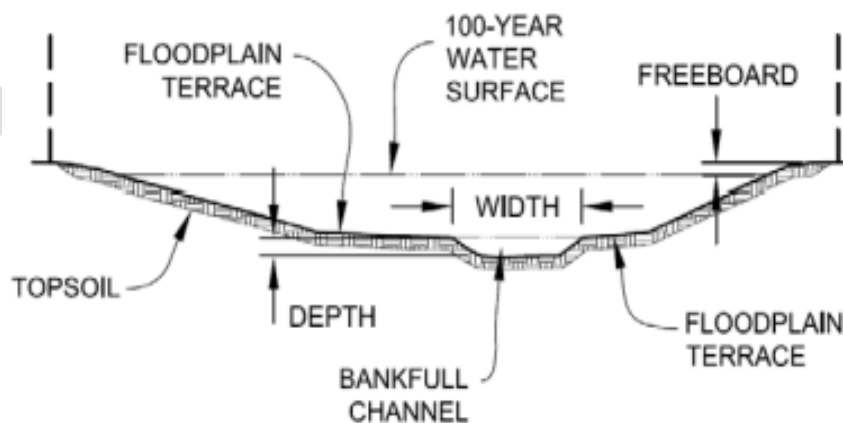


FIGURE 6-5: TYPICAL NATURAL CHANNEL GEOMETRY

TABLE 6-10: GRASS LINED CHANNEL PARAMETERS

Geometric Configuration		Grass Swale Permitted?	Stability 5:1 to 10:1 2'-4' bottom width		Stability 10:1 or flatter 2' -4' bottom width		Stability flatter than 10:1 >4' bottom width		Grass Swale Permitted?
Bottom Width	Side Slopes		Longitudinal Slope	Flow Rate	Longitudinal Slope	Flow Rate	Longitudinal Slope	Flow Rate	
2-4 feet	Between 5:1 and 10:1	YES ¹	.05% to 1%	0-30 cfs	.05% to 1%	0-40 cfs	.05% to 1%	0-60 ²	YES ¹
2-4 feet	10:1 or flatter	YES ¹	1% to 1.5%	0-20 cfs	1% to 1.5%	0-30 cfs	1% to 1.5%	0-40 cfs	YES ¹
Greater than 4 feet	Between 5:1 and 10:1	YES ¹	1.5% to 3%	0-10 cfs	1.5% to 3.5%	0-15 cfs	1.5% to 3%	0-20 cfs	YES ¹
Greater than 4 feet	10:1 or flatter	YES ¹	3% to 6.5%	0-5 cfs	3.5% to 5%	0-10 cfs	3% to 6.5%	0-10	YES ¹
Less than 2'	Steeper than 5:1	NO	Greater than 6.5%	5 or more cfs	Greater than 7.5%	5 or more cfs	Greater than 10%	5 or more	NO
¹ Where flow velocity exceeds seven feet per second (7 fps) , regardless of proposed geometry, side slope, longitudinal slope, and/or quantified flow rate, the Design Professional must submit a Design Exception Request as outlined in Chapter 2 and a composite section may be considered. Refer to MHFD standards for additional information on naturalized and/or composite channels. ² MHFD recommends not exceeding 40 cfs in <u>ANY</u> grass lined channel									

G. Concrete Lined Channels—Major Drainage Ways

1. Concrete lined channels for major drainage ways will be permitted only where right-of-way restrictions within existing development prohibit grass lined channels, and placement of stormdrain conveyance piping is not feasible. The lining must be designed to withstand the various forces and actions which tend to overtop the bank, deteriorate the lining, erode the soil beneath the lining, and erode unlined areas, especially for supercritical flow conditions.
2. Super-Elevation of the water surface shall be determined at all horizontal curves, and the design of the channel adjusted accordingly.
3. Velocity shall be such that critical or supercritical flow conditions are not created. In no case shall velocity exceed 18 fps.
4. Critical or supercritical flow are not permitted. Drop structures or other appropriate energy dissipation will be required to maintain a subcritical flow regime.
5. Reinforcing steel shall be placed per the Town's Standard Specifications.
6. Sideslopes shall be a maximum of 2.5H:1V, or shall be designed as a structurally reinforced retaining wall, if steeper.
7. Safety Fencing will be required as described in Section 1.01L for all channels where slope exceeds 4:1, or where Major Storm flow depth exceeds 3'.
8. Concrete channels shall be continuously reinforced and contain transverse joints.
 - i. Expansion joints shall be installed where new concrete lining is connected to a rigid structure or to an existing concrete lining which is not continuously reinforced.
 - ii. Longitudinal joints, where required, shall be constructed on the sidewalls at least one foot vertically above the channel invert.
 - iii. All joints shall be designed to prevent differential movement.
 - iv. Construction joints are required for all cold joints and where the lining thickness changes.
 - v. Reinforcement shall be continuous through the joint.
9. Maintenance Access shall be provided as outlined in Chapter 2, Table 2-1: Minimum Easement Design Criteria, and may be required on both sides of the channel. Where channel length exceeds 250' feet maintenance access to the bottom of the channel will be required.

H. Riprap Lined Channels

1. Riprap lined channels shall be permitted only in areas of existing development where right-of-way for drainage ways is limited and such limitation prohibits the use of grass lined channels.
 - i. If the project constraints dictate the use of riprap lining, then the Design Professional shall present the concept, with justification, to the Town for consideration of an exception per the process outlined in Chapter 2, Section 2.05
 - ii. Grouted riprap will be considered on a case-by-case basis.
2. The criteria for the design and construction of riprap channel linings shall be in accordance with the MHFD'S USDCM.
3. Riprap lined channels shall be designed for a turbulence factor (Froude Number) less than 0.8 for the 100-year recurrence interval storm event.
4. A minimum of one foot (1') of freeboard must be provided.

I. Channel Freeboard (minor and major drainageways)

1. Freeboard will be required for all channel and swale types.
 - i. Adequate freeboard for natural and grass lined channels shall be determined based on the following equation:

$$H_{FB} = 1.0 + 0.025V(y_o)^{1/3} + \Delta y$$

Where:

- H_{FB} = freeboard height (feet)
- V = average channel velocity (fps)
- y_o = depth of flow (feet)
- Δy = increase in water surface elevation due to super elevation at bends (see MHFD USDCM, equation MD-9; no bends allowed in supercritical channels)

- ii. Adequate freeboard for concrete channels shall be determined based on the following equation:

$$H_{FB} = 1.0 + 0.025 V (d)^{1/3}$$

Where:

- H_{FB} = freeboard height (feet)
- V = velocity (fps)
- d = depth of flow (feet)

- iii. Freeboard shall be in addition to super-elevation, standing waves, and/or other water surface disturbances.
2. Minimum freeboard for all channel and swale types will be 1.0 foot or 1/3 of the major storm design flow depth, whichever is greater.
3. Freeboard calculations must be included in the required Drainage Report.

J. Concrete Trickle Channels and Combination Channel Sections

1. Base flow for grass lined channels will be conveyed in a concrete trickle channel where channel longitudinal slope is less than 2% and/or where flow velocity is less than 2 fps.
2. Minimum width of the required concrete trickle channel shall be 4', as indicated on Standard Detail 307.
3. Alternative low flow treatment will be considered on a case-by-case basis, using the Town's Special Exception Process outlined in Chapter 2.

K. Channel Rundowns

1. A channel rundown is used to convey storm runoff from the bank of a channel to the invert of an open channel or drainageway. The purpose of the structure is to minimize channel bank erosion from concentrated overland flow.
2. The use of rundowns to convey storm runoff down a channel bank is discouraged due to their high rate of failure and the resulting maintenance and repair burden. Instead, use a pipe to convey runoff to a point just above the channel invert (normally 1 foot for small receiving streams or ponds and up to 2 feet for large receiving channels).
 - i. Unlined rundowns or riprap rundowns are discouraged, the Town prefers the use of either a concrete channel as shown on Standard Detail 310 (to be developed) or use of a pipe (slope drain).
3. The channel rundown will be designed to carry a minimum of the minor storm runoff or 1 cfs, whichever is greater.
4. The maximum depth at the design flow cannot exceed 12". Due to the typical profile of a channel rundown beginning with a flat slope and then dropping steeply into the channel, the design depth of flow will be the computed critical depth for the design flow.

5. The rundown outlet will enter the drainageway at the trickle channel flowline.
 - i. Erosion protection of the opposite channel bank will be provided by a 24-inch layer of grouted Type-L riprap. The width of this riprap erosion protection will be at least three times the channel rundown width or pipe diameter. Riprap protection will extend up the opposite bank to the minor storm flow depth in the drainageway or 2 feet, whichever is greater.

Table 6-11: CHANNEL DESIGN PARAMETERS		
UNLINED CHANNEL	Non-Cohesive Soils or Poor Vegetation	Cohesive Soils and Established Vegetation
Maximum Flow Velocity (based on average in section)	5.0 ft/s	7.0 ft/s
Minimum Velocity (lower velocity will require Trickle Channel and/or underdrain section)	2.0 ft/s	2.0 ft/s
Maximum Froude Number	0.6	0.8
Manning's 'n' Value for Hydraulic Evaluation	Table 6-12: Roughness Values	
Minimum Freeboard	1 ft or 1/3 design flow depth (whichever is greater) Refer to Section 6.11 for criteria at bends, etc.	
Minimum Easement and Maintenance Access	Chapter 2, Table 2-1: Minimum Easement Design Criteria	
Maximum Sideslopes	4:1	4:1
LINED CHANNEL	Concrete	Riprap
Maximum Flow Velocity	18 ft/s	Based on Rock Size, cannot exceed 10 ft/s for loose riprap or 15 ft/s for grouted or gabion lining
Maximum Froude Number	0.8	0.8
Manning's 'n' Value for Hydraulic Evaluation	0.012	0.033
Minimum Freeboard	1'	1'
Minimum Easement and Maintenance Access	Chapter 2, Table 2-1: Minimum Easement Design Criteria	
Maximum Sideslopes	2.5H:1V	2.5H:1V

L. Safety Requirements

1. Channel and swale sideslopes shall be compliant with the maximum sideslope criteria based on channel type as described in these DESIGN STANDARDS.
2. Concrete Channels
 - i. A fence³ will be installed, wherever the 100-year channel flow depths exceed three (3) feet and wherever the channel side slope(s) exceed 4:1.
 - ii. Gates, with top latch, shall be placed at 250-foot intervals and staggered where fence is required on both sides of the channel.
 - iii. Ladder-type steps shall be installed not more than 400 feet apart on alternating sides of the channel. Bottom rungs of ladder steps shall be placed 12 inches vertically above the channel invert.
3. Where multi-use facilities in the regulatory floodplain are proposed, flash flood safety signage will be required. Refer to Standard Detail 311.

M. Manning's Roughness Coefficient

1. As stated in the MHFD's USDCM, selecting roughness values for the main channel and overbanks of each cross section in the submitted hydraulic model is important.

³ Fence type must be approved by the appropriate Town department.

2. Because this tends to be somewhat subjective rather than deterministic, it is recommended that hydraulic modeling be conducted in two ways.
 - i. Conservatively low roughness values should be used for assessing velocities, Froude numbers, and shear stresses.
 - ii. Conservatively high roughness values should be used for assessing water surface elevations and depths.
3. The lack of vegetation in post construction conditions will result in higher channel velocities and greater potential for erosion. Channels with fully established vegetation will have reduced velocities but higher flow depths.
4. Recommended Roughness Values for initial approximations of hydraulic conditions shall be based on Table 6-8.

TABLE 6-12: ROUGHNESS VALUES		
Location and Cover	When Assessing Velocity, Froude Number, Shear Stress	When Assessing Water Surface Elevation and Flow Depth
Main Channel (bankfull channel)		
Sand or Clay Bed	0.03	0.04
Gravel or Cobble Bed	0.035	0.07
Vegetated Overbanks		
Turfgrass sod	0.03	0.04
Native grasses	0.032	0.05
Herbaceous wetlands (few or no willows)	0.06	0.12
Willow stands, woody shrubs	0.07	0.16

Section 6.12 Hydraulic Structures

A. Minimum Hydraulic Standards

1. This section of the DESIGN CRITERIA addresses the technical criteria for the evaluation and design of hydraulic structures in the Town.
2. This information shall be considered a minimum standard.
3. Except as modified herein,, all hydraulic structure design shall be in accordance with the most current edition and/or revisions of the MHFD's Urban Storm Drainage Criteria Manual (USDCM).
 - i. The shape, size, and features of hydraulic structures vary widely for different projects, depending upon the design discharge and functional needs of the structure.
 - ii. For the purpose of these DESIGN STANDARDS grade control and outfall structures in the Town are defined as Grade Control Structures, Conduit Outlet Structures, Drop Structures, Energy Dissipators, and check structures.

B. Grade Control and Drop Structures

1. Grade control and drop structures must be designed for fully developed future basin conditions.
2. Maximum unit discharge for the 100-year recurrence interval event shall not exceed 35 cfs.
3. Drop height (upstream channel invert less downstream channel invert) must be 3' or less.
4. The hydraulic siting of grade control structures is relatively straightforward⁴ and can be determined by the following equation:

⁴ USDA Technical Supplement 14G

$$H = (S_o - S_f)X$$

Where:

H	=	amount of drop to be removed from the reach
S _o	=	original bed slope
S _f	=	final, or equilibrium slope
X	=	length of the reach (Goitom and Zeller 1989)

The number of structures (N) required for a given reach can then be determined by:

$$N = \frac{H}{h}$$

Where:

h	=	selected drop height of the structure
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5. The Simplified Design Procedures as described in the MHFD's USDCM can be utilized if the maximum net drop is the required 3' or less.
6. Where Simplified Design Procedures cannot be met, a detailed hydraulic analysis is required. Hydraulic Model input and output files, and all computations developed for siting and design of drop structures shall be referenced in the narrative of the required Drainage Report and supporting documentation included in the Drainage Report's appendix.
7. The Town of Johnstown prohibits the use of check structures.
8. Placement of grouted stepped boulder drop structures, and sculpted concrete drop structures are approved in the Town of Johnstown, but the Design Professional must include appropriately detailed plans and specifications to prove compliance with the MHFD's USDCM.
 - i. Decorative elements of sculpted concrete drops should be discussed in the narrative of the required Drainage Report and well detailed on the Construction Improvement Drawings.
 - ii. Maintenance must be discussed in the required Operations and Maintenance Manual.
9. Profile and cross-sectional drawings at key locations must be included on the submitted construction improvements plans for all drop structures, regardless of type.

C. Pipe Outfalls and Rundowns

1. Pipe end treatment and downstream erosion protection at pipe outfalls is required to protect the structural integrity of the pipe and to maintain the stability of the adjacent slope.
2. Flared end sections are required on the inlet and outlet ends of 36" (and smaller) diameter culverts or storm drain systems where combination headwalls and wingwalls are not provided.
3. All flared end sections must include a concrete cutoff wall.
4. Combination headwall/wingwalls are required on all inlets and outlets where pipe diameter exceeds 36".

D. Energy Dissipation and Erosion Protection

1. The criteria developed by the MHFD in the USDCM shall be used for the design of energy dissipation and erosion protection at outfall points in the Town of Johnstown.
2. Riprap Aprons at conduits and culvert outlets must be sized appropriately and all dimensions and details included on the Construction Improvement Drawings.
 - i. The riprap apron must extend until velocity is decreased to no more than 5 ft/s for all soil types.
 - ii. Maximum sideslopes on rip rap aprons is 4:1.
 - iii. Depth of rock shall be 2xD₅₀ minimum.
 - iv. Rock sizing shall be based on the equations provided in the MHFD's USDCM.

3. The Design Professional shall include all computations and design in the required Drainage Report and discuss long term maintenance in the required Operations and Maintenance Report.

Section 6.13 Stream Access and Recreational Channels

A. Shared Use Paths and Trails Adjacent to Streams

1. Paths and/or trails are often constructed along streams to provide access for maintenance vehicles. However, if public access is provided to the path/trail, it should be assumed that it will be used by the public. For this reason, it is important to design paths and/or trails with the health, safety, and welfare of the public as a primary design objective.
2. In the Town of Johnstown all path/trail types (including stream crossings, bridge underpasses, culvert underpasses, etc.) shall base design on the frequency of inundation as outlined in the MHFD's USDCM.
3. Where new paths/trails are proposed:
 - i. All stream path floodplain crossings must be evaluated as part of the hydraulic model and must be constructed to withstand forces associated with the 100-year flood event.
 - ii. All crossings must be included/described in the required Operations and Maintenance Plan to address periodic and post-runoff debris and sediment removal.
 - iii. Crusher fines are prohibited below the 10-year WSE.
 - iv. Elevate the path to 2' above the 5-year WSE.
 - v. Safety railing will be required where steep side slopes (steeper than 4:1-within 4' of trail), vertical walls (height exceeding 2'-within 4' of trail/path), steep longitudinal slopes, bends, and/or areas where cross drainages create hazard are present. The safety railing must be placed no closer than 2' from edge of sidewalk.
 - a. Railings, fences, or barriers on both sides of a bicycle path structure shall be a minimum of 4.5 feet high. Smooth rub rails should be attached to the barriers at handlebar height of 3.5 feet. Barriers should not impede storm water runoff from the path.
 - vi. When rails are used, the hydraulic model should consider the full area of the rail to be clogged with debris.
 - vii. Rails must be designed to allow movement of snow through the bottom of the rail, without creating a hazard for children.
 - viii. A minimum 3' thickened edge on both the upstream and downstream edges of the trail must be provided where paths or trails cross perpendicular to channels or swales, extended to the width of the 10-year WSE.
 - ix. Where cross flow intersects the path or trail, culverts shall be provided to pass the 5-year event.

Section 6.14 Culverts and Bridges

A. General

1. A culvert is defined as a conduit for the passage of surface water under a, street/road, driveway, railroad, canal or other embankment (except detention pond outlets which are not considered a culvert for the purpose of this Section).
 - i. Culvert design involves both hydraulic and structural design considerations.
 - ii. This section sets forth only the hydraulic aspects of culvert design. Bridges are defined by span, typically crossings over 20' in length.

B. Culvert Hydraulics

1. The procedures and basic data to be used for the hydraulic evaluation of culverts in the Town of Johnstown will be in accordance with the MHFD's USDCM except as modified herein.
 - i. In culvert hydraulic evaluations the Design Professional may utilize Culvert Capacity Charts, Culvert Nomographs, HY-8, HECRAS or other non-proprietary software as approved by the Town.
 - ii. Culvert tailwater analysis must be analyzed using HY-8 or HECRAS, tailwater ponding area must be within and easement and depicted on the Construction Drawings.
 - iii. To determine outlet protection requirements, use the MHFD's UD-Culvert. All outlet protection calculations must be included in the required Drainage Report.
2. The HGL and EGL shall be determined for each culvert and included in the required Drainage Report.
3. Each culvert location must be shown on the Construction Improvement Drawings (CD's) and all details provided.
 - i. Details must include:
 - a. Cross-sectional details showing roadway/crossing.
 - b. 10-year HGL and 100- year WSE.
 - c. Invert and outlet configuration.
4. Culverts must be designed to pass the 25-year recurrence interval storm event with no street overtopping on all streets other than arterial classifications. On arterial classification streets, culvert(s) must be designed to convey 100-year recurrence interval storm event.
 - i. Where culverts are not designed to pass the 100-year recurrence interval storm event, backwater pond must be depicted on Construction Improvement Drawings (CD's).
 - ii. Overtopping cannot exceed lessor of: 6" at gutter flow line for minor storm (5-year event) and 12" at the gutter flow line for the major storm (100-year event), the maximum depth fully contained within the public right-of-way, or the maximum depth which does prevent the required open lane width during the major storm event (**see Street Standards**).
 - iii. Cross flow shall be avoided, refer to Table 6.6 for criteria.
 - iv. If the design of culvert conveyances includes cross flow over local streets, this cross flow must not exceed the overtopping limits as stated in above, and must be presented in tabular form and included in the required Drainage Report.
 - v. Headwater depth/culvert diameter ratio shall not exceed 1.5 for the 100-year event, and 1.0 for the 5-year event.
5. The entire tailwater pond must be within the public right-of-way or a drainage easement.
6. Culverts must be designed to maintain a minimum velocity of 3 ft/s during the average annual flow event, and a maximum outlet velocity of 18 ft/s, for any design storm event.
 - i. Where outlet energy dissipation is needed based on receiving channel/ditch configuration, the entire outlet works must be within a drainage easement and designed per MHFD USDCM standards.

C. Culvert Material, Pipe Size and Design

1. All culverts will be constructed from the following materials:
 - i. Reinforced concrete pipe
 - ii. High Density Polyethylene Pipe.
 - iii. Corrugated Metal Pipe shall not be used for culverts in Johnstown.
2. Minimum diameter of all culverts shall be 18".
3. Culverts over 36" in diameter must include headwalls and wingwalls or flared end sections with cutoff walls.
4. Culvert openings less than 42" in diameter and for instances of long culverts (e.g., daylight cannot be seen), placement should include a safety grate on the culvert entrance, as required by MHFD's USDCM.

5. Grate design must be discussed in the narrative of the required Drainage Report and calculations must be submitted.
 - i. Grates must be inclined at a slope no steeper than 4H:1V.
 - ii. No grates are permitted on culvert outlets.
6. Projecting inlets are not permitted, all culvert entrances must include headwalls, wingwalls, or flared end sections to maximize efficiency and minimize turbulence, head loss, and erosion.
7. If an existing culvert is replaced by one with more capacity, the downstream effects of the increased flow must be evaluated and discussed in the required Drainage Report narrative and all downstream conveyance capacity calculations submitted for review.
8. Bends in culverts are only permitted at junction structures

D. Bridge Design

1. Bridge design shall be compliant with AASHTO's Hydraulic Analysis for the Location and Design of Bridges and the Colorado Department Transportation's Bridge Design Manual.
2. Minimum Freeboard below the bridge soffit is 1.5'.
 - i. Additional freeboard may be required if significant debris flow during major events is likely to occur.
3. Bridge hydraulic calculations and scour analysis must be included in the Drainage Report. The HGL and EGL must be depicted on a cross sectional diagram of the bridge and included in the Construction Improvement Drawings (CD's).
4. Structural Plans must be incorporated into the Construction Improvement Drawings (CD's).
5. Dependent on the size and conveyance capacity needed for a new bridge, a Basis of Design Report may be required by the Town.
6. If a regulatory floodplain/floodway is being crossed, all requirements of the Town's Floodplain Ordinance and any/all state and federal criteria for structure placement in a regulatory floodplain/floodway must be met.
 - i. Pedestrian bridges must be designed to break away.
7. Bridges that are designed within subdivisions, with the intent to be maintained by a Metropolitan District, must be outlined in the required Operations and Maintenance Report and must include a routine maintenance and inspection schedule. These inspections must be documented annually and available to the Town upon request.

Section 6.15 Stormwater Detention

A. Detention of Stormwater Policy

1. This section clarifies the Town's specific requirements for the analysis and design of stormwater detention in combination with stormwater quality facilities.
2. Specific design guidance for stormwater quality facilities (e.g., extended detention basins, wetland basins, sand filters, etc.) are in Volume 3 of the USDCM-which the Town adopts in its entirety.

B. Detention Facility Purpose

1. The main purpose of a detention facility is to store excess stormwater runoff associated with an increased basin imperviousness and discharge the stormwater at a rate similar to the rate experienced from the predevelopment site drainage basin. The Town requires that stormwater detention is provided to control the 100-year event peak flow for all new development within the Town's jurisdictional limits to ensure that no development creates an adverse downstream impact.

2. The detention pond's primary purposes shall be to provide water quality benefit and to provide for storage and control of the peak flow associated with the 100-year recurrence interval storm event; however, the Town supports the design of multi-use stormwater detention facilities.
 - i. Multi-use facilities must consider public safety.
 - ii. Must be appropriately signed to advise the public that stormwater inundation may be present.
 - iii. Storage depth in parking area detention areas cannot exceed 12".

C. Stormwater Detention Applicability

1. The Town of Johnstown requires all development sites to restrict post development major storm event peak runoff rate to:
 - i. The lessor of the documented pre-development historical peak runoff rate or the design allowance for the development site as specified in an adopted Town Stormwater Master Plan; or,
 - ii. In the case of site that is part of a qualifying regional downstream stormwater master planned detention facility, the allowance for the development site as identified in the basis of design for the regional detention facility. (See Section 6.15(d) for QRSDf requirements.
2. In the event the post development runoff rate would be more than the above, appropriate stormwater detention facilities must be provided for the proposed development.
3. The detention requirement criteria may be evaluated on a case-by-case basis using the Exception Request process outlined in Chapter 2, Section 2.05 for:
 - i. Redevelopment sites.
 - ii. New development sites having a total area of less than one acre.
 - iii. Sites that can "free drain" - described as follows:
 - a. Property that is directly adjacent to a major drainage way (the Little or Big Thompson Rivers), the peak flows in the major drainage way may be reduced by allowing discharge of stormwater from the site to occur prior to the major drainage way upstream peak flow occurrence.
 - 1) *In these instances, the Town may require only Water Quality and/or EURV detention, but not 100-yr detention, for the Development Site.*
 - 2) *Calculations must be provided to demonstrate timing of the discharge of the major drainage way, in comparison to the Development Site's coinciding time of the un-detained 100-year event discharge.*
 - 3) *Peaks cannot be coincident, and the Town may require additional evaluation of storm centering to ensure a coincident peak would be unlikely in any circumstance.*
4. Developments upstream (upgradient) of the Hillsborough Ditch would not qualify for "free drain" reduction in required detention.
5. Site's tributary to a Qualifying Downstream Detention Facility, as defined in Section 6.15, where the Developed Peak Runoff (flow rate and/or total volumes) may exceed the identified allowance, if:
 - i. A letter from the owner/design engineer of the existing stormwater detention pond is included in the Development Site's required drainage report attesting that the downstream regional facility and has adequate available capacity to receive the additional flow.
 - ii. Appropriate pertinent excerpts from the downstream detention facility design documentation/drainage is included in the proposed Development Site's drainage report to support the capacity consideration.
6. Un-detained flows cannot cause adverse impacts in terms of flooding, erosion and/or water quality to other structures or property

D. Qualifying Regional Stormwater Detention Facility (QRSDf)

1. A downstream stormwater detention facility may be approved as a QRSDf relative to an upstream development area if:
 - i. Detention Facility was designed and sized to accommodate the post-development stormwater flow associated with the upstream site.
 - ii. The Detention Facility design has been approved by the Town.
 - iii. As-builts of the Detention Facility are on file with the Town.
 - iv. A Town approved Operation & Maintenance program/document and/or Maintenance Agreement for the Facility is on file with the Town.

- v. The Detention Facility has been registered with the State Engineer's office (if constructed after August 5, 2015).

E. Detention Design Requirements

1. The criteria and methodology for determining the required stormwater detention configuration and design shall follow the procedures outlined in the DESIGN STANDARDS and in the MHFD's USDCM.
2. The post development stormwater runoff discharge point generally must be at the historical discharge point for the site.
3. Unless specifically approved through a Design Standards Special Exception as outlined in [Chapter 2](#), required stormwater detention per these DESIGN STANDARDS shall be provided by a full spectrum extended detention basin providing Water Quality, Excess Urban Runoff Volume and 100-Yr (WQ, EURV, 100-Yr) detention as recommended by the MHFD and described in the MHFD's USDCM.
 - i. As stated in the MHFD's USDCM, full spectrum detention:
 - a. Controls peak discharges over the full spectrum of runoff events from small, frequent storms up to and including the 100-year event.
 - b. Produces outflow hydrographs that, other than a small release rate of the excess urban runoff volume (EURV), closely replicates the shape of pre-development hydrographs.
 - c. Full spectrum detention modeling shows reduction of urban runoff peaks to levels similar to pre-development conditions over an entire watershed, even with multiple independent full spectrum detention facilities.
 - ii. The criteria and methodology for determining the required stormwater detention configuration and design shall follow the procedures outlined in the DESIGN STANDARDS and in the MHFD's USDCM. The most current version of the MHFD-Detention Excel software shall be utilized for sizing and design of the Full Spectrum Detention Basins.
 - iii. SWMM (or other approved) modeling programs may be used to generate input to the MHFD-Detention for larger or complex drainage basins and/or where multiple in-series or interlinked EDB's may be proposed.
4. Below ground detention facilities/vaults and/or use of proprietary water quality or detention systems may be allowed on a case-by-case basis where site constraints preclude feasible use of above ground extended detention basin facilities.
 - i. Detention facilities shall not be constructed within public right-of-way, and the design high WSE of stormwater detention ponds shall not encroach upon public right-of-way.
 - ii. Downstream streets, channels, roadside ditches, sloughs, swales, and other conveyances must have the capacity to accept the historic flow rate that reached the new development. If downstream capacity below the site is not in place to accept the concentrated flow from the detention pond outlet, additional stormwater conveyance below the project may be required to assure that no adverse impacts are inadvertently introduced to downstream properties.
 - iii. All State (Water Rights) Statutes governing stormwater detention shall be complied with. Detention facilities constructed after August 5, 2015, must meet the requirements of "stormwater detention and infiltration facilities" under CRS Title 37 §37-92-602(8) which was enacted through Colorado Senate Bill 15-212. This statute states that stormwater detention and infiltration facilities are considered compliant with the statute if the facility:
 - a. Continuously releases or infiltrates at least ninety-seven percent of the water from a rainfall event that is equal to or less than a five-year storm within seventy-two hours after the end of the rainfall event.
 - b. Continuously releases or infiltrates all the water from a rainfall event greater than a five-year storm as quickly as practicable, but in all cases at least ninety-nine percent of the water from the rainfall event within one hundred twenty hours after the end of the rainfall event, and;

- c. Operates passively and does not subject the storm water runoff to any active treatment process.
 - d. Parking lot surface detention is strongly discouraged, see item 14 below.
- 5. Any dam constructed for the purpose of storing water, with a surface, volume, or dam height as specified in CRS Title 37 §37-87-105 (as amended) (equal to or greater than 10-feet total), will require approval of the plans by the State Engineer's Office.
- 6. The property owner shall be responsible for maintenance of all drainage facilities installed pursuant to the Development Agreement and/or drainage Maintenance Agreement. Requirements include but are not limited to maintaining the specified storm water detention volumes, maintaining outlet structures, maintaining pond embankments and emergency overflow, maintaining flow restriction devices and facilities needed to convey flows to the stormwater detention basin.
- 7. Retention ponds are not acceptable unless there is no feasible method for draining the pond by gravity. If a retention pond is found to be the only alternative, the minimum volume of the facility must be adequate to retain the storm runoff from twice the 100-year recurrence interval storm event.
 - i. Percolation/evaporation alone may be an accepted method for draining the pond, but percolation will not be acceptable in situations where an increase in groundwater flow because of pond percolation could cause an adverse impact down gradient of the pond site.
- 8. For any storm event, if the retention facility cannot be drained within 72 hours, permanent pumping facilities shall be required to drain the pond in compliance with the State Stormwater Detention Facilities regulations.
- 9. The minimum required volume shall be determined using either:
 - i. The Rational Formula Method, restricted to basins less than or equal to 90 acres.
 - ii. The CUHP method as documented in the USDCM Volume 2 "Storage" or the UD SWMM computer program.
 - iii. Alternative computer programs for routing flows through detention facilities must be reviewed and approved by the appropriate Town department prior to utilization.
- 10. Where desirable and feasible, multiple uses of a stormwater detention basin should be considered, such as creation of riparian and wetland vegetation, wildlife habitat, paths and other passive or active recreation opportunities.
- 11. Active recreation facilities such as ballparks, playing fields and picnic areas shall not be located within Water Quality (WQ) and EURV inundation zones of a detention facility. Habitat creation and trails may be permitted by the Public Works Director in these zones on a case-by-case basis.
- 12. Passive recreation areas may be allowed within the EURV (but not the WQ) inundation areas of the detention facility but should be outside of the 5-yr event inundation limits.
- 13. Detention Facility Freeboard Requirement:
 - i. The minimum required freeboard for detention facilities is 1.0 foot above the computed 100-year emergency overflow water surface elevation.
 - ii. Surface detention in a parking lot is strongly discouraged. In limited cases where permitted by Town staff, the maximum ponding depth shall not exceed 8" (approved overflow path required). Minimum required freeboard for parking lot detention is .75 feet above the computed 100-year water surface elevation.
 - iii. Emergency Spillway and Stormwater Detention Pond Embankments:
 - a. All stormwater detention ponds must be provided with an appropriately designed Emergency Overflow Spillway to prevent uncontrolled overtopping in the event the stormwater detention pond outlet becomes obstructed and/or if a larger than "design storm" event occurs. An "approved" emergency overflow drainage pathway must be identified and provided.
 - b. The emergency spillway must be sized having a minimum capacity equal to the 100-year recurrence interval storm event from the fully developed tributary area (prior to routing flows through the detention basin).
 - c. The emergency overflow embankment must be provided adequate protection from erosion during the overflow event – such as in the form of a 24" deep, Type M, buried riprap layer on the entire downstream face of the embankment.
 - d. The elevation of the top of the entire detention facility boundary must provide a minimum of 1-foot freeboard above the pond WSE when the emergency spillway is conveying the maximum 100-yr event emergency overflow.

- e. Clearly depict the emergency spillway and the path of the emergency overflow downstream on the Drainage Plan and include a discussion in the narrative of the required Drainage Report.
- 14. Forebay Requirement: All outlets into stormwater detention ponds shall include a sediment forebay.
- 15. Trickle Channel Requirement: All grassed bottom stormwater detention ponds shall include a concrete lined trickle channel from the (each) forebay to the outlet structure. Minimum longitudinal slope of trickle channel shall be 0.4%. Refer to Standard Detail 307.
- 16. Pond Vegetation shall meet the criteria outlined in the Town's Landscape Design Standards, available on the Town's website.
 - i. Trees and shrubs are not permitted on dams or fill embankments, or inside the 100-year storage WSE boundary.
 - ii. Maintenance of landscaping in, and removal of invasive and undesirable plants from, storm water swales and/or detention facilities must be discussed in the required Operations and Maintenance Plan.
- 17. Retaining walls within stormwater detention basins may not be allowed in the Town of Johnstown except on a limited case-by-case basis through the exception process.

F. Detention Pond Sizing/Storage Volume

- 1. The USDCM methods described for sizing of full spectrum detention ponds based on watershed area shall be utilized, as outlined on Table 6-13: Full Spectrum Sizing Methods. The use of simplified equations is not allowed in the Town of Johnstown.
 - i. The maximum allowable 100-year release rate for a full spectrum detention facility is equal to 90 percent of the predevelopment discharge for the upstream watershed.
- 2. Pond sizing calculations must be prepared using the latest edition of the MHFD-Detention MSeExcel, provided by the MHFD. The completed design must be provided and described in the required Drainage Report narrative and a summary of the detention pond design included in the required Drainage Report and on the Construction Drawings.

G. Stormwater Detention Pond Maintenance and Certification

- 1. New Stormwater Detention Ponds will require a Maintenance Agreement and Operations and Maintenance Plan.
- 2. A maintenance access road must be provided to all areas of the pond that will require regular maintenance. See Chapter 2 for easement and maintenance access road requirements.
- 3. Each of the detention facilities, one approved and before going actively "on-line" must be appropriately entered in to the Colorado Stormwater Detention and Infiltration Notification Portal.
 - i. The Design Professional must provide the completed MHFD Detention V4.04 (or most current version) design worksheet (as active MSeExcel Files) to the Town for each approved detention basin, for the Town to upload to the State Portal.
- 4. Refer to [Appendix E](#), for a sample Operations and Maintenance Plan. (to be developed)

Table 6-13: FULL SPECTRUM SIZING METHODS			
Watershed Properties	SIZING METHOD		
	Simplified Equations	UD-Detention	CUHP/SWMM Hydrograph Routing
Less than 10 acres	Not allowed in the Town of Johnstown	X	
10 to 50 acres		X	X
50 to 130 acres		X	X
130 acres to 1 mile ²		X	X
Greater than 1 mile ²		X	X
Multiple detention facilities (in parallel or series)			X

Section 6.16 Stormwater Pollution Prevention

A. General Information

1. The Town of Johnstown requires compliance with Federal and State requirements to reduce the pollution of stormwater within the municipal boundary.
2. Since the National Environmental Policy Act of 1969 (NEPA), much attention has been given to the control of erosion and sedimentation by Federal, State and local governments. Numerous laws and regulations governing land-disturbing activities have been developed and published. Some important legislation that affects construction activities in regard to erosion and sediment control are: The Clean Water Act (sections 401,402 and 404); Senate Bill 40 (SB40) Wildlife Certification (Title 33, Article 5, CRS); The Colorado Water Quality Control Act (Title 25, Article 8, CRS).

B. Regulatory Background:

1. Clean Water Act Clean Water Act Summary:
 - i. The Federal Water Pollution Control Act of 1972, as amended (33 U.S.C. 1251 et seq.) is commonly known as the Clean Water Act and establishes minimum stormwater management requirements for urbanized areas in the United States. At the federal level, the EPA is responsible for administering and enforcing the requirements of the Clean Water Act. Section 402(p) of the Clean Water Act requires urban and industrial stormwater be controlled through the NPDES permit program. Requirements affect both construction and post-construction phases of development.
 - ii. Urban areas must meet requirements of Municipal Separate Storm Sewer System (MS4) permits. Many industries and institutions such as state departments of transportation must also meet NPDES stormwater permit requirements.

- iii. MS4 permittees are required to develop a Stormwater Management Program that includes measurable goals and must implement needed stormwater management controls (i.e., BMPs).
 - iv. MS4 permittees also are required to assess controls and the effectiveness of their stormwater programs and to reduce the discharge of pollutants to the "maximum extent practicable."
 - v. The EPA has delegated Clean Water Act authority to the State of Colorado. The State, through the Colorado Department of Public Health & Environment (CDPHE), implements and enforces the CWA NPDES Programs through the Colorado Discharge Permit System (CDPS).
 - vi. Colorado is an NPDES state, which means the EPA's authority to issue NPDES permits is delegated to the state regulatory agency, the Colorado Department of Public Health & Environment (CDPHE). CDPHE implements and enforces the NPDES Programs through the Colorado Discharge Permit System (CDPS) program.
2. Colorado's Stormwater Permitting Program
- i. The Colorado Water Quality Control Act (25-8-101 et seq., CRS 1973, as amended) established the Colorado Water Quality Control Commission (CWQCC) within the Colorado Department of Public Health and Environment (CDPHE) to develop water quality regulations and standards, classifications of state waters for designated uses, and water quality control regulations. The Act also established the Colorado Water Quality Control Division (CWQCD) to administer and enforce the Act and administer the discharge permit system, among other responsibilities. Violations of the Act are subject to significant monetary penalties, as well as criminal prosecution in some cases.
 - ii. Colorado's stormwater management regulations have been implemented in two phases and are included in Regulation No. 61 Colorado Discharge Permit System (CDPS) Regulations (CWQCC 2009). After the 1990 EPA "Phase I" stormwater regulation became effective, Colorado was required to develop a stormwater program that covered specific types of industries and storm sewer systems for municipalities with populations of more than 100,000. Phase I affected Denver, Aurora, Lakewood, Colorado Springs, and the Colorado Department of Transportation (CDOT). Phase 1 requirements included inventory of stormwater outfalls, monitoring and development of municipal stormwater management requirements, as well as other requirements. Construction activities disturbing five or more acres of land were required to obtain construction stormwater discharge permits.
 - a. Phase II of Colorado's stormwater program was finalized in March 2001, establishing additional stormwater permitting requirements. Two major changes included regulation of small municipalities, (<100,000 population) in urbanized areas and requiring construction permits for sites disturbing one acre or more. The Phase II regulation resulted in many new required MS4 permit communities.
 - b. MS4 permittees are required to develop, implement, and enforce a CDPS Stormwater Management Program designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Colorado Water Quality Control Act (25-8-101 et seq., C.R.S.) and the Colorado Discharge Permit Regulations (Regulation 61).

C. Performance and Design Criteria

1. The Town of Johnstown requires that development projects/sites that disturb (or may disturb) one acre or greater, or those less than one acre but that are part of a larger common development exceeding one acre to obtain NPDES Permit Coverage through the Colorado Construction Stormwater Permit Program and to provide documentation of coverage to the Town prior to initiation of site disturbance activities. The sites must incorporate BMP's to achieve the objectives of stormwater quality control that adhere to the CDPHE's base design standards.
 - i. Due to the variability of factors such as land use, extent of development, existing improvements, and the physical characteristics of the site (including soils, slope, and runoff) the appropriate BMP's designed for each site may vary considerably.
 - ii. The Town of Johnstown encourages the innovative use and application of measures to ensure stormwater quality control. Design Professionals are encouraged to utilize the newest BMP technology available and to incorporate design data for these new methods in the Stormwater Management Plan.
 - iii. The Town of Johnstown recommends the use of the Low Impact Development (LID) and BMP's (such as the following or equivalent) where reasonably feasible, as presented in the USDCM, Volume 3, "Best Management Practices":
 - a. Minimization of Directly Connected Impervious Areas (DCIA)

- b. Irrigated grass buffer strips
 - c. Grass lined swales
 - d. Extended detention basins (dry basins)
 - e. Constructed wetlands
 - f. Modular block porous pavement
- 2. The design of structural BMP's shall be incorporated by the Design Professional for all new construction activities, and will be evaluated by the Town based on the following minimum criteria:
 - i. A site-specific Stormwater Water Management Plan describing the type of BMP's selected, a construction and implementation schedule, and a description of long-term maintenance requirements.
 - ii. The design of developing sites shall incorporate one or more BMP's designed to capture and treat the calculated runoff equal to the 80th percentile rainfall event (see USDCM, Volume 3, "Best Management Practices, Section 5 - Stormwater Quality Hydrology). A variance may be allowed for development of small sites, such as the construction of small parking lot type detention ponds. Alternatives for stormwater quality treatment include extended detention basins (dry), retention ponds, or constructed wetlands.
 - iii. The evaluation and design for permanent erosion protection and stabilization measures shall be provided for all detention pond outlets, conveyance, outfall and channel facilities constructed on the site.
 - iv. To aid in the selection of BMP's the MHFD has developed a BMP selection tool (UD_BMP) to help determine what types of BMP's are the most appropriate for a site. Design Professionals are encouraged to use the MHFD's tool in BMP selection, and BMP-REALCOST to gain a comparison of whole life cycle cost of various BMP's.

D. Stormwater Management Plan (SWMP)

- 1. The Stormwater Management Plan (SWMP) shall be submitted to the Town for review and approval for all construction projects exceeding one (1) acre of disturbance or that are less than one acre but part of a common plan of development or sale exceeding one acre.
- 2. The Stormwater Management Plan (SWMP) should be consistent with the site's required Drainage Report.
 - i. A copy of the SWMP (either a separate standalone document, or included within the required Drainage Report in a referenced appendix) must be submitted to the Director of Public Works for review and approval.
- 3. The Stormwater Management Plan (SWMP) must be prepared in accordance with the standards set forth by the Colorado Department of Public Health and Environment, Water Quality Control Division's General Permit for Stormwater Discharges Associated with Construction Activity.

END OF CHAPTER

CHAPTER NINE
STANDARD DETAILS & CONSTRUCTION NOTES

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TOWN OF JOHNSTOWN GENERAL CONSTRUCTION NOTES:

- ALL MATERIALS, WORKMANSHIP, AND CONSTRUCTION OF PUBLIC IMPROVEMENTS SHALL MEET OR EXCEED THE STANDARDS AND SPECIFICATIONS SET FORTH BY THE TOWN OF JOHNSTOWN AND APPLICABLE STATE AND FEDERAL REGULATIONS, WHERE THERE IS CONFLICT BETWEEN THESE PLANS AND THE SPECIFICATIONS, OR ANY APPLICABLE STANDARDS, THE MOST RESTRICTIVE STANDARD SHALL APPLY. ALL WORK SHALL BE INSPECTED AND APPROVED BY THE TOWN OF JOHNSTOWN.
- THE CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL DESIGN INFORMATION (I.E. UTILITY LOCATIONS, ELEVATIONS, ETC.). THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) AT 1-800-922-1987, AT LEAST 4 WORKING DAYS PRIOR TO BEGINNING EXCAVATION OR GRADING, TO HAVE ALL REGISTERED UTILITY LOCATIONS MARKED. OTHER UNREGISTERED UTILITY ENTITIES (I.E. DITCH / IRRIGATION COMPANY) ARE TO BE LOCATED BY CONTACTING THE RESPECTIVE REPRESENTATIVE. UTILITY SERVICE LATERALS ARE ALSO TO BE LOCATED PRIOR TO BEGINNING EXCAVATION OR GRADING. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER TO RELOCATE ALL EXISTING UTILITIES THAT CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THESE PLANS
- NO WORK MAY COMMENCE WITHIN ANY IMPROVED PUBLIC RIGHT-OF-WAY UNTIL A RIGHT-OF-WAY PERMIT IS OBTAINED. THE DEVELOPER SHALL SUBMIT A CONSTRUCTION TRAFFIC CONTROL PLAN, IN ACCORDANCE WITH MUTCD, TO THE APPROPRIATE RIGHT-OF-WAY AUTHORITY (TOWN OF JOHNSTOWN, LARIMER COUNTY, WELD COUNTY, OR STATE OF COLORADO), FOR APPROVAL, PRIOR TO ANY CONSTRUCTION ACTIVITIES WITHIN, OR AFFECTING, THE RIGHT-OF-WAY. THE DEVELOPER SHALL BE RESPONSIBLE FOR PROVIDING ANY AND ALL TRAFFIC CONTROL DEVICES AS MAY BE REQUIRED BY THE CONSTRUCTION ACTIVITIES.
- THE DEVELOPER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS FOR ALL APPLICABLE AGENCIES. THE DEVELOPER SHALL NOTIFY THE TOWN OF JOHNSTOWN PUBLIC WORKS DIRECTOR AT LEAST 4 WORKING DAYS PRIOR TO THE START OF ANY EARTH DISTURBING ACTIVITY, OR CONSTRUCTION ON ANY AND ALL PUBLIC IMPROVEMENTS. IF THE DEVELOPER COMMENCES CONSTRUCTION WITHOUT ALL NECESSARY PERMITS/NOTIFICATIONS, THE TOWN OF JOHNSTOWN RESERVES THE RIGHT NOT TO ACCEPT THE IMPROVEMENTS.
- THE ENGINEER WHO HAS PREPARED THESE PLANS, BY EXECUTION AND/OR SEAL, HEREOF, DOES HEREBY AFFIRM RESPONSIBILITY TO THE TOWN OF JOHNSTOWN, AS BENEFICIARY OF SAID ENGINEER'S WORK, FOR ANY ERRORS AND OMISSIONS CONTAINED IN THESE PLANS, AND APPROVAL OF THE TOWN SIGNATORY SHALL NOT RELIEVE THE ENGINEER WHO HAS PREPARED THESE PLANS OF ALL SUCH RESPONSIBILITY. FURTHER, TO THE EXTENT PERMITTED BY LAW, THE ENGINEER HEREBY AGREES TO HOLD HARMLESS AND INDEMNIFY THE TOWN, AND EMPLOYEES, FROM AND AGAINST ALL LIABILITIES, CLAIMS, AND DEMANDS WHICH MAY ARISE FROM ANY ERRORS AND OMISSIONS CONTAINED IN THESE PLANS.
- ALL UTILITY INSTALLATIONS WITHIN OR ACROSS NEW RESIDENTIAL ROADS MUST BE COMPLETED PRIOR TO THE FINAL STAGES OF ROAD CONSTRUCTION. FOR THE PURPOSES OF THESE STANDARDS, ANY WORK EXCEPT C/G ABOVE THE SUBGRADE IS CONSIDERED FINAL STAGE WORK. SANITARY SEWER SERVICES SHALL BE EXTENDED A MINIMUM OF 5-FEET BEYOND PROPERTY LINE. WATER SERVICE LINES SHOULD BE EXTENDED TO THE LOCATION OF THE WATER METER PIT.
- THE DEVELOPER SHALL COORDINATE AND COOPERATE WITH THE TOWN OF JOHNSTOWN, AND ALL UTILITY COMPANIES INVOLVED, WITH REGARD TO RELOCATIONS, ADJUSTMENTS, EXTENSIONS AND REARRANGEMENTS OF EXISTING UTILITIES DURING CONSTRUCTION, AND TO ASSURE THAT THE WORK IS ACCOMPLISHED IN A TIMELY FASHION AND WITH A MINIMUM DISRUPTION OF SERVICE. THE DEVELOPER SHALL BE RESPONSIBLE FOR CONTACTING ALL PARTIES AFFECTED BY ANY DISRUPTION OF ANY UTILITY SERVICE AS WELL AS THE UTILITY COMPANIES A MINIMUM OF 7 DAYS PRIOR TO THE SERVICE DISRUPTION.
- NO WORK MAY COMMENCE WITHIN ANY PUBLIC STORMWATER, SANITARY SEWER OR POTABLE WATER SYSTEM UNTIL THE DEVELOPER NOTIFIES THE UTILITY PROVIDER. NOTIFICATION SHALL BE A MINIMUM OF 4 WORKING DAYS PRIOR TO COMMENCEMENT OF ANY WORK. AT THE DISCRETION OF THE TOWN, A PRE-CONSTRUCTION MEETING MAY BE REQUIRED PRIOR TO COMMENCEMENT OF ANY WORK.
- THE DEVELOPER SHALL BE RESPONSIBLE FOR PROTECTING ALL UTILITIES DURING CONSTRUCTION AND FOR COORDINATING WITH THE APPROPRIATE UTILITY COMPANY FOR ANY UTILITY CROSSINGS REQUIRED.
- THE TYPE, SIZE, LOCATION AND NUMBER OF ALL KNOWN UNDERGROUND UTILITIES ARE APPROXIMATE WHEN SHOWN ON THE DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER TO VERIFY THE EXISTENCE AND LOCATION OF ALL UNDERGROUND UTILITIES ALONG THE ROUTE OF THE WORK BEFORE COMMENCING NEW CONSTRUCTION. THE DEVELOPER SHALL BE RESPONSIBLE FOR UNKNOWN UNDERGROUND UTILITIES.
- THE DEVELOPER SHALL BE RESPONSIBLE FOR ALL ASPECTS OF SAFETY INCLUDING, BUT NOT LIMITED TO, EXCAVATION, TRENCHING, SHORING, TRAFFIC CONTROL, AND SECURITY. REFER TO OSHA 1926. SUBPART 2226, EXCAVATING AND TRENCHING.
- IF, DURING THE CONSTRUCTION PROCESS, CONDITIONS ARE ENCOUNTERED WHICH COULD INDICATE A SITUATION THAT IS NOT IDENTIFIED IN THE PLANS OR SPECIFICATIONS, THE DEVELOPER SHALL CONTACT THE DESIGNER AND THE TOWN OF JOHNSTOWN IMMEDIATELY. AT THE TOWN'S DISCRETION, ALL WORK SHALL CEASE UNTIL UPDATED SIGNED AND SEALED PLANS HAVE BEEN SUBMITTED AND APPROVED BY THE TOWN.
- ALL REFERENCES TO ANY PUBLISHED STANDARDS SHALL REFER TO THE LATEST REVISION OF SAID STANDARD, UNLESS SPECIFICALLY STATED OTHERWISE.
- THE DEVELOPER IS RESPONSIBLE FOR PROVIDING ALL LABOR AND MATERIALS NECESSARY FOR THE COMPLETION OF THE INTENDED IMPROVEMENTS, SHOWN ON THESE DRAWINGS, OR DESIGNATED TO BE PROVIDED, INSTALLED, OR CONSTRUCTED, UNLESS SPECIFICALLY NOTED OTHERWISE.
- THE DEVELOPER SHALL BE RESPONSIBLE FOR RECORDING AS-BUILT INFORMATION ON A SET OF RECORD DRAWINGS KEPT ON THE CONSTRUCTION SITE, AND AVAILABLE TO THE TOWN OF JOHNSTOWN'S INSPECTOR AT ALL TIMES. A FINAL COPY (HARD AND ELECTRONIC COPIES PER TOWN REQUIRED FORMATS) SHALL BE PROVIDED TO THE TOWN UPON COMPLETION AND BEFORE ANY FINAL TOWN ACCEPTANCES.
- DIMENSIONS FOR LAYOUT AND CONSTRUCTION ARE NOT TO BE SCALED FROM ANY DRAWING. IF PERTINENT DIMENSIONS ARE NOT SHOWN, CONTACT THE DESIGNER FOR CLARIFICATION, AND ANNOTATE THE DIMENSION ON THE AS-BUILT RECORD DRAWINGS.
- THE DEVELOPER SHALL SEQUENCE INSTALLATION OF UTILITIES IN SUCH A MANNER AS TO MINIMIZE POTENTIAL UTILITY CONFLICTS. IN GENERAL, UTILITIES SHOULD BE CONSTRUCTED FROM DEEPEST TO SHALLOWEST.
- SITE CONSTRUCTION ACTIVITIES ON WEEKDAYS (MONDAY - FRIDAY) SHALL ONLY BE CONDUCTED BETWEEN 7:00AM AND 8:00PM OR DUSK, WHICHEVER IS EARLIER. SITE CONSTRUCTION ACTIVITIES ON WEEKENDS (SATURDAY AND SUNDAY) OR HOLIDAYS SHALL ONLY BE CONDUCTED BETWEEN 8:00AM AND 7:00PM OR DUSK, WHICHEVER IS EARLIER. THERE SHALL BE NO CONSTRUCTION ACTIVITIES CONDUCTED OUTSIDE OF THESE HOURS, UNLESS SPECIFICALLY APPROVED BY THE TOWN OF JOHNSTOWN PUBLIC WORKS DIRECTOR.
- UPON COMPLETION OF CONSTRUCTION, THE SITE SHALL BE CLEANED AND RESTORED TO A CONDITION EQUAL TO, OR BETTER THAN, THAT WHICH EXISTED BEFORE CONSTRUCTION, OR TO THE GRADES AND CONDITION AS REQUIRED BY THESE PLANS.
- EXISTING FENCES, TREES, STREETS, SIDEWALKS, CURBS AND GUTTERS, LANDSCAPING, STRUCTURES, AND IMPROVEMENTS DESTROYED, DAMAGED OR REMOVED DUE TO CONSTRUCTION OF THIS PROJECT SHALL BE REPLACED OR RESTORED IN LIKE KIND AT THE DEVELOPER'S EXPENSE, UNLESS OTHERWISE INDICATED ON THESE PLANS.
- A STATE CONSTRUCTION DEWATERING WASTEWATER DISCHARGE PERMIT IS REQUIRED IF DEWATERING IS REQUIRED IN ORDER TO INSTALL UTILITIES OR WATER IS DISCHARGED INTO A STORMWATER PIPE, CHANNEL, IRRIGATION DITCH OR ANY WATERS OF THE UNITED STATES.
- THE DEVELOPER IS RESPONSIBLE FOR FIELD LOCATING AND VERIFYING ELEVATIONS OF ALL EXISTING SEWER MAINS, WATER MAINS, CURBS, GUTTERS AND OTHER UTILITIES AT THE POINTS OF CONNECTION SHOWN ON THE PLANS, AND AT ANY UTILITY CROSSINGS PRIOR TO INSTALLING ANY OF THE NEW IMPROVEMENTS. IF A CONFLICT EXISTS AND/OR A DESIGN MODIFICATION IS REQUIRED, THE DEVELOPER SHALL COORDINATE WITH THE ENGINEER TO MODIFY THE DESIGN. DESIGN MODIFICATION(S) MUST BE APPROVED BY THE TOWN OF JOHNSTOWN PRIOR TO BEGINNING CONSTRUCTION.
- AFTER ACCEPTANCE BY THE TOWN OF JOHNSTOWN, PUBLIC IMPROVEMENTS DEPICTED IN THESE PLANS SHALL BE GUARANTEED TO BE FREE FROM MATERIAL AND WORKMANSHIP DEFECTS FOR A PERIOD OF TWO YEARS FROM THE DATE OF ACCEPTANCE, AS REQUIRED BY THE DEVELOPMENT AGREEMENT.
- THESE PUBLIC IMPROVEMENT CONSTRUCTION PLANS SHALL BE VALID FOR A PERIOD OF TWO YEARS FROM THE DATE OF APPROVAL BY THE TOWN OF JOHNSTOWN ENGINEER. USE OF THESE PLANS AFTER THE EXPIRATION DATE WILL REQUIRE A NEW REVIEW AND APPROVAL PROCESS BY THE TOWN OF JOHNSTOWN PRIOR TO COMMENCEMENT OF ANY WORK SHOWN IN THESE PLANS.
- PAVING SHALL NOT START UNTIL A SOILS REPORT, PAVEMENT DESIGN, AND SUBGRADE COMPACTION TESTS ARE TAKEN AND BY THE TOWN OF JOHNSTOWN.
- THE DEVELOPER SHALL BE RESPONSIBLE FOR OBTAINING SOILS TESTS WITHIN THE PUBLIC RIGHT-OF-WAY AFTER RIGHT-OF-WAY GRADING AND ALL UTILITY TRENCH WORK IS COMPLETE. IF THE FINAL SOILS/PAVEMENT DESIGN REPORT DOES NOT CORRESPOND WITH THE RESULTS OF THE ORIGINAL GEOTECHNICAL REPORT, THE DEVELOPER SHALL BE RESPONSIBLE FOR A RE-DESIGN OF THE SUBJECT PAVEMENT SECTION OR ALL FINAL SOILS/PAVEMENT DESIGN REPORTS SHALL BE STAMPED AND SIGNED BY A COLORADO LICENSED PROFESSIONAL ENGINEER. THE FINAL REPORT AND JOB MIX SHALL BE SUBMITTED TO THE TOWN A MINIMUM OF 10 WORKING DAYS PRIOR TO SCHEDULING A PRE-PAVING MEETING. PLACEMENT OF BASE AND ASPHALT SHALL NOT OCCUR UNTIL THE TOWN APPROVES THE FINAL REPORT. FULL DEPTH ASPHALT SECTIONS ARE NOT PERMITTED. MINIMUM SECTION SHALL BE 6" ASPHALT OVER 8" ABC.
- ALL ROAD CONSTRUCTION IN AREAS DESIGNATED AS WILDFIRE HAZARD AREAS SHALL BE DONE IN ACCORDANCE WITH THE CONSTRUCTION CRITERIA AS ESTABLISHED IN THE WILDFIRE HAZARD AREA MITIGATION REGULATIONS IN FORCE AT THE TIME OF FINAL PLAN APPROVAL.
- STANDARD DIRECTIONAL HANDICAP RAMPS ARE TO BE CONSTRUCTED AT ALL CURB RETURNS AND AT ALL "T" INTERSECTIONS.
- NO GRADES SHALL EXCEED 4:1 IN AREAS WITH IRRIGATED TURF AND 3:1 IN SHRUB BEDS OR NATIVE SEEDED AREAS, PER SECTION H.1.S OF THE CURRENT TOWN OF JOHNSTOWN LANDSCAPE STANDARDS AND SPECIFICATIONS.
- ALL IRRIGATION SHALL MEET SECTIONS H.5.A-D OF THE CURRENT TOWN OF JOHNSTOWN LANDSCAPE STANDARDS AND SPECIFICATIONS.
- MAINTENANCE ACCESS SHALL BE PROVIDED TO ALL STORMWATER FACILITIES TO ASSURE CONTINUOUS OPERATIONAL CAPABILITY OF THE SYSTEM. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL DRAINAGE FACILITIES INCLUDING INLETS, PIPES, CULVERTS, CHANNELS, DITCHES, HYDRAULIC STRUCTURES AND DETENTION BASINS LOCATED ON THEIR LAND UNLESS MODIFIED BY THE DEVELOPMENT AGREEMENT. SHOULD THE OWNER FAIL TO ADEQUATELY MAINTAIN SAID FACILITIES, THE TOWN OF JOHNSTOWN SHALL HAVE THE RIGHT TO ENTER SAID LAND FOR THE PURPOSES OF OPERATIONS AND MAINTENANCE. ALL SUCH MAINTENANCE COSTS INCURRED BY THE TOWN WILL BE ASSESSED TO THE PROPERTY OWNER.
- ALL REBAR SHALL BE EPOXY COATED.
- SQUEEGEE SHALL MEET ASTM D448, GRADATION NO. 67 REQUIREMENTS.
- CONCRETE USED FOR SIDEWALKS SHALL BE A MINIMUM OF 6-INCHES THICK, CDOT CLASS B 5000 PSI.
- NAD83 COLORADO STATE PLANES, NORTH ZONE, US FOOT SHALL BE USED AS THE COORDINATE SYSTEM FOR ALL DESIGNS.
- SIDEWALKS ALONG PUBLIC STREETS SHALL BE DETACHED WALKS, EXCEPT IN LIMITED LOCATIONS WHERE SPECIFICALLY APPROVED BY EXCEPTION REQUEST AND SHOWN IN THE PLANS.
- ALL RAMPS SHALL INCLUDE APPROPRIATE DETECTABLE ADA TRUNCATED DOMES MEETING THE FOLLOWING: "DETECTABLE WARNING INLAID PATTERN OF TRUNCATED DOMES SHALL BE BRICK RED CAST-IN-PLACE PANELS BY ADA SOLUTIONS, INC. (WWW.ADATILE.COM, 800-372-0519), OR APPROVED EQUAL."
- CONCRETE STREET PAVEMENT TO BE A MINIMUM OF 7" SACK MIX, 5000 PSI AT 28 DAYS.

GENERAL ROADWAY NOTES

- A PAVING SECTION DESIGN, SIGNED AND STAMPED BY A COLORADO LICENSED ENGINEER, MUST BE SUBMITTED TO THE TOWN PUBLIC WORKS DEPARTMENT FOR APPROVAL. PRIOR TO ANY STREET CONSTRUCTION ACTIVITY, FULL DEPTH ASPHALT SECTIONS ARE NOT PERMITTED AT A DEPTH GREATER THAN 8 INCHES OF ASPHALT. THE JOB MIX SHALL BE SUBMITTED FOR APPROVAL PRIOR TO PLACEMENT OF ANY ASPHALT. MINIMUM SECTION SHALL BE 6" ASPHALT OVER 8" ABC.
- WHERE PROPOSED PAVING ADJOINS EXISTING ASPHALT, THE EXISTING ASPHALT SHALL BE SAW CUT, A MINIMUM DISTANCE OF 12 INCHES FROM THE EXISTING EDGE, TO CREATE A CLEAN CONSTRUCTION JOINT. THE DEVELOPER SHALL BE REQUIRED TO REMOVE EXISTING PAVEMENT TO A DISTANCE WHERE A CLEAN CONSTRUCTION JOINT CAN BE MADE. WHEEL CUTS SHALL NOT BE ALLOWED UNLESS APPROVED BY THE TOWN. REFERENCE PAVEMENT PATCH BACK DETAIL.
- STREET SUBGRADES SHALL BE SCARIFIED THE TOP 12 INCHES AND RE-COMPACTED PRIOR TO SUBBASE INSTALLATION. NO BASE MATERIAL SHALL BE LAID UNTIL THE SUBGRADE HAS BEEN INSPECTED AND APPROVED BY THE TOWN PUBLIC WORKS DEPARTMENT.
- WHEN AN EXISTING ASPHALT STREET MUST BE CUT, THE STREET MUST BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN ITS ORIGINAL CONDITION. THE EXISTING STREET CONDITION SHALL BE DOCUMENTED BY THE INSPECTOR BEFORE ANY CUTS ARE MADE. CUTTING AND PATCHING SHALL BE DONE IN CONFORMANCE WITH TOWN STANDARDS AND/OR AS DIRECTED BY TOWN STREET INSPECTORS. THE FINISHED PATCH SHALL BLEND SMOOTHLY INTO THE EXISTING SURFACE. THE DETERMINATION OF NEED FOR A COMPLETE OVERLAY SHALL BE MADE BY THE TOWN. ALL OVERLAY WORK SHALL BE COORDINATED WITH ADJACENT LANDOWNERS SUCH THAT FUTURE PROJECTS DO NOT CUT THE NEW ASPHALT OVERLAY WORK.
- ALL TRAFFIC CONTROL DEVICES SHALL BE IN CONFORMANCE WITH THESE PLANS OR AS OTHERWISE SPECIFIED IN M.U.T.C.D. (INCLUDING COLORADO SUPPLEMENT) AND AS PER THE RIGHT-OF-WAY WORK PERMIT TRAFFIC CONTROL PLAN.
- THE DEVELOPER IS REQUIRED TO PERFORM A GUTTER WATER FLOW TEST IN THE PRESENCE OF THE TOWN PUBLIC WORKS INSPECTOR AND PRIOR TO INSTALLATION OF ASPHALT. GUTTERS THAT HOLD MORE THAN 1/4-INCH DEEP OR 5-FEET LONGITUDINALLY, OF WATER, SHALL BE COMPLETELY REMOVED AND RECONSTRUCTED TO DRAIN PROPERLY.
- PRIOR TO PLACEMENT OF H.B.P. OR CONCRETE WITHIN THE STREET AND AFTER MOISTURE/DENSITY TESTS HAVE BEEN TAKEN ON THE SUBGRADE MATERIAL OR ON THE SUBGRADE AND BASE MATERIAL (WHEN A COMPOSITE SECTION IS PROPOSED), A MECHANICAL "PROOF ROLL" WILL BE REQUIRED. THE ENTIRE SUBGRADE AND/OR BASE MATERIAL SHALL BE ROLLED WITH A HEAVILY LOADED VEHICLE HAVING A TOTAL GVW OF NOT LESS THAN 50,000 LBS. AND A SINGLE AXLE WEIGHT OF AT LEAST 18,000 LBS. WITH PNEUMATIC TIRES INFLATED TO NOT LESS THAN 90 P.S.I.G. "PROOF ROLL" VEHICLES SHALL NOT TRAVEL AT SPEEDS GREATER THAN 3 M.P.H. ANY PORTION OF THE SUBGRADE OR BASE MATERIAL WHICH EXHIBITS EXCESSIVE PUMPING OR DEFORMATION, AS DETERMINED BY THE TOWN, SHALL BE REWORKED, REPLACED OR OTHERWISE MODIFIED TO FORM A SMOOTH, NON-YIELDING SURFACE. THE TOWN SHALL BE NOTIFIED AT LEAST 4 WORKING DAYS PRIOR TO THE "PROOF ROLL." ALL "PROOF ROLLS" SHALL BE PERFORMED IN THE PRESENCE OF AN INSPECTOR.

GENERAL WATER NOTES:

- ALL WATER LINE PIPE, SANITARY SEWER PIPES, PIPE FITTINGS, FIRE HYDRANTS, AND WATER SERVICE LINE MATERIALS SHALL CONFORM TO THE MOST CURRENT SPECIFICATIONS AND REQUIREMENTS OF THE TOWN OF JOHNSTOWN STANDARD CONSTRUCTION SPECIFICATIONS.
- A MINIMUM VERTICAL SEPARATION OF 18-INCHES SHALL BE PROVIDED BETWEEN UTILITIES AT ALL CROSSINGS.
- ALL WATER LINE LOWERINGS AT CROSSINGS WITH OTHER UTILITIES SHALL BE ACCOMPLISHED BY VERTICAL BEND LOWERING UNLESS OTHERWISE SPECIFIED ON THESE PLANS
- ALL WATER MAINS AND SERVICES SHALL HAVE A MINIMUM SEPARATION OF 10- FEET FROM ANY STORM OR SANITARY SEWER SERVICE LINES.
- ALL WATER MAINS, FIRE HYDRANT LINES, AND SERVICES SHALL HAVE A MINIMUM COVER OF 4.5- FEET AND A MAXIMUM COVER OF 6- FEET UNLESS OTHERWISE APPROVED BY THE TOWNS UTILITY DEPARTMENT.
- ALL WATER METER SETTINGS MUST BE INSPECTED BY THE TOWN'S REPRESENTATIVE.
- IF THE STREET OR GROUND IS NOT TO FINAL GRADE AT THE TIME OF INSTALLATION OF THE METER, THE OWNER MUST RAISE OR LOWER THE METER VAULT WHEN THE FINAL GRADE IS ESTABLISHED.
- LEADED JOINTS AND GALVANIZED PIPING SHALL NOT BE ALLOWED IN THE WATER SYSTEM.
- BYPASS IS TO BE INSTALLED ON 1 1/2-INCH, 2-INCH, AND LARGER METERS UNLESS OTHERWISE SPECIFIED.
- THE SERVICE LINE THROUGH AND ON BOTH SIDES OF THE METER PIT MUST BE OF THE SAME MATERIAL.
- NO CONNECTIONS SHALL BE MADE IN THE METER PIT. SPRINKLER CONNECTIONS MUST BE MADE MORE THAN 5- FEET FROM THE METER PIT ON THE DOWNSTREAM SIDE.
- ALL GATE VALVES 3-INCH AND LARGER SHALL CONFORM WITH TOWN OF JOHNSTOWN STANDARD SPECIFICATIONS.
- ALL DRESSER (OR APPROVED EQUAL) COUPLING SHALL HAVE THE PIPE STOP REMOVED.
- METERS 1 1/2-INCH AND LARGER TO BE INSTALLED BY THE CONTRACTOR WITH THE TOWNS SUPERVISION. METERS 1-INCH AND SMALLER WILL BE INSTALLED BY THE TOWN.
- ALL BY-PASS VALVES SHALL BE LOCKABLE.
- ALL METER PIT LIDS SHALL BE POLYMER MATERIAL.
- TRACER WIRE AND MARKING TAPE SHALL BE INSTALLED ON ALL WET UTILITIES.
- ALL METER VAULT LIDS SHALL BE METALLIC WITH 2-INCH HOLES.
- TRACER WIRE SHALL BE AUG NO. 12 GAUGE SOLID COPPER WITH 30 MILS BLUE HDPE INSULATION.

GENERAL METER NOTES:

- LOCATION OF THE METER TO BE ESTABLISHED BY THE DEVELOPMENT ENGINEER AND APPROVAL BY TOWN.
- ALL SETTINGS MUST BE INSPECTED BY THE WATER DEPARTMENT REPRESENTATIVE.
- IF THE STREET OR GROUND IS NOT TO FINAL GRADE AT THE TIME OF INSTALLATION OF THE METER, THE OWNER MUST RAISE OR LOWER THE METER VAULT WHEN THE FINAL GRADE IS ESTABLISHED.
- A BYPASS IS TO BE INSTALLED ON 1 1/2-INCH AND LARGER METERS UNLESS OTHERWISE SPECIFIED.
- THE SERVICE LINE THROUGH AND ON BOTH SIDES OF THE METER PIT MUST BE OF THE SAME MATERIAL. CAN UPSIZE AND/OR CHANGE MATERIAL 5- FEET PAST THE METER FOR OUTSIDE SETS, OR JUST PAST THE METER FOR INSIDE METER SETS.
- NO CONNECTIONS SHALL BE MADE IN THE METER PIT. SPRINKLER CONNECTIONS MUST BE MADE MORE THAN 5- FEET FROM THE METER PIT ON THE DOWNSTREAM SIDE AND MUST INCLUDE A REDUCED PRESSURE BACKFLOW PREVENTOR.
- ALL GATE VALVES SHALL CONFIRM WITH JOHNSTOWN'S STANDARD SPECIFICATIONS.
- ALL DRESSER COUPLINGS SHALL HAVE THE PIPE STOP REMOVED.

GENERAL STORMWATER NOTES:

- TRACER WIRE SHALL BE AUG NO. 12 GAUGE SOLID COPPER WITH 30 MILS BLACK HDPE INSULATION.
- ALL STORMWATER PIPE INSTALLED UNDER A STREET/ROADWAY SHALL BE CLASS V RCP.

GENERAL SANITARY SEWER NOTES:

- ALL SANITARY SEWER PIPES, PIPE FITTINGS, AND SERVICE LINE MATERIALS SHALL CONFORM TO THE MOST CURRENT SPECIFICATIONS AND REQUIREMENTS OF THE TOWN OF JOHNSTOWN STANDARD CONSTRUCTION SPECIFICATIONS
- TRACER WIRE SHALL BE AUG NO. 12 GAUGE SOLID COPPER WITH 30 MILS GREEN HDPE INSULATION.
- FOR GRAVITY MAIN AND/OR LATERAL INSTALLATIONS LESS THAN 8- FEET, THE TRACING WIRE SHALL BE ATTACHED TO THE PIPE. TRACER WIRE SHALL BE LAID FLAT AND SECURELY AFFIXED TO THE PIPE AT 5- FOOT INTERVALS USING ZIP TIES. FOR GRAVITY MAIN AND/OR LATERAL INSTALLATION DEEPER THAN 8- FEET, THE TRACING WIRE SHALL BE ATTACHED TO THE PIPE AND PLACED AT A DEPTH OF 4- TO 5- FEET DIRECTLY ABOVE THE SEWER PIPE. THE WIRE SHALL BE PROTECTED FROM DAMAGE DURING THE EXECUTION OF THE WORK. NO BREAKS OR CUTS IN THE TRACER WIRE OR INSULATION SHALL BE PERMITTED.
- WHERE LATERAL TAPS ARE MADE BY SERVICE SADDLES, THE TRACER WIRE SHALL NOT BE ALLOWED TO BE PLACED BETWEEN THE SADDLE AND MAIN.
- SPICES IN THE PRIMARY TRACER WIRE ALONG THE SEWER MAIN SHALL INCLUDE 3- FEET OF SLACK WIRE ON EACH SIDE OF THE SPLICE.
- MANHOLE MARKERS SHALL BE PLACED ADJACENT TO MANHOLES AT THE DISCRETION OF THE TOWN OF ENGINEER.
- THE TRACER WIRE SHALL BE CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. WHERE SPLICES ARE NECESSITATED IN THE WIRE, THE SPICES SHALL BE SECURELY BONDED TOGETHER WITH AN APPROVED INDUSTRIAL CONNECTOR TO PROVIDE ELECTRICAL CONTINUITY. CONNECTOR SHALL BE COPPER AND INSULATION SHALL BE REPAIRED TO SEAL OUT MOISTURE AND CORROSIONS AND SHALL BE INSTALLED IN A MANNER SO AS TO PREVENT ANY UNINSULATED WIRE EXPOSURE.
- THE CLEANOUT AT THE RIGHT OF WAY AND/OR EASEMENT SHALL SERVE AS THE TEST PORT.
- SPICED CONNECTIONS SHALL BE ALLOWED BETWEEN THE MAIN LINE TRACER WIRE AND THE LATERAL TRACER WIRE.
- FOR NEW SEWER TAPS ON EXISTING MAINS VOID OF ANY TRACER WIRE, PROVIDE A GROUNDING ROD FOR THE TRACING WIRE. TERMINATION AT THE POINT OF THE NEW TAP ON THE EXISTING SEWER MAIN. PLACE GROUNDING ROD AT BOTTOM EDGE OF TRENCH AWAY FROM MAIN & LATERAL.
- PRIOR TO ACCEPTANCE EACH WIRE SEGMENT SHALL PASS A CONDUCTIVITY TEST, WITNESSED BY THE TOWN.

PRECAST MANHOLE NOTES:

- MANHOLE BARREL MINIMUM DIAMETER SHALL CONFORM TO THE TOWN STANDARD DETAILS.
- SHAPING FOR SMOOTH MANHOLE INVERTS MUST BE DONE BY FORMING OR SHAPING BASE CONCRETE. REFER TOWN STANDARD DETAILS.
- MANHOLE STEPS SHALL CONFORM TO THE TOWN STANDARD DETAILS.
- PRECAST CONCRETE SECTIONS SHALL CONFORM TO ASTM C-478.
- BLOCK-OUTS WHEN APPROVED SHALL EXTEND A MAX. OF 6-INCHS PAST MANHOLE O.D. AND BE SATISFACTORILY PLUGGED AND SEALED.
- CONCRETE MANHOLES MAY BE POURED IN PLACE ONLY WITH PRIOR APPROVAL.
- ALL MORTAR GROUT SHALL BE MIXED WITH TYPE II CEMENT.
- BENCH MUST HAVE A BRUSHED, NON-SKID SURFACE.
- OUTFALL OR DROP MANHOLES SHALL BE LINED WITH SIKARD NO. 62 OR APPROVED EQUAL, COATED WITH 4-7 MIL PER COAT WITH A MINIMUM OF 2 LAYERS APPLIED, AS PER MANUFACTURERS SPECIFICATIONS.
- DROP MANHOLES ARE REQUIRED IF THE ELEVATION BETWEEN PIPE INVERTS EXCEED 18-INCHES.
- DROP MANHOLES WILL ONLY BE CONSIDERED WHERE NO ALTERNATIVE IS FEASIBLE.

EROSION CONTROL NOTES:

- THE EROSION CONTROL INSPECTOR MUST BE NOTIFIED AT LEAST FOUR WORKING DAYS PRIOR TO ANY CONSTRUCTION.
- THERE SHALL BE NO EARTH-DISTURBING ACTIVITY OUTSIDE THE LIMITS DESIGNATED ON THE ACCEPTED PLANS.
- ALL REQUIRED PERIMETER SILT AND CONSTRUCTION FENCING SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITY (STOCKPILING, STRIPPING, GRADING, ETC.). ALL OTHER REQUIRED EROSION CONTROL MEASURES (EMCs) SHALL BE INSTALLED AT THE APPROPRIATE TIME IN THE CONSTRUCTION SEQUENCE AS INDICATED IN THE APPROVED PROJECT SCHEDULE, CONSTRUCTION PLANS, AND EROSION CONTROL REPORT.
- AT ALL TIMES DURING CONSTRUCTION, THE DEVELOPER SHALL BE RESPONSIBLE FOR PREVENTING AND CONTROLLING ON-SITE EROSION INCLUDING KEEPING THE PROPERTY SUFFICIENTLY WATERED SO AS TO MINIMIZE WIND BLOWN SEDIMENT. THE DEVELOPER SHALL ALSO BE RESPONSIBLE FOR INSTALLING AND MAINTAINING ALL EROSION CONTROL FACILITIES SHOWN HEREIN.
- PRE-DISTURBANCE VEGETATION SHALL BE PROTECTED AND RETAINED WHEREVER POSSIBLE. REMOVAL OR DISTURBANCE OF EXISTING VEGETATION SHALL BE LIMITED TO THE AREA(S) REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS, AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.
- ALL SOILS EXPOSED DURING LAND DISTURBING ACTIVITY (STRIPPING, GRADING, UTILITY INSTALLATIONS, STOCKPILING, FILLING, ETC.) SHALL BE KEPT IN A ROUGHENED CONDITION BY RIPPING OR DISKING ALONG LAND CONTOURS UNTIL MULCH, VEGETATION, OR OTHER PERMANENT EROSION CONTROL BMPs ARE INSTALLED. NO SOILS IN AREAS OUTSIDE PROJECT STREET RIGHTS-OF-WAY SHALL REMAIN EXPOSED BY LAND DISTURBING ACTIVITY FOR MORE THAN THIRTY (30) DAYS BEFORE REQUIRED TEMPORARY OR PERMANENT EROSION CONTROL (E.G. SEED/MULCH, LANDSCAPING, ETC.) IS INSTALLED, UNLESS OTHERWISE APPROVED BY THE LOCAL ENTITY.
- IN ORDER TO MINIMIZE EROSION POTENTIAL, ALL TEMPORARY (STRUCTURAL) EROSION CONTROL MEASURES SHALL: a. BE INSPECTED AT A MINIMUM OF ONCE EVERY TWO (2) WEEKS AND AFTER EACH SIGNIFICANT STORM EVENT AND REPAIRED OR RECONSTRUCTED AS NECESSARY IN ORDER TO ENSURE THE CONTINUED PERFORMANCE OF THEIR INTENDED FUNCTION. b. REMAIN IN PLACE UNTIL SUCH TIME AS ALL THE SURROUNDING DISTURBED AREAS ARE SUFFICIENTLY STABILIZED AS DETERMINED BY THE EROSION CONTROL INSPECTOR. c. BE REMOVED AFTER THE SITE HAS BEEN SUFFICIENTLY STABILIZED AS DETERMINED BY THE EROSION CONTROL INSPECTOR.
- WHEN TEMPORARY EROSION CONTROL MEASURES ARE REMOVED, THE DEVELOPER SHALL BE RESPONSIBLE FOR THE CLEAN UP AND REMOVAL OF ALL SEDIMENT AND DEBRIS FROM ALL DRAINAGE INFRASTRUCTURE AND OTHER FACILITIES.
- THE CONTRACTOR SHALL CLEAN UP ANY INADVERTENT DEPOSITED MATERIAL IMMEDIATELY AND MAKE SURE STREETS ARE FREE OF ALL MATERIALS BY THE END OF EACH WORKING DAY.
- ALL RETAINED SEDIMENTS, PARTICULARLY THOSE ON PAVED ROADWAY SURFACES, SHALL BE REMOVED AND DISPOSED OF IN A MANNER AND LOCATION SO AS NOT TO CAUSE THEIR RELEASE INTO ANY WATERS OF THE UNITED STATES.
- NO SOIL STOCKPILE SHALL EXCEED TEN (10) FEET IN HEIGHT. ALL SOIL STOCKPILES SHALL BE PROTECTED FROM SEDIMENT TRANSPORT BY SURFACE ROUGHENING, WATERING, AND PERIMETER SILT FENCING. ANY SOIL STOCKPILE REMAINING AFTER THIRTY (30) DAYS SHALL BE SEEDED AND MULCHED.
- THE STORMWATER VOLUME CAPACITY OF DETENTION PONDS WILL BE RESTORED AND STORMWATER LINES WILL BE CLEANED UPON COMPLETION OF THE PROJECT AND BEFORE TURNING THE MAINTENANCE OVER TO THE LOCAL ENTITY, METRO DISTRICT, OR HOMEOWNERS ASSOCIATION (HOA).
- LOCAL ORDINANCE AND COLORADO DISCHARGE PERMIT SYSTEM (CDPS) REQUIREMENTS MAKE IT UNLAWFUL TO DISCHARGE OR ALLOW THE DISCHARGE OF ANY POLLUTANT OR CONTAMINATED WATER FROM CONSTRUCTION SITES. POLLUTANTS INCLUDE, BUT ARE NOT LIMITED TO DISCARDED BUILDING MATERIALS, CONCRETE TRUCK WASHOUT, CHEMICALS, OIL AND GAS PRODUCTS, LITTER, AND SANITARY WASTE. THE DEVELOPER SHALL AT ALL TIMES TAKE WHATEVER MEASURES ARE NECESSARY TO ASSURE THE PROPER CONTAINMENT AND DISPOSAL OF POLLUTANTS ON THE SITE IN ACCORDANCE WITH ANY AND ALL APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.
- A DESIGNATED AREA SHALL BE PROVIDED ON SITE FOR CONCRETE TRUCK CHUTE WASHOUT. THE AREA SHALL BE CONSTRUCTED SO AS TO CONTAIN WASHOUT MATERIAL, AND SHALL BE LOCATED AT LEAST FIFTY (50) FEET AWAY FROM ANY WATERWAY DURING CONSTRUCTION. UPON COMPLETION OF CONSTRUCTION ACTIVITIES, THE CONCRETE WASHOUT MATERIAL WILL BE REMOVED AND PROPERLY DISPOSED OF PRIOR TO THE AREA BEING RESTORED.
- TO ENSURE THAT SEDIMENT DOES NOT MOVE OFF OF INDIVIDUAL LOTS ONE OR MORE OF THE FOLLOWING SEDIMENT/EROSION CONTROL BMPs SHALL BE INSTALLED AND MAINTAINED UNTIL THE LOTS ARE SUFFICIENTLY STABILIZED, AS DETERMINED BY THE EROSION CONTROL INSPECTOR: a. BELOW ALL GUTTER DOWNSPOUTS. b. OUT TO DRAINAGE SWALES. c. ALONG LOT PERIMETER. d. OTHER LOCATIONS, IF NEEDED.
- CONDITIONS IN THE FIELD MAY WARRANT EROSION CONTROL MEASURES IN ADDITION TO WHAT IS SHOWN ON THESE PLANS. THE DEVELOPER SHALL IMPLEMENT WHATEVER MEASURES ARE DETERMINED NECESSARY, OR AS DIRECTED BY THE TOWN/COUNTY.
- A VEHICLE TRACKING CONTROL PAD SHALL BE INSTALLED WHEN NEEDED FOR CONSTRUCTION EQUIPMENT, INCLUDING BUT NOT LIMITED TO PERSONAL VEHICLES EXITING EXISTING ROADWAYS. NO EARTHEN MATERIALS, I.E. STONE, DIRT, ETC. SHALL BE PLACED IN THE CURB & GUTTER OR ROADWAY AS A RAMP TO ACCESS TEMPORARY STOCKPILES, STAGING AREAS, CONSTRUCTION MATERIALS, CONCRETE WASHOUT AREAS, AND/OR BUILDING SITES.
- ANY LAND DISTURBANCE WITHIN THE LIMITS OF DISTURBANCE NOTED ON THE PLAN BY ANY OWNER, DEVELOPER, BUILDER, CONTRACTOR, OR OTHER PERSON SHALL COMPLY WITH THE BEST MANAGEMENT PRACTICES REQUIREMENTS AND PROHIBITIONS NOTED IN THE USDCM: VOL. II STORMWATER QUALITY, CHAPTER 7. NOTE THAT THE USE OF STRAW BALE BARRIERS (SBB), NOTED AS SC-03 IN THE URBAN STORM DRAIN CRITERIA MANUAL, IS DISCOURAGED IN THE TOWN. SPECIFIC APPROVAL FROM THE TOWN'S STORMWATER PROGRAM COORDINATOR IS REQUIRED FOR USE.
- THE DEVELOPER SHALL HAVE, ONSITE AT ALL TIMES, AN UPDATED STORMWATER MANAGEMENT PLAN (SWMP), A BMP MAINTENANCE FOLDER, ONE (1) SIGNED COPY OF THE APPROVED PLANS, ONE (1) COPY OF THE APPROPRIATE STANDARDS AND SPECIFICATIONS, AND A COPY OF ANY PERMITS AND EXTENSION AGREEMENTS NEEDED FOR THE JOB.
- THE DEVELOPER SHALL BE RESPONSIBLE FOR INSURING THAT NO MUD OR DEBRIS SHALL BE TRACKED ONTO THE EXISTING STREET SYSTEM. MUD AND DEBRIS MUST BE REMOVED BY THE END OF EACH WORKING DAY BY AN APPROPRIATE MECHANICAL METHOD (I.E. MACHINE BROOM SWEEP, LIGHT DUTY FRONT-END LOADER, ETC.) OR AS APPROVED BY THE TOWN OF JOHNSTOWN STREET INSPECTOR.
- THE DEVELOPER SHALL COMPLY WITH ALL TERMS AND CONDITIONS OF THE COLORADO PERMIT FOR STORMWATER DISCHARGE, THE STORMWATER MANAGEMENT PLAN, AND THE EROSION CONTROL PLAN.
- OVERLOT GRADING CONSTRUCTION MUST COMPLY WITH STATE OF COLORADO PERMITTING PROCESS FOR "STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY." CONTACT THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE), WATER QUALITY CONTROL DIVISION, AT (303) 692-3500.



GENERAL CONSTRUCTION NOTES

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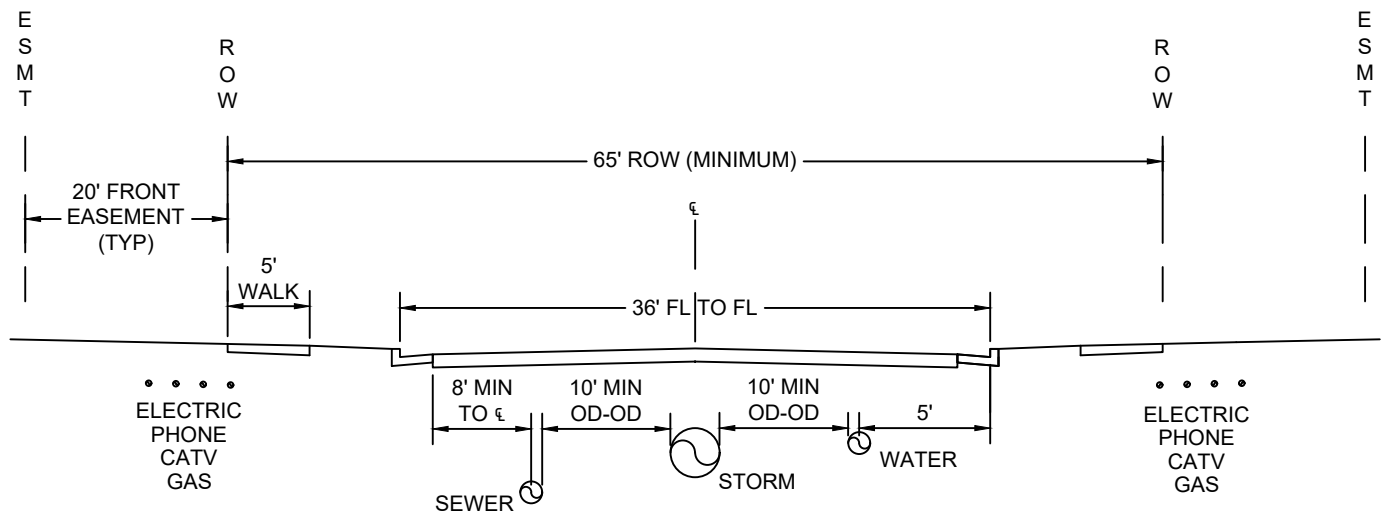
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DETAIL NO.

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NOTES:

1. STREET SECTION IS TYPICAL.
2. WATER LINE TO BE EAST OR NORTH OF CENTERLINE.
3. MINIMUM DEPTH OF COVER PER STANDARDS.
4. STORM SEWER NOT ALLOWED AT CENTERLINE OR UNDER SIDEWALK.
5. DRY UTILITIES ARE WITHIN FRONT LOT EASEMENT.
6. FOR DRY UTILITIES, REFERENCE ALL APPLICABLE PROVISIONS IN THE JOHNSTOWN CODE, LATEST EDITION.



TYPICAL UTILITY LOCATION

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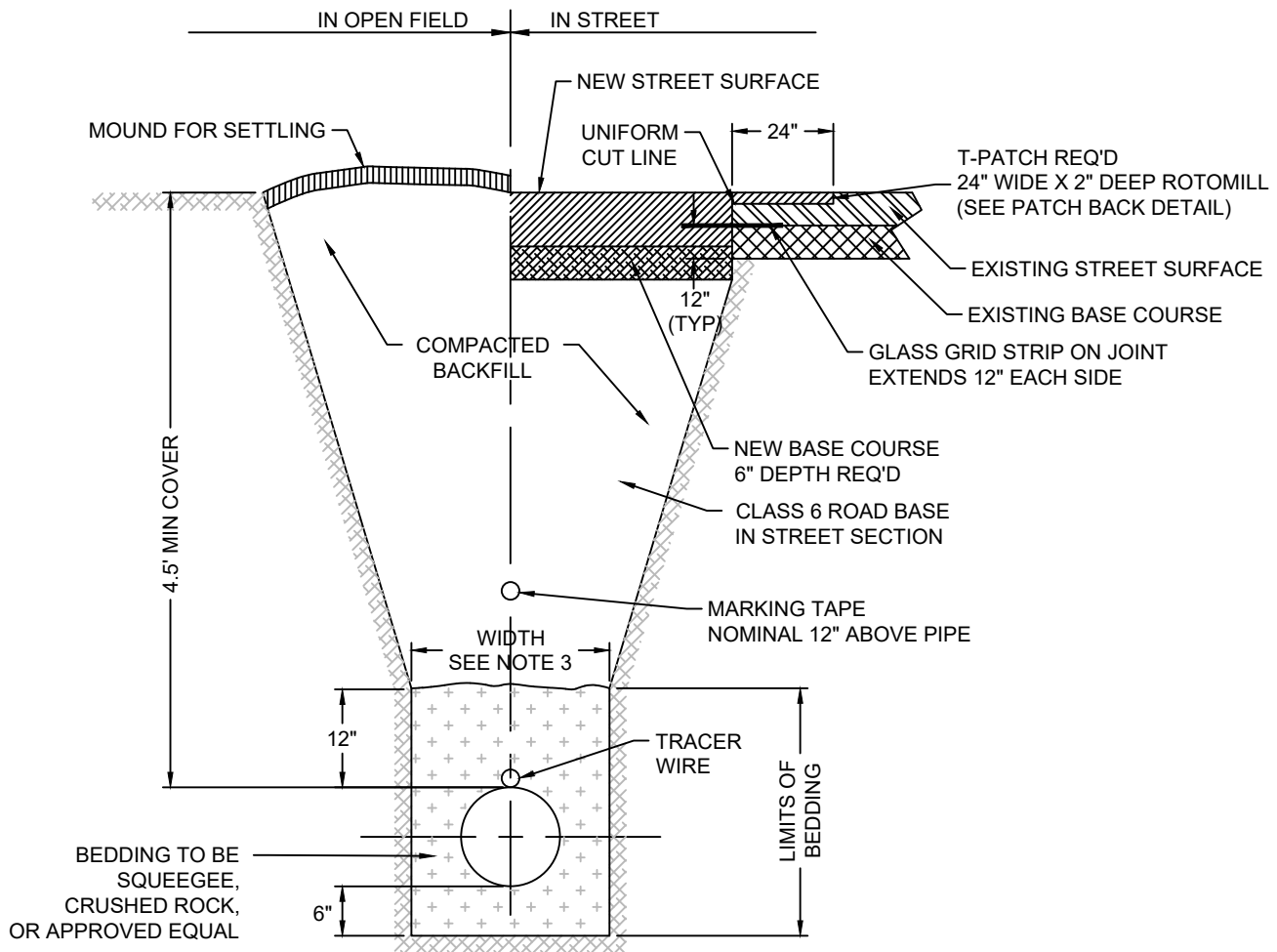
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DATE: 9/20/2022

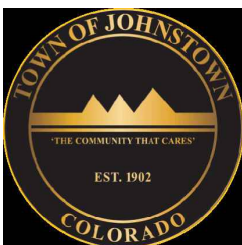
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NOTES:

1. BACKFILL SHALL BE CLASS 6 ROAD BASE OR APPROVED EQUAL BY TOWN ENGINEER.
2. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE.
3. TRENCH WIDTH SHALL NOT BE MORE THAN 16" NOR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.
4. COMPACTION FOR TRENCH ZONE SHALL BE 95% S.P.D. IN STREET R.O.W., AND 90% S.P.D. OUTSIDE THE R.O.W.
5. MINIMUM COVER TO BE 4.5' BELOW FINAL GRADE.
6. TRENCH SHALL BE BRACED OR SHEETED FOR THE WORKMAN AND PROTECTION OF THE UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS.
7. TRACER WIRE AND MARKING TAPE SHALL BE INSTALLED FOR ALL WET UTILITIES.



STANDARD BEDDING FOR WET UTILITIES

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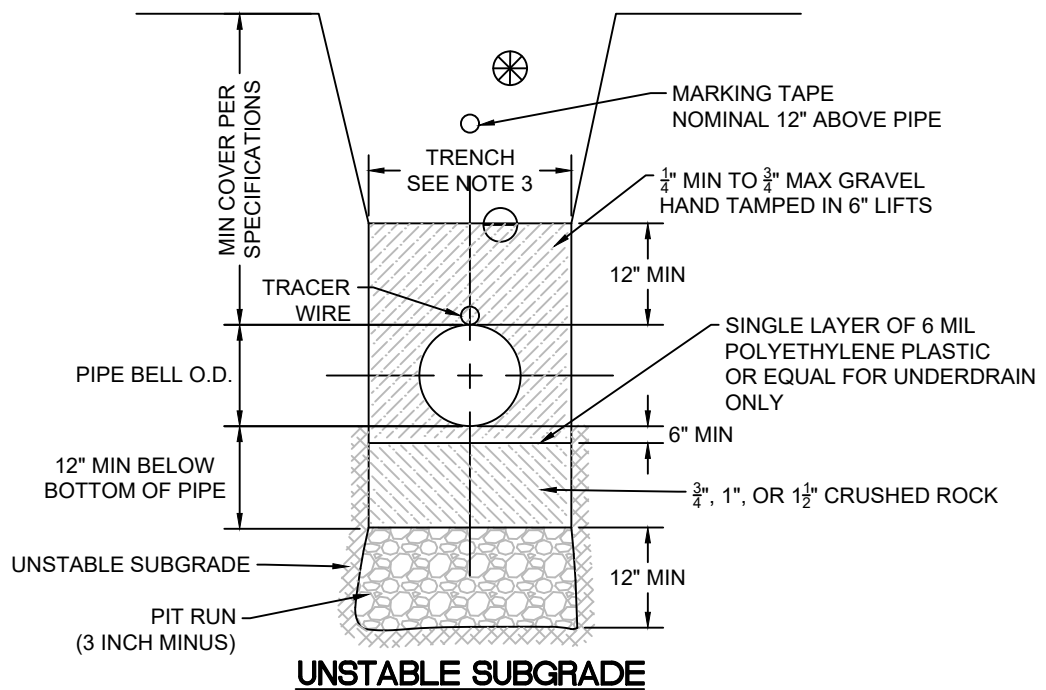
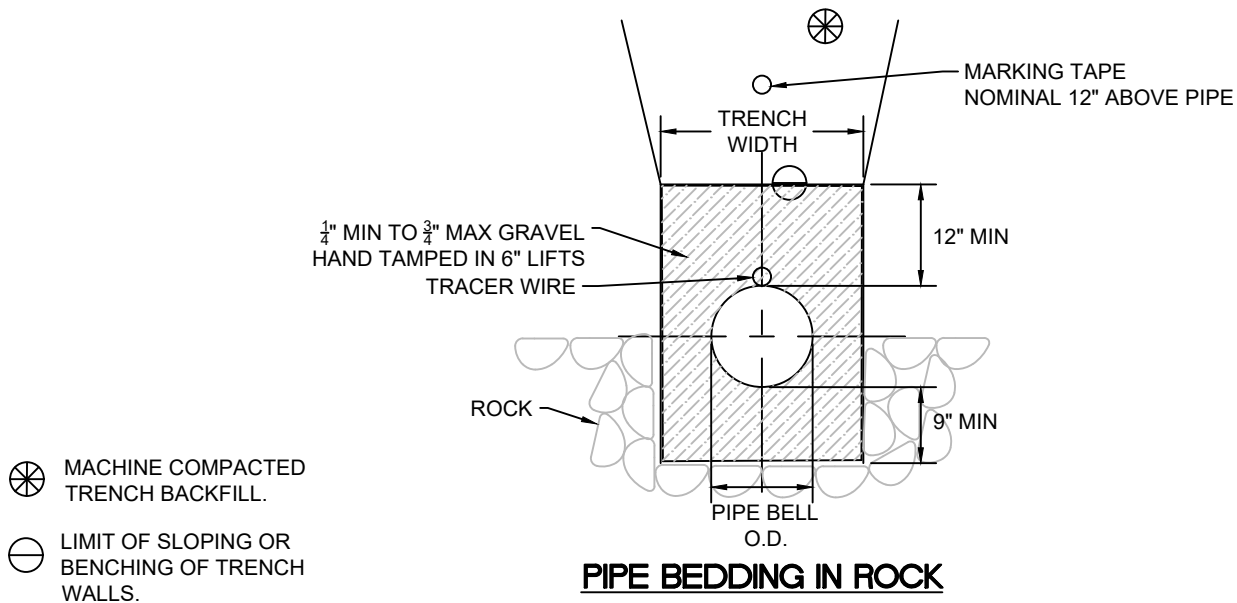
DATE: 9/20/2022

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DETAIL NO.

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NOTES:

1. MIN. COVER TO BE BELOW FINAL STREET GRADE WHEN AVAILABLE.
2. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE PROTECTION OF OTHER UTILITIES AND TO MEET TOWN REQUIREMENTS.
3. TRENCH WIDTH SHALL NOT BE MORE THAN 16" OR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE LAID THEREIN. (BELL OR COUPLING O.D., IF APPLICABLE).
4. THESE DETAILS ARE A MIN. REQUIREMENT. IF GEOTECH INVESTIGATIONS DETERMINE ADDITIONAL OVER EXCAVATION, OR BEDDING MODIFICATIONS ARE NECESSARY, CONTRACTOR SHALL ADHERE TO THE SITE SPECIFIC DESIGN REQUIREMENTS.
5. TRACER WIRE AND MARKING TAPE SHALL BE INSTALLED FOR ALL WET UTILITIES.



SPECIAL BEDDING FOR WET UTILITIES

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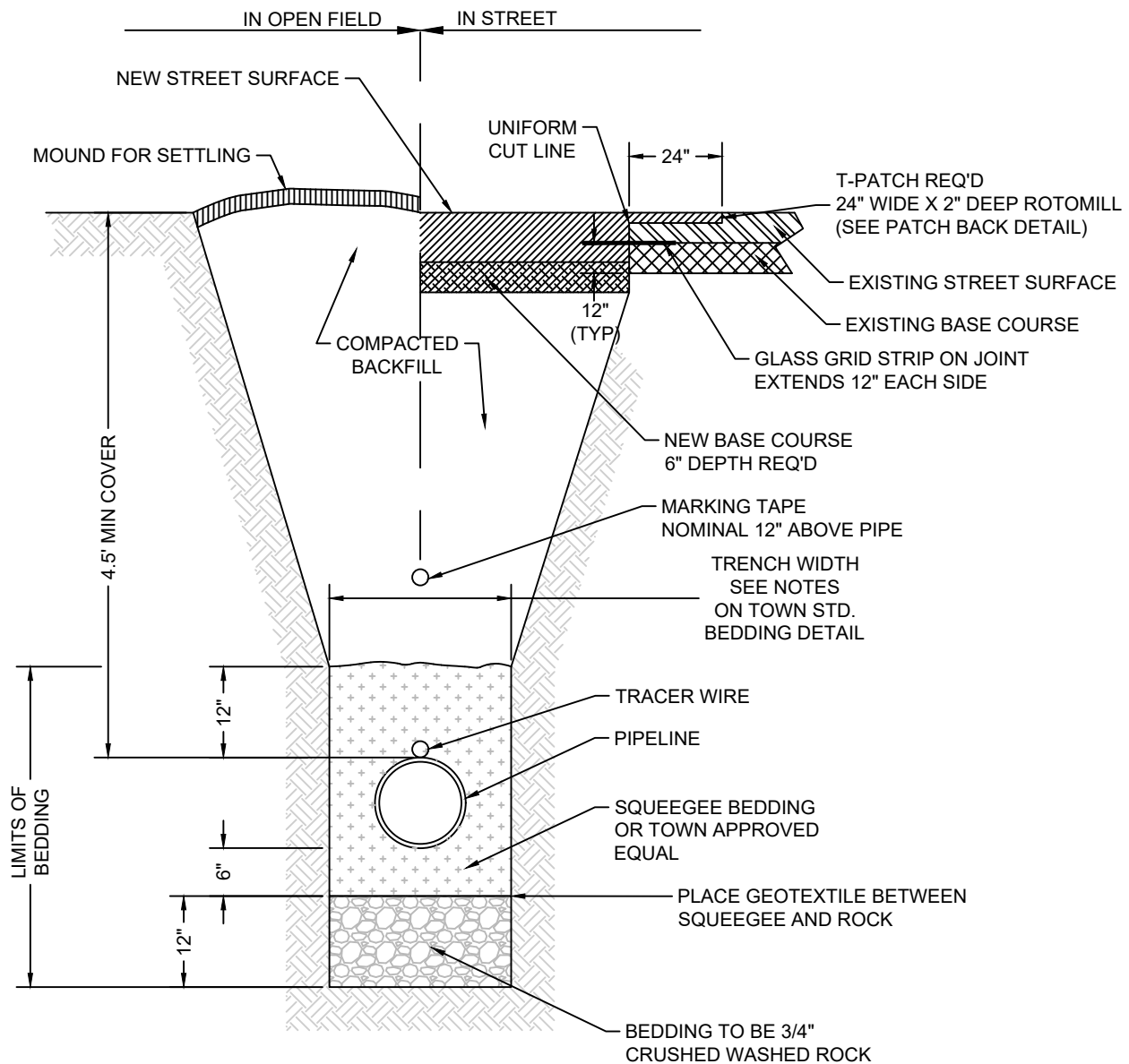
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NOTES:

1. REFER TO OTHER DETAILS FOR MINIMUM DEPTH, TRENCH WIDTH, COMPACTION REQUIREMENTS ETC.
2. TRENCH SHALL BE BRACED OR SHEETED FOR THE WORKMAN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS.
3. PIPE SHALL BE BEDDED FROM 18" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE. THIS DETAIL IS A MINIMUM REQUIREMENT. IF GEOTECHNICAL INVESTIGATIONS DETERMINE ADDITIONAL OVER EXCAVATION, OR BEDDING MODIFICATIONS ARE NECESSARY, CONTRACTOR SHALL ADHERE TO THE SITE SPECIFIC DESIGN REQUIREMENTS.
4. TRACER WIRE AND MARKING TAPE SHALL BE INSTALLED FOR ALL WET UTILITIES.



BEDDING FOR WET UTILITIES IN EXPANSIVE SOILS

DETAIL NO.

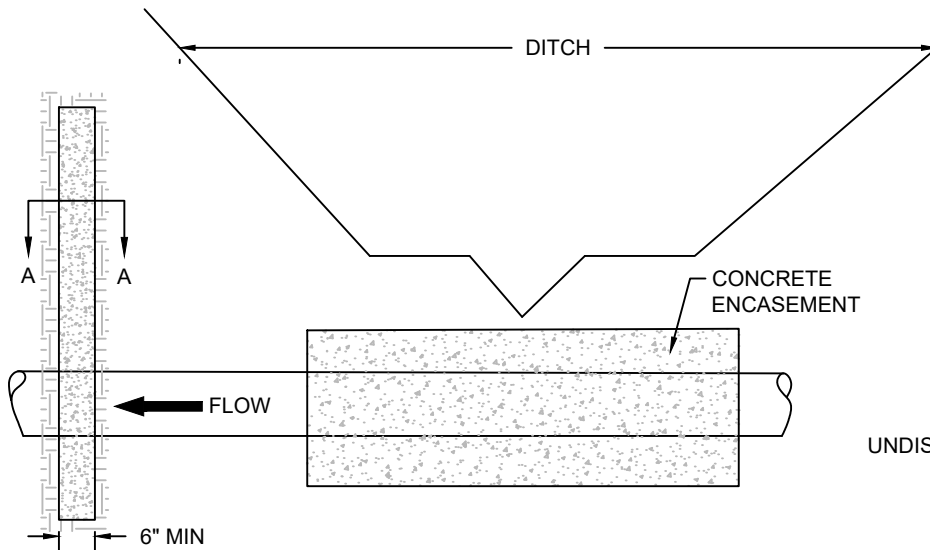
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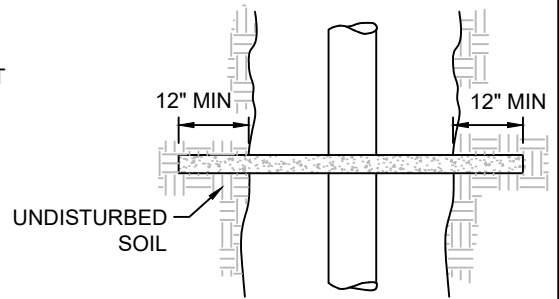
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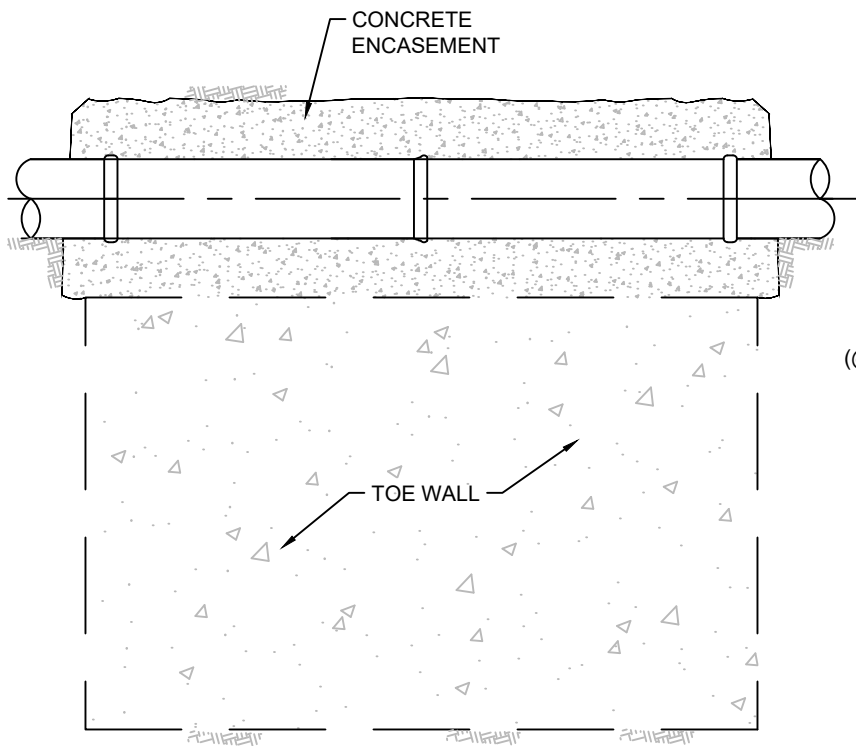
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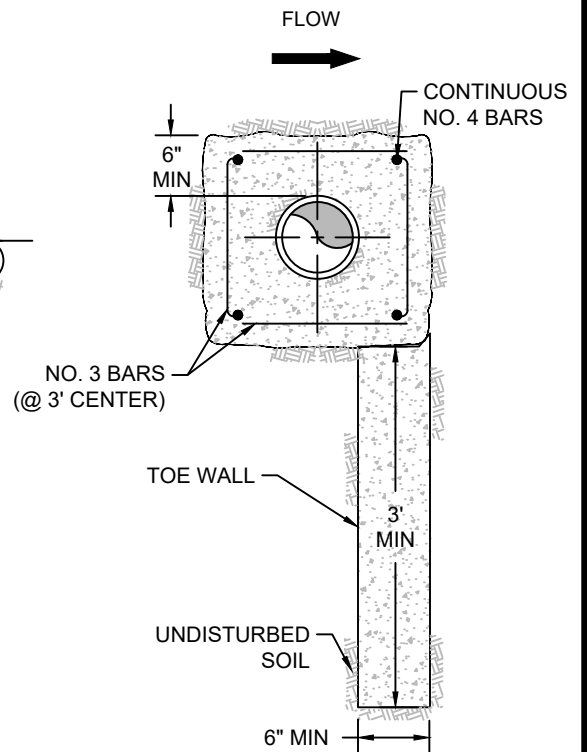
PROFILE



SECTION A-A



PROFILE



CROSS SECTION



DITCH CROSSING

DETAIL NO.

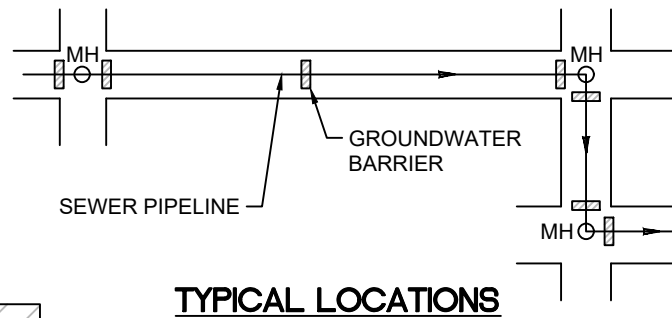
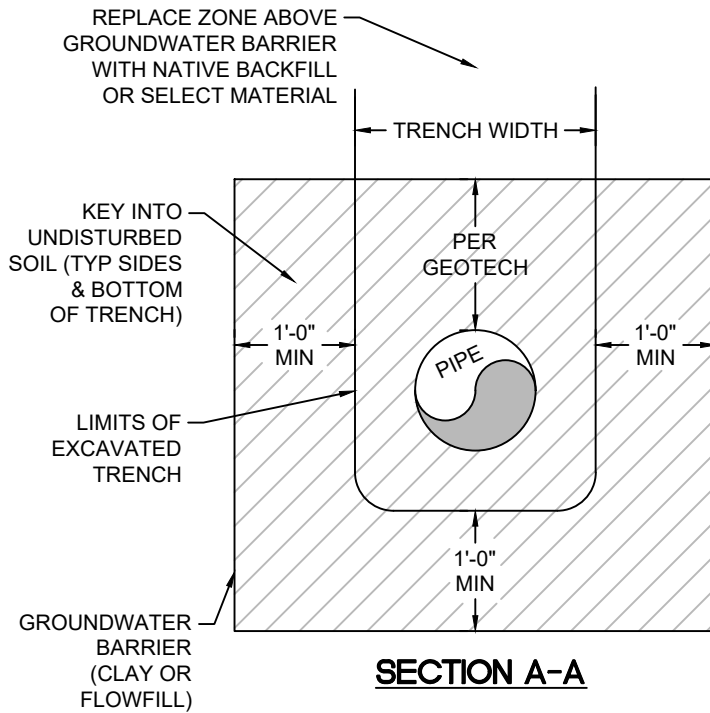
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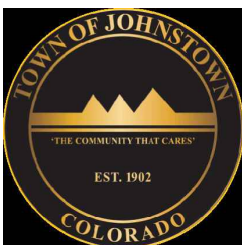
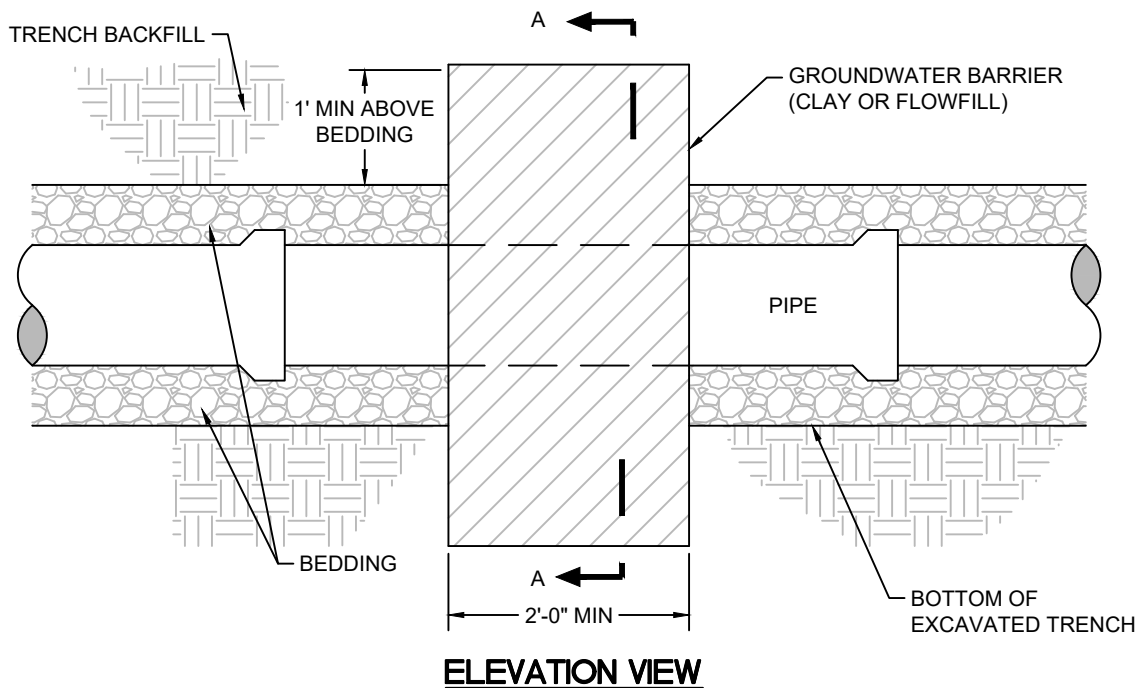
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NOTES:

1. GROUNDWATER BARRIER SHALL BE PLACED AS PIPE CROSSING ENTERS PUBLIC R.O.W.
2. NOMINAL SPACING IS $\pm 300'$, TYPICALLY AT MIDBLOCK AND EACH SIDE OF CROSS STREET.



GROUNDWATER BARRIER

DETAIL NO.

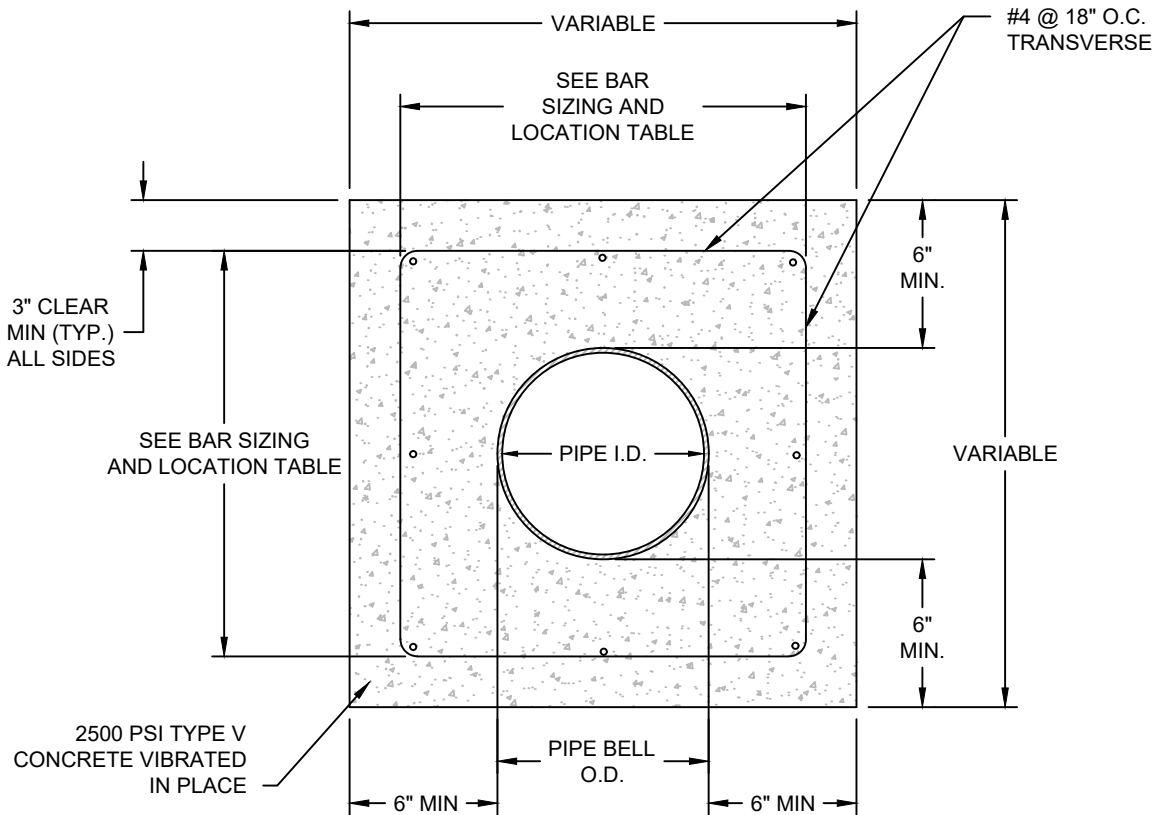
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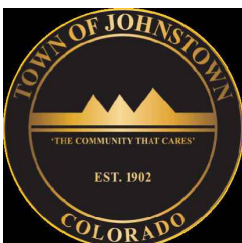
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PIPE I.D.	LONGITUDINAL BARS - LOCATION	
6 IN.	4-#4 BARS	1 EACH CORNER
8 IN.	4-#4 BARS	1 EACH CORNER
10 IN.	8-#4 BARS	3 EACH SIDE
12 IN.	8-#4 BARS	3 EACH SIDE
15 IN.	8-#4 BARS	3 EACH SIDE
18 IN.	8-#4 BARS	3 EACH SIDE
21 IN.	12-#4 BARS	4 EACH SIDE
24 IN.	12-#4 BARS	4 EACH SIDE
27 IN.	12-#4 BARS	4 EACH SIDE
30 IN.	12-#4 BARS	4 EACH SIDE
33 IN.	12-#4 BARS	4 EACH SIDE
36 IN.	16-#4 BARS	5 EACH SIDE

NOTE:

PER TOWN'S DISCRETION, A CASING PIPE FOR THE CARRIER PIPE MAY BE REQUIRED.



CONCRETE ENCASEMENT

DETAIL NO.

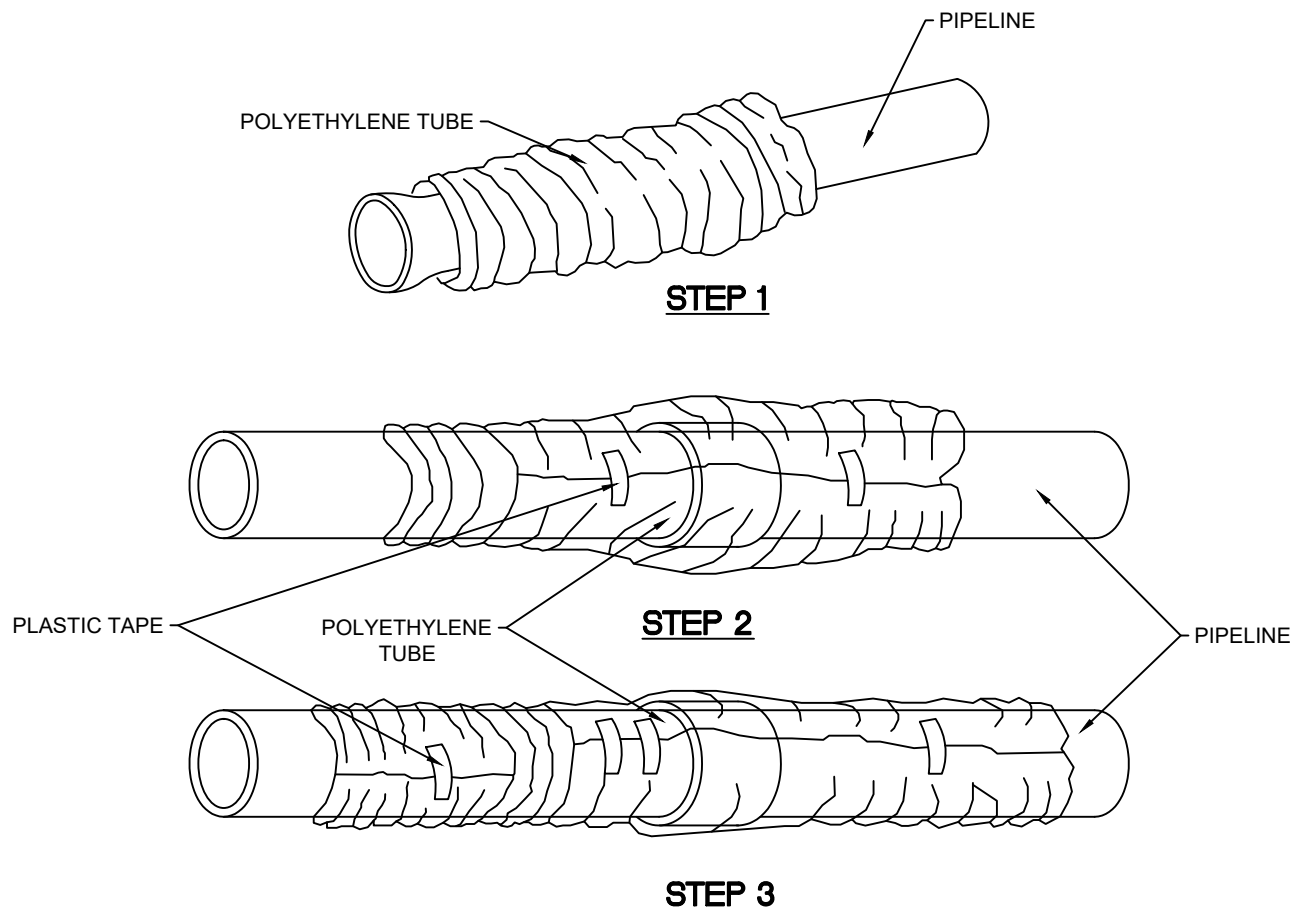
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FIELD INSTALLATION - POLYETHYLENE WRAP

- STEP 1- PLACE TUBE OF POLYETHYLENE MATERIAL ON PIPE PRIOR TO LOWERING IT INTO THE TRENCH.
 STEP 2- PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT, FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE.
 STEP 3- OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF PIPE AND TAPED IN PLACE.

NOTE:

ALL BURIED DUCTILE IRON PIPE, FITTINGS, VALVES, FIRE HYDRANT ASSEMBLIES, ETC. SHALL BE POLYETHYLENE WRAPPED.



POLYETHYLENE WRAP

DETAIL NO.

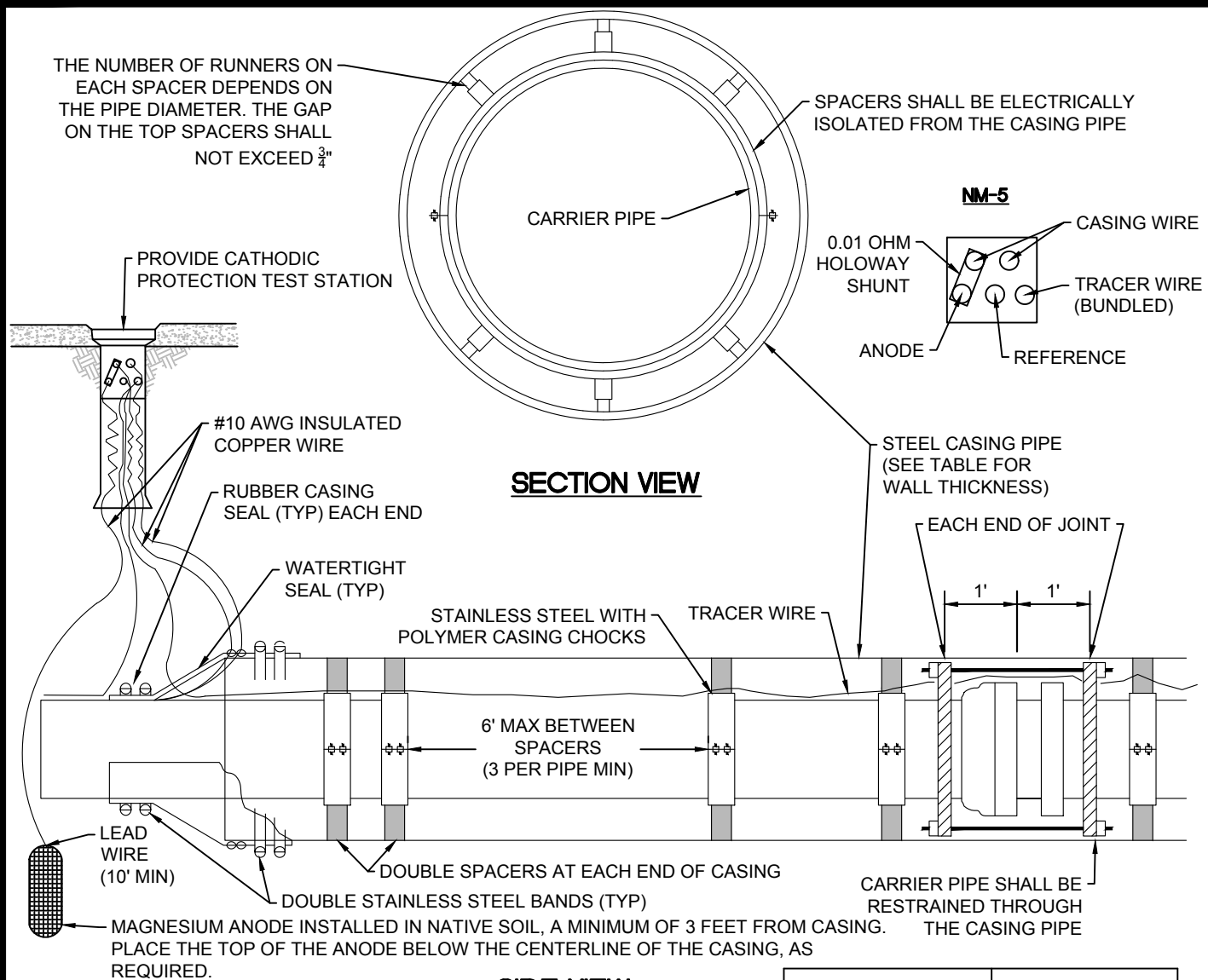
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SIDE VIEW

CARRIER PIPE NOMINAL Ø	CASING PIPE	
	MIN OD	MIN WALL THICKNESS
4"	12"	0.188"
6"	16"	0.250"
8"	18"	0.282"
12"	22"	0.344"
16"	28"	0.406"
20"	32"	0.469"

ANODE LEADS	BLACK
PIPELINE TEST WIRES	RED FOR STEEL, BLUE FOR DI
CASINGS	ORANGE
REF ELECTRODE	YELLOW
TRACER WIRE	WHITE

NOTE:

1. THE ANNULAR SPACE BETWEEN THE CASING AND CARRIER PIPES SHALL NOT BE FILLED WITH ANY MATERIAL.
2. EACH BARREL SECTION OF PIPE WITHIN THE CASING SHALL HAVE A MINIMUM OF THREE (3) CASING CHOCKS. THE MIDDLE CHOCK SHOULD BE CENTERED BETWEEN EACH PIPE JOINT.



BORING DETAIL

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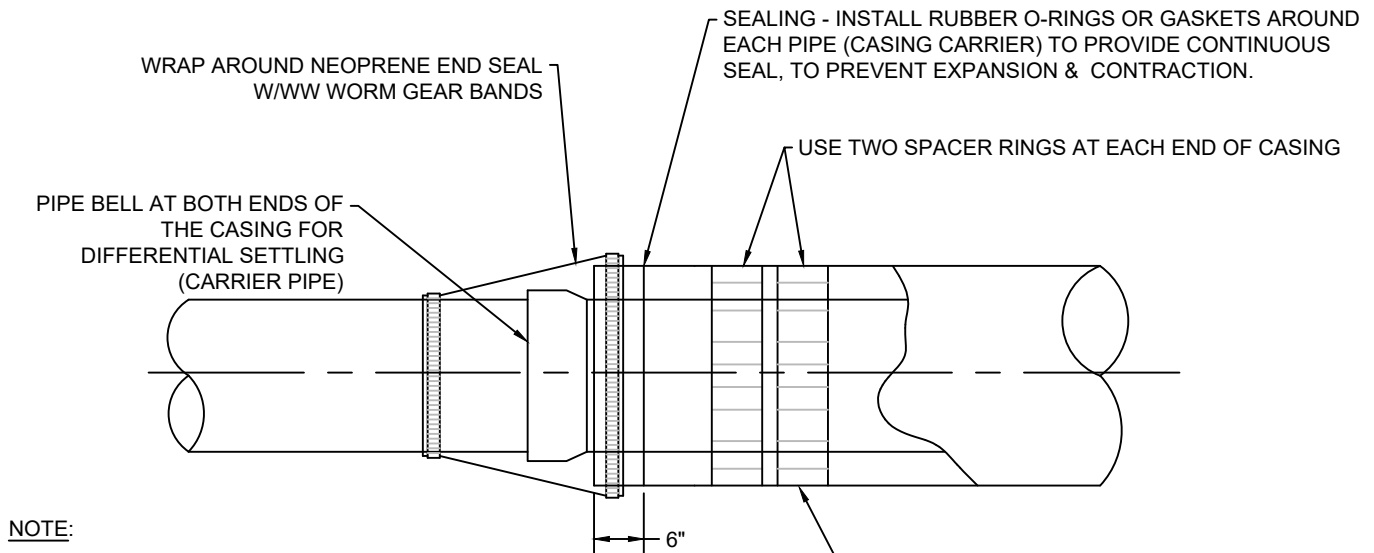
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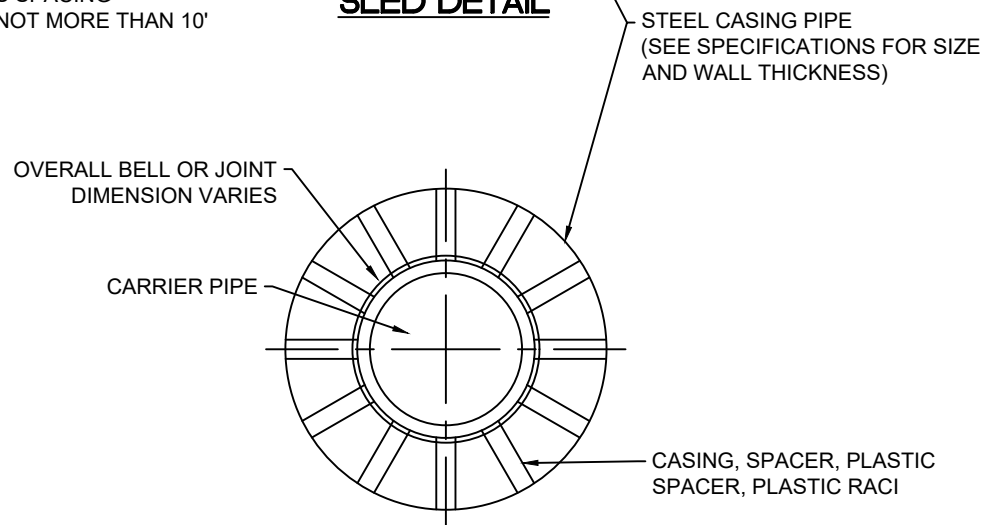
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NOTE:

CASING SPACERS SHOULD BE INSTALLED PER MANUFACTURER'S SPACING REQUIREMENTS, BUT NOT MORE THAN 10' SPACING.

SLED DETAIL



PIPE CASING DETAIL

CARRIER PIPE NOMINAL Ø	CASING THICKNESS (in)	
	HIGHWAY	RAILROAD
24"- LESS	0.281	0.375
30"	0.312	0.469
36"	0.344	0.531
42"	0.344	0.625
48"	0.344	0.688



PIPE CASING AND SLED

DETAIL NO.

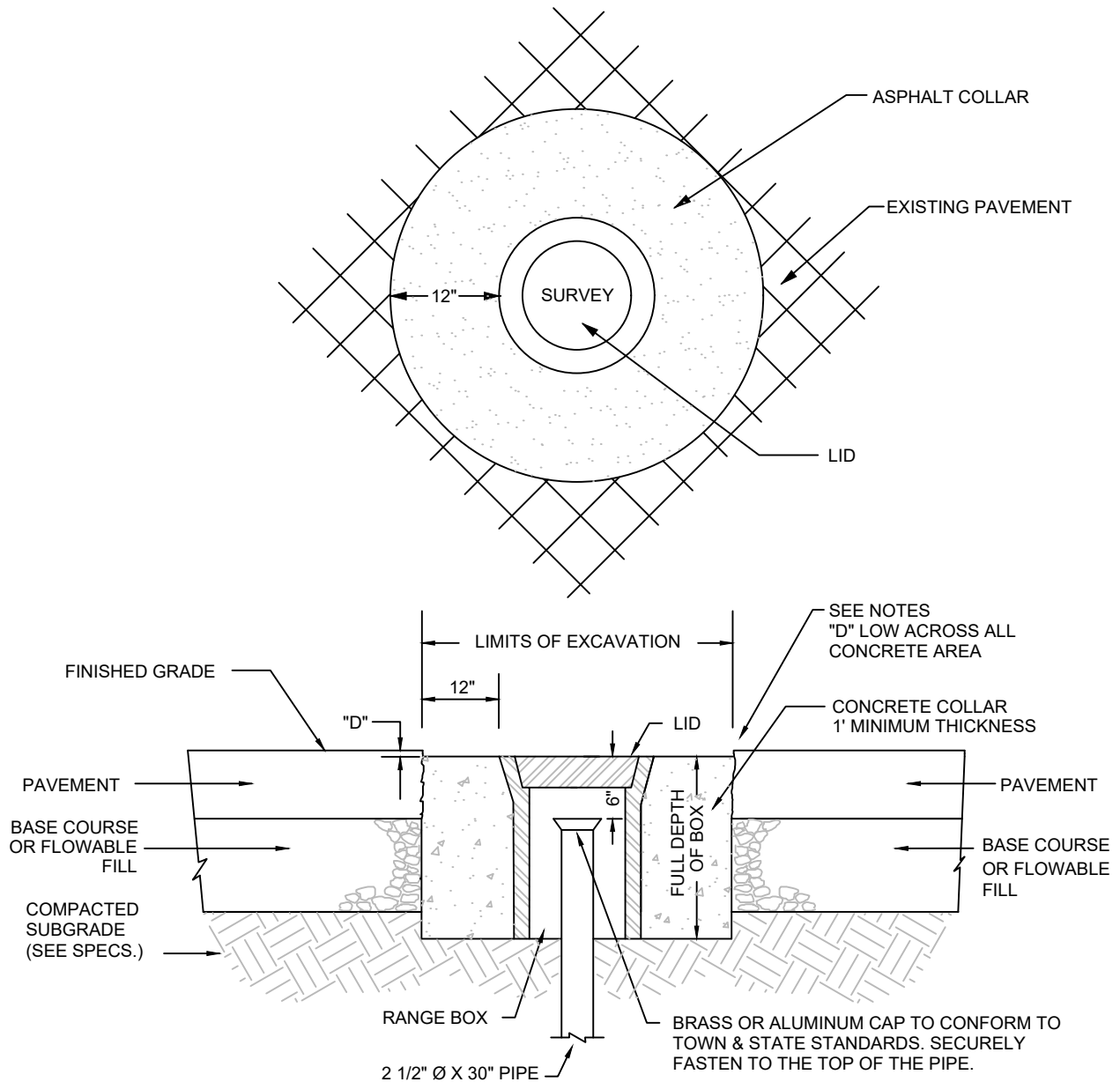
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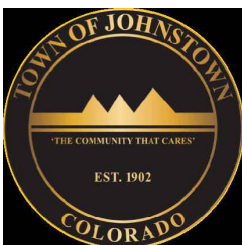
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NOTES:

1. "D" = 1/2" FOR H.M.A. PAVEMENT OVERLAYS OR SURFACE TREATMENTS
2. "D" = 1/2" FOR H.M.A. PAVEMENT RECONSTRUCTION OR NEW CONSTRUCTION
3. "D" = 1/4" FOR CONCRETE STREETS.
4. THIS MONUMENT TO BE INSTALLED AT ALL ALIQUOT CORNERS.
5. SURVEY MONUMENTS SHALL CONFORM TO ALL LAND SURVEYING REQUIREMENTS AS DETERMINED BY TOWN & STATE STDS.
6. RANGE BOX, CAP & MONUMENT PIPE TO BE PROVIDED BY THE PROFESSIONAL LAND SURVEYOR.



SURVEY MONUMENT

DETAIL NO.

114

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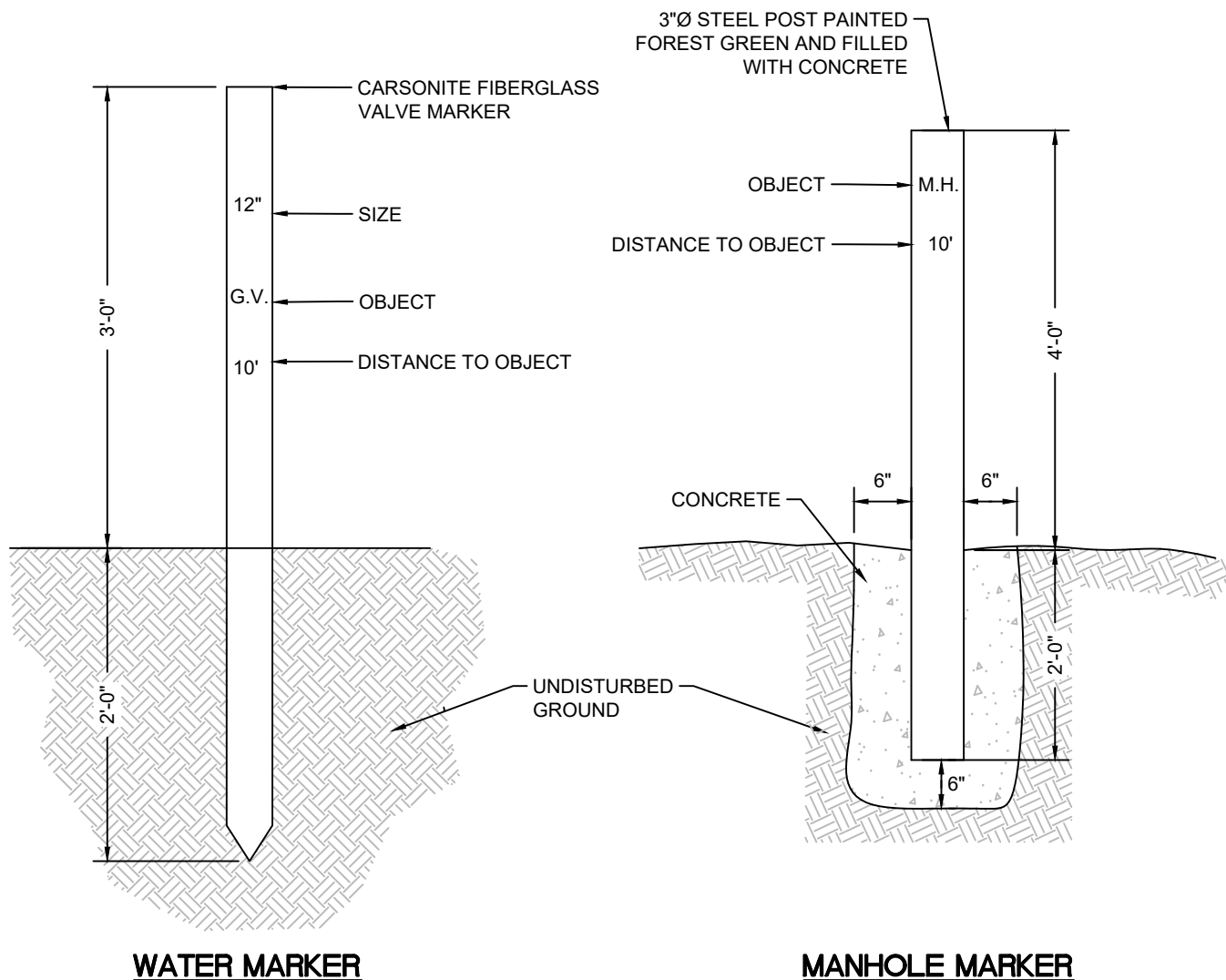
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NOTE:

ALL LETTER ARE TO BE 2" HIGH IN BLACK CAPITAL LETTERS, FACING THE OBJECT



CODE	OBJECT
BFV	BUTTERFLY VALVE
GV	GATE VALVE
AV	AIR VAC & VAULT
90 DEG	90 DEG BEND (TYP ALL BENDS)
BV	BLOW-OFF VALVE
PRV	PRESSURE REDUCING VALVE

CODE	OBJECT
MH	MANHOLE



UTILITY MARKERS

DETAIL NO.

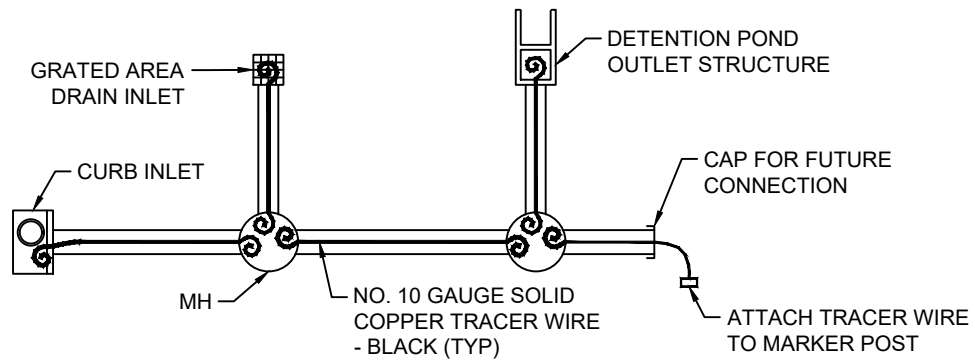
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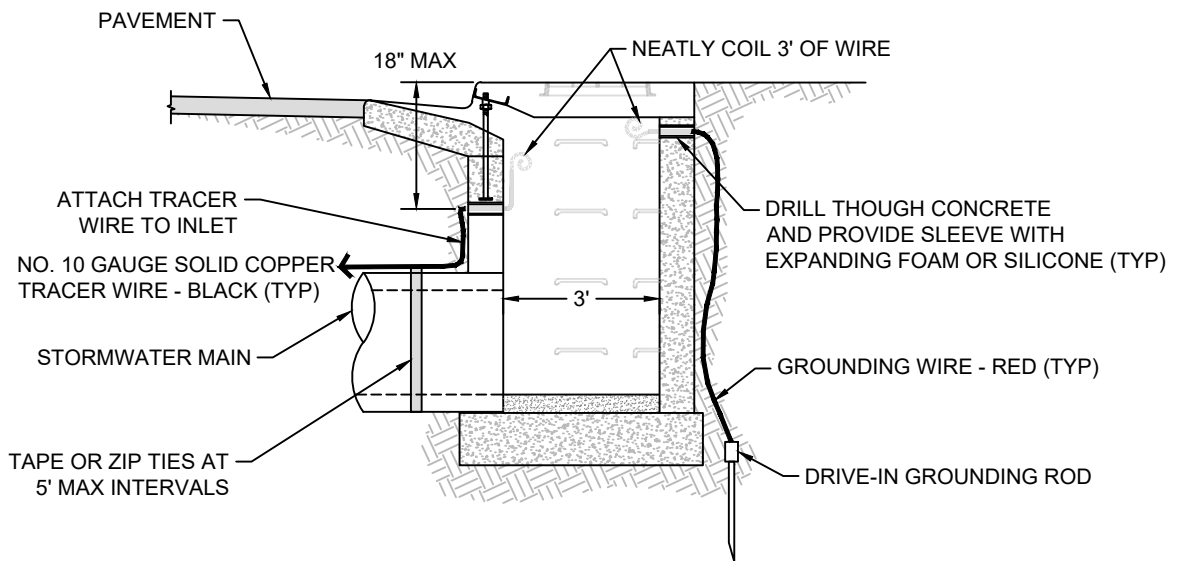
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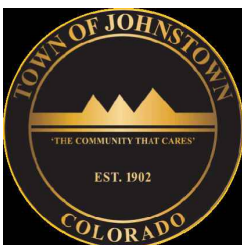
STANDARD STORMWATER SYSTEM LAYOUT



CURB INLET

NOTES:

1. TRACER WIRE SHALL BE FASTENED TO THE TOP OF THE PIPE WITH TAPE OR ZIP TIES AT 5-FOOT INTERVALS. TRACER WIRE MAY BE SHOWN AWAY FROM PIPE FOR CLARITY.
2. TRACER WIRE SHALL BE SOLID COPPER NO. 10 GAUGE WITH 30 MILS HDPE INSULATION, BLACK FOR STORMWATER PIPE.
3. MARKING TAPE SHALL BE INSTALLED 12" ABOVE THE TOP OF PIPE.



TRACER WIRE - STORMATER

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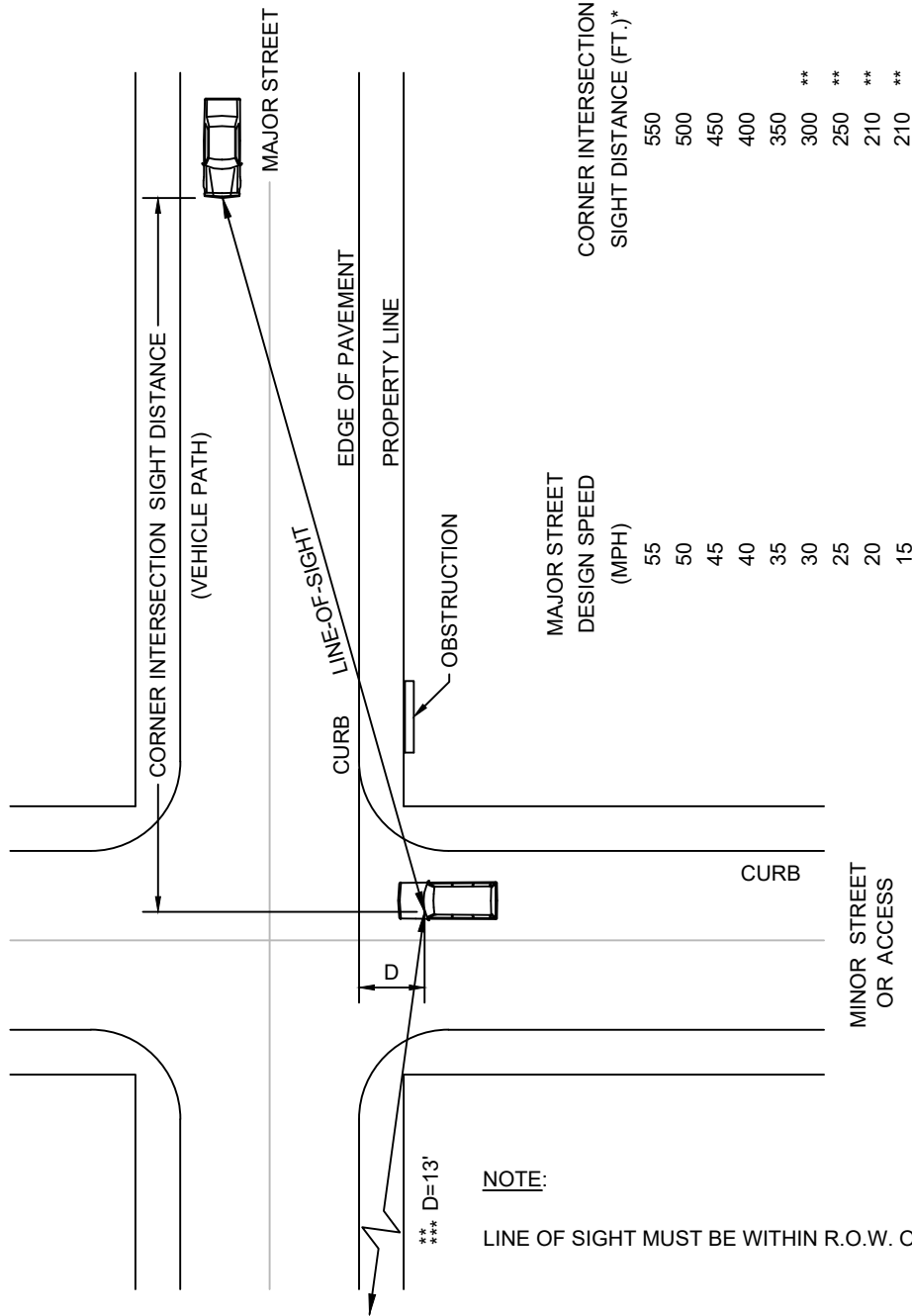
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SIGHT DISTANCE AT INTERSECTIONS
(UNSIGNALIZED)

FROM CDOT STATE HIGHWAY ACCESS CODE TABLE 4-2

- * CORNER SIGHT DISTANCE MEASURED FROM A POINT ON THE MINOR ROAD AT 13 FEET BACK FROM THE EDGE OF THE MAJOR ROAD PAVEMENT (FLOWLINE) AND MEASURED FROM A HEIGHT OF EYE AT 3.50 FEET ON THE MINOR ROAD TO A HEIGHT OF OBJECT AT 4.25 FEET ON THE MAJOR ROAD.
- ** AT LOCAL-LOCAL STREET INTERSECTIONS ONLY, THE "D" DISTANCE SHALL BE TEN FEET (10') AND THE SIGHT DISTANCE SHALL BE MEASURED TO THE CENTERLINE OF THE STREET.
- *** FOR PRIVATE DRIVEWAY ACCESS TO A PUBLIC STREET, USE 10 FEET BACK FROM FLOWLINE (OR SHOULDER FOR GRAVEL ROADS).
1. THESE VALUES APPLY TO PASSENGER CARS ON 2-LANE ROADS WITH GRADES OF 3% OR LESS. INTERSECTIONS WITH TRUCKS, STEEPER GRADES, OR ON MULTI-LANE ROADWAYS REQUIRES ADDITIONAL ANALYSIS.
 2. ADJUSTMENTS MAY BE REQUIRED FOR A SKEWED INTERSECTION.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 7-16



SIGHT TRIANGLE

DETAIL NO.

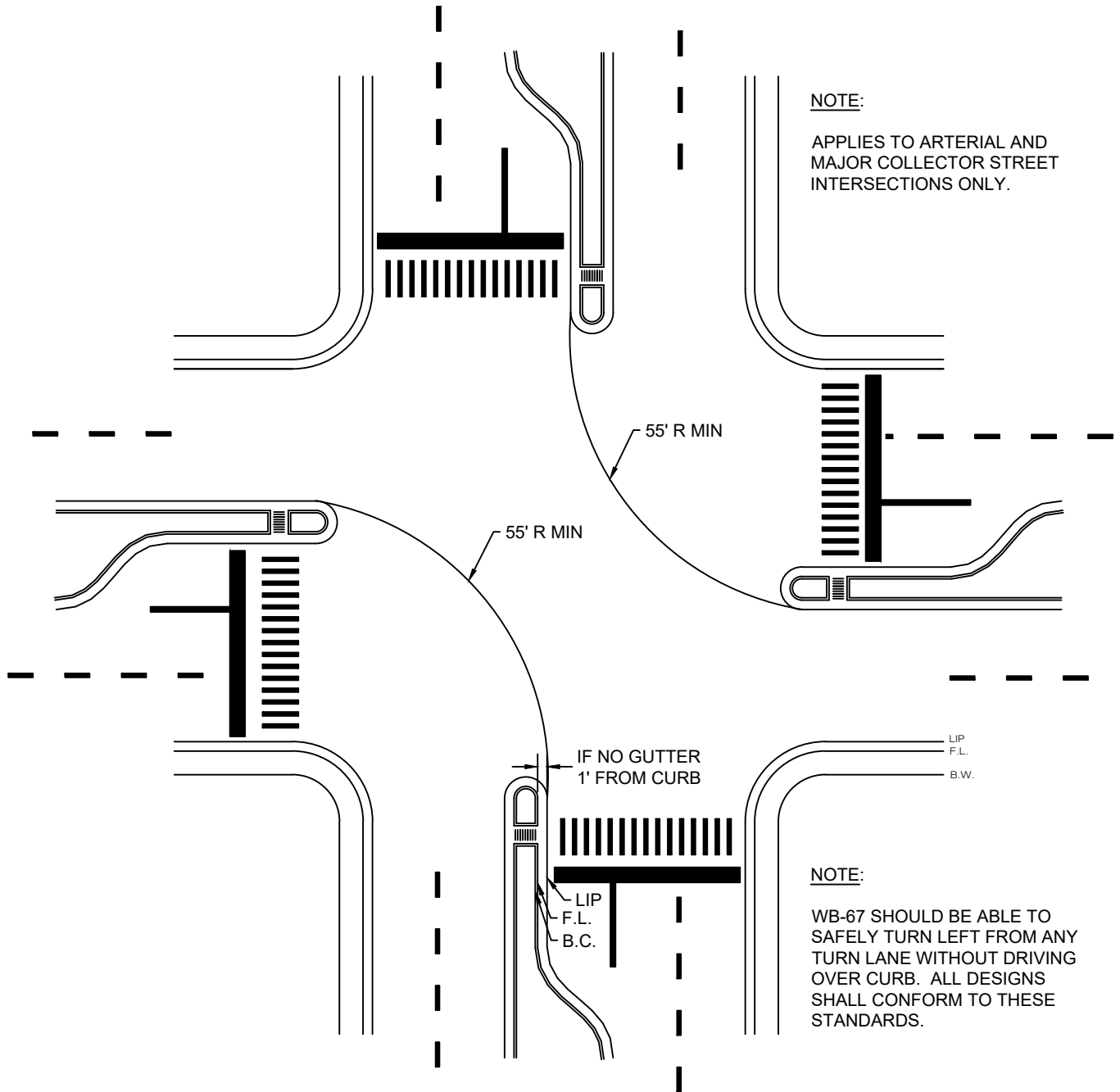
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ADOPTED DETAIL SOURCE: LCUASS FIGURE 7-20



LEFT TURN CLEARANCE

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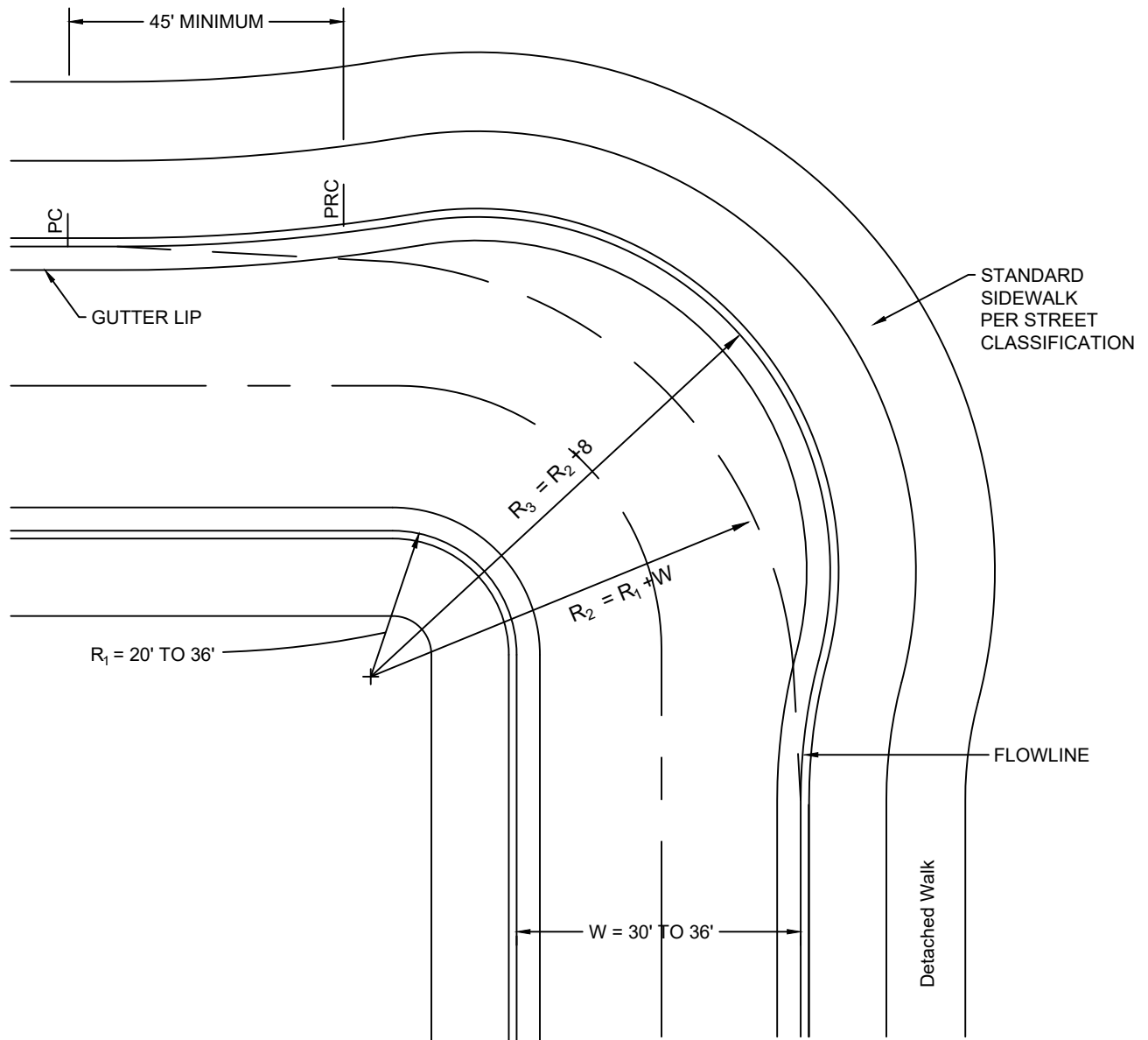
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ADOPTED DETAIL SOURCE: LCUASS FIGURE 7-24



WIDENING FOR STREET TURNS OVER 60 DEG. (LOCAL STREETS ONLY)

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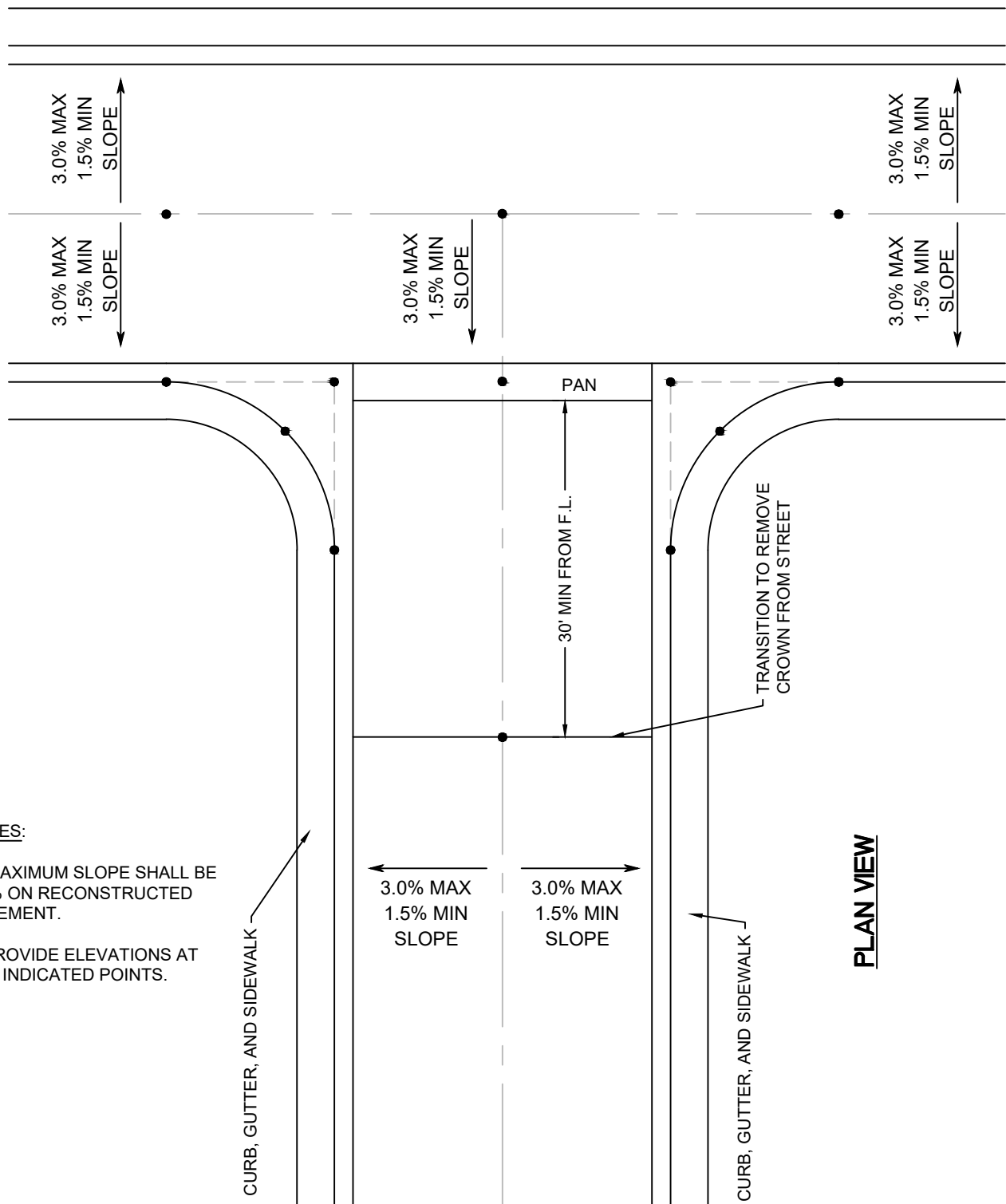
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NOTES:

1. MAXIMUM SLOPE SHALL BE 4.0% ON RECONSTRUCTED PAVEMENT.
2. PROVIDE ELEVATIONS AT THE INDICATED POINTS.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 7-27



STREET INTERSECTION CROSSPAN APPROACH

DETAIL NO.

200.04

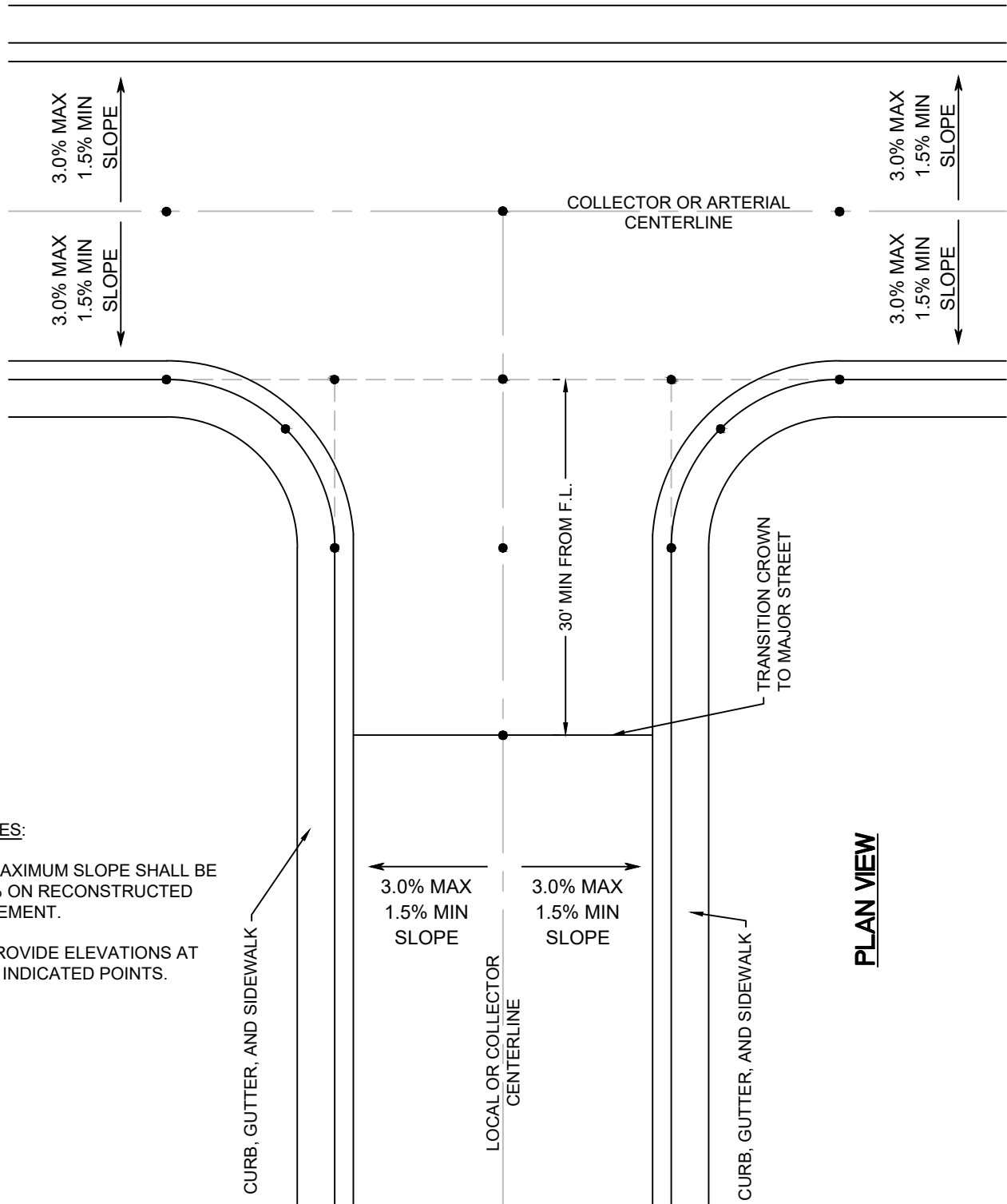
REVISION NO: 1

DATE: 9/20/2022

SCALE: NTS

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● DESIGN ENGINEER
PROVIDE SPOT ELEVATIONS AT THESE POINTS



NOTES:

1. MAXIMUM SLOPE SHALL BE 4.0% ON RECONSTRUCTED PAVEMENT.
2. PROVIDE ELEVATIONS AT THE INDICATED POINTS.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 7-28



STREET INTERSECTION APPROACH

REVISION NO: 1

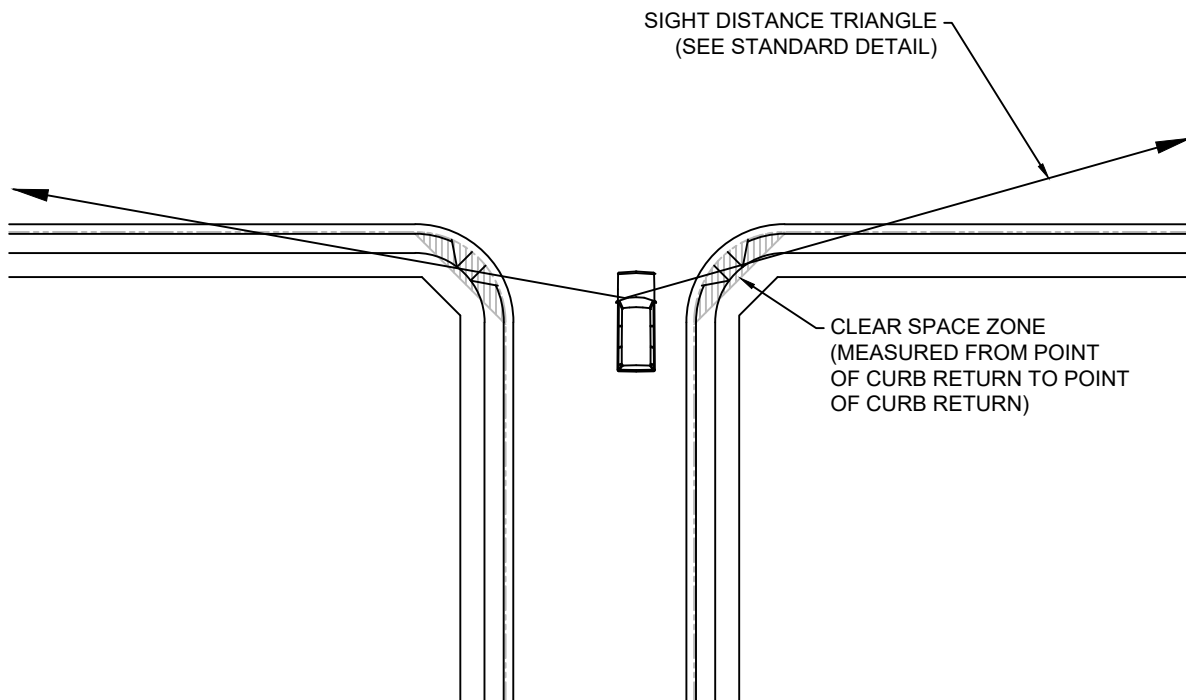
DATE: 9/20/2022

SCALE: NTS

DETAIL NO.

200.05

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NOTE:

IN ADDITION TO THE SIGHT DISTANCE TRIANGLE REQUIREMENTS, A CLEAR SPACE ZONE IS REQUIRED WITHIN ALL CURB RETURNS (MEASURED FROM POINT OF CURB RETURN TO POINT OF CURB RETURN) WHERE NO TREES, SHRUBS, AESTHETIC STRUCTURES/FEATURES, MONUMENT SIGNS, OR OBJECTS THAT HAVE THE POTENTIAL TO HINDER DRIVER VISIBILITY, AND/OR PEDESTRIAN AND BICYCLE SAFETY, ARE ALLOWED.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 7-34



CLEAR SPACE ZONE

DETAIL NO.

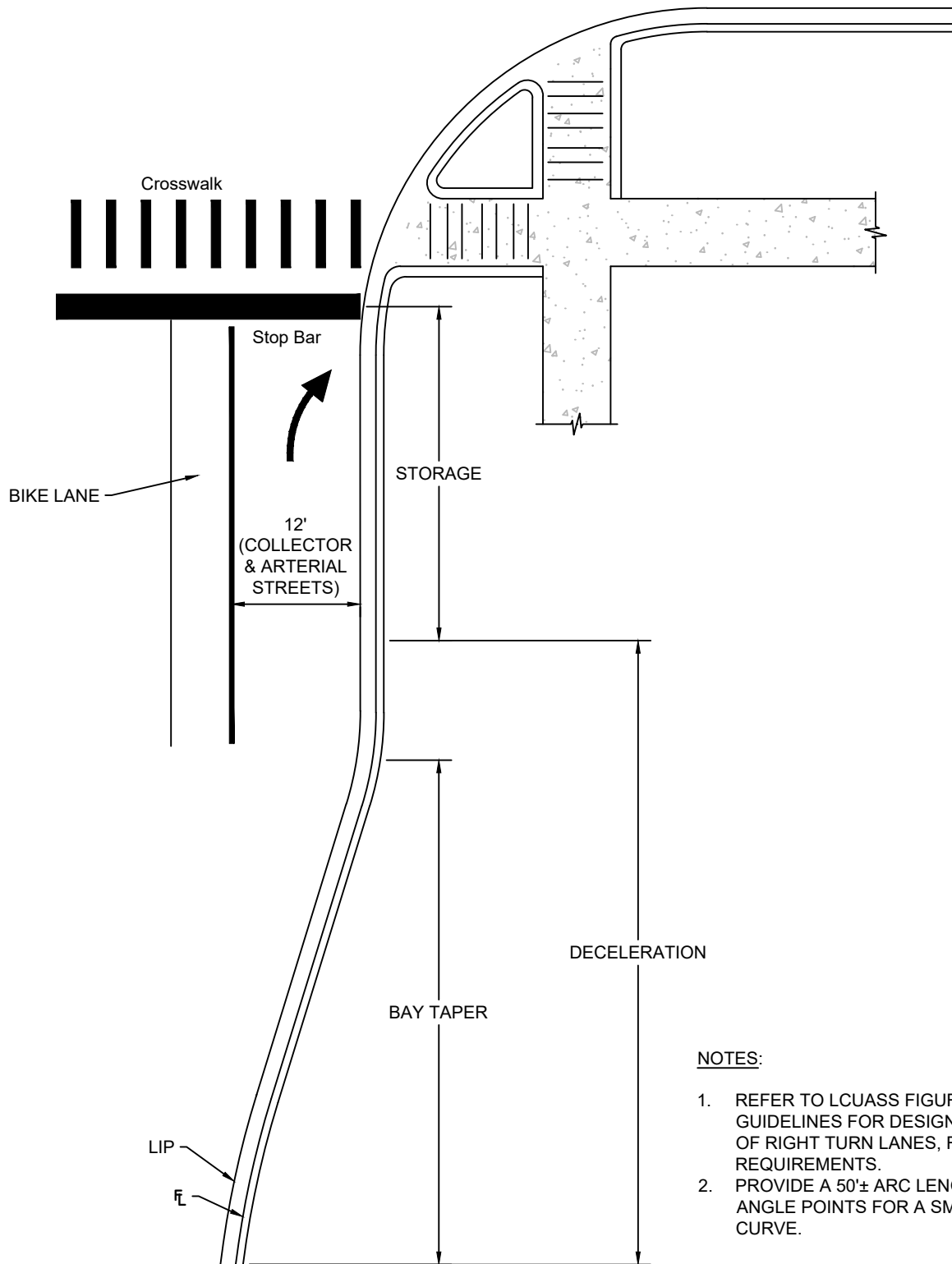
200.06

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DATE: 9/20/2022

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NOTES:

1. REFER TO LCUASS FIGURE 8-5, GUIDELINES FOR DESIGN LENGTHS OF RIGHT TURN LANES, FOR DESIGN REQUIREMENTS.
2. PROVIDE A $50' \pm$ ARC LENGTH AT ANGLE POINTS FOR A SMOOTH CURVE.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 8-9



EXCLUSIVE RIGHT TURN

DETAIL NO.

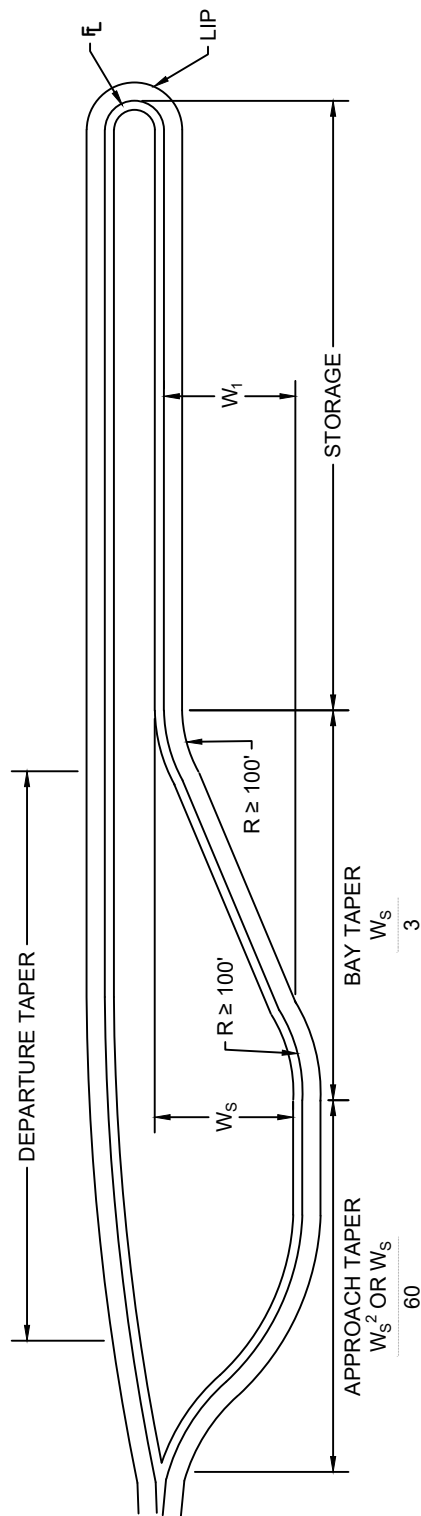
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DATE: 9/20/2022

SCALE: NTS

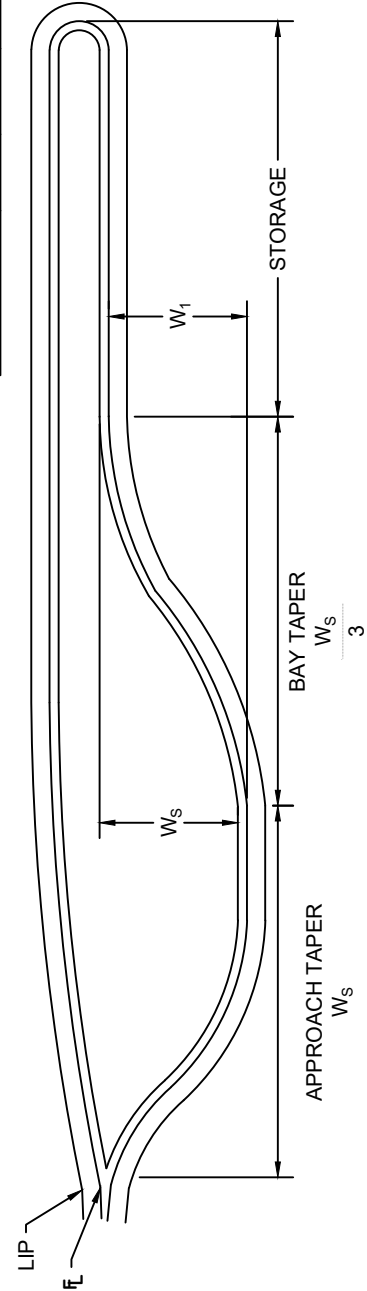
PAGE 1 OF 1



LEFT TURN LANE WITH FULL SHADOW

HIGH SPEED (≥ 45 MPH)

TAPER RATIOS				
TAPER TYPE	DESIGN SPEED			
	35	40	45	50
BAY	12:1	13.3:1	15:1	16.7:1
APPROACH	20:1	27:1	45:1	50:1
DEPART	NA	NA	NA	NA
COMBINED	20:1	27:1	45:1	50:1



LEFT TURN LANE WITH PARTIAL SHADOW

NOTE:

REFER TO LCUASS FIGURE 8-3, GUIDELINES FOR DESIGN TAPERS FOR LEFT TURN LANES, FOR DESIGN REQUIREMENTS.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 8-11



TURN LANE DESIGN CRITERIA

DETAIL NO.

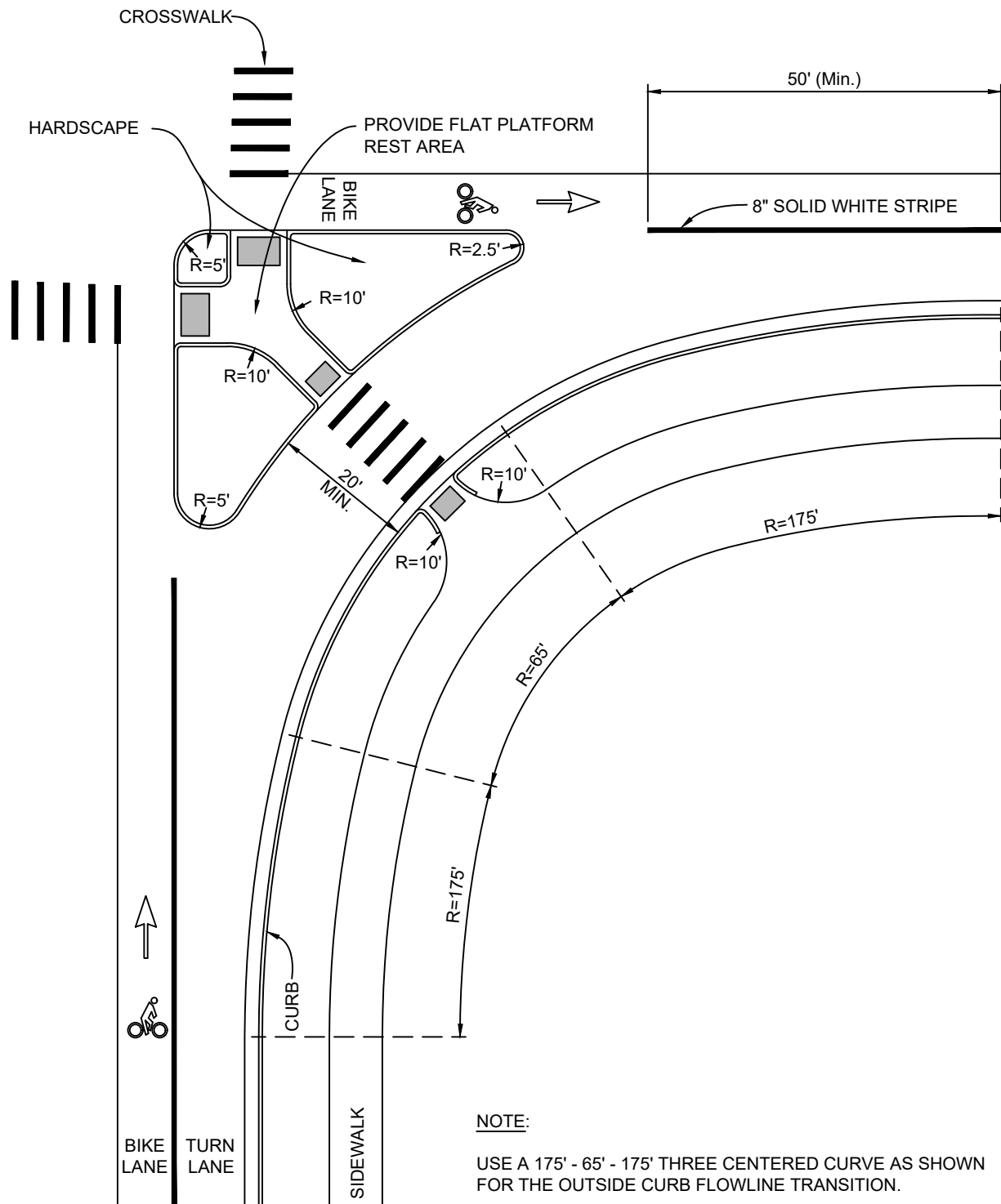
200.08

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ADOPTED DETAIL SOURCE: LCUASS FIGURE 8-18



RIGHT TURN LANE TO A CONTINUOUS LANE WITH PEDESTRIAN REFUGE

DETAIL NO.

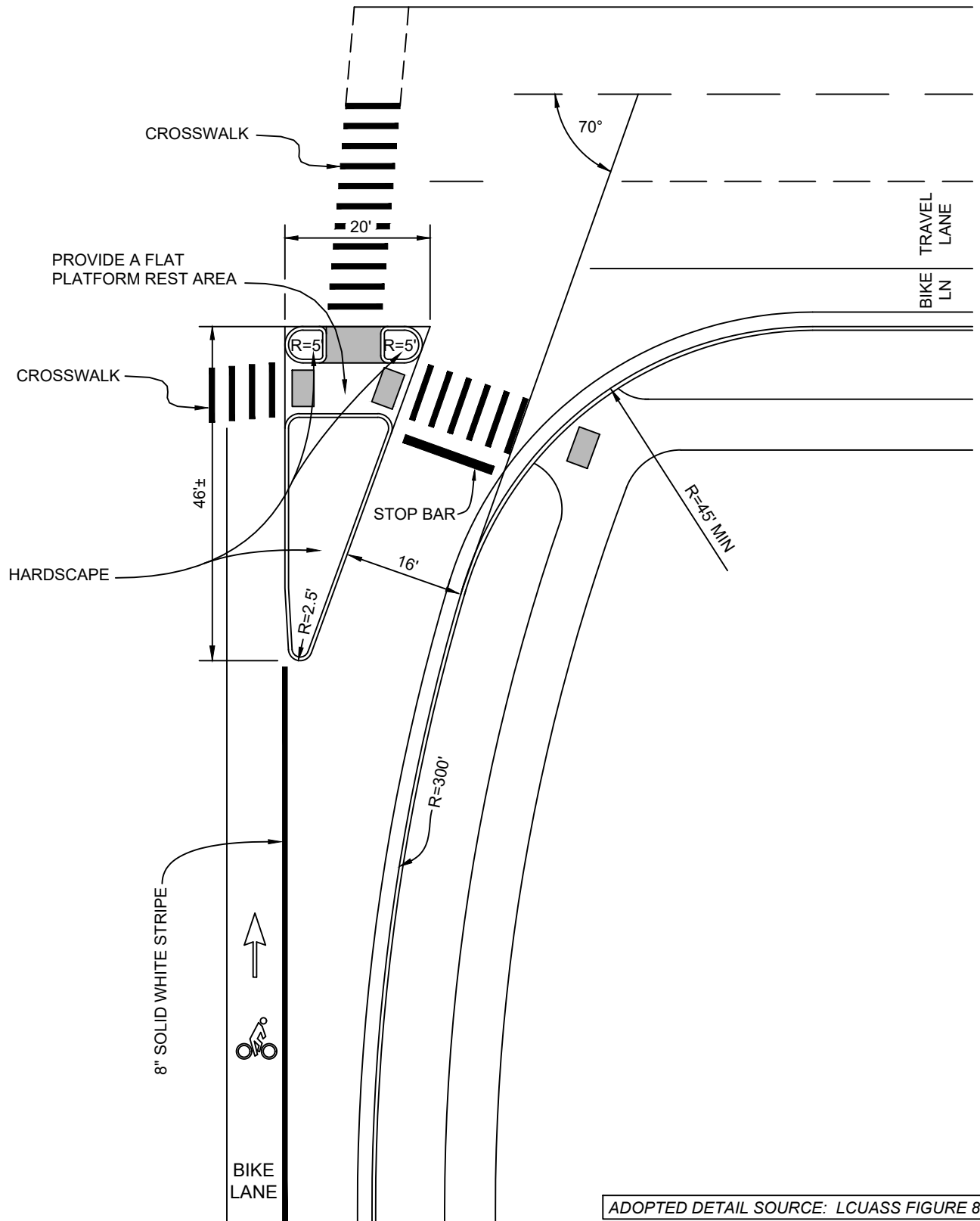
200.09

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DATE: 9/20/2022

SCALE: NTS

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PEDESTRIAN REFUGE ISLAND RIGHT TURN LANE

DETAIL NO.

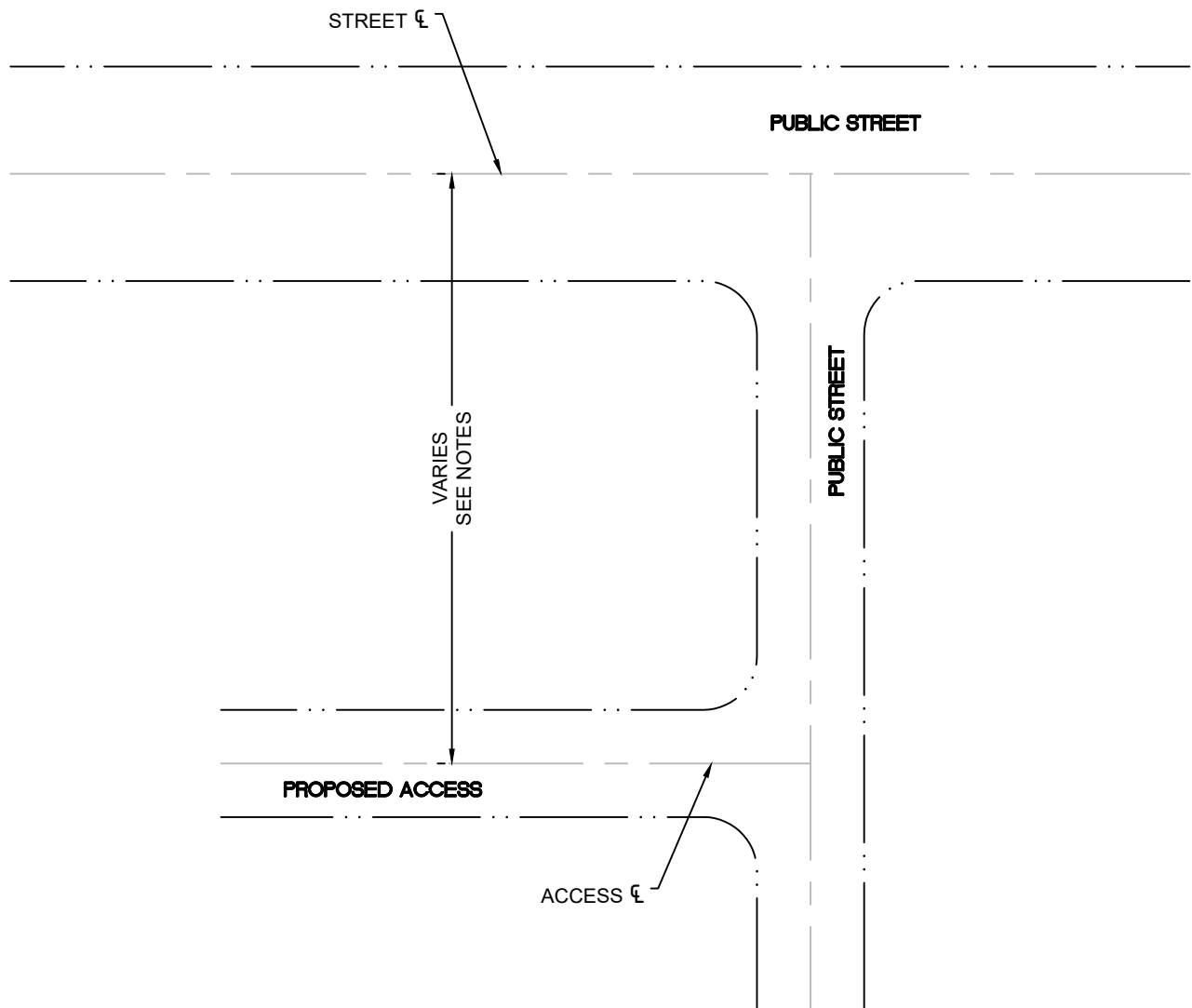
200.10

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NOTES:

1. REFER TO LCUASS FOR SEPARATION REQUIREMENTS FOR DIFFERENT ROAD CLASSIFICATIONS. (LCUASS TABLES 7-3 & 7-4)
2. ADDITIONAL SEPARATION DISTANCE MAYBE REQUIRED WHEN THE ADJACENT INTERSECTION IS A ROUNDABOUT.
3. THE PROPOSED ACCESS SHALL NOT BE <200' FROM THE CENTERLINE OF AN ARTERIAL ROADWAY.
4. ADDITIONAL SEPARATION DISTANCE MAYBE REQUIRED AS DEEMED APPROPRIATE.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 9-1



ACCESS SPACING

DETAIL NO.

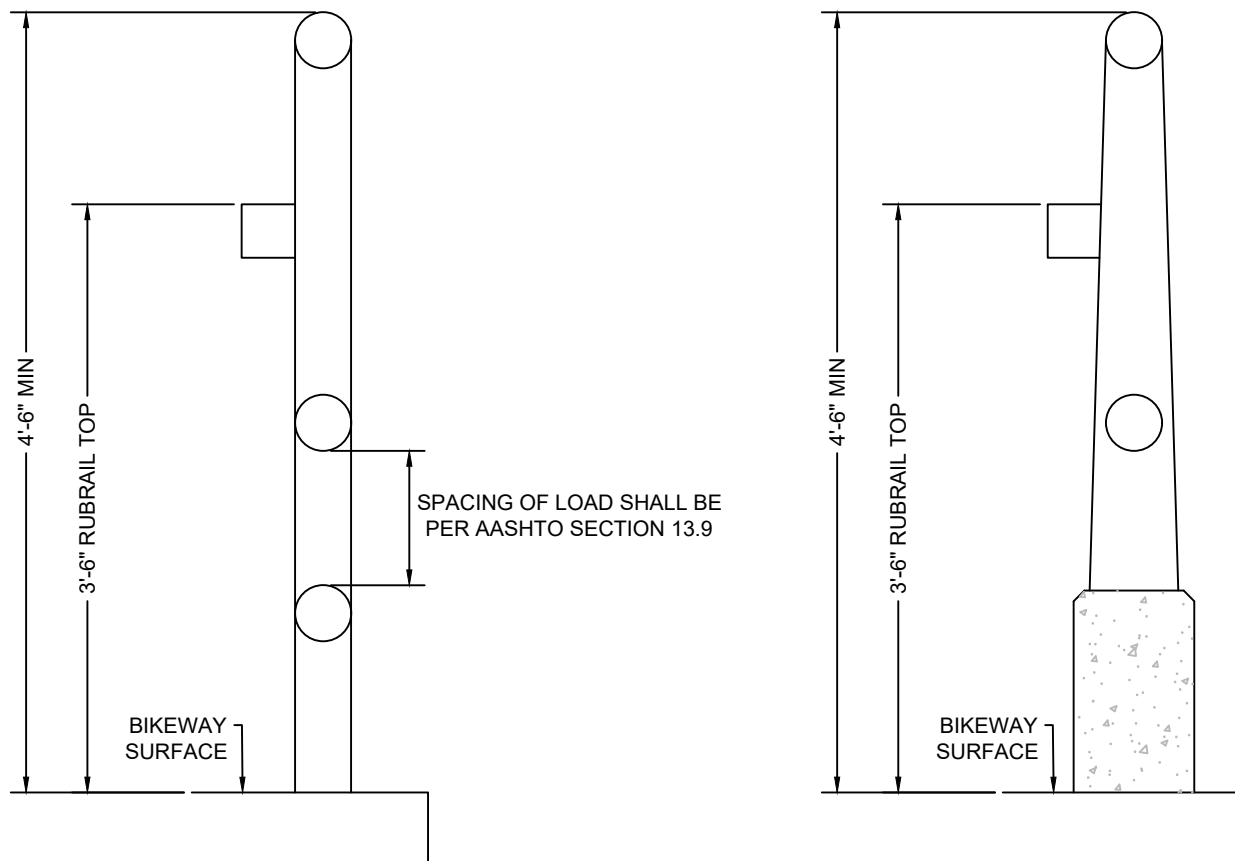
200.11

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NOTE:

TO BE USED ON THE OUTER EDGE OF A BIKEWAY WHEN TRAFFIC IS SEPARATED FROM BICYCLE TRAFFIC BY A TRAFFIC RAILING. RAILING SHAPE ILLUSTRATIVE ONLY.

FROM AASHTO ROADWAY GUIDELINE

ADOPTED DETAIL SOURCE: LCUASS FIGURE 11-4



BICYCLE AND PEDESTRIAN LOADING RAILS

DETAIL NO.

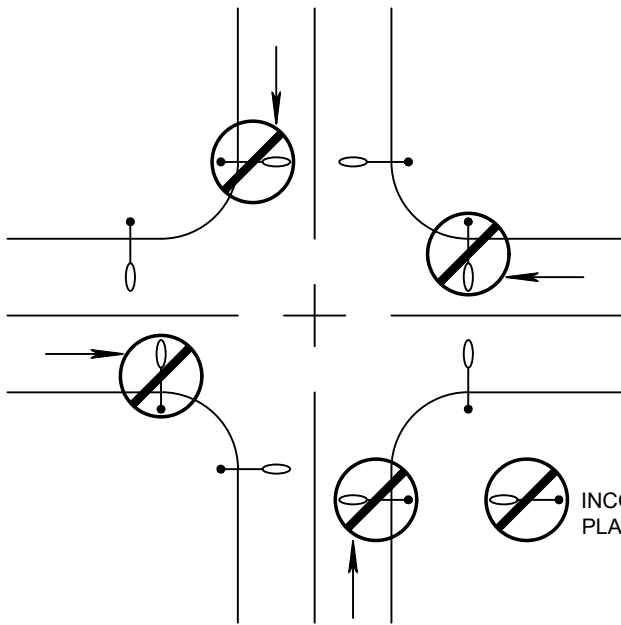
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REVISION NO: 1

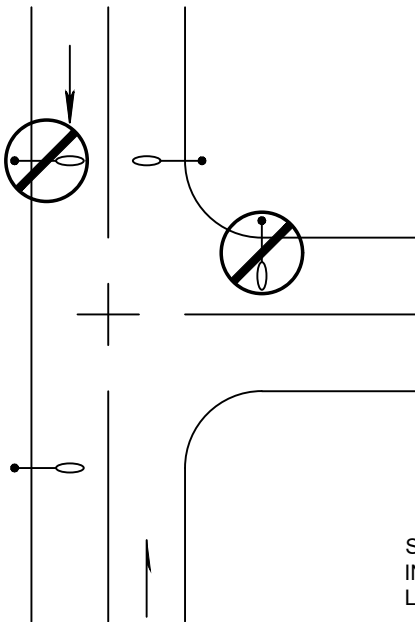
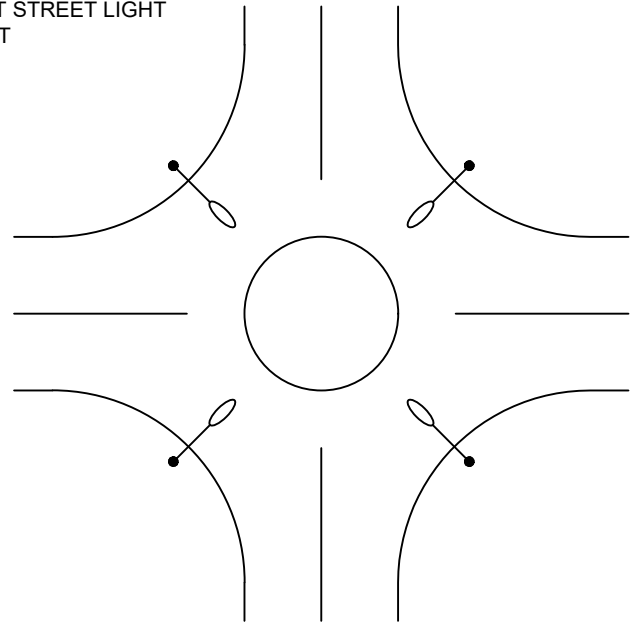
DATE: 9/20/2022

SCALE: NTS

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INCORRECT STREET LIGHT
PLACEMENT



STREET LIGHTS SHALL BE PLACED ON THE DOWNSTREAM SIDE OF
INTERSECTION, AS VIEWED BY A MOTORIST IN THE LANE BENEATH THE
LUMINAIRE.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 15-1



STREET LIGHT PLACEMENT AT INTERSECTION

DETAIL NO.

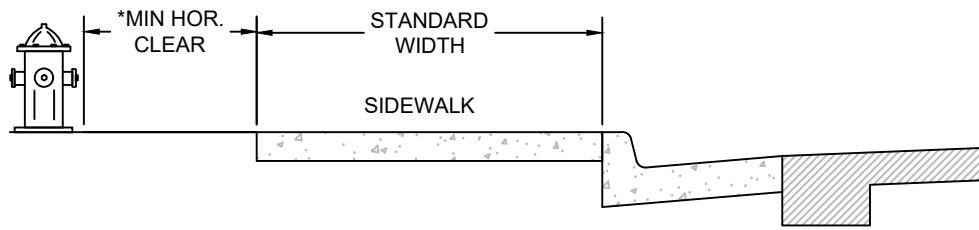
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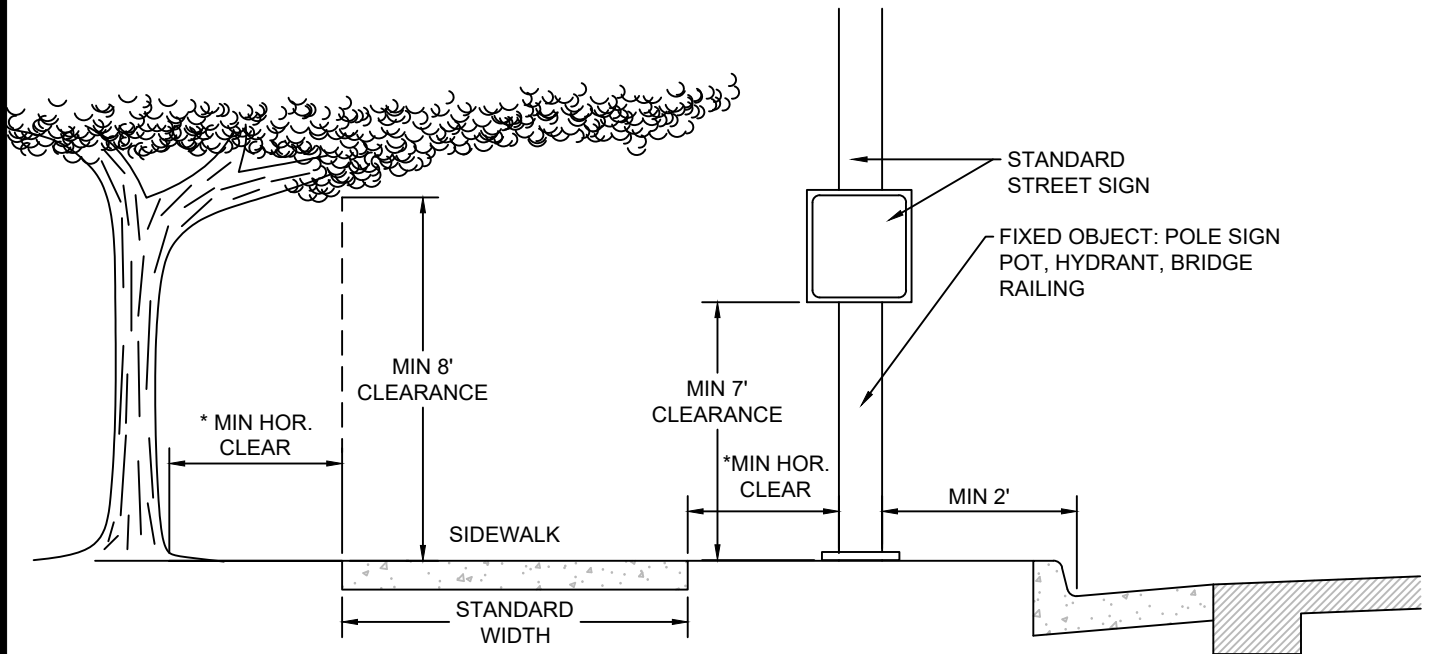
DATE: 9/20/2022

SCALE: NTS

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ATTACHED SIDEWALK SECTION



DETACHED SIDEWALK SECTION

NOTE:

1. ALL ABOVE GROUND UTILITIES OR OTHER FEATURES MUST BE A MINIMUM OF 2' FROM SIDEWALK.

* THE MINIMUM HORIZONTAL CLEARANCE MAY BE REDUCED TO ZERO FEET IN LOCATIONS SUCH AS DOWNTOWN, SPECIAL PEDESTRIAN PLAZAS AND BRIDGES, WHERE BICYCLE TRAFFIC IS RESTRICTED. IN SUCH LOCATIONS THE MINIMUM CLEAR PATH EQUAL TO THE STANDARD SIDEWALK WIDTH FOR THE STREET CLASSIFICATION SHALL BE CLEAR OF ALL OBSTRUCTIONS.

OBJECTS & MATERIALS	MINIMUM HORIZONTAL CLEARANCE
TREES	2.5'
SHRUBS, HEDGES FENCES & WALLS	2'
SOLID FIXED OBJECTS	1'
MOVABLE SOLID OBJECTS	1'
GRAVEL, ROCKS, OR MATERIAL THAT MAY SLOUGH OR LAND ON THE SIDEWALK	2'

ADOPTED DETAIL SOURCE: LCUASS FIGURE 16-1



VERTICAL AND HORIZONTAL CLEARANCES FOR SIDEWALKS

DETAIL NO.

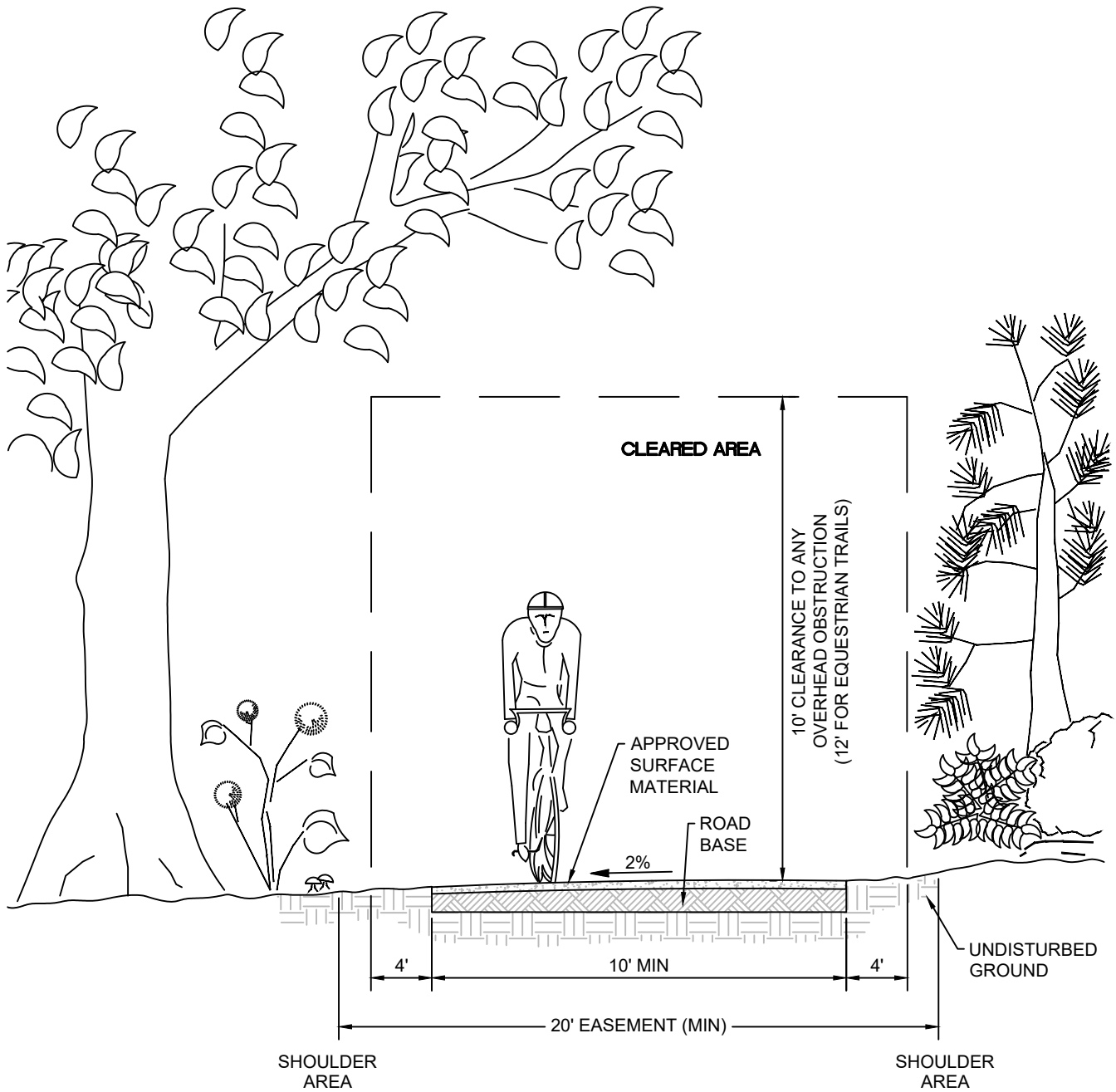
200.14

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BIKE PATH CLEARING

NOTES:

1. CLEAR TRAIL AND SHOULDER AREAS OF ALL VEGETATIVE MATTER AND DEBRIS.
2. FOR BIKE PATHS 10 FEET OR GREATER IN WIDTH, 4 FEET IN WIDTH MORE THAN THE BIKE PATH SHALL BE CLEARED.
3. 10' WIDTH (MIN.) FOR ONE WAY AND TWO WAY TRAFFIC.

ADOPTED DETAIL SOURCE: LCUASS FIGURE 17-1



BIKE PATH CLEARANCE

DETAIL NO.

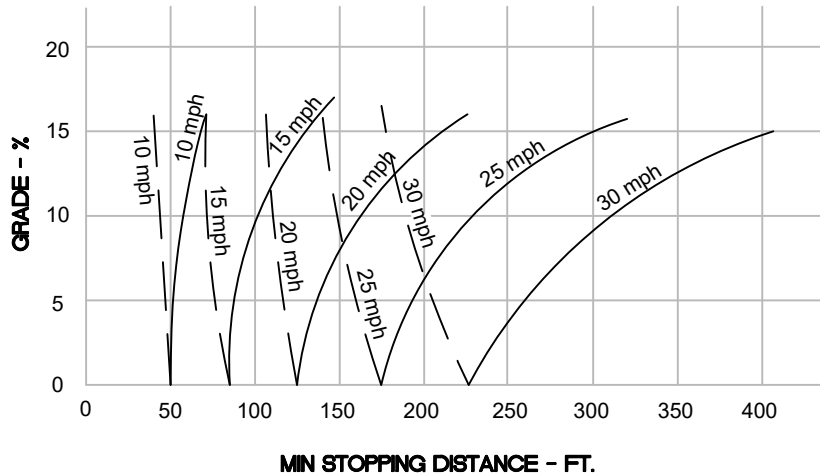
200.15

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$$S = \frac{V^2}{30(f \pm G)} + 3.67 V$$

WHERE:

S = MINIMUM SIGHT DISTANCE, FT.

V = VELOCITY, MPH

F = COEFFICIENT OF FRICTION (USE 0.25)

G = GRADE FT./FT. (RISE/RUN)

DESCEND (-G) ————

ASCEND (+G) ————

(METRIC CONVERSION: 1 FT. = 0.3 M. 1 MPH = 1.6 KM/H)

FROM AASHTO

ADOPTED DETAIL SOURCE: LCUASS FIGURE 17-2



MINIMUM STOPPING SIGHT DISTANCE

DETAIL NO.

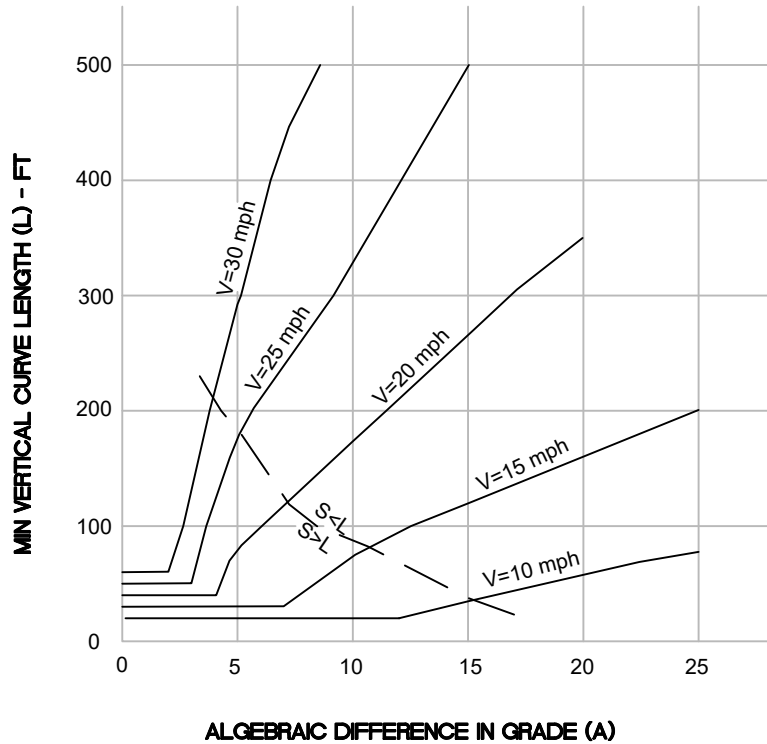
200.16

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$$L = 25 - \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A} \quad \text{WHEN } S > L$$

$$L = \frac{AS^2}{100(\sqrt{2h_1} + \sqrt{2h_2})^2} \quad \text{WHEN } S < L$$

$$L (\text{MIN}) = 2V$$

WHERE:

S = STOPPING SIGHT DISTANCE (FT)
A = ALGEBRAIC DIFFERENCE IN GRADE
 h_1 = EYE HEIGHT OF BICYCLIST (4.5 FEET)
 h_2 = HEIGHT OF OBJECT (0 FEET)
L = MINIMUM VERTICAL CURVE LENGTH (FT)

FROM AASHTO

ADOPTED DETAIL SOURCE: LCUASS FIGURE 17-3



MINIMUM LENGTH OF VERTICAL CURVES

DETAIL NO.

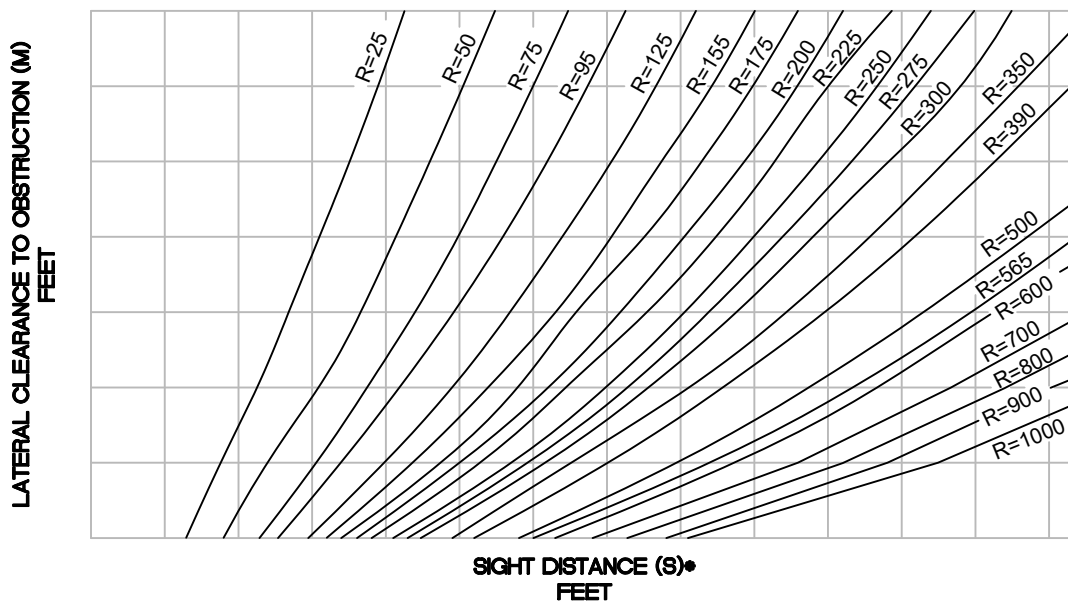
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DATE: 9/20/2022

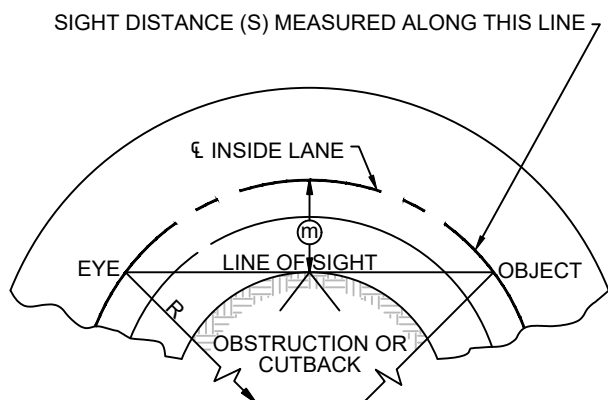
SCALE: NTS

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(METRIC CONVERSION: 1 FT. = 0.3 M.)

* LATERAL CLEARANCES ON HORIZONTAL CURVES SHOULD BE CALCULATED BASED ON THE SUM OF THE STOPPING SIGHT DISTANCES FOR BICYCLISTS TRAVELING IN OPPOSITE DIRECTIONS AROUND THE CURVE. SEE TEXT FOR ADDITIONAL DISCUSSION.



S = SIGHT DISTANCE IN FEET.
R = RADIUS OF $\frac{1}{2}$ INSIDE LANE IN FEET.
M = DISTANCE FROM $\frac{1}{2}$ INSIDE LANE IN FEET.
V = DESIGN SPEED FOR 5 IN MPH.

ANGLE IS EXPRESSED IN DEGREES

$$m = R \left[v \text{ or } s \left(\frac{28.655}{R} \right) \right]$$

$$S = \frac{R}{28.65} \left[\cos^{-1} \left(\frac{R-m}{R} \right) \right]$$

LINE OF SIGHT IS 2.0' ABOVE $\frac{1}{2}$ INSIDE LANE AT POINT OF OBSTRUCTION.

FORMULA APPLIES ONLY WHEN S IS EQUAL TO OR LESS THAN LENGTH OF CURVE.

FROM AASHTO

ADOPTED DETAIL SOURCE: LCUASS FIGURE 17-4



MINIMUM LATERAL CLEARANCES ON HORIZONTAL CURVES

DETAIL NO.

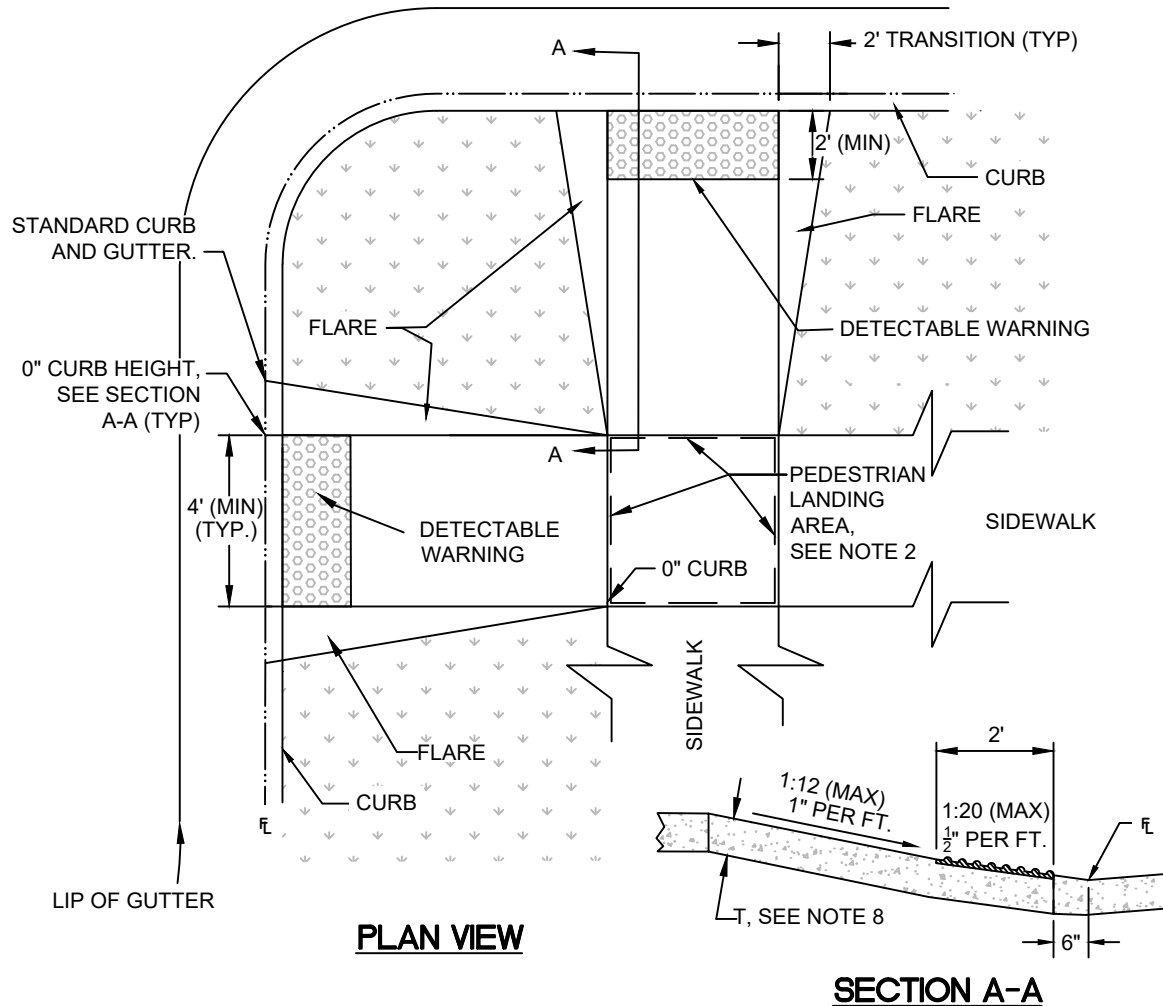
200.18

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NOTES:

1. NO JOINTS ARE ALLOWED IN THE FLOWLINE. 6" WIDE CURB OR "DUMMY JOINT" MAY BE TOOLED NO CLOSER THAN 6" FROM FLOWLINE AS SHOWN.
2. PEDESTRIAN LANDING AREA REQUIRED 4.0' LENGTH X 4.0' WIDTH, MAX SLOPE IN ANY DIRECTION IS 1:50 OR $\frac{1}{4}$ " PER FOOT.
3. JOINT PATTERN TO BE ACCORDING TO INTERSECTION GUTTER DETAIL OR AS DETERMINED BY THE LOCAL ENTITY.
4. WOOD FLOAT FINISH IS REQUIRED OVER THE SLOPED SURFACE OF RAMP AND FLARES.
5. MINIMUM RAMP WIDTH SHALL BE FOUR FEET, OR THE SAME AS THE WIDEST ADJACENT SIDEWALK, WHICHEVER IS GREATER, UP TO A MAXIMUM WIDTH OF 8.0'.
6. DETECTABLE WARNING IS TO EXTEND FULL WIDTH OF THE RAMP AND BE A MINIMUM OF 2.0' IN THE DIRECTION OF TRAVEL. MATERIAL TO BE APPROVED BY LOCAL ENGINEER
7. T = CONCRETE THICKNESS, 6" MINIMUM FOR ENTIRE RAMP AREA.

ADOPTED DETAIL SOURCE: LCUASS DETAIL 1606



PEDESTRIAN RAMP (FOR NEW CONSTRUCTION AND ALTERATIONS)

DETAIL NO.

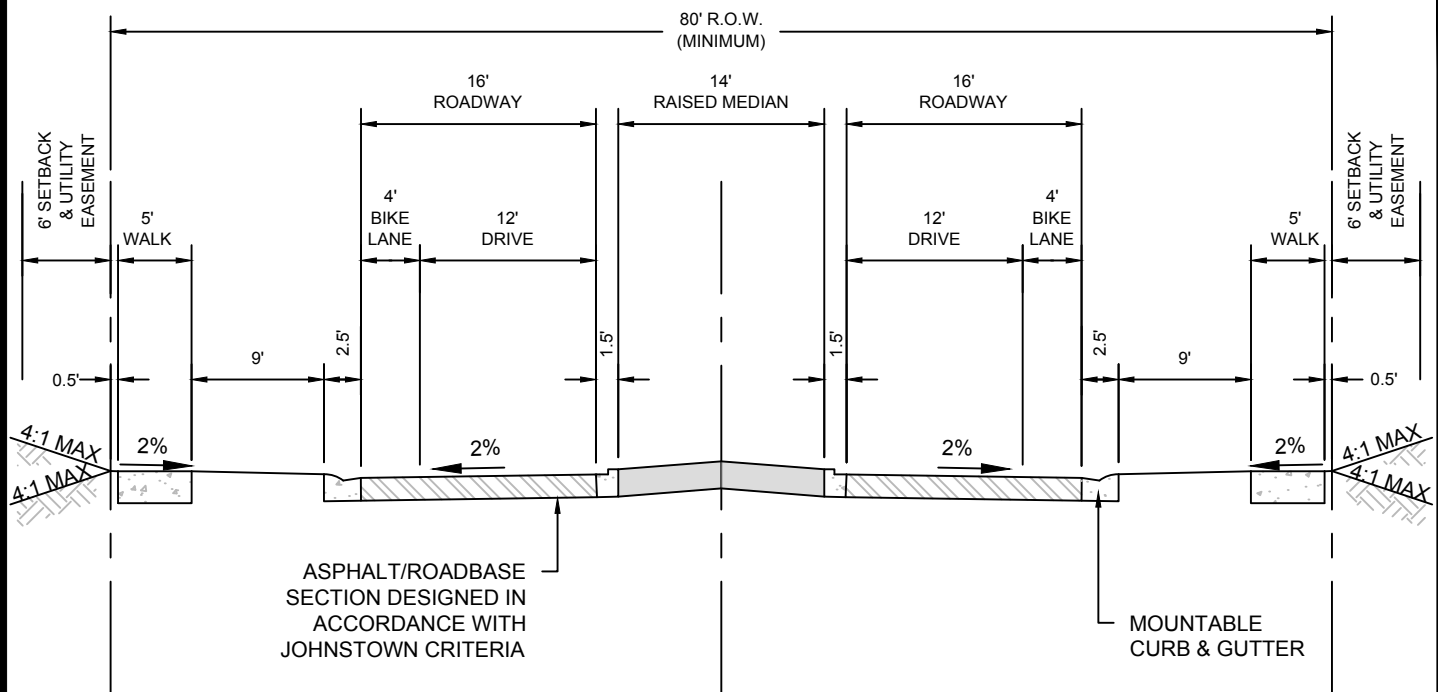
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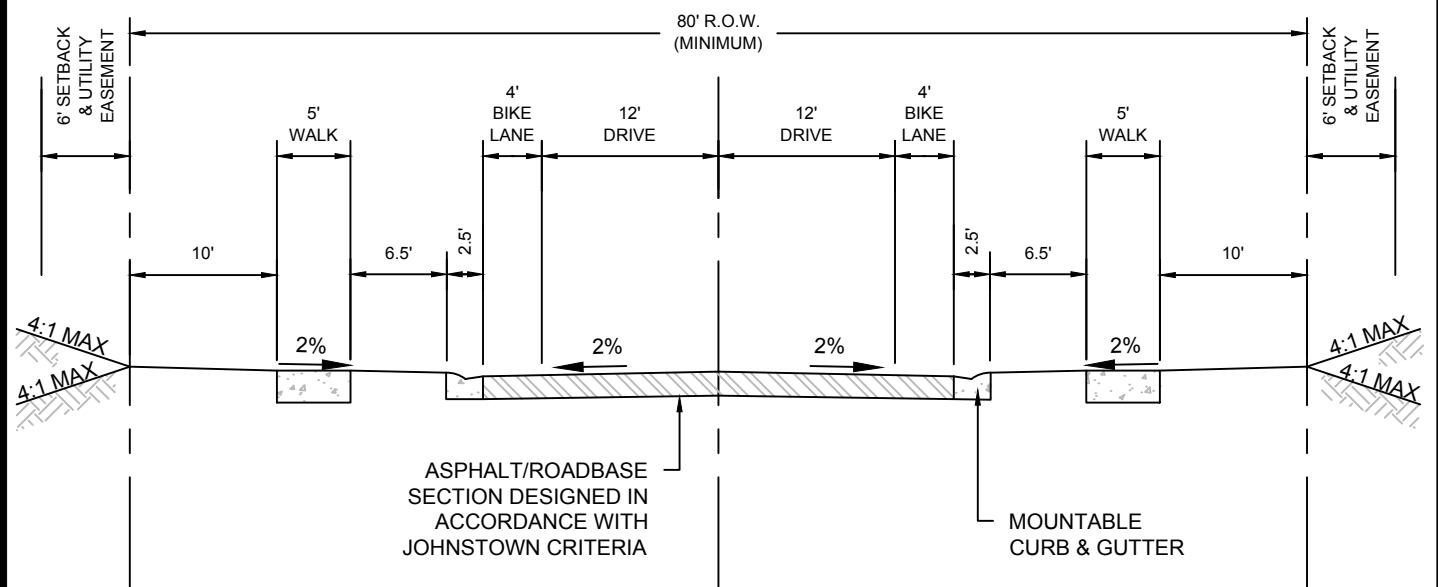
DATE: 9/20/2022

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MAJOR COLLECTOR WITH RAISED MEDIAN



MAJOR COLLECTOR WITHOUT PARKING OR MEDIAN



MAJOR COLLECTOR ROAD SECTION

DETAIL NO.

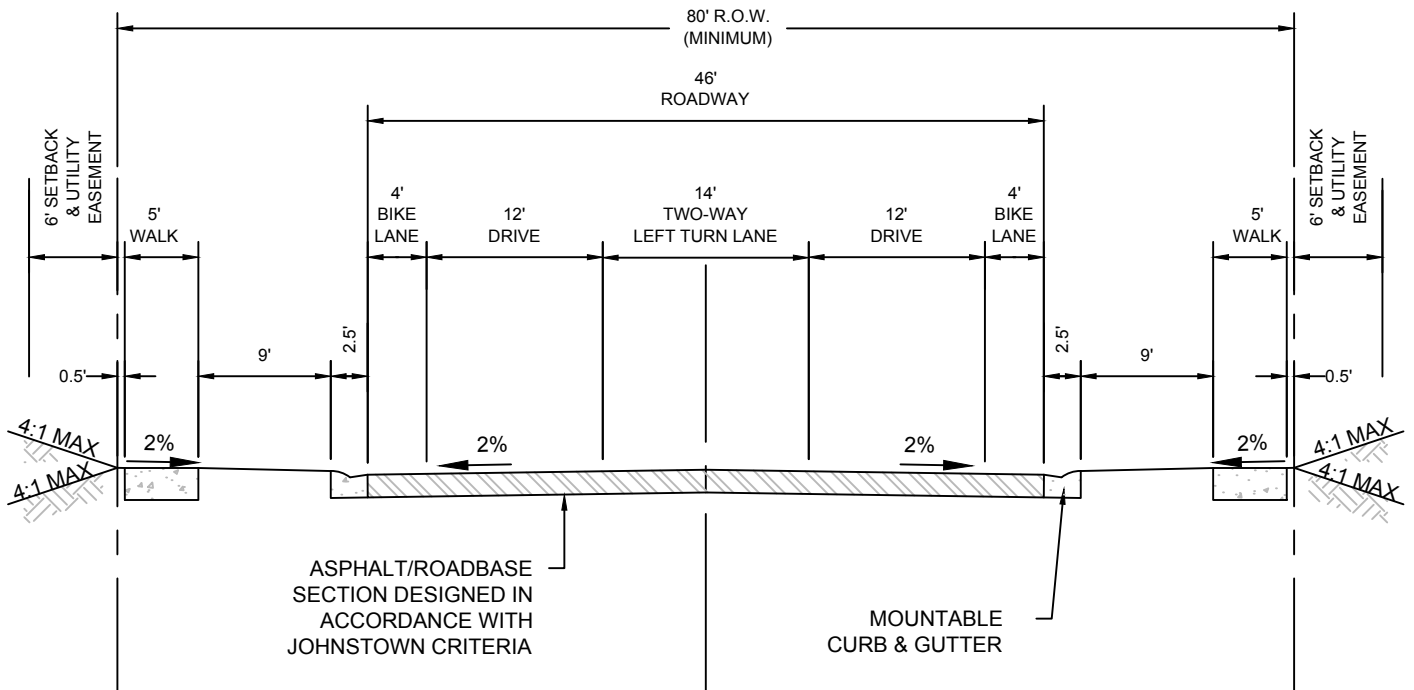
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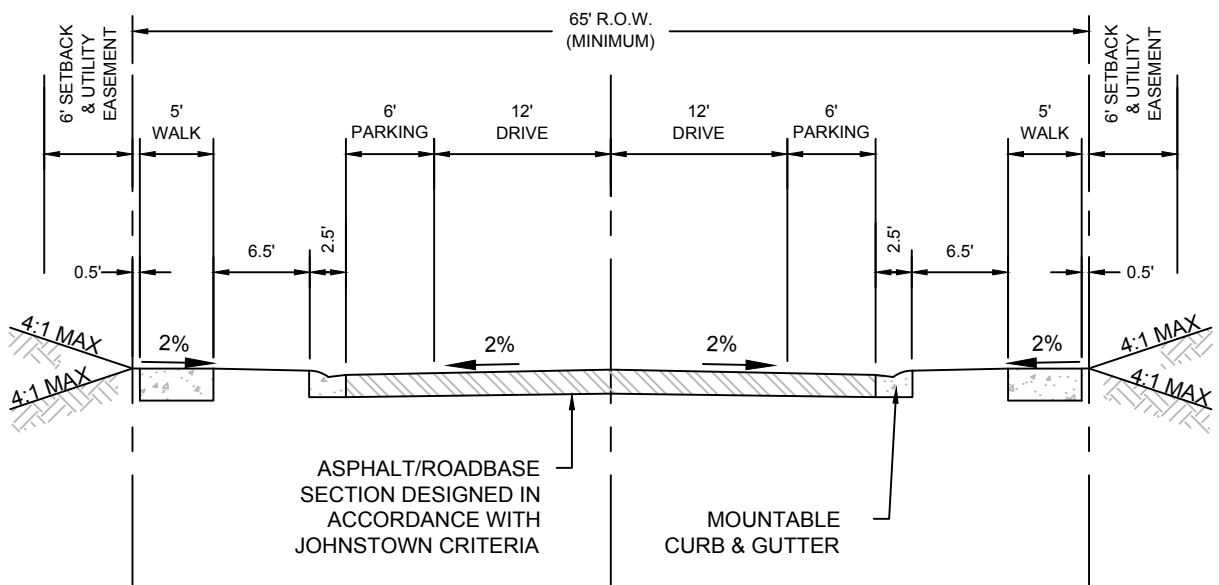
DATE: 9/20/2022

SCALE: NTS

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MINOR COLLECTOR WITH FLUSH MEDIAN
(PRIMARYLY INTENDED FOR INDUSTRIAL AREAS)



MINOR COLLECTOR WITH ON-STREET PARKING
(CAN ALSO BE USED FOR COMMERCIAL AREAS)



MINOR COLLECTOR ROAD SECTION

DETAIL NO.

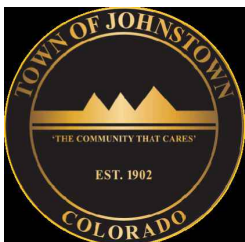
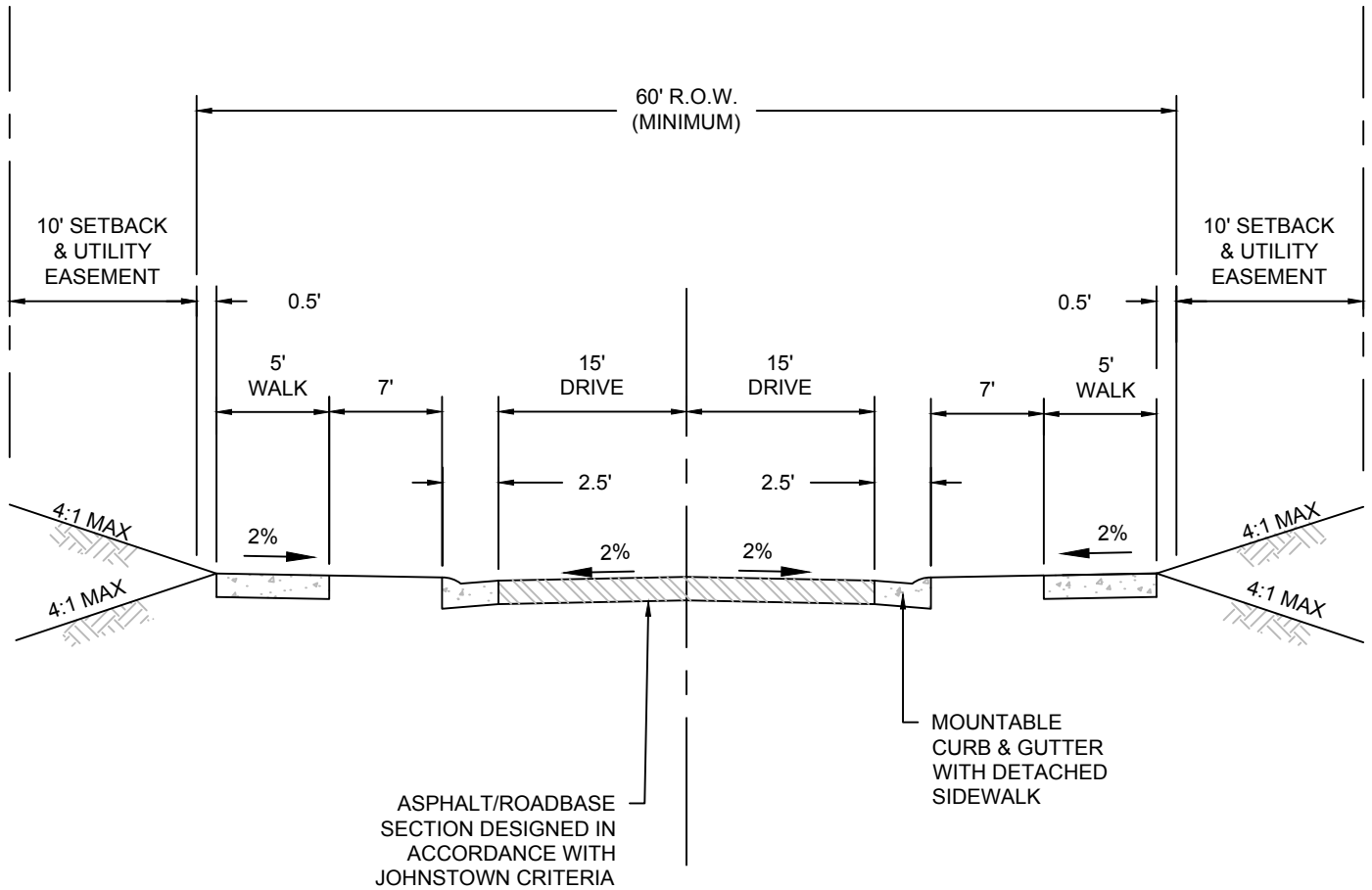
202

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DATE: 9/20/2022

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LOCAL STREET ROAD SECTION LOW VOLUME OR COMMERCIAL

DETAIL NO.

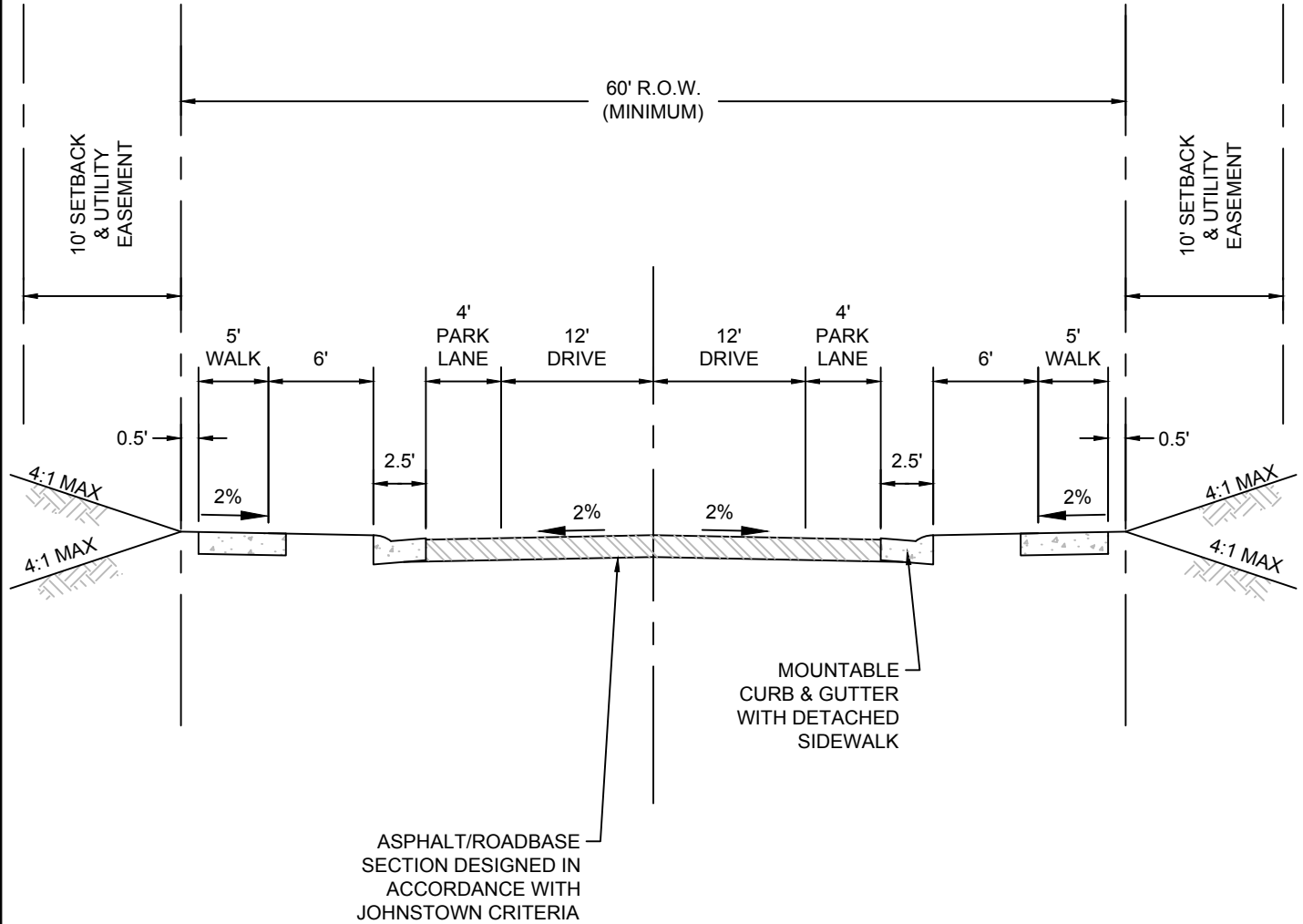
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LOCAL STREET ROAD SECTION RESIDENTIAL

DETAIL NO.

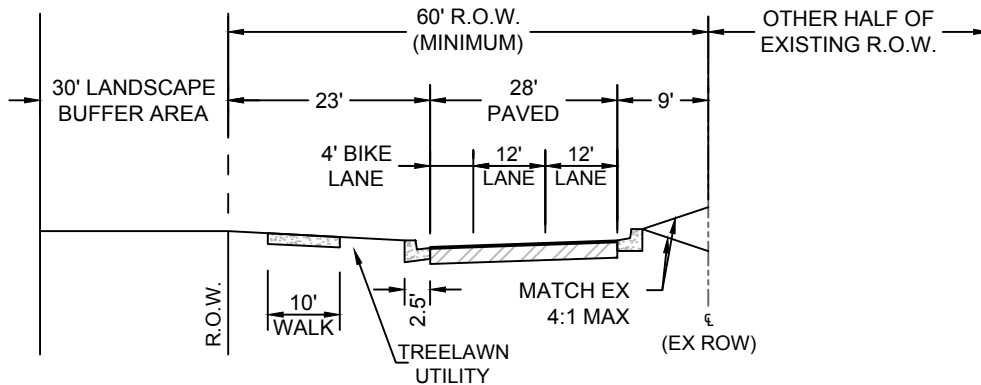
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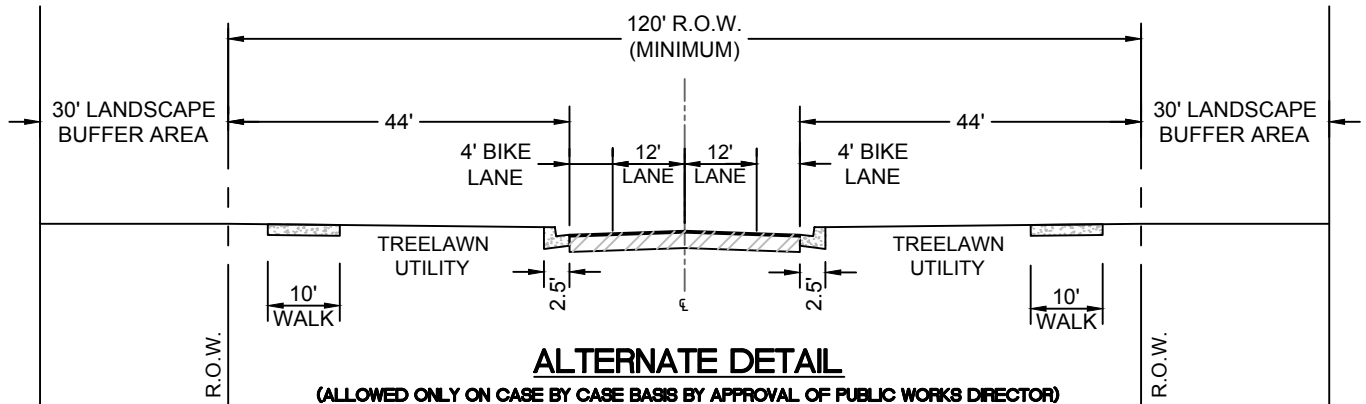
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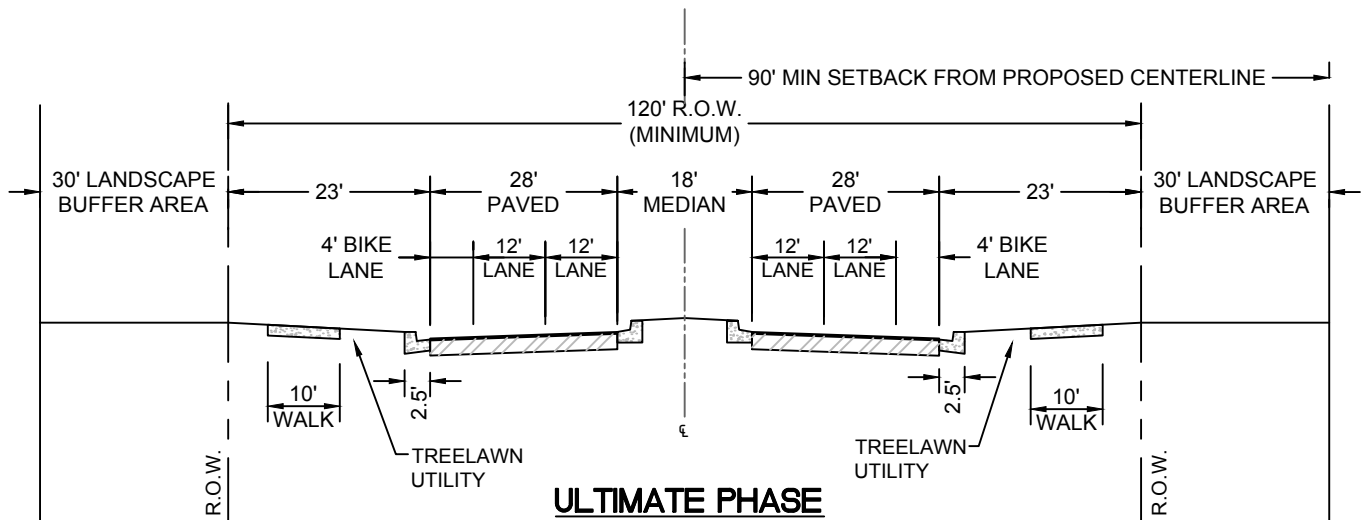


STANDARD DETAIL



ALTERNATE DETAIL

(ALLOWED ONLY ON CASE BY CASE BASIS BY APPROVAL OF PUBLIC WORKS DIRECTOR)



ULTIMATE PHASE

NOTES:

1. LEFT AND RIGHT TURN LANES AT INTERSECTIONS AND ACCESSES AS NECESSARY.
2. ON-STREET BIKE LANES.



MAJOR ARTERIAL ROAD SECTION

DETAIL NO.

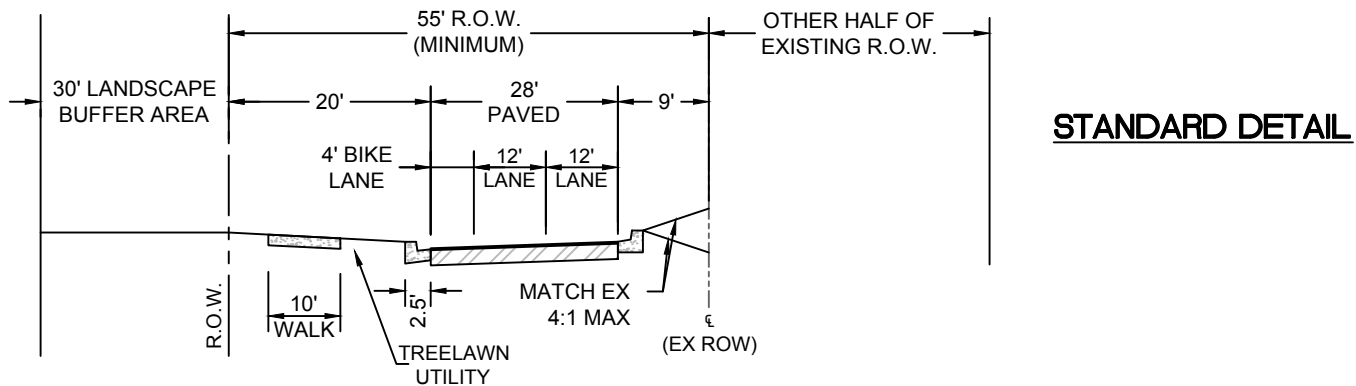
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REVISION NO: 1

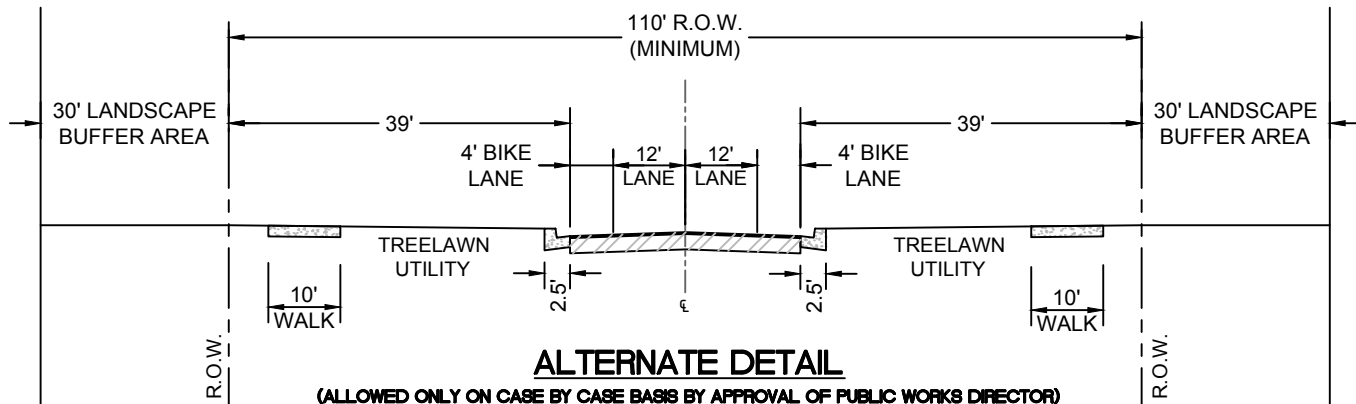
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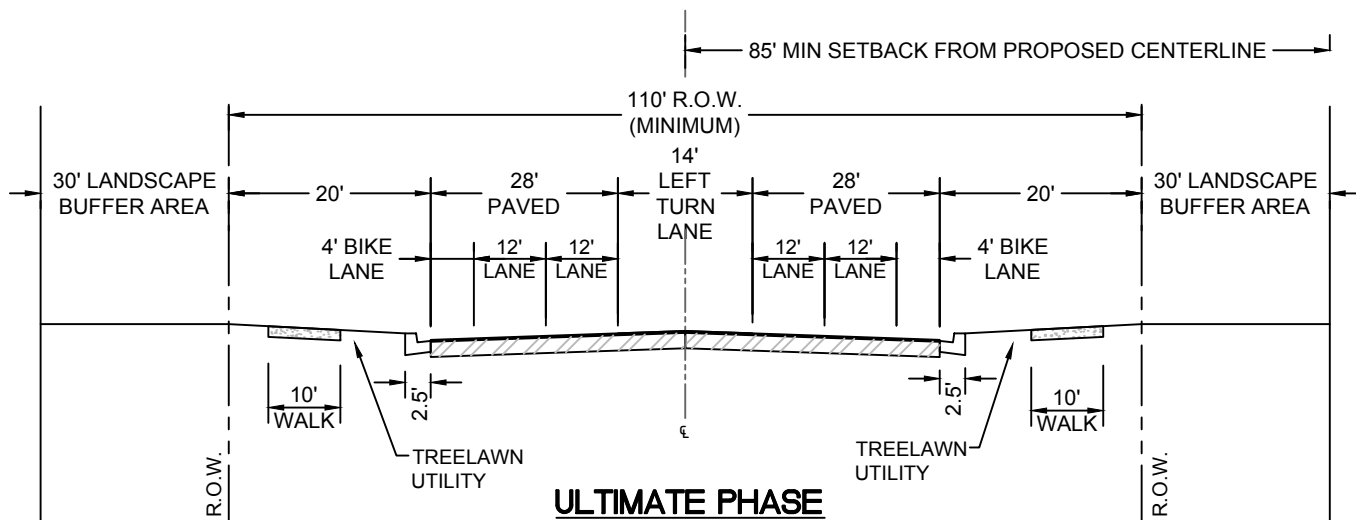


STANDARD DETAIL



ALTERNATE DETAIL

(ALLOWED ONLY ON CASE BY CASE BASIS BY APPROVAL OF PUBLIC WORKS DIRECTOR)



ULTIMATE PHASE

NOTES:

1. LEFT AND RIGHT TURN LANES AT INTERSECTIONS AND ACCESSES AS NECESSARY
2. ON-STREET BIKE LANES
3. WITH PARKING, ADD 5' TO EACH SIDE



MINOR ARTERIAL ROAD SECTION

DETAIL NO.

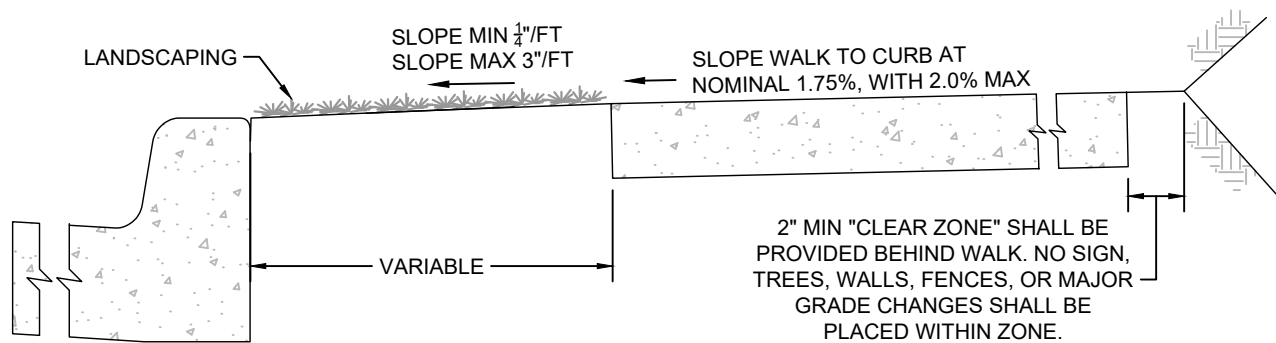
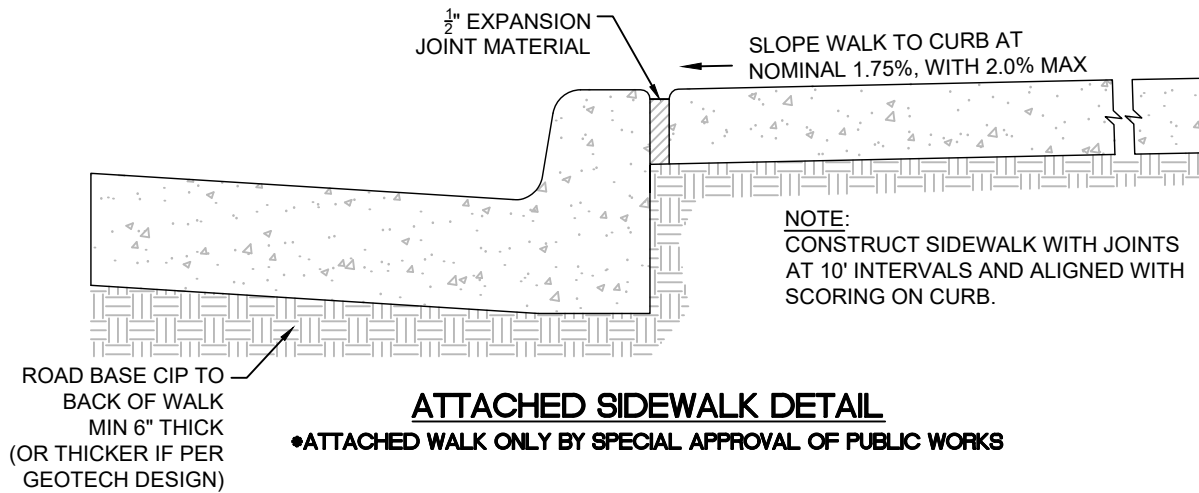
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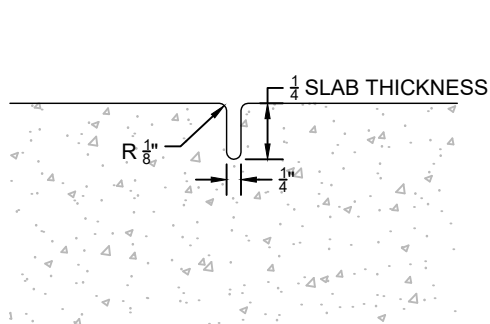
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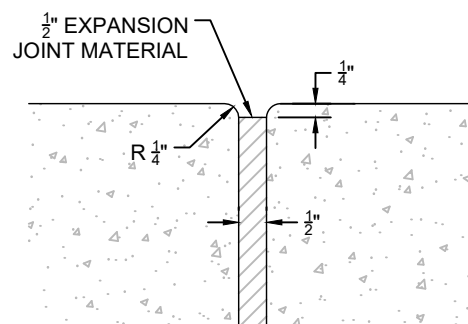
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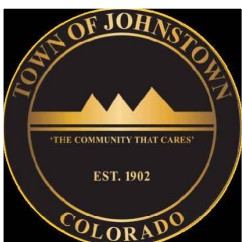
DETACHED SIDEWALK DETAIL



WEAKENED PLANE JOINT



EXPANSION JOINT



SIDEWALK

DETAIL NO.

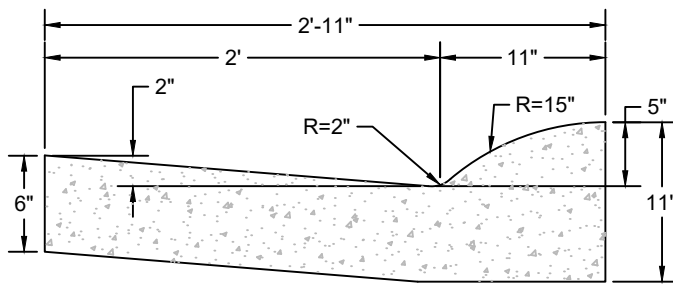
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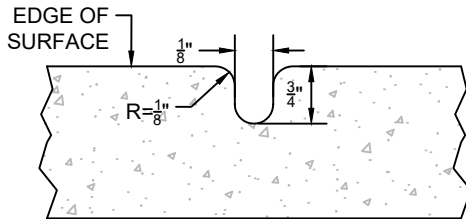
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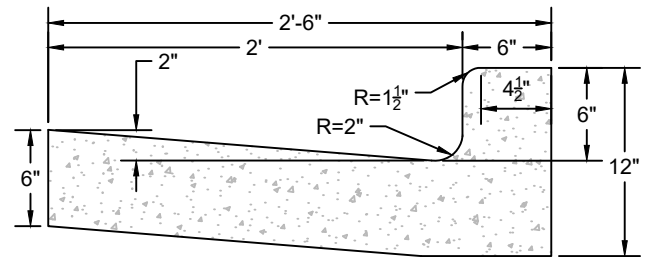
MOUNTABLE CURB AND GUTTER



DUMMY JOINT FOR WALKS

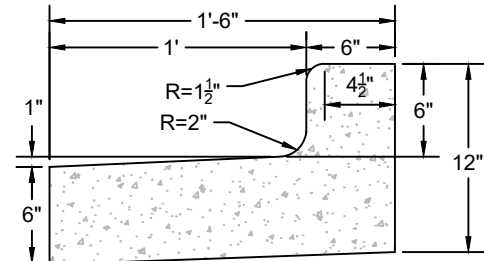
NOTES:

1. SIDEWALKS SHALL BE DETACHED, EXCEPT AS NECESSARY FOR APPROPRIATE ADA RAMPS AT INTERSECTION RETURNS. IN ALL OTHER CASES, ATTACHED WALKS WILL ONLY BE ALLOWED ON A CASE BY CASE BASIS WHERE SPECIAL CONDITION(S) REASONABLY PREVENT DETACHED WALKS.
2. "T" THICKNESS: 6" MIN. INCREASE TO 8" MIN FOR
3. COMMERCIAL/INDUSTRIAL DRIVEWAYS. (REFERENCE
4. LCUASS 1601)
5. SIDEWALK WIDTH IF USED FOR PEDESTRIAN/BICYCLE COMBINED WALK, SHALL BE AT MINIMUM 8'-0" IN WIDTH.
6. IF, ON A CASE BY CASE BASIS "ATTACHED" WALK IS ALLOWED, THE WALK AND CURB SHALL NOT BE MONOLITHIC. EXPANSION JOINT MATERIAL AND A SILICONE BASE SEALER MUST BE APPLIED BETWEEN WALK AND CURB. (REFERENCE LCUASS 1602)
7. GUTTER THICKNESS SHALL BE INCREASED TO MATCH CONCRETE PAVEMENT THICKNESS AS APPLICABLE.
8. IF/WHEN ATTACHED WALKS ARE ALLOWED (BY DESIGN EXCEPTION APPROVAL), THE VERTICAL CURB SHALL BE DOWELED TO THE SIDEWALK. DOWEL SHALL BE #4 COATED REBAR @ 18" O.C. 3" INTO VERTICAL CURB AND 6" INTO SIDEWALK.
9. IF FORM CAN BE ACHIEVED TO MEET TO SPECIFICATIONS, IT MAY BE ALLOWED AND CONSIDERED ON A CASE BY CASE BASIS.



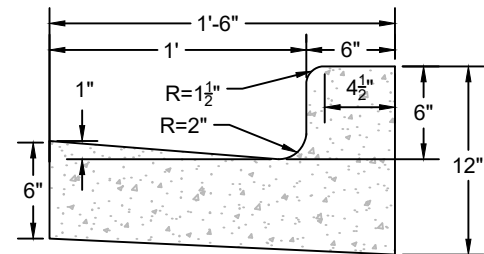
VERTICAL CURB AND GUTTER

2' CATCH



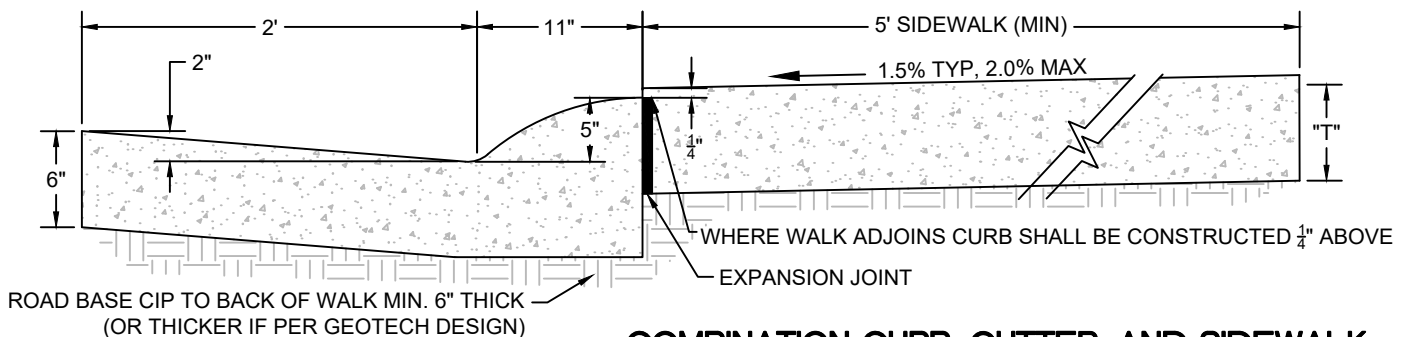
VERTICAL CURB AND GUTTER

1' SPILL



VERTICAL CURB AND GUTTER

1' CATCH



COMBINATION CURB, GUTTER, AND SIDEWALK



CURB, GUTTER, AND SIDEWALK

DETAIL NO.

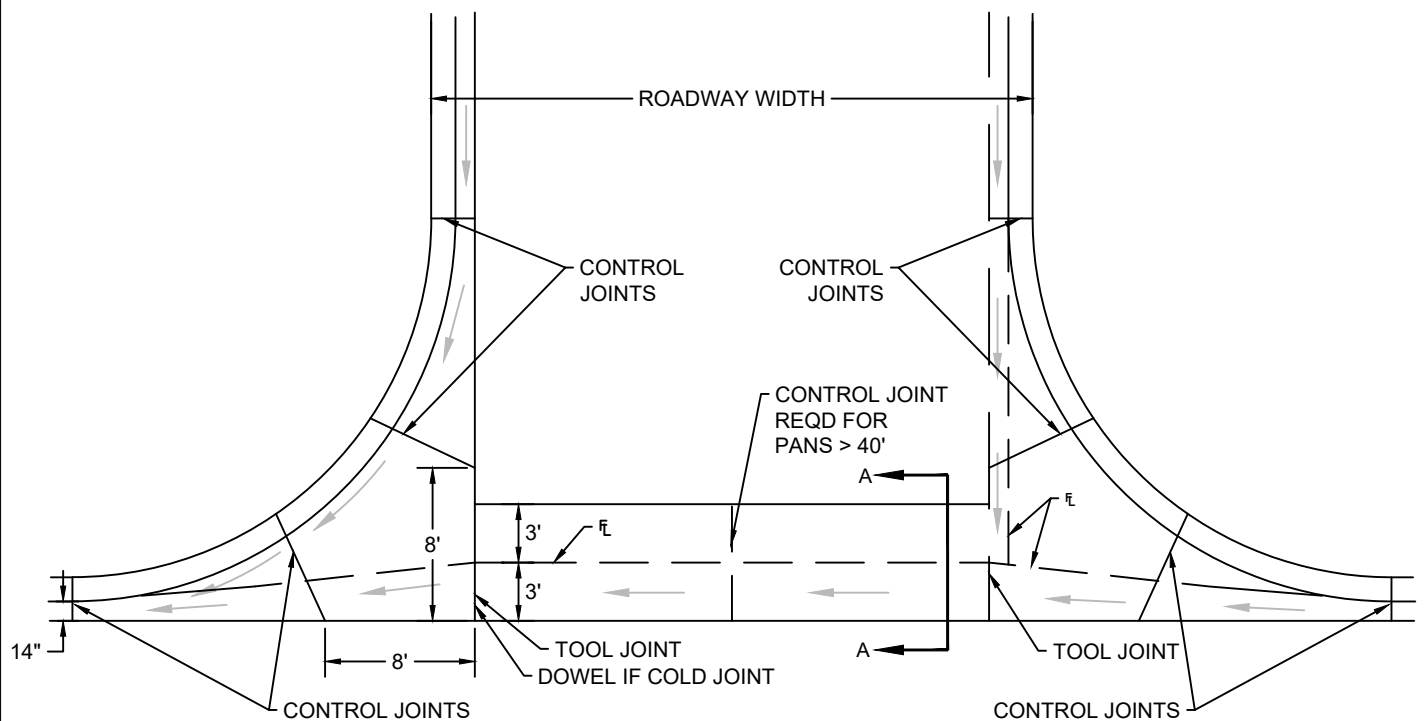
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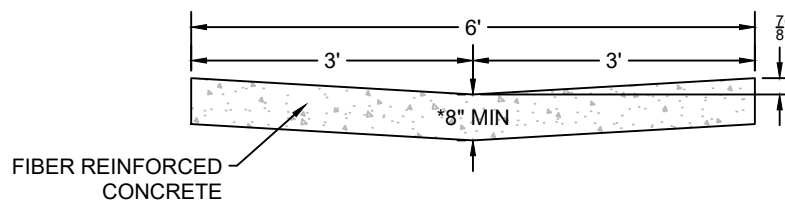
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NOTES:

1. 6' WIDE PAN FOR RESIDENTIAL STREETS.
2. 8' WIDE PAN FOR COLLECTOR & ARTERIAL STREETS.
3. ALL INTERSECTIONS TO HAVE ACCESS RAMPS

* 8" MIN. ON RESIDENTIAL. 10" MIN. ON ALL OTHER STREETS.
USE CONCRETE PAVEMENT DESIGN + $\frac{1}{2}$ " FOR COLLECTOR & ARTERIALS



SECTION A-A



CROSSPAN

DETAIL NO.

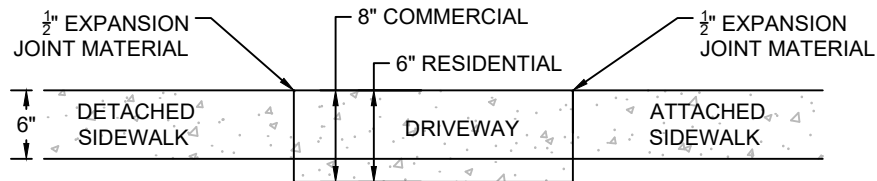
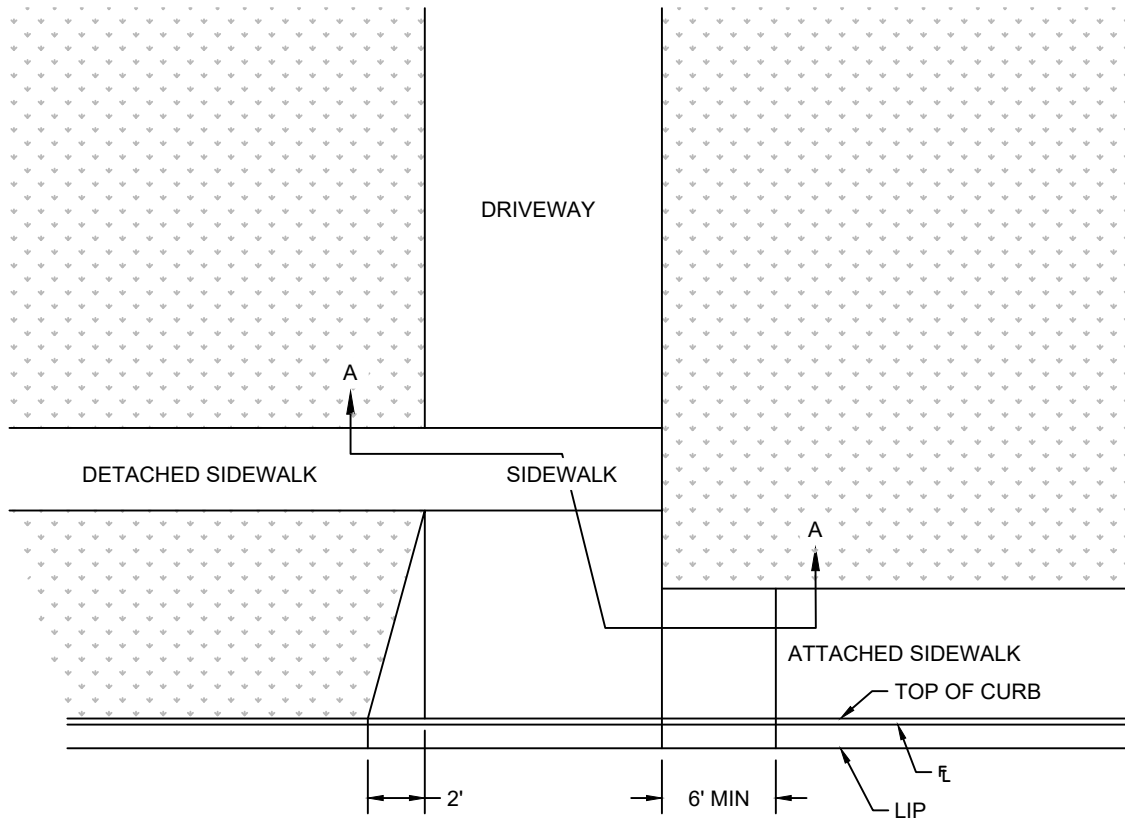
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SECTION A-A

ALL SIDEWALK THICKNESS SHALL BE 6" MINIMUM.

NOTES:

1. SIDEWALK GRADE SHALL REMAIN CONSISTENT ACROSS DRIVEWAY.
2. FOR DRIVEWAY DESIGN REQUIREMENTS, REFERENCE TOWN STANDARD DETAILS.
3. THIS DETAIL APPLIES TO RESIDENTIAL & COMMERCIAL DRIVEWAYS.



STANDARD SIDEWALK AND DRIVEWAY CROSSING

DETAIL NO.

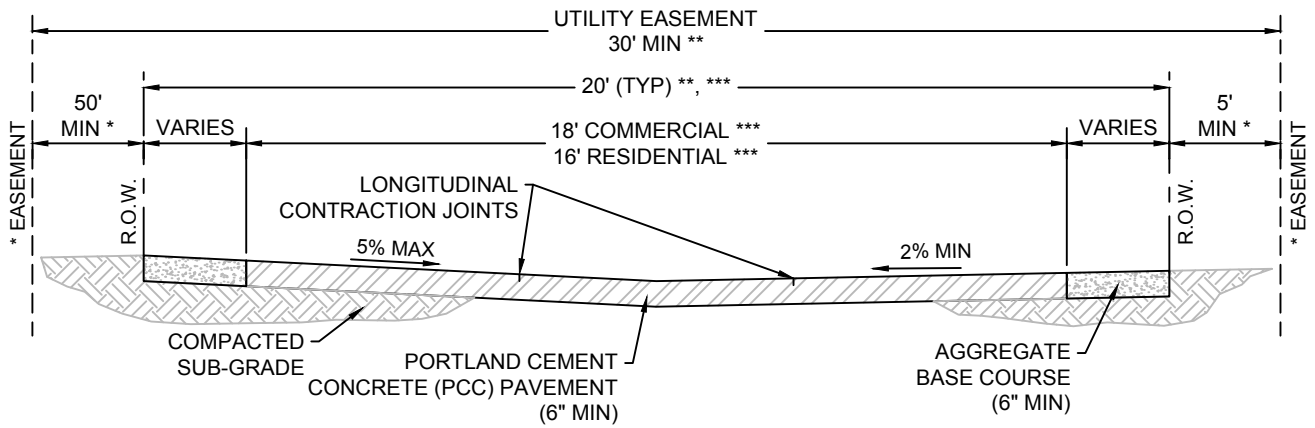
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* PUBLIC UTILITY EASEMENT (WATER, SANITARY, STORM) - DEDICATED TO THE TOWN

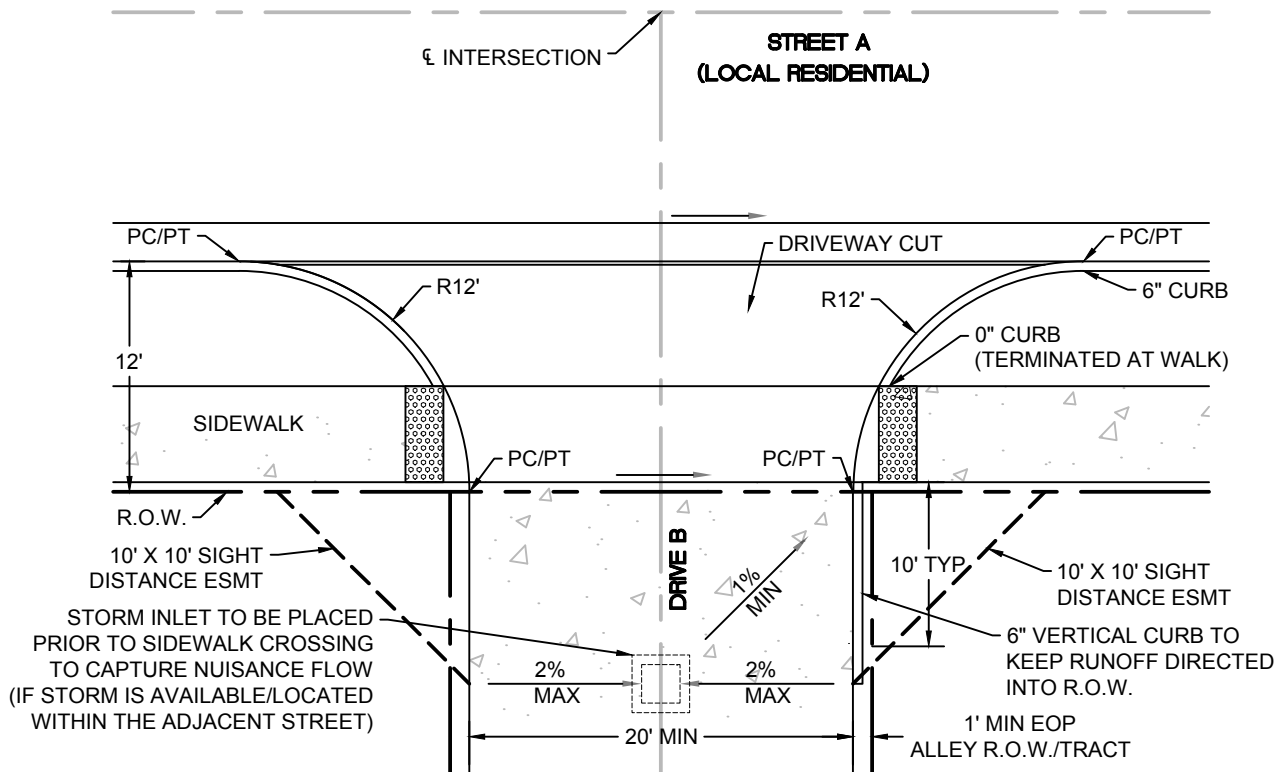
** ONE PUBLIC UTILITY - 20.0' min.

TWO PUBLIC UTILITIES - 30.0' min.

*** MINIMUM WIDTH OF A PAVED ALLEY MAY BE INCREASED PER THE REQUIREMENTS OF THE FIRE DEPARTMENT.

NOTES:

1. SAW-CUT LONGITUDINAL CONTRACTION JOINTS, SPACED AT $\frac{1}{3}$ PAVEMENT WIDTH.
2. SAW-CUT TRANSVERSE CONTRACTION JOINTS AT 10' SPACING
3. ALL EXPANSION AND CONTRACTION JOINTS SHALL BE SEALED
4. NO PARKING ALLOWED IN ALLEY



STANDARD ALLEY AND SHARED DRIVE

DETAIL NO.

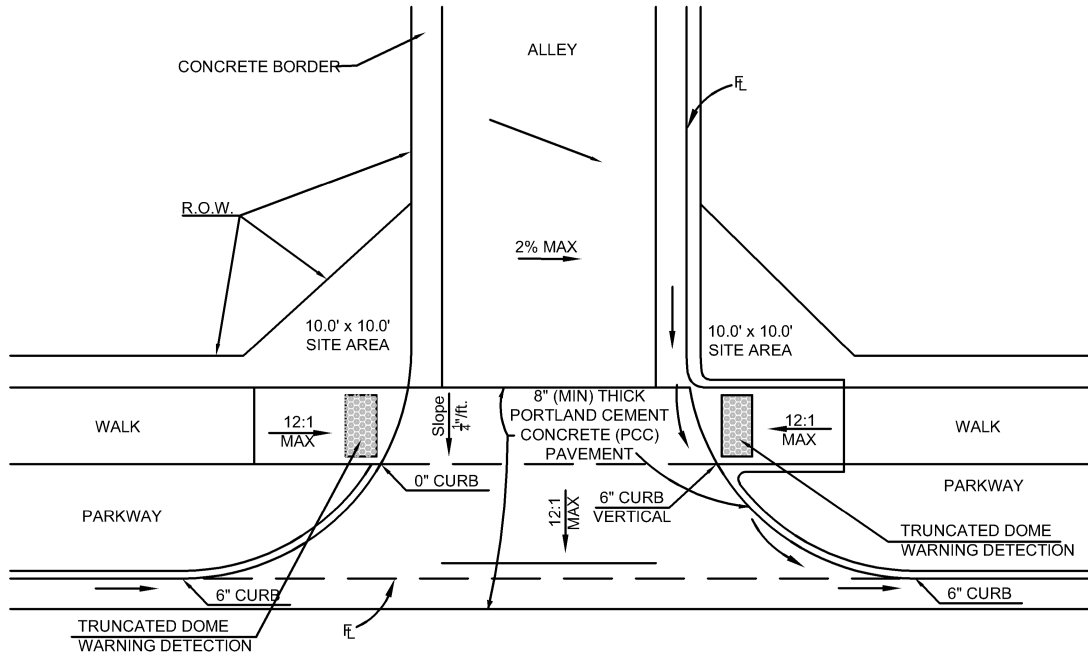
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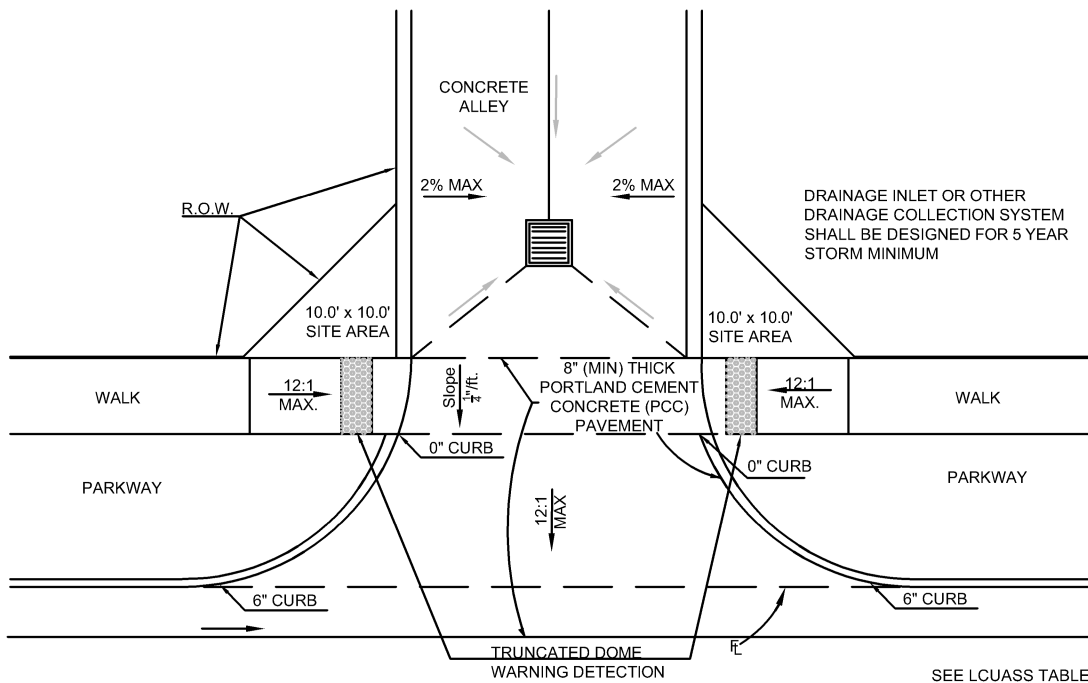
DATE: 9/20/2022

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STREET ALLEY/ SHARED DRIVE WITH SIDE DRAINAGE
 DRAINAGE MAY CROSS THE WALK UP TO A MAXIMUM OF 0.5 CFS FOR THE
 DESIGN 5 YEAR STORM.



STREET ALLEY/ SHARED DRIVE WITH CENTER DRAINAGE
 DRAINAGE MAY NOT CROSS THE WALK UNLESS THE WATER IS SHEET FLOW AND
 DOES NOT INTERFERE WITH PEDESTRIAN USE OF WALK.

SEE LCUASS TABLES 8-1 & 8-2
 FOR RADIUS REQUIREMENTS



ALLEY INTERSECTION

DETAIL NO.

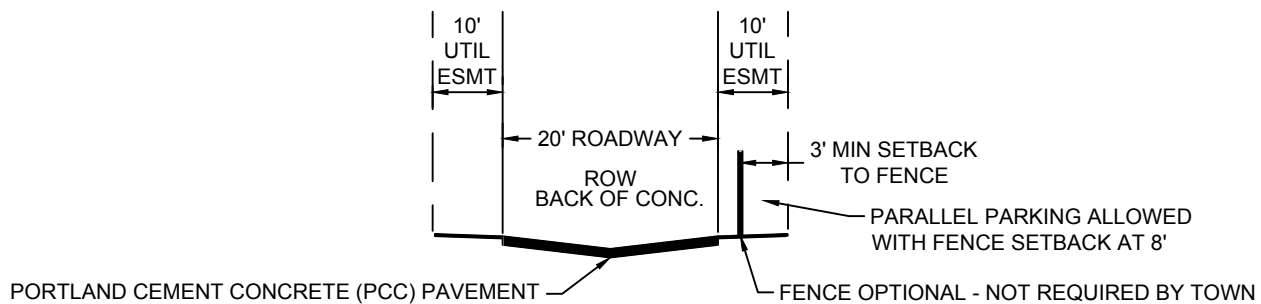
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<u>ROADWAY WIDTH:</u>	20' MIN. WIDTH REQUIRED FOR FIRE ACCESS.
<u>RIGHT OF WAY WIDTH:</u>	20'
<u>TRAVEL LANES:</u>	20' WIDE (EXCLUSIVE OF GUTTER 1' SHY DISTANCE TO CURB).
<u>PARKING:</u>	NONE. PARKING MUST BE PROVIDED ON PRIVATE PROPERTY.
<u>WHERE USED:</u>	SECONDARY ACCESS ONLY UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER. TRAFFIC VOLUME IS ANTICIPATED TO BE LESS THAN 200 ADT.
<u>DESIGN SPEED:</u>	N/A.
<u>ACCESS:</u>	ACCESS WILL BE UNLIMITED.
<u>CONTINUITY:</u>	STREETS ARE LIMITED IN LENGTH TO 660 FEET.
<u>FENCES:</u>	FENCES MAY BE PLACED AS CLOSE AS 3' FROM THE RIGHT OF WAY LINE ON PRIVATE PROPERTY. FENCES ARE NOT REQUIRED BY THE TOWN, HOWEVER, IF A FENCE IS INSTALLED IT SHALL NOT CONFLICT WITH STREET OR PEDESTRIAN SIGHT DISTANCES.
<u>ALLEY CONNECTIONS:</u>	A 10' X 10' PEDESTRIAN SIGHT TRIANGLE IS REQUIRED. ANY PORTION OF WHICH THAT FALLS OUTSIDE THE R.O.W. MUST BE IN A SIGHT TRIANGLE EASEMENT GRANTED TO THE TOWN. SEE STANDARD ALLEY INTERSECTION DETAIL.
<u>GARAGE DOOR SET BACK:</u>	SETBACKS SHALL BE IN ACCORDANCE WITH THE APPLICABLE DEVELOPMENT STANDARDS.



ALLEY WITH DRAINAGE TO CENTER

DETAIL NO.

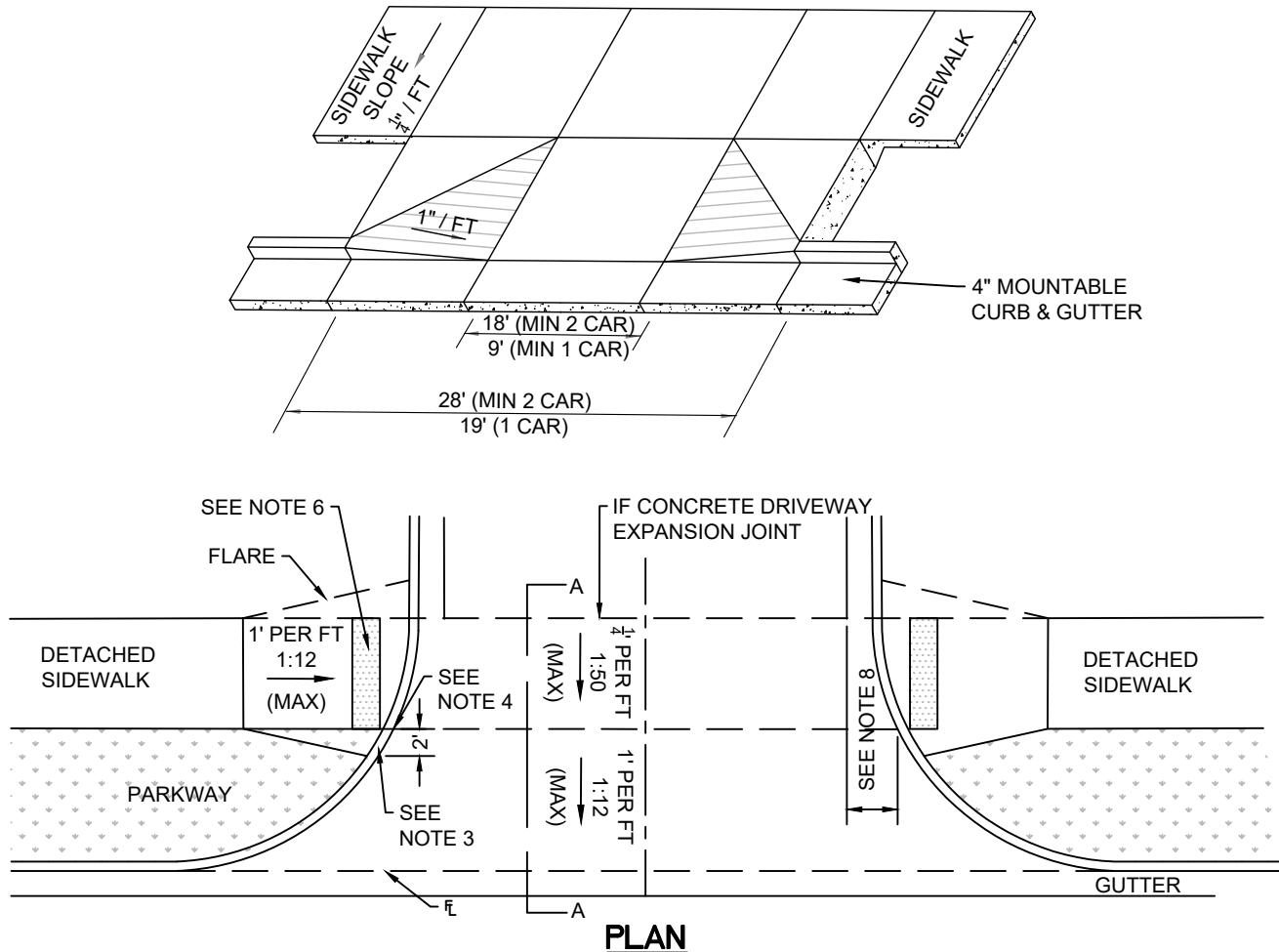
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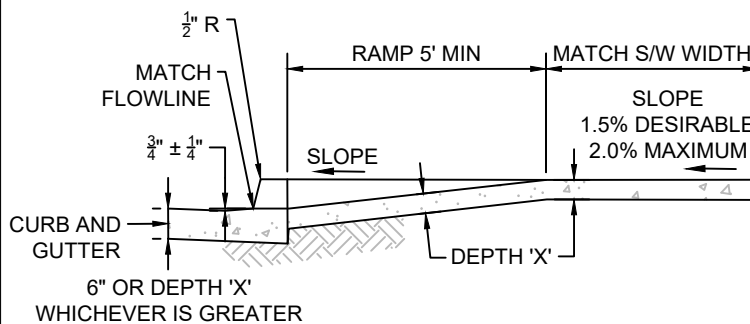
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DRIVEWAY WIDTHS

CLASSIFICATION	MIN WIDTH	MAX WIDTH
SINGLE FAMILY	12'	24' *
MULTI FAMILY ○	24'	36' **
COMMERCIAL	24'	36' **

- HIGH VOLUME DRIVEWAYS ALLOWED FOR 350 OR GREATER TRIP ENDS/DAY.
- * 30' MAXIMUM FOR 3 CAR GARAGES
- ** NO SINGLE OPENING SHALL EXCEED 36'. WIDER DRIVEWAYS SHALL BE DIVIDED W/A DIVIDED WITH A MEDIAN NOT LESS THAN 6' WIDE.



NOTES:

1. 6' WIDE PAN FOR ADA COMPLIANT DIRECTIONAL RESIDENTIAL STREETS.
2. ALL INTERSECTIONS TO HAVE ADA COMPLIANT DIRECTION ACCESS RAMPS.
3. 0" CURB HEIGHT, SEE SECTION A-A.
4. ALL OF THESE PEDESTRIAN IMPROVEMENTS SHALL BE IN ROW OR A PEDESTRIAN OR PUBLIC ACCESS EASEMENT.
5. DETECTABLE WARNING TO EXTEND THE FULL WIDTH OF THE RAMP AND BE 2'-0" IN THE DIRECTION OF TRAVEL. MAXIMUM SLOPE IN THE DIRECTION OF TRAVEL SHALL BE NO MORE THAN 5.0 PERCENT (1:20).
6. T=6' FOR RESIDENTIAL AND 8' FOR COMMERCIAL.
7. DISTANCE FROM BACK OF CURB TO THE BEGINNING OF DETECTABLE WARNING CANNOT BE GREATER THAN 5'-0".



STANDARD DRIVE APPROACH

DETAIL NO.

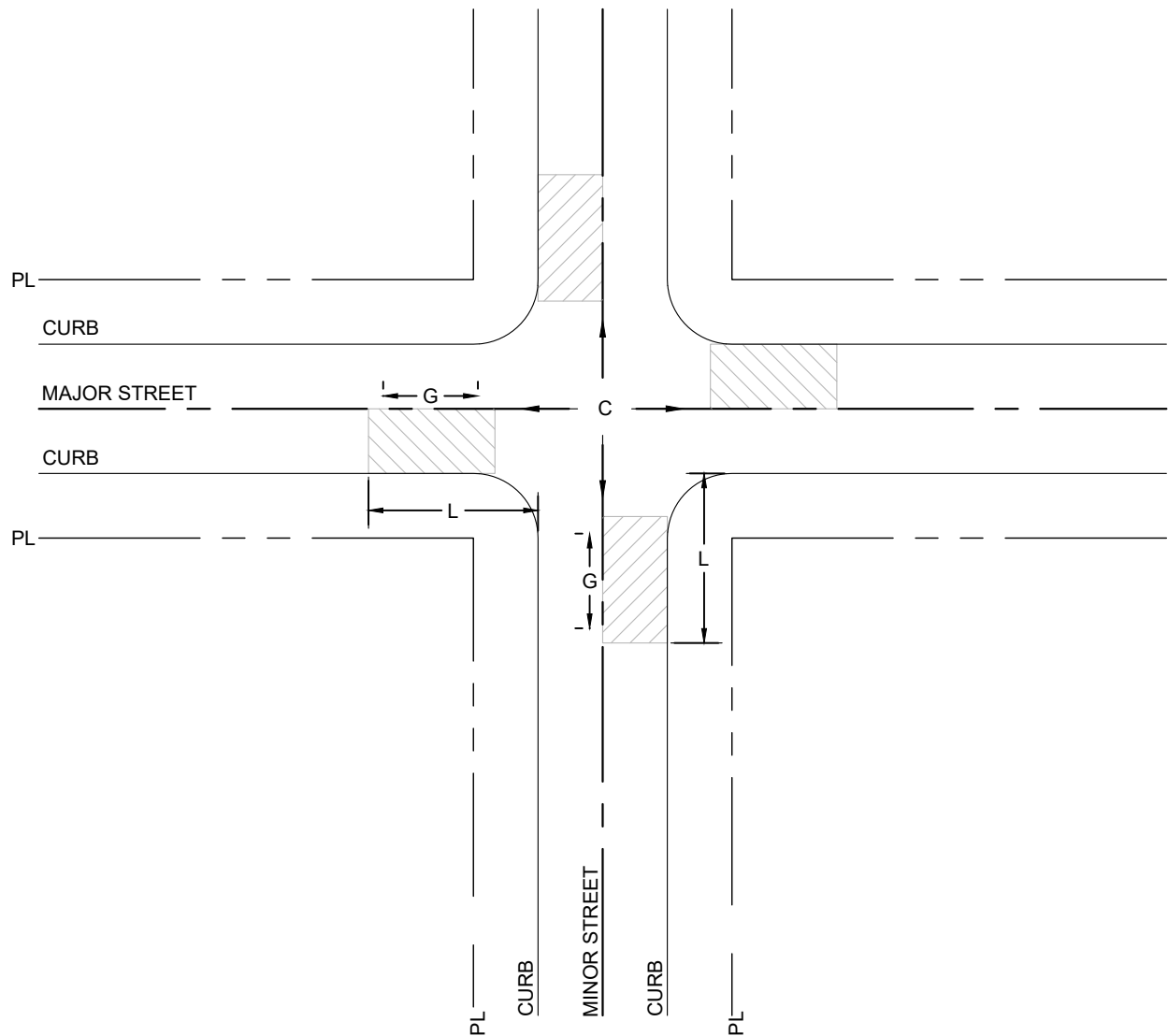
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MAJOR STREET \ MINOR STREET	LOCAL	MINOR COLLECTOR	MAJOR COLLECTOR	MINOR ARTERIAL	MAJOR ARTERIAL
LOCAL	L 95' G 4%	100' 4%	100' 4%	125' 4%	125' 4%
MINOR COLLECTOR	L -- G --	100' 4%	120' 3%	150' 3%	150' 3%
MAJOR COLLECTOR	L -- G --	-- --	120' 3%	150' 3%	200' 3%
MINOR ARTERIAL	L -- G --	-- --	-- --	200' 2%	200' 2%
MAJOR ARTERIAL	L -- G --	-- --	-- --	-- --	200' 2%

ALL INTERSECTIONS: C 50' @ 2%



MAXIMUM PERMISSIBLE INTERSECTION GRADE

DETAIL NO.

215

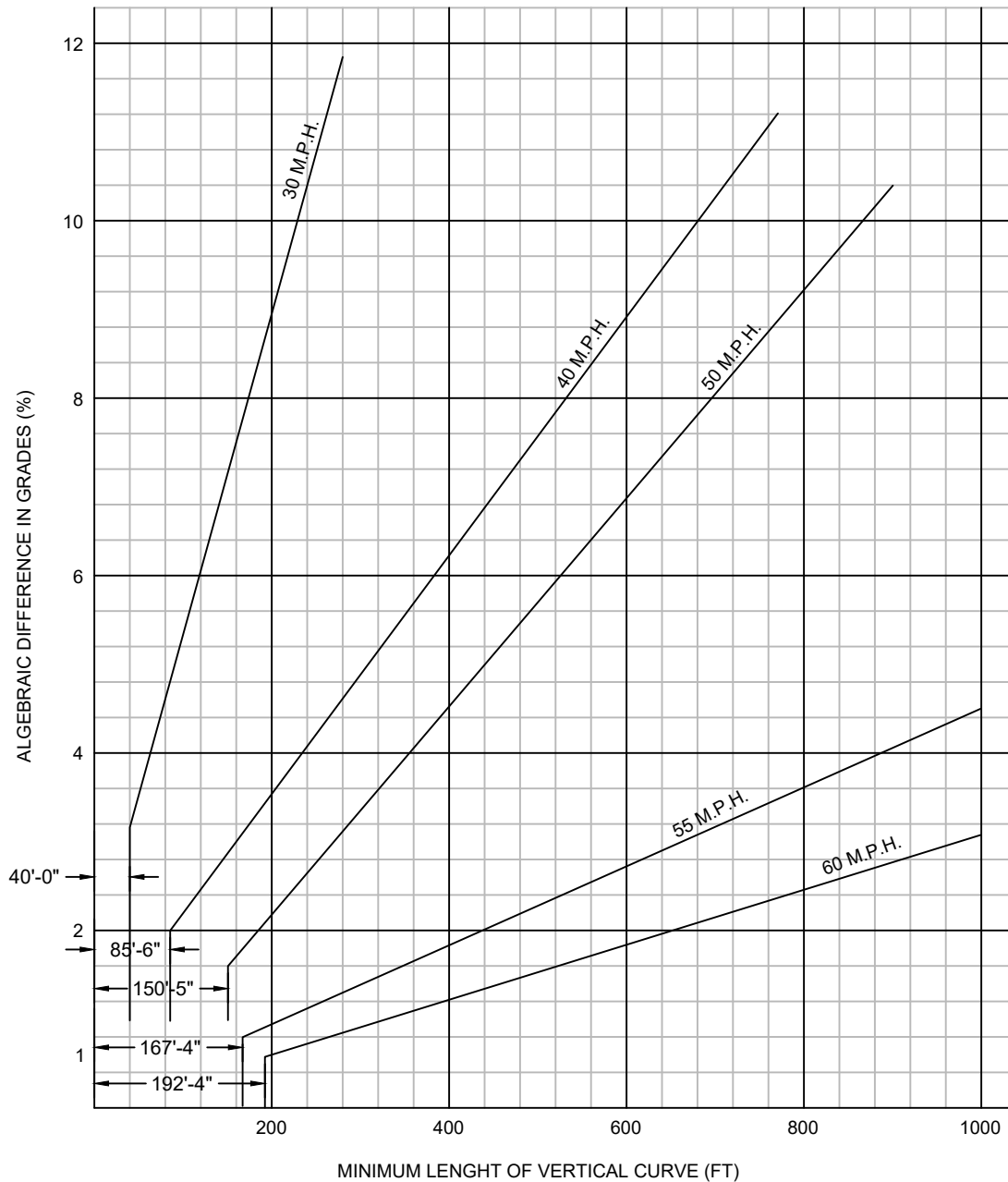
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CREST VERTICAL CURVES



NOTE:

BASED ON AASHTO "GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" 1984



MINIMUM VERTICAL CURVE FOR CREST CURVES

DETAIL NO.

216

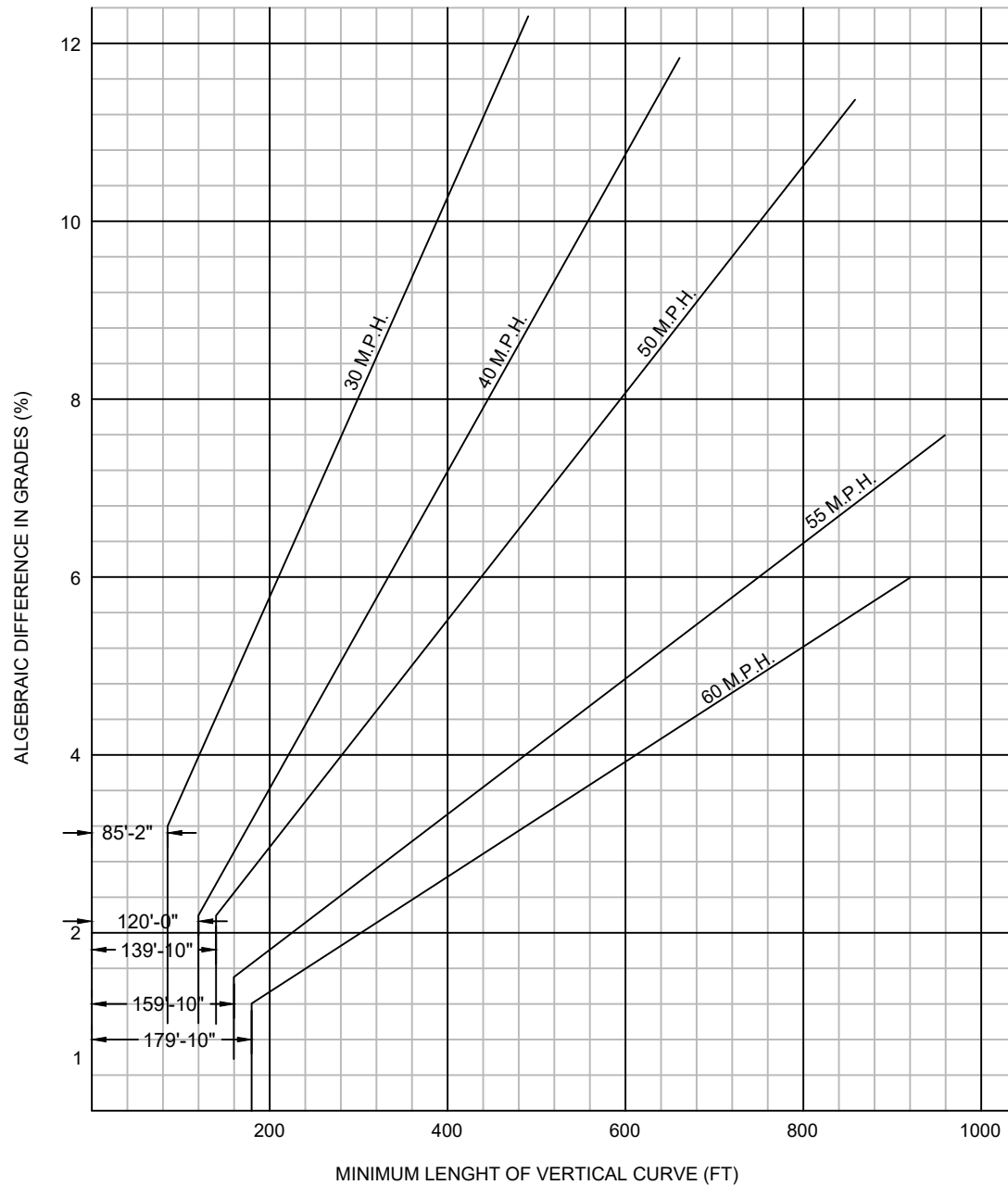
REVISION NO: 1

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SAG VERTICAL CURVES



NOTE:

BASED ON AASHTO "GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" 1984



MINIMUM VERTICAL CURVE FOR SAG CURVES

DETAIL NO.

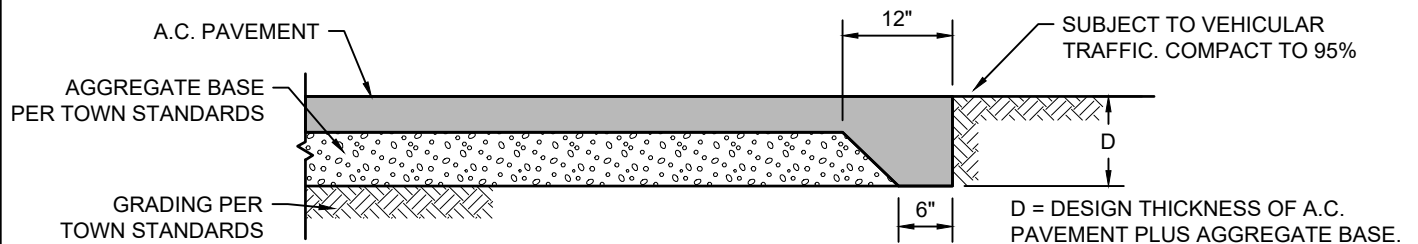
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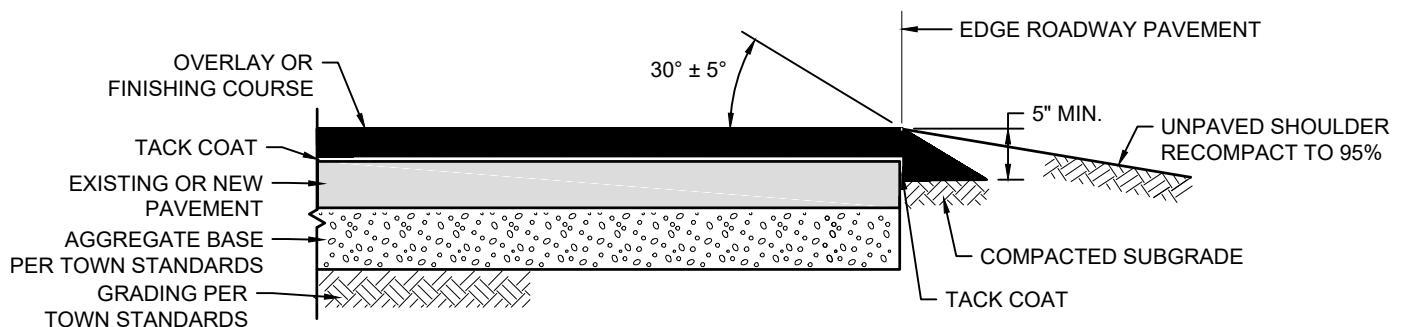
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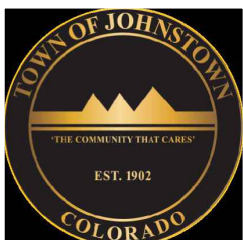
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TYPE 'A'



SAFETY EDGE



ASPHALT PAVEMENT THICKENED AND SAFETY EDGE

DETAIL NO.

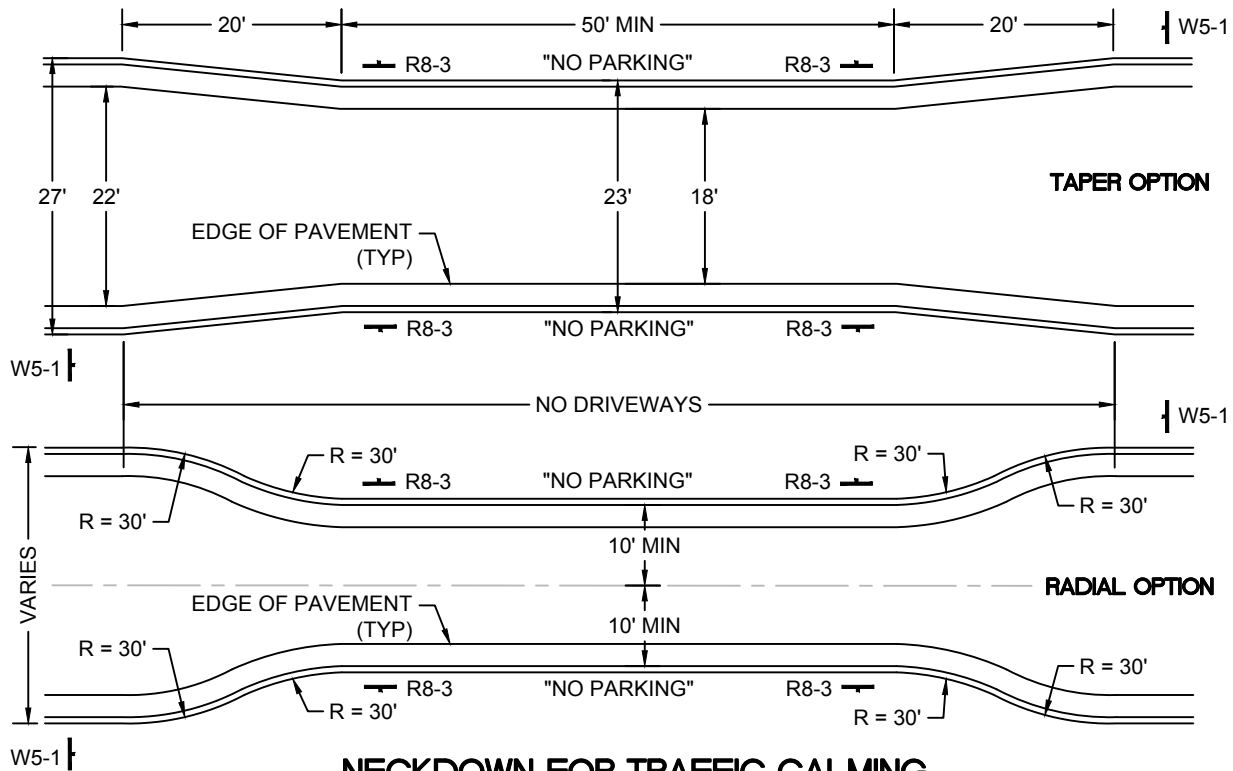
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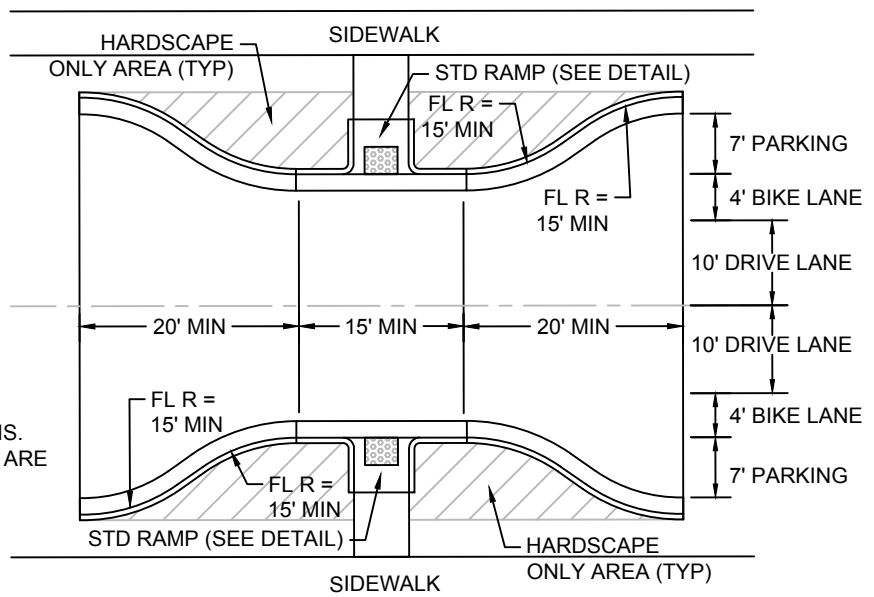
NOTES:

1. NOT FOR USE WITHIN 50 FT OF HORIZONTAL CURVES, ADJACENT TO CURVES UNDER 300-FT RADIUS, OR WITHIN 50 FT OF AN INTERSECTION.
2. W5-1 "ROAD NARROWS" SIGNAGE SHALL BE 100 FT IN ADVANCE FOR EACH APPROACH (2).
3. R8-3 "NO PARKING" SIGNAGE SHALL BE AT EACH END OF NECKDOWN ON BOTH SIDES OF THE STREET (4).
4. MAY BE USED TO REDUCE ENVIRONMENTAL IMPACTS OVER LONGER DISTANCES WHERE DRIVEWAYS ARE NOT PRESENT, INCLUDING STREAM OR WETLAND CROSSINGS.

**NECKDOWN WITH
MID-BLOCK CROSSING**

NOTE:

1. MID-BLOCK CROSSINGS WILL BE CONSIDERED ON A CASE-BY-CASE BASIS. HOWEVER, INTERSECTION CROSSINGS ARE PREFERRED BY THE TOWN.



NECKDOWN

DETAIL NO.

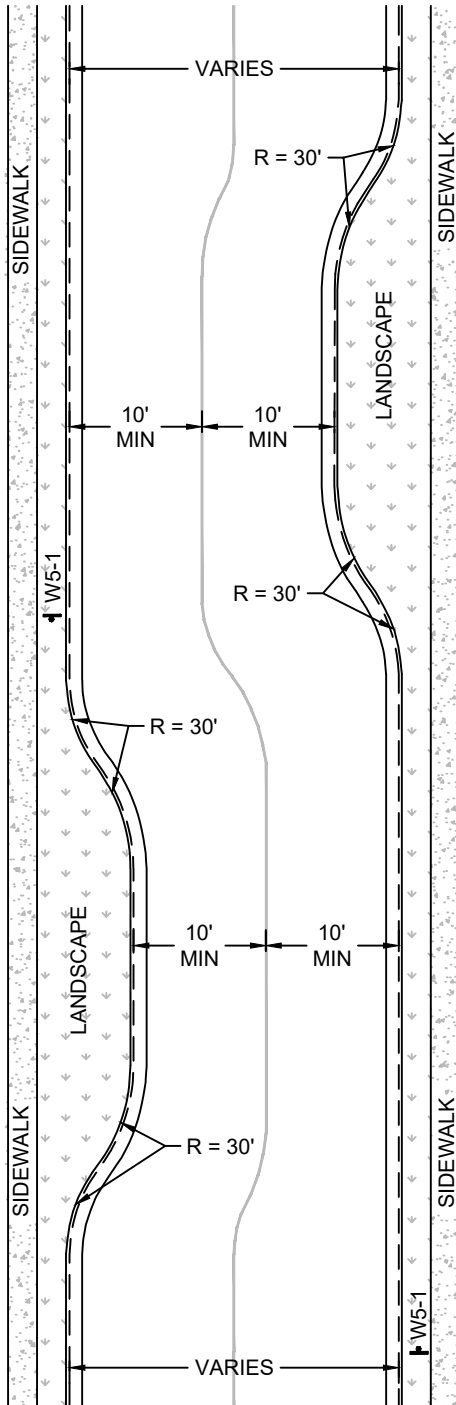
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NOTES:

1. NOT FOR USE WITHIN 50 FT OF HORIZONTAL CURVES, ADJACENT TO CURVES UNDER 300-FT RADIUS, OR WITHIN 50 FT OF AN INTERSECTION.
2. W5-1 "ROAD NARROWS" SIGNAGE SHALL BE 100 FT IN ADVANCE FOR EACH APPROACH (2).



CHICANE

DETAIL NO.

220

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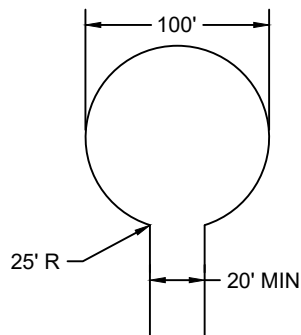
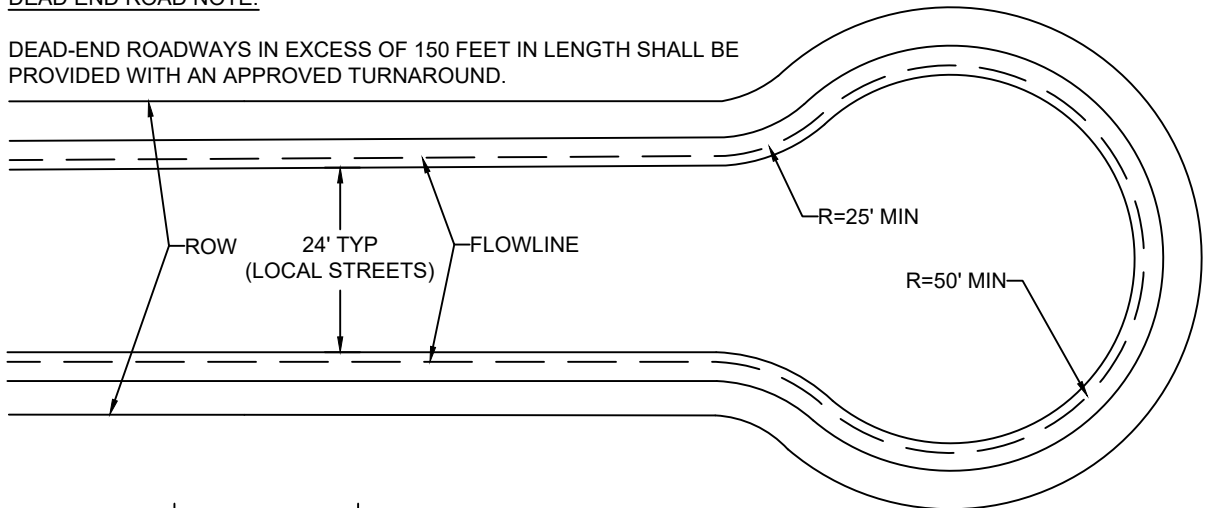
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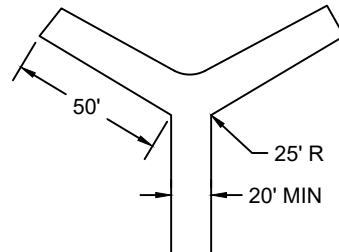
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DEAD END ROAD NOTE:

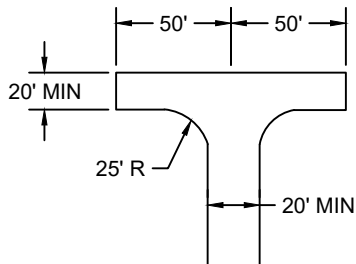
DEAD-END ROADWAYS IN EXCESS OF 150 FEET IN LENGTH SHALL BE PROVIDED WITH AN APPROVED TURNAROUND.



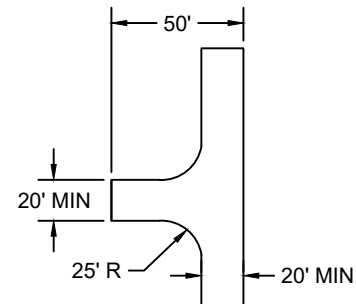
100' CUL-DE-SAC



50' "Y"



100' HAMMERHEAD



**ACCEPTABLE ALTERNATIVE
TO 100' HAMMERHEAD**

NOTES:

1. TURNAROUND SURFACE SHALL BE CAPABLE OF SUPPORTING NO LESS THAN 82,000 POUNDS LIVE LOAD.
2. INSIDE TURNING RADIUS SHALL NOT BE LESS THAN 25 FEET.
3. OUTSIDE TURNING RADIUS SHALL NOT BE LESS THAN 50 FEET.
4. TURNAROUND SHALL BE LEVEL WITH EXCEPTION OF CROWING FOR WATER RUNOFF.
5. REFER TO LOVELAND FIRE RESCUE AUTHORITY'S (LFRA) AND/OR FRONT RANGE FIRE AUTHORITY CODE DEVELOPMENT GUIDE FOR VEHICLE DESIGN SPECIFICATIONS.
6. MINIMUM SLOPE = 0.50%
7. MAXIMUM SLOPE = 6.0%



CUL-DE-SAC AND FIRE TURN AROUND

DETAIL NO.

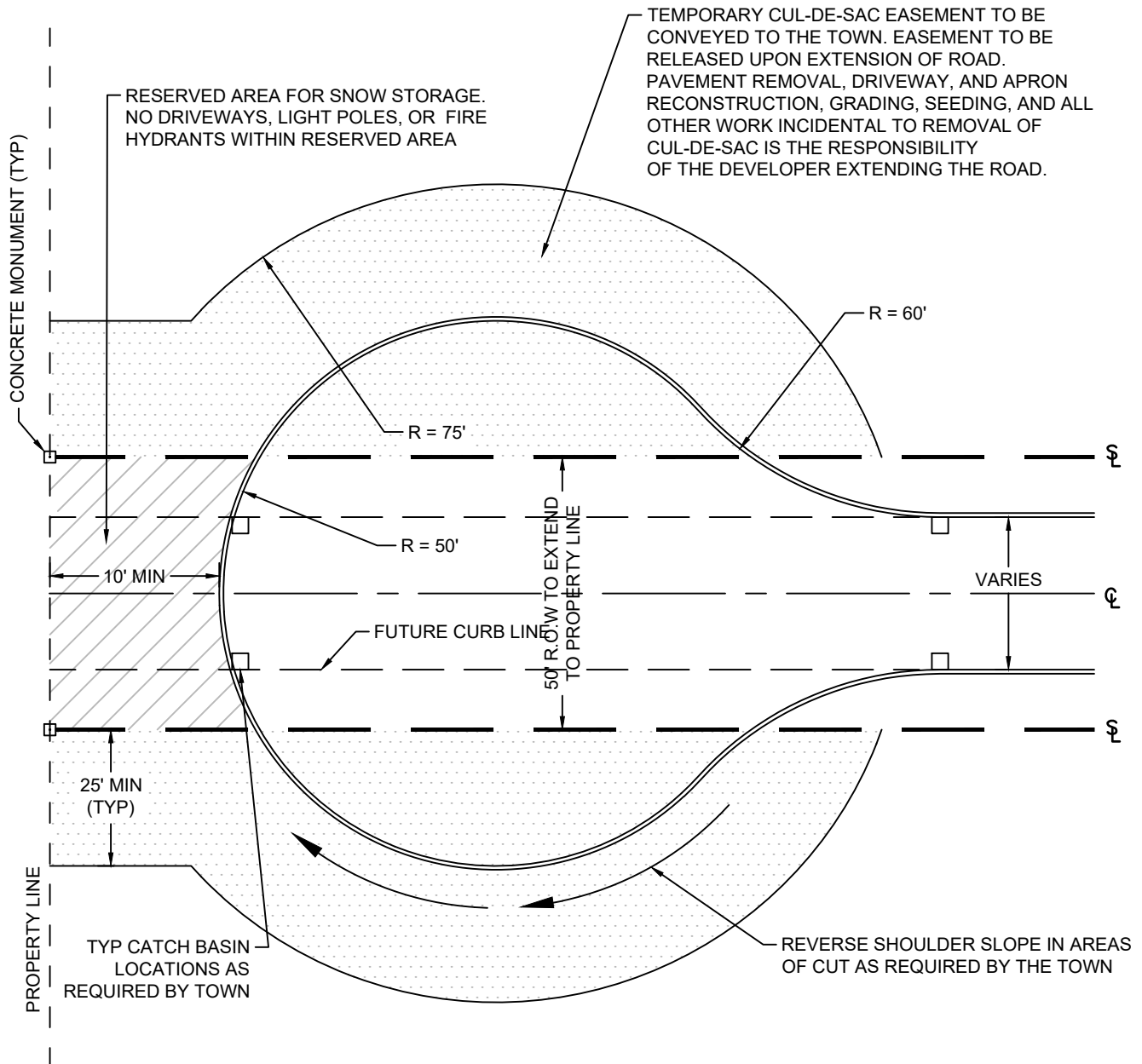
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NOTES:

1. THE MINIMUM AND MAXIMUM GUTTER SLOPE TO THE P.C. OF THE CUL-DE-SAC SHALL BE 2% AND 5% RESPECTIVELY.
2. TYPICAL CROSS SLOPE TO BE MAINTAINED THROUGH TEMPORARY CUL-DE-SAC.



TEMPORARY CUL-DE-SAC SNOW STORAGE

DETAIL NO.

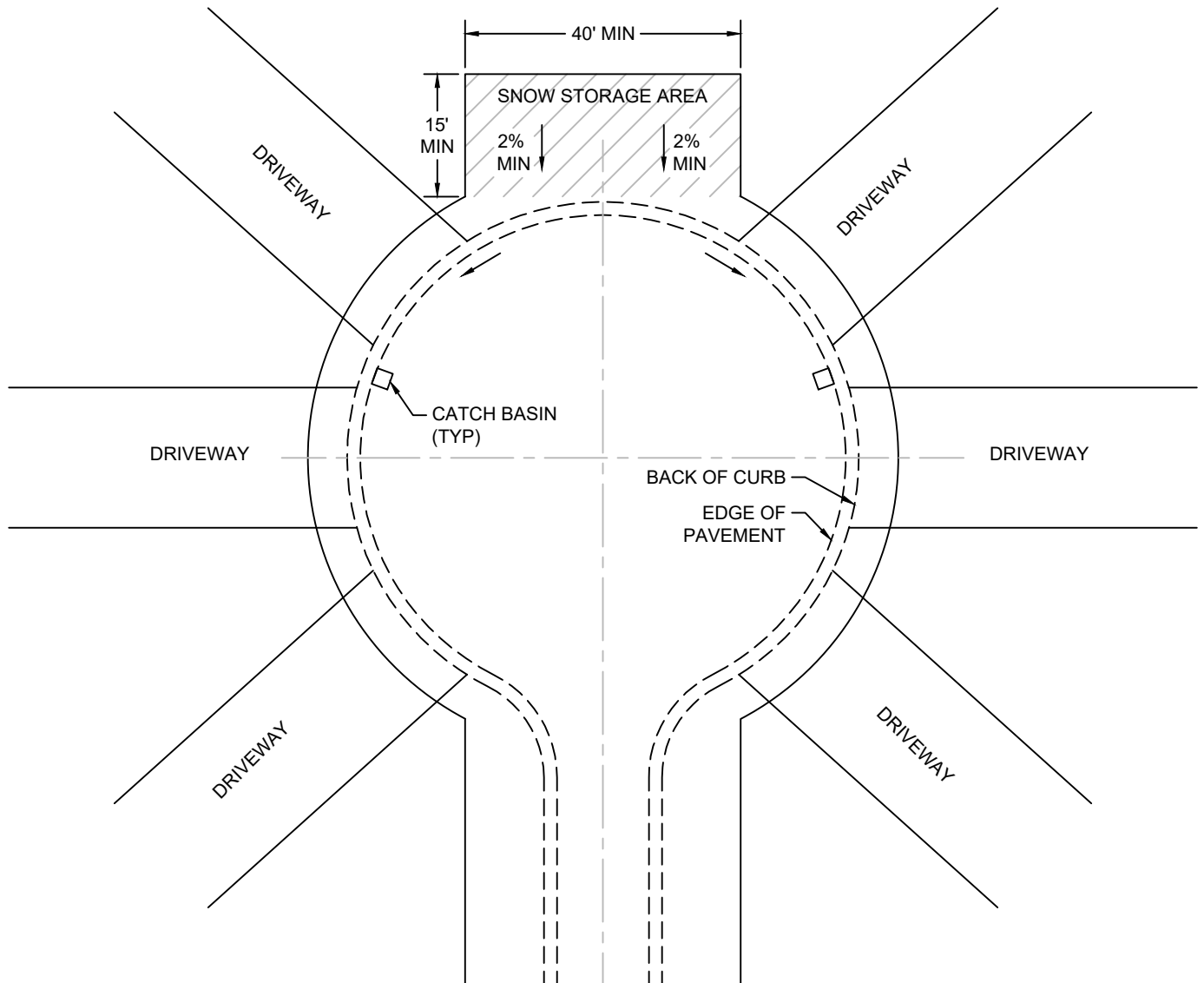
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NOTES:

1. CUL-DE-SAC CONSTRUCTION TO BE THE SAME STANDARD AS SPECIFIED FOR ROAD.
2. NO DRIVEWAY ACCESS WILL BE ALLOWED THROUGH THE SNOW STORAGE AREA.
3. NO UTILITY OBSTRUCTIONS, SUCH AS STREETLIGHTS, SHALL BE INSTALLED IN FRONT OF THE SNOW STORAGE AREA.



PERMANENT CUL-DE-SAC SNOW STORAGE

DETAIL NO.

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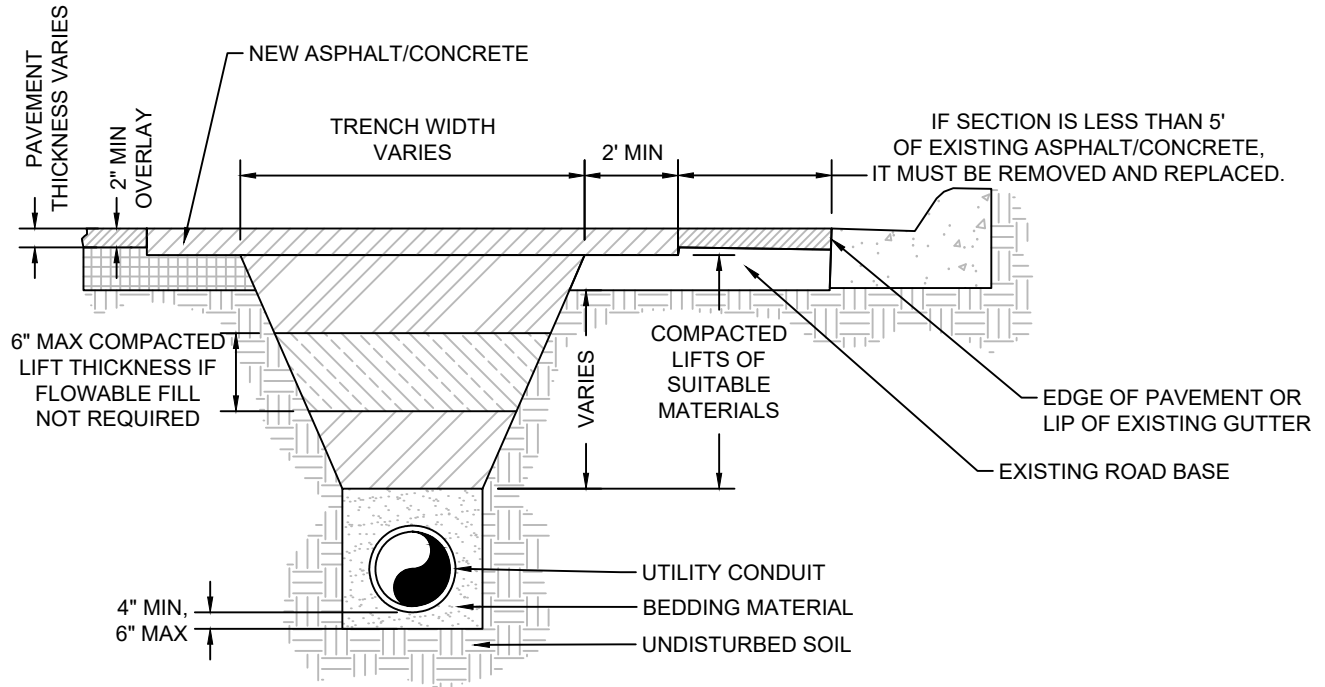
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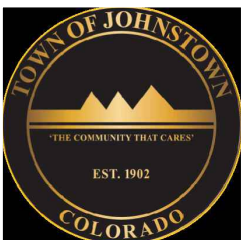
FULL DEPTH ASPHALT PATCH:

THE THICKNESS OF THE ASPHALT PATCH SHALL BE 1" THICKER THAN THE EXISTING ASPHALT THICKNESS WITH A MINIMUM ASPHALT THICKNESS OF 6" OR GEOTECHNICAL RECOMMENDATION (WHICHEVER IS GREATER).



NOTES:

1. ALL TRENCHES SHALL BE BACKFILLED IN ACCORDANCE WITH THE ABOVE DETAIL UNLESS OTHERWISE SPECIFIED BY THE LOCAL ENTITY ENGINEER.
2. PRIOR TO PLACEMENT OF ASPHALT/CONCRETE, PAVEMENT EDGE SHALL BE SAW CUT TO A CLEAN, VERTICAL, AND STRAIGHT EDGE & OUTSIDE OF THE WHEEL PATH.
3. WHERE THE SURROUNDING SOILS ARE NON-EXPANSIVE, A FLOWABLE FILL MAY BE SUBSTITUTED FOR BACKFILL MATERIAL.
4. TRENCH WIDTH SHALL NOT BE MORE THAN 16" NOR LESS THAN 12" WIDER THAN THE OUTSIDE DIAMETER OF THE PIPE.
5. USE A 18" LONG #4 EPOXY REBAR AT 18" ON CENTERS ALONG THE PERIMETER OF CONCRETE PANEL REPLACEMENT SECTIONS.
6. REFER TO TOWN SPECIFICATIONS FOR COMPACTION AND TESTING REQUIREMENTS.
7. IN UNIMPROVED AREAS, ALL DISTURBED AREAS SHALL BE REGRADED, SEEDED & MULCHED.
8. IN CONCRETE ROADWAYS, A MINIMUM OF ONE ENTIRE CONCRETE PANEL MUST BE REPLACED.
9. BEDDING MATERIAL DEPTH WHEN INSTALLING STORM SEWER SHALL BE UP TO SPRING LINE, EXCEPT IN AREAS OF UNSUITABLE BACKFILL; THEN, BEDDING MATERIAL SHALL BE PLACED TO A LEVEL 12" ABOVE PIPE.



STREET CUT

DETAIL NO.

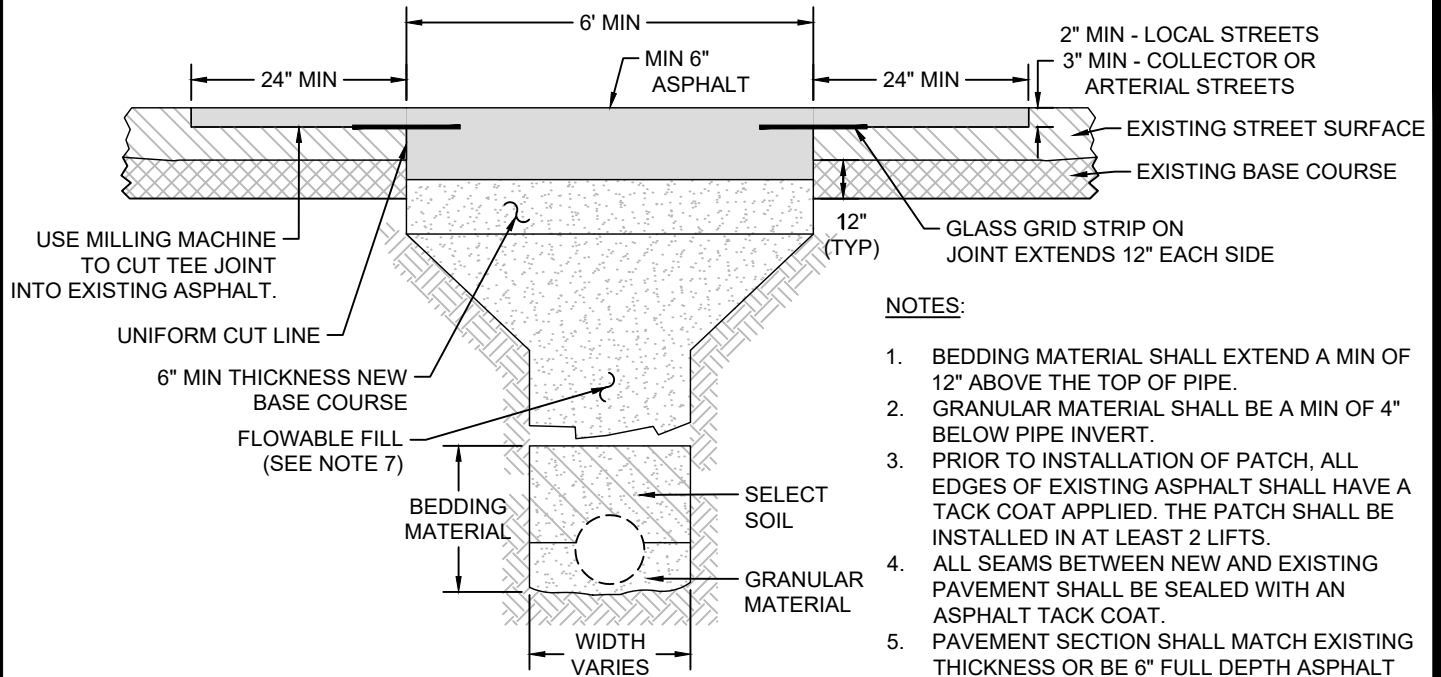
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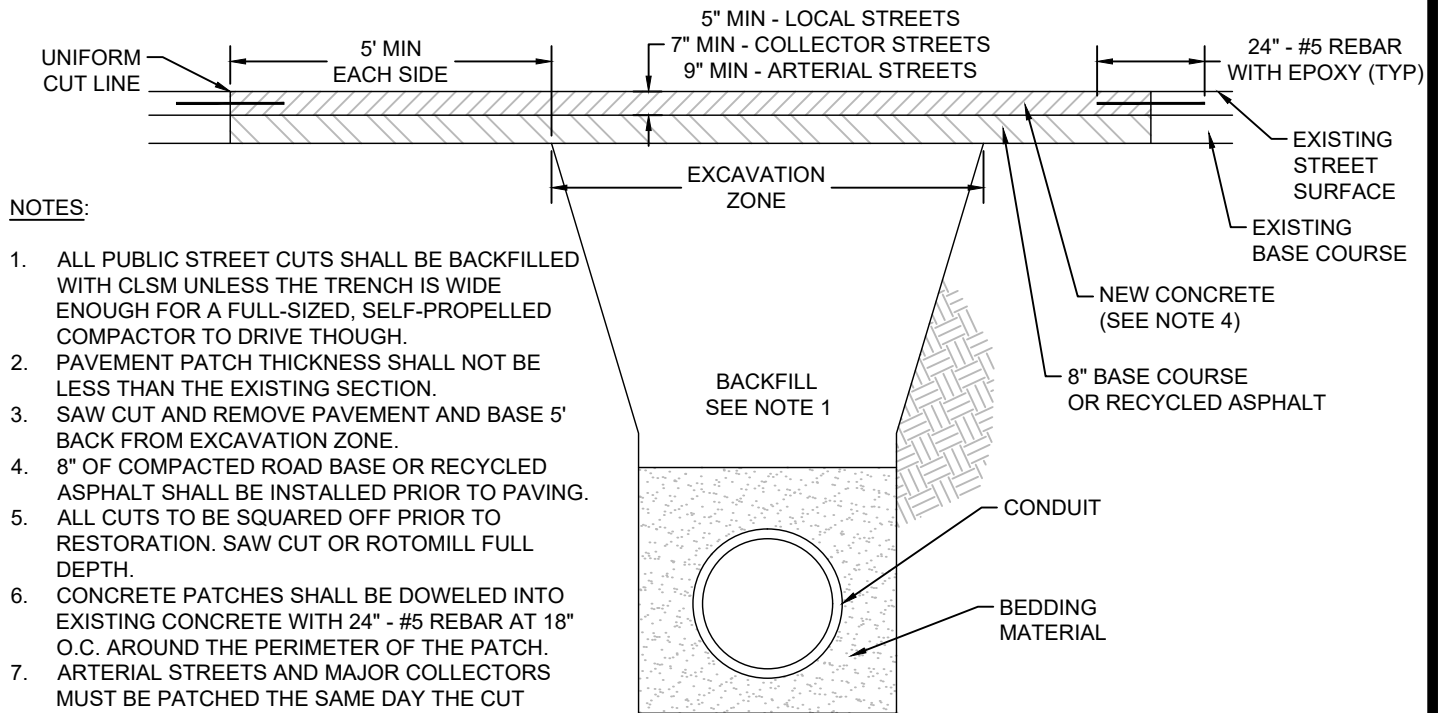
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ASPHALT PATCH BACK

NOTES:

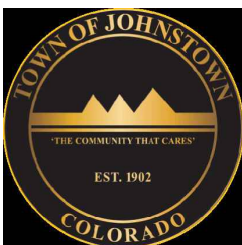
1. BEDDING MATERIAL SHALL EXTEND A MIN OF 12" ABOVE THE TOP OF PIPE.
2. GRANULAR MATERIAL SHALL BE A MIN OF 4" BELOW PIPE INVERT.
3. PRIOR TO INSTALLATION OF PATCH, ALL EDGES OF EXISTING ASPHALT SHALL HAVE A TACK COAT APPLIED. THE PATCH SHALL BE INSTALLED IN AT LEAST 2 LIFTS.
4. ALL SEAMS BETWEEN NEW AND EXISTING PAVEMENT SHALL BE SEALED WITH AN ASPHALT TACK COAT.
5. PAVEMENT SECTION SHALL MATCH EXISTING THICKNESS OR BE 6" FULL DEPTH ASPHALT CONCRETE, WHICHEVER IS GREATER.
6. REFERENCE STANDARD STREET SPECIFICATIONS.
7. THE TOWN MAY REQUIRE FLOWABLE FILL IN LIEU OF COMPACTED BACKFILL ON A CASE-BY-CASE BASIS.



NOTES:

1. ALL PUBLIC STREET CUTS SHALL BE BACKFILLED WITH CLSM UNLESS THE TRENCH IS WIDE ENOUGH FOR A FULL-SIZED, SELF-PROPELLED COMPACTOR TO DRIVE THROUGH.
2. PAVEMENT PATCH THICKNESS SHALL NOT BE LESS THAN THE EXISTING SECTION.
3. SAW CUT AND REMOVE PAVEMENT AND BASE 5' BACK FROM EXCAVATION ZONE.
4. 8" OF COMPACTED ROAD BASE OR RECYCLED ASPHALT SHALL BE INSTALLED PRIOR TO PAVING.
5. ALL CUTS TO BE SQUARED OFF PRIOR TO RESTORATION. SAW CUT OR ROTOMILL FULL DEPTH.
6. CONCRETE PATCHES SHALL BE DOWELED INTO EXISTING CONCRETE WITH 24" - #5 REBAR AT 18" O.C. AROUND THE PERIMETER OF THE PATCH.
7. ARTERIAL STREETS AND MAJOR COLLECTORS MUST BE PATCHED THE SAME DAY THE CUT OCCURS, UNLESS APPROVED BY THE TOWN.

CONCRETE PATCH BACK



PAVEMENT PATCH BACK

DETAIL NO.

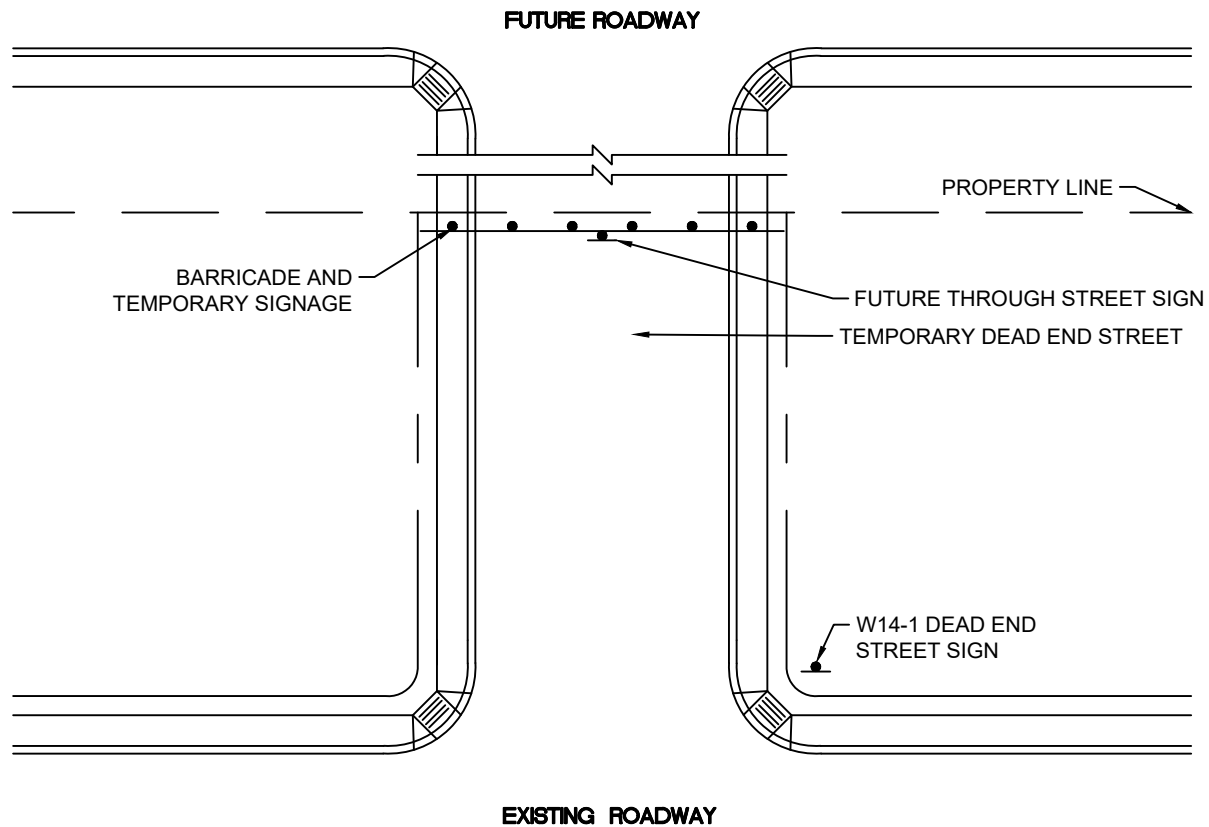
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NOTES:

1. THE TEMPORARY DEAD END IS LIMITED TO 150' IN LENGTH.
2. A CUL-DE-SAC IS NOT REQUIRED.
3. NO ACCESS MAY BE TAKEN FROM A DEAD END STREET WITH NO TURN-AROUND OR CUL-DE-SAC.
4. IF TEMPORARY DEAD END CONDITION IS TO LAST LESS THAN 12 MONTHS, AN ALL-WEATHER SURFACE SHALL BE USED ON THE STREET.
5. IF TEMPORARY DEAD END CONDITION IS TO LAST MORE THAN 12 MONTHS, THE STREET MUST BE PAVED.
6. WHEN STREET EXTENSION IS CONSTRUCTED, ALL TEMPORARY DESIGNS SHALL BE REPLACED WITH PERMANENT ONES.



TEMPORARY DEAD END STREET

DETAIL NO.

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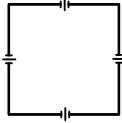
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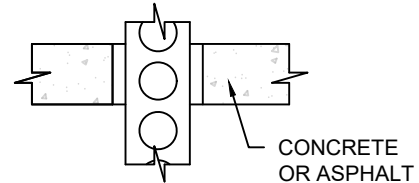
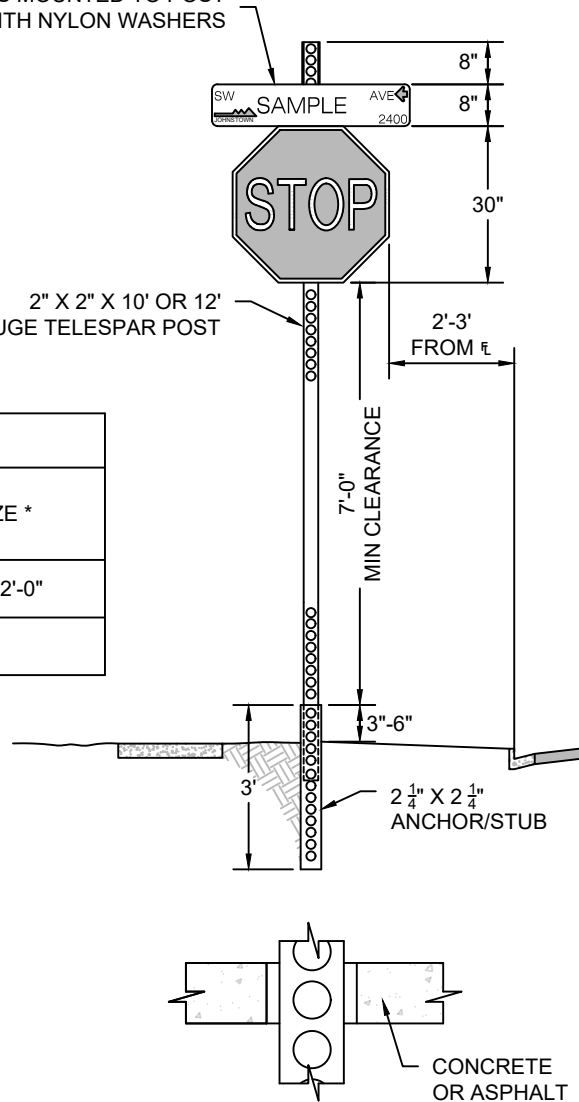
2 EACH 8" BLADES MOUNTED TO POST
WITH 4 EACH DRIVE RIVETS WITH NYLON WASHERS



CROSS SECTION OF POST

CRITERIA FOR SINGLE POST		
MAX. SIGN PANEL	ANCHOR POST *	POST SIZE *
36" X 36"	2.25" X 2.25 "X 3'-0"	2" X 2" X 12'-0"
* 12 GAUGE		

2" X 2" X 10' OR 12'
12 GAUGE TELESAR POST



NOTES:

1. ATTACH THE SIGN PANELS TIGHTLY TO THE POST AND USE OVERSIZED WASHERS TO KEEP THE SIGN FROM BREAKING LOOSE FROM THE POST WHEN HIT BY A VEHICLE.
2. SIGN PANELS SHOULD BE MOUNTED A MINIMUM OF 7 FEET ABOVE THE PAVEMENT OR GROUND.
3. SIGNS LARGER THAN 36 INCHES IN LENGTH OR WIDTH REQUIRE WIND BRACING AND SPECIAL POST DESIGN.
4. ANCHOR STUB AND POST ARE SQUARE STEEL TUBE (PERFORATED).
5. ALL "NO PARKING" SIGNS SHALL BE INSTALLED AT 45° FROM FLOW LINE.
6. R1-1 "STOP" SIGN 30" HIGH DENSITY/DIAMOND GRADE. SIGN MOUNTED TO POST WITH 1 EACH DRIVE RIVET WITH NYLON WASHER AGAINST SIGN FACE (ON TOP OF THE SIGN). SIGN SHALL BE MOUNTED WITH 1 EACH 5/16"X2 1/2" HEW BOLT WITH NYLON WASHERS AGAINST SIGN FACE (ON BOTTOM OF THE SIGN). SECURED WITH 1 EACH 5/16" HEX NUT ON THE BACK SIDE OF POST.
7. STOP SIGNS TO BE INSTALLED AT POINT OF CURVATURE FOR DIRECTION OF TRAVEL.
8. 4" CORE DRILL IN ASPHALT OR CONCRETE OR PROVIDE A 4" PVC SLEEVE CUT FLUSH TO THE SURFACE FOR PLACEMENT OF ANCHOR POST. VOIDS TO BE FILLED IN WITH SAND OR OTHER FINE SUITABLE MATERIAL..
9. STREET SIGNS FOR PUBLIC STREETS SHALL BE WHITE LETTERING ON GREEN BACKGROUND PER TOWN STANDARDS. STREET SIGNS FOR PRIVATE STREETS/DRIVES SHALL BE GREEN LETTERING ON WHITE BACKGROUND.



SIGN POST

DETAIL NO.

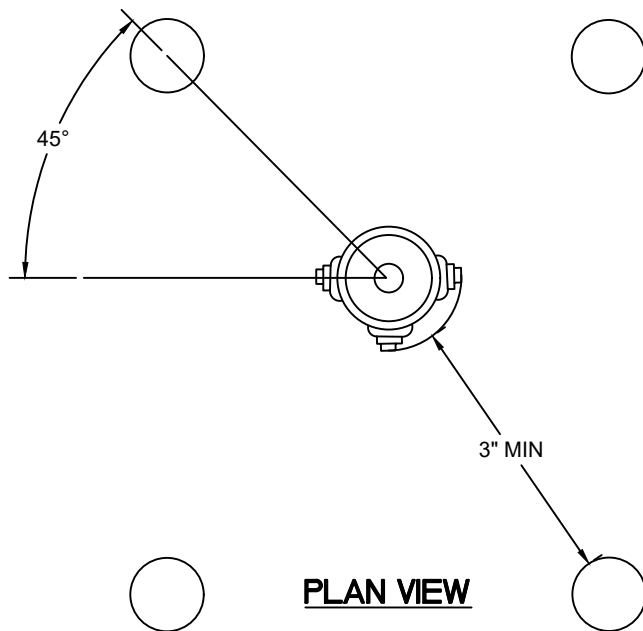
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DATE: 9/20/2022

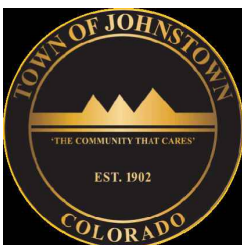
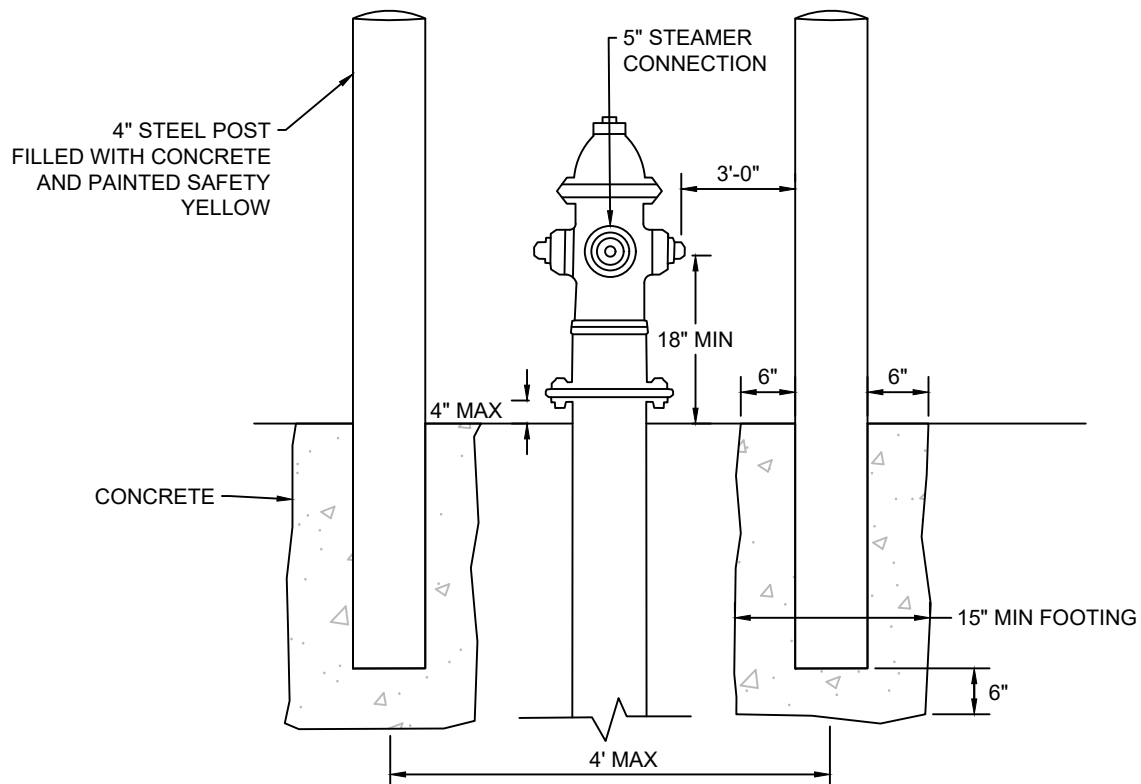
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NOTES:

1. TO BE USED IN COMMERCIAL OR INDUSTRIAL AREAS WHERE HYDRANTS ARE UNPROTECTED FROM THE MAIN FLOW OF TRAFFIC
2. STEAMER CONNECTION ON FIRE HYDRANT SHOULD FACE THE STREET
3. PAINT COLOR SHALL BE SAFETY YELLOW.



BOLLARDS

DETAIL NO.

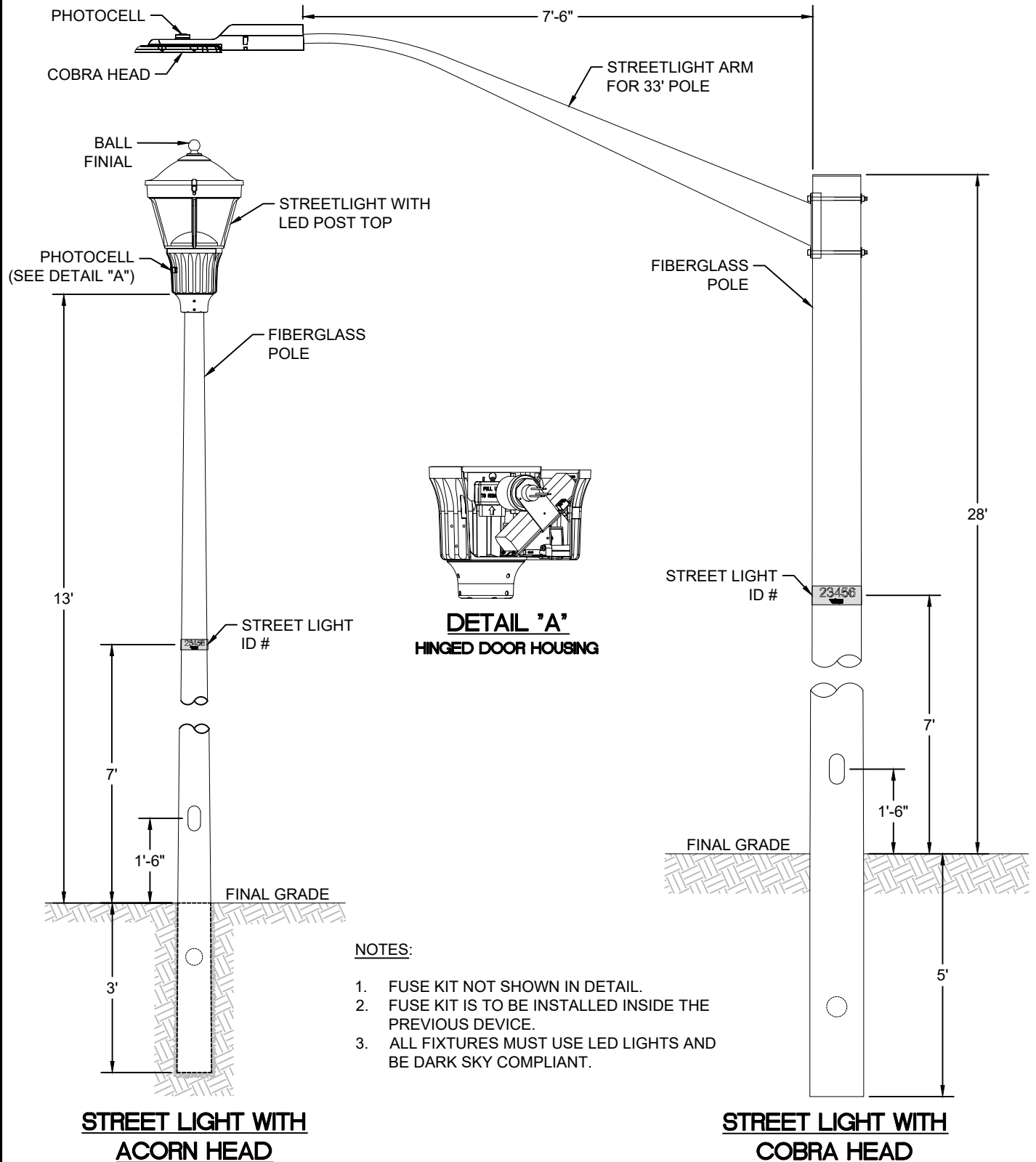
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STREET LIGHTS

DETAIL NO.

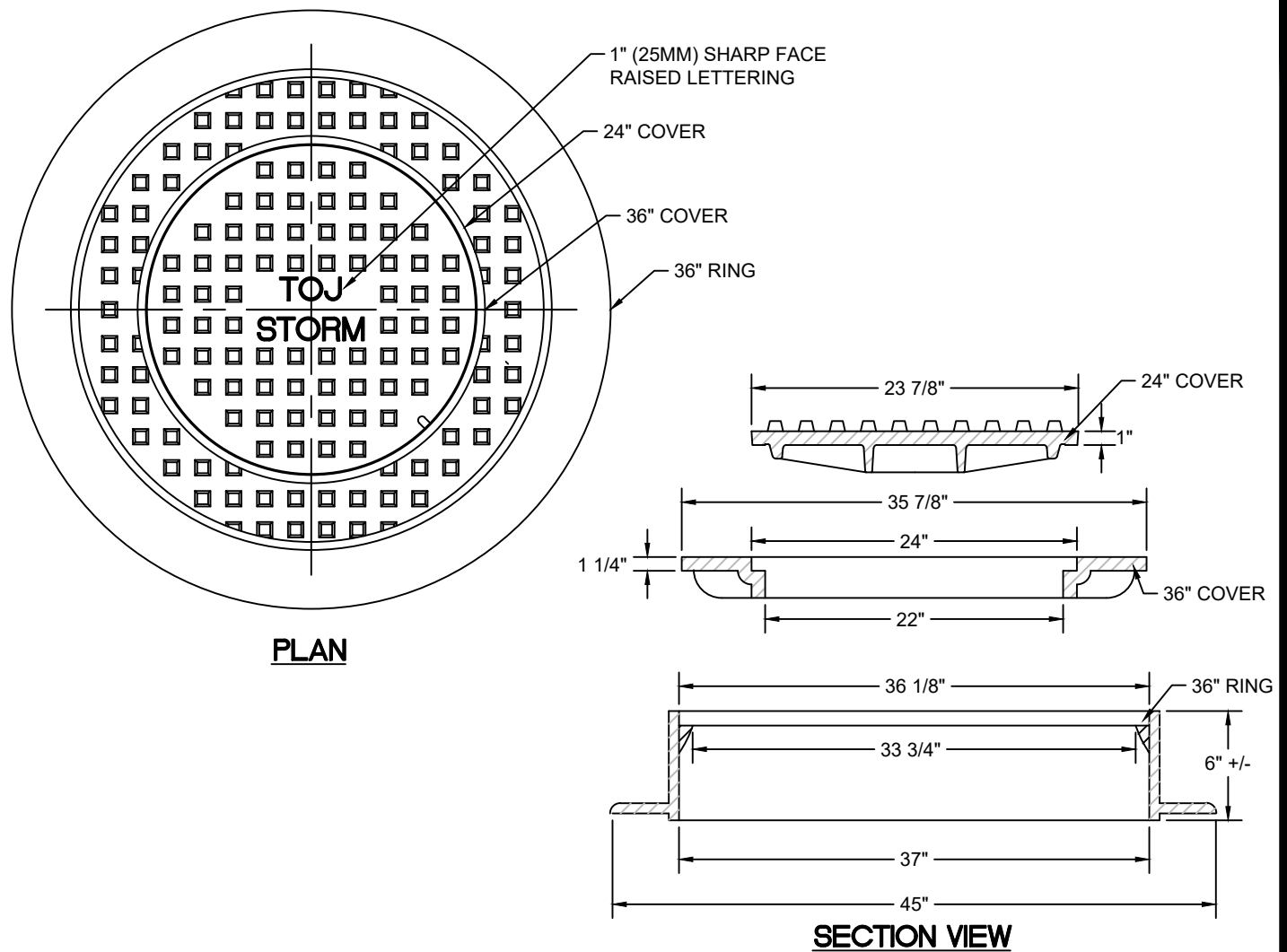
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NOTES:

1. CASTING SPECIFICATIONS ASTM A-48 CLASS 35.
2. ALL CASTINGS TO BE FINISHED WITH BLACK BITUMINOUS PAINT.
3. TOWN MAY REQUIRE LARGER RING & COVER SIZINGS (30"+) DEPENDING ON APPLICATIONS.
4. CASTINGS AS SPECIFIED OR APPROVED EQUAL.
5. FOR USE IN ALL LOCATIONS OTHER THAN SIDEWALKS, WHERE SMOOTH LIDS ARE REQUIRED.



STORMWATER MANHOLE RING AND COVER

DETAIL NO.

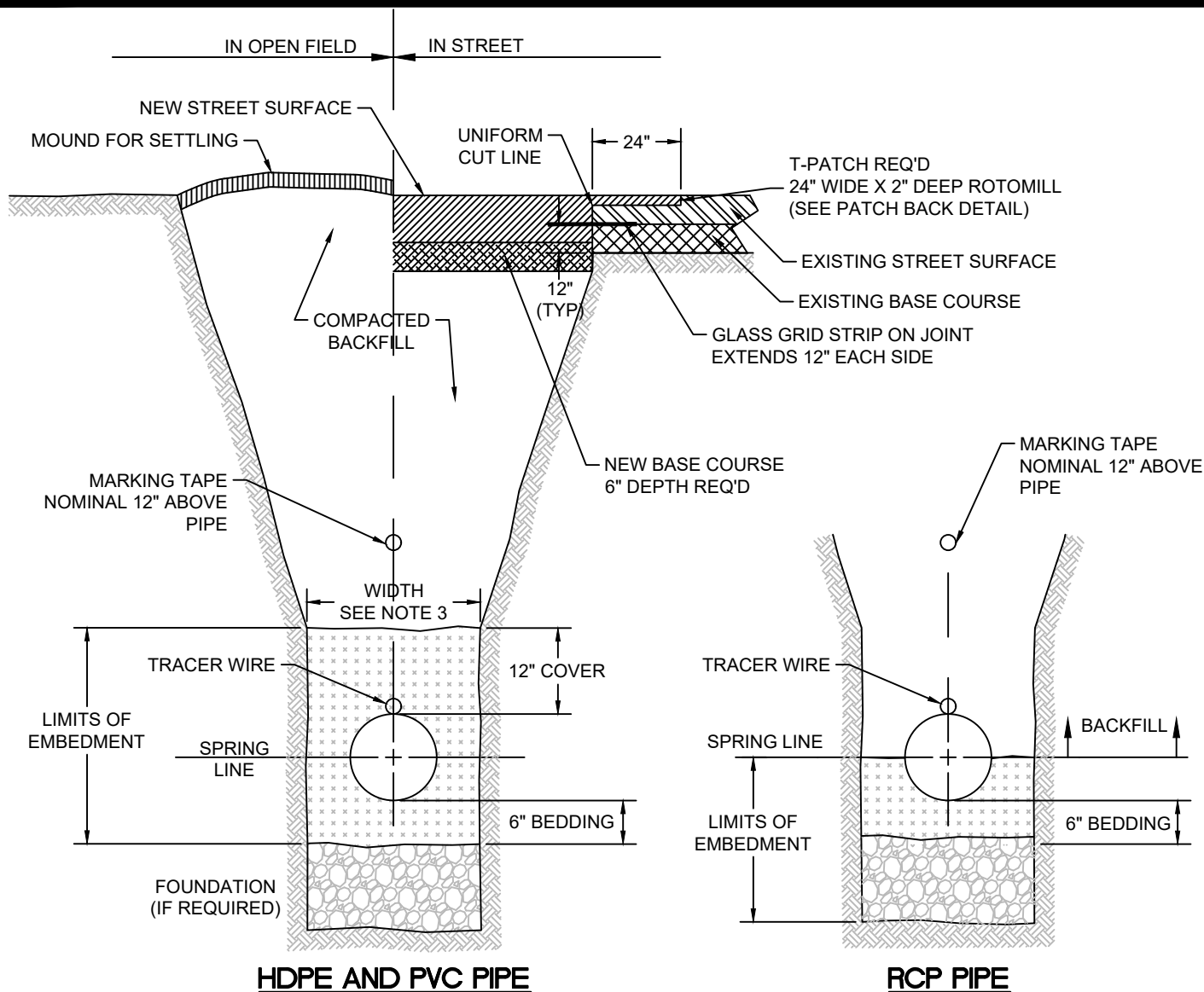
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NOTES:

1. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKERS AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS.
2. ALL PIPE SHALL HAVE SIX INCHES MINIMUM (6" MIN) OF BEDDING.
3. TRENCH WIDTH SHALL NOT BE MORE THAN EIGHTEEN INCHES (18") NOR LESS THAN TWELVE INCHES (12") WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.
4. BEDDING MATERIAL SHALL CONFORM TO ASTM D448, GRADATION NO. 67.
5. FOUNDATION, IF REQUIRED, SHALL BE 1 1/2" MINUS ROCK OR CRUSHED STONE.
6. COMPACTION FOR THE TOP 3 FEET OF TRENCH ZONE SHALL BE 95% STANDARD PROCTOR DENSITY WITHIN THE STREET RIGHT-OF-WAY AND/OR UNDER ALL PAVEMENT/CONCRETE SURFACES EXTENDED A MIN OF 2' BEYOND THE EDGE OF PAVEMENT/CONCRETE.
7. TRACER WIRE AND MARKING TAPE SHALL BE INSTALLED FOR ALL WET UTILITIES.



STANDARD STORMWATER BEDDING

REVISION NO: 0

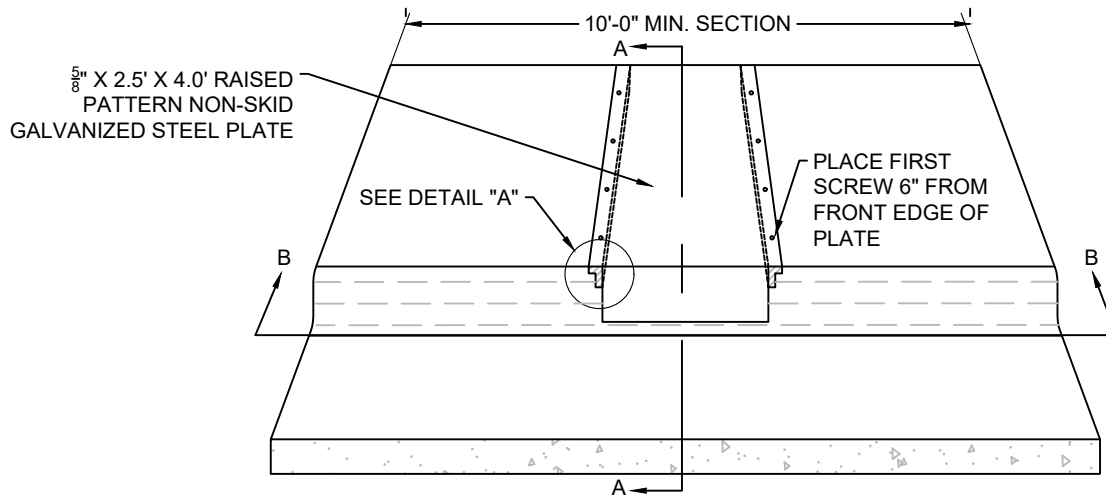
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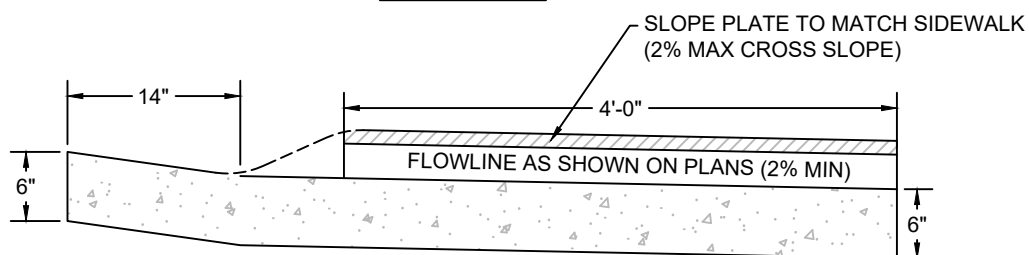
DETAIL NO.

302

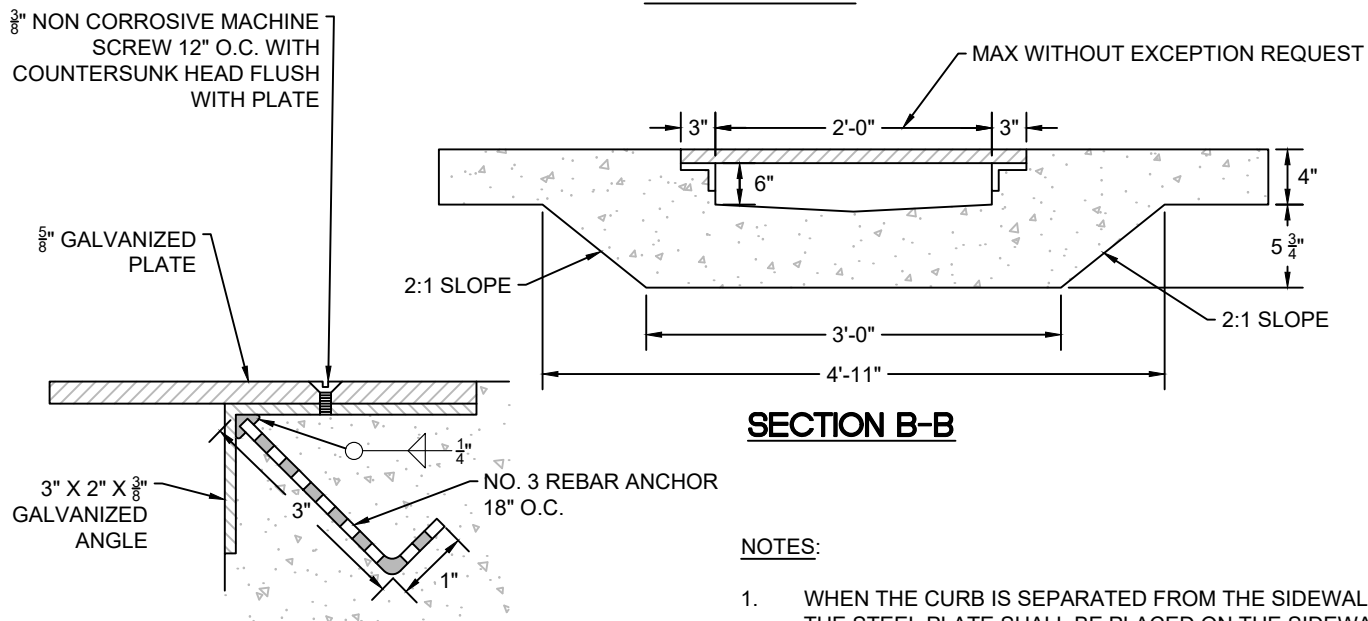
PAGE 1 OF 1



PLAN VIEW



SECTION A-A



SECTION B-B

DETAIL 'A'

NOTES:

1. WHEN THE CURB IS SEPARATED FROM THE SIDEWALK THE STEEL PLATE SHALL BE PLACED ON THE SIDEWALK AND THE CONCRETE CHANNEL (WITH 6" THICK WALLS WITH 6" MIN BELOW CHASE ON EACH SIDE) CONTINUED INTO THE CURB AND GUTTER.



SIDEWALK CHASE

DETAIL NO.

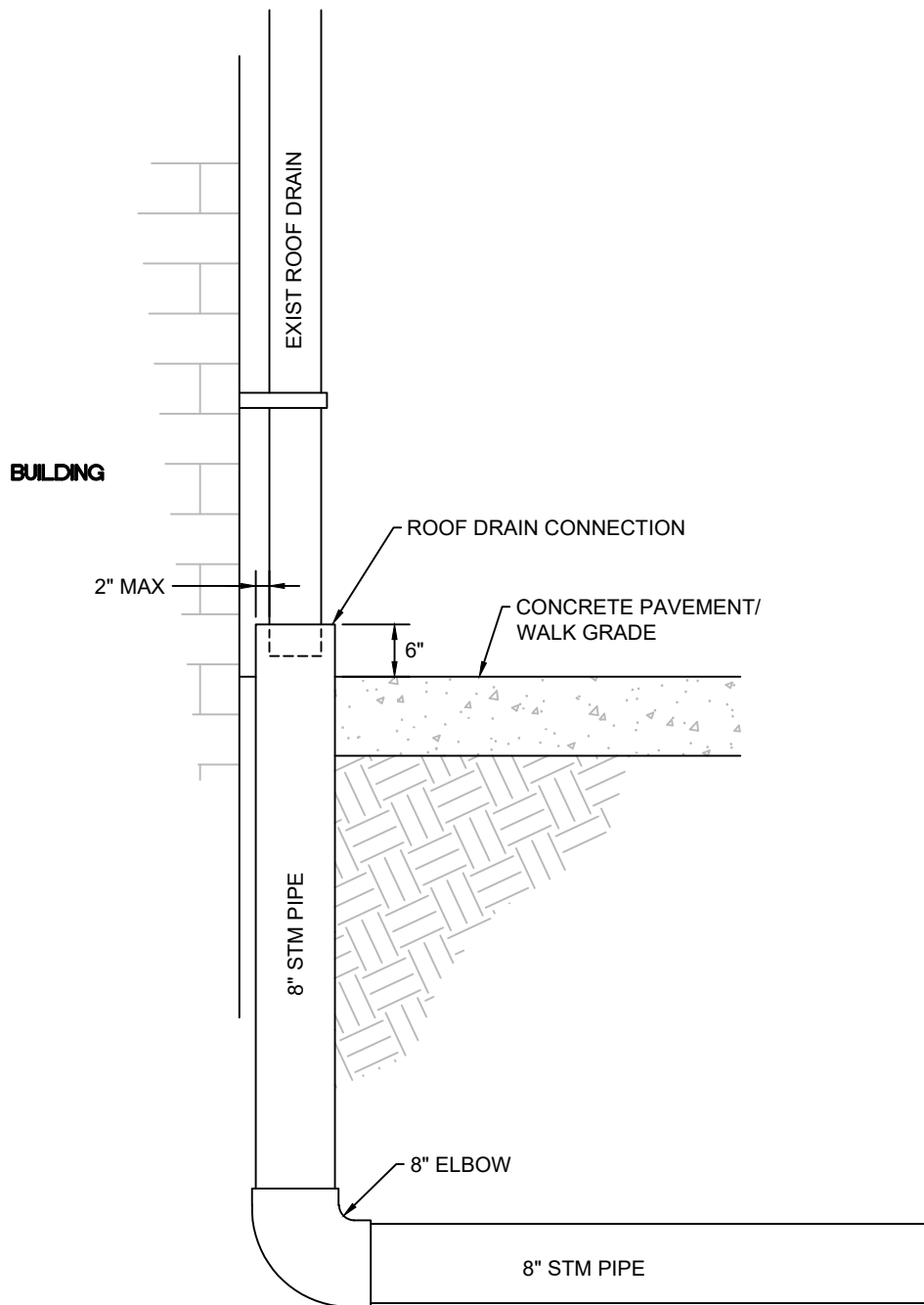
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ROOF DRAIN CONNECTION

DETAIL NO.

304

REVISION NO: 1

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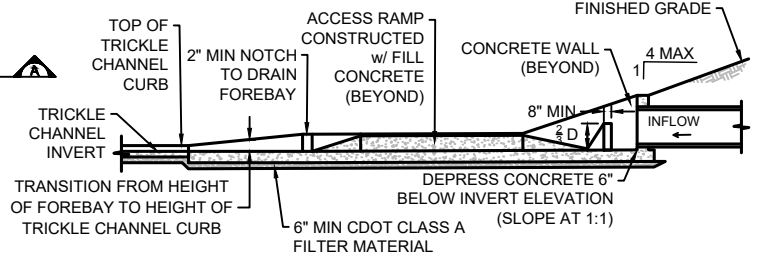
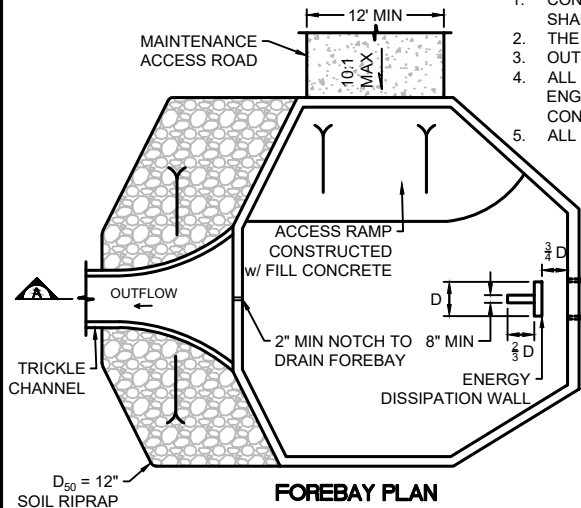
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NOTES:

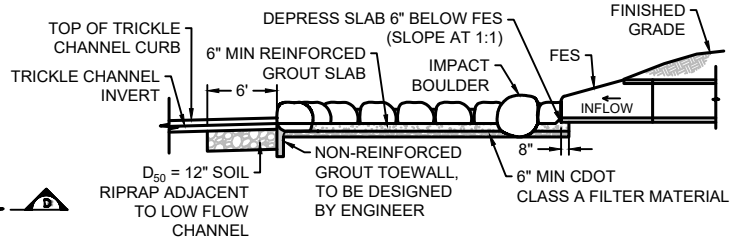
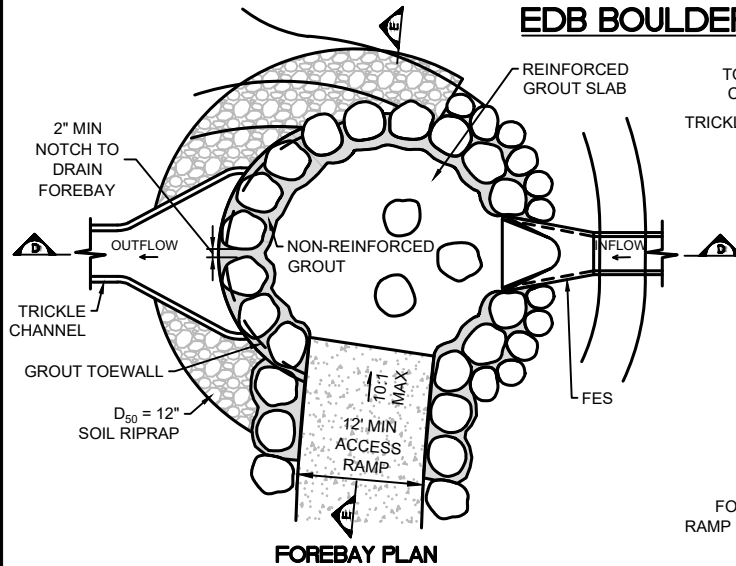
1. CONCRETE FOREBAY SHOWN INCLUDES ACCESS RAMP AS REQUIRED FOR STANDARD EDBS. THIS DETAIL SHALL BE MODIFIED AS APPROPRIATE FOR MODIFIED EDBS, INCLUDING REMOVAL OF THE ACCESS RAMP.
2. THE DESIGN ENGINEER SHALL SIZE FOREBAY AND OUTLET NOTCH IN ACCORDANCE WITH USDCM VOLUME 3.
3. OUTLET NOTCH SHALL EXTEND TO BOTTOM ELEVATION OF FOREBAY TO ALLOW FOR COMPLETE DRAINAGE.
4. ALL CONCRETE SHALL BE REINFORCED, CAST-IN-PLACE AND DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER. THE ENGINEER SHALL DESIGN AND DETAIL CONCRETE THICKNESS, REBAR AND COLD JOINT CONNECTIONS (WHEN MULTIPLE CONCRETE POURS ARE REQUIRED).
5. ALL DIMENSIONS PROVIDED SHALL BE CONSIDERED MINIMUMS.

CONCRETE LINED FOREBAY

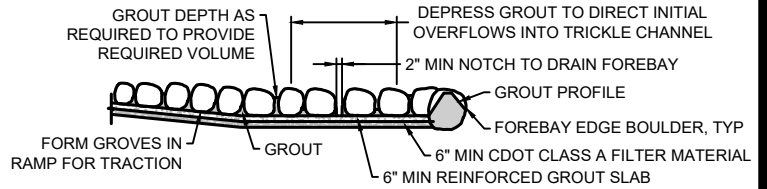


SECTION A-A

EDB BOULDER LINED FOREBAY

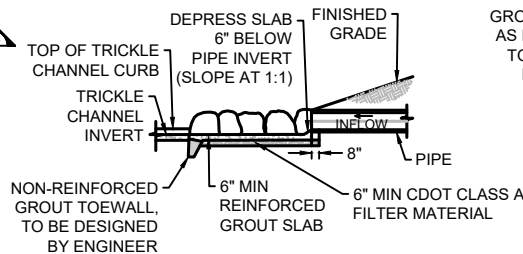
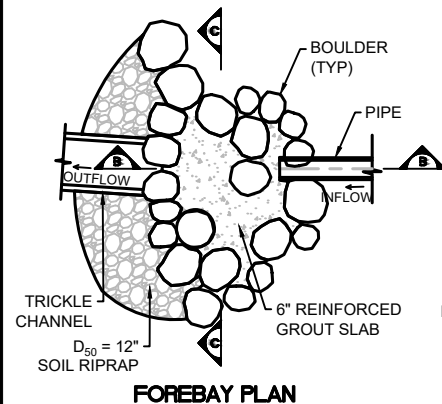


SECTION A-A

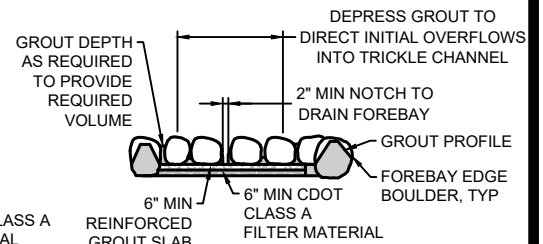


SECTION B-B

MEDB BOULDER LINED FOREBAY



SECTION A-A



SECTION B-B



FOREBAY CONFIGURATION

DETAIL NO.

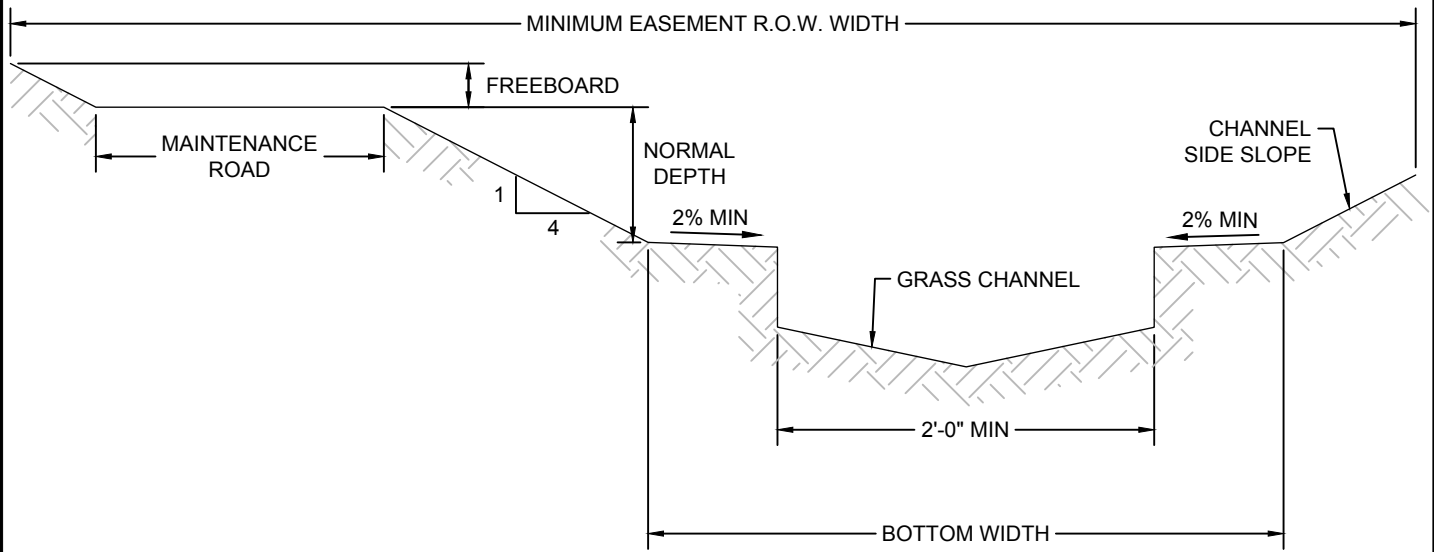
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GRASS CHANNEL SECTION

NOTES:

1. BOTTOM WIDTH:
CONSISTENT WITH MAXIMUM ALLOWABLE DEPTH AND VELOCITY REQUIREMENTS, SHALL NOT BE LESS THAN CHANNEL WIDTH.
MINIMUM WIDTH OF 2 FEET.
2. GRASS CHANNEL:
MINIMUM CAPACITY TO BE 2% TO 4% OF 100-YEAR FLOW BUT NOT LESS THAN 1 CFS.
3. NORMAL DEPTH:
NORMAL DEPTH AT 100-YEAR FLOW SHALL NOT EXCEED 5 FEET. MAXIMUM 100-YEAR FLOW VELOCITY AT NORMAL DEPTH
SHALL NOT EXCEED 5 FPS.
4. FREEBOARD:
FREEBOARD TO BE A MINIMUM OF 1 FOOT.
5. MAINTENANCE ACCESS ROAD: MINIMUM WIDTH TO BE 12 FEET. TOWN MAY REQUIRE ALL OR PART OF THE ROAD TO BE
SURFACED.
6. EASEMENT/R.O.W. WIDTH:
MINIMUM WIDTH TO INCLUDE FREEBOARD AND MAINTENANCE ACCESS ROAD.
7. CHANNEL SIDE SLOPE:
MAXIMUM SIDE SLOPE FOR GRASSED CHANNELS TO BE 4:1.
8. FROUDE NUMBER:
MAXIMUM VALUE SHALL NOT EXCEED 0.8 FOR MINOR AND MAJOR STORM EVENTS.
9. LOW FLOW PIPE MAY BE USED IN LIEU OF GRASS CHANNEL.



GRASS SWALE

DETAIL NO.

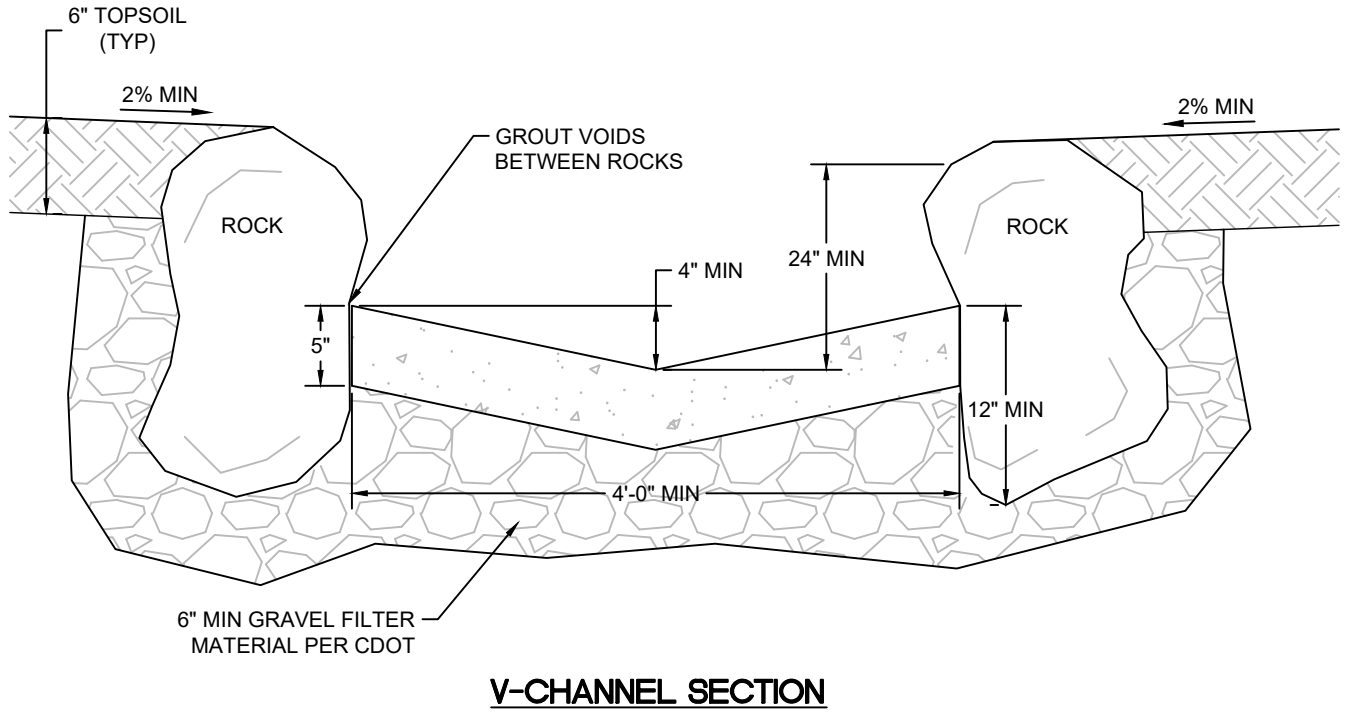
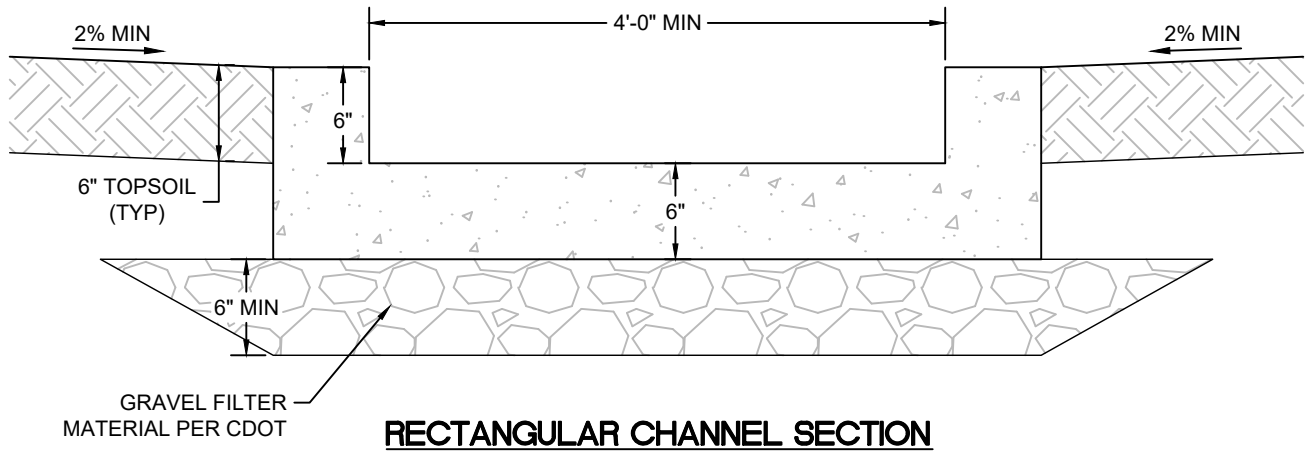
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NOTE:

CONCRETE TO BE REINFORCED WITH FIBERMESH PER MANUFACTURERS SPECIFICATIONS.



TRICKLE CHANNEL

DETAIL NO.

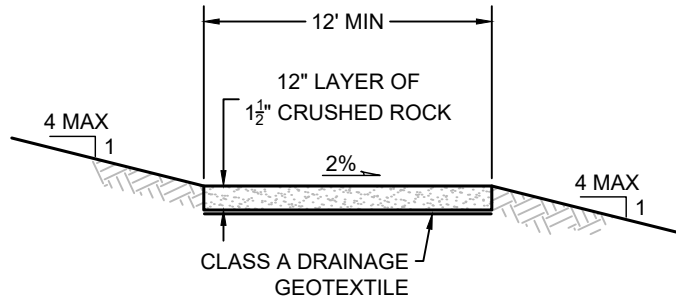
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REVISION NO: 0

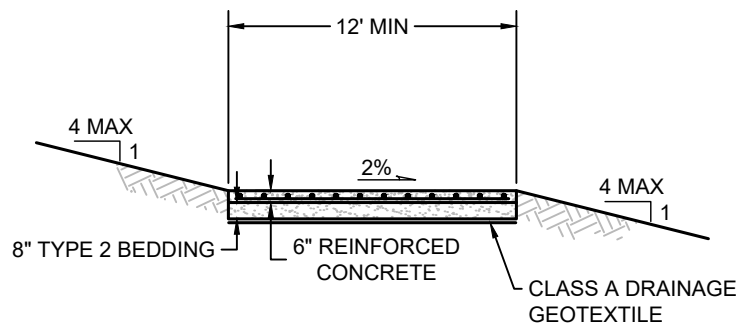
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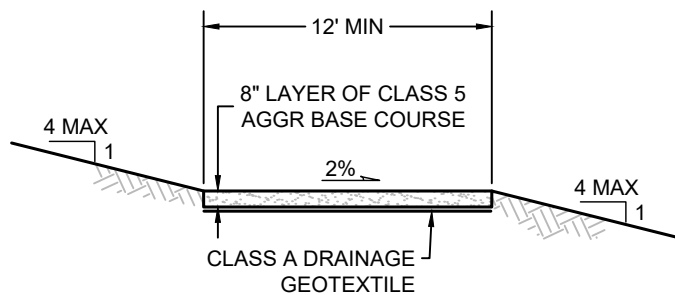
GRAVEL OPTION



CONCRETE OPTION

60% REVIEW QUESTION:

CHANGE REINFORCED
CONCRETE TO FIBERMESH
REINFORCED CONCRETE TO
MATCH TRICKLE CHANNEL
DETAIL?



ROAD BASE OPTION



ACCESS ROAD

DETAIL NO.

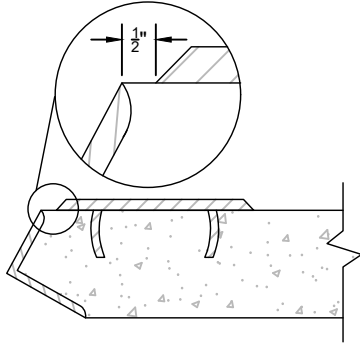
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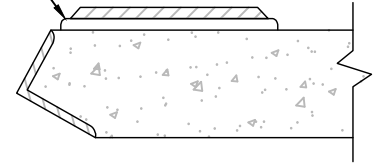
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TYPE 'A'

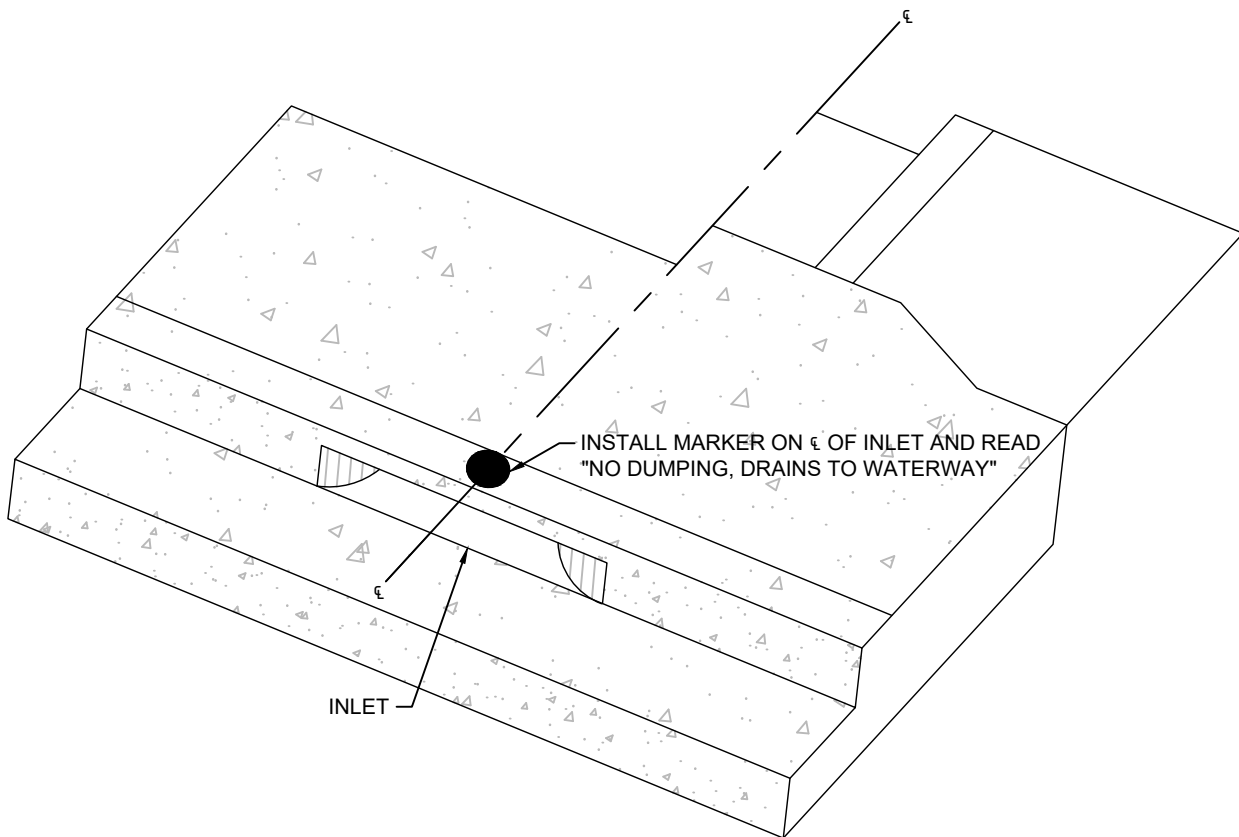
TO BE USED FOR ALL NEW CONSTRUCTION. INSTALL IN WET CONCRETE DURING CONSTRUCTION OF CAST-IN-PLACE OR PREFABRICATED STRUCTURE.

SEE TECH. SPECS.
FOR APPROVED ADHESIVE



TYPE 'B'

TO BE USED FOR ALL EXISTING/RETROFIT INLETS.



NOTE:

MARKERS ARE REQUIRED ON ALL INLETS FOR STORMWATER, INCLUDING CULVERTS AND FES INLETS.



INLET MARKER

DETAIL NO.

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APPENDIX A

Transportation Impact Analysis Guidelines

Transportation Impact Analysis Guidelines



Johnstown
Colorado

May 2023

Transportation Impact Analysis Guidelines

Johnstown, Colorado

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1. INTRODUCTION

The purpose of this document is to outline the procedures and requirements for preparing a Transportation Impact Analysis (TIA) report for the Town of Johnstown. A TIA may be required for new development or redevelopment. The TIA will assist the Town in determining needed modifications to the existing and planned transportation system because of the proposed development.

One of the Town of Johnstown's primary objectives is to operate and maintain a safe and efficient transportation system. The review and management of development-generated traffic is an integral part of that objective. The TIA Guidelines, as outlined in this document, have been established for this purpose. The TIA Guidelines establish two categories based on the characteristics of development and estimated peak hour traffic volumes. The TIA Guidelines also outline the analysis approach and methods.

The TIA identifies existing and projected traffic volumes and conditions, site-generated traffic, and their combined impacts on the existing and planned roadway system. The TIA provides an opportunity for the Town and the developer to share information and jointly address traffic-related objectives. It provides a means of balancing development needs with the functional integrity of the roadways that serve both the development and the surrounding transportation system. The need for a TIA should be assessed as early as possible in the development process when there is maximum flexibility for mitigating traffic-related problems.

The guidelines contained herein are provided to:

- Assist developers through the approval process by outlining the requirements and level of detail of traffic analysis that will be required
- Standardize the types and details of analysis required in the assessment of traffic impacts for developments with similar levels of size and intensity
- Ensure consistency in the preparation and review of the TIA through standardization of the reports

The TIA shall address the following:

- The current transportation system and operational characteristics in the vicinity of the site
- The interface between on-site circulation and adjacent roadway circulation system
- The intensity and character of the development
- Trip generation
- Trip distribution and assignment estimates
- Impacts of the development on the existing and planned transportation system

The TIA is to be prepared by a professional engineer registered in the State of Colorado, and the final TIA report shall be signed and sealed by the engineer.

2. DETERMINING ANALYSIS REQUIREMENTS

A. TRANSPORTATION ASSESSMENT

The first step for all development or redevelopment is to determine the size and scope of study required for the site through a Transportation Assessment.

An initial Transportation Assessment is required for all proposed development regardless of size. A form is included in this document for the developer/consultant to use in **APPENDIX A**. The Transportation Assessment should provide basic information regarding location, type, and size of the development and an initial estimate of the number of peak hour trips expected. The Transportation Assessment is also required at the Overall Development Plan (ODP) level. The Town of Johnstown Traffic Engineer, or designee, will review the initial Transportation Assessment and determine the level of study required for the proposed development. Additional information may also be requested at the ODP level at the discretion of the Town Traffic Engineer, or designee. Although the peak hour trips are the primary factor for determining the level of study, other factors such as location and existing traffic conditions may require a more detailed study than the trip generation would indicate.

The developer must first estimate the number of vehicular trips generated by the proposed development using the procedure(s) outlined in this document. The developer must obtain the concurrence of the Town Traffic Engineer, or a designated representative, on the number of trips generated by the development and the appropriate analysis category. The Town Traffic Engineer, or designee, will make the final decision.

B. TRANSPORTATION IMPACT ANALYSIS (TIA)

Upon Town of Johnstown review of the Transportation Assessment, a determination will be made regarding the appropriate level of TIA to be completed for the proposed development. The initial determination of TIA level will be made based on estimated peak hour vehicle-trips to be generated by the proposed development or redevelopment. TIA categories based on trip generation are described below.

LEVEL 1 TIA: if the vehicular peak hour trips are fewer than 100 with no other negative factors, this will serve as the only TIA document. A Level 1 TIA shall include, at a minimum, the site location, access points, and expected vehicular trip generation.

LEVEL 2 TIA: if the vehicular peak hour trips are equal to or greater than 100, or the following factors are present, a given site development or redevelopment action will require a Level 2 TIA, even if the development generates fewer than 100 vehicular peak hour trips:

- Transportation concerns that currently exist and could be aggravated by the proposed development
- Public concerns regarding the development
- Negative impact on adjacent neighborhoods
- Internal connectivity to existing or proposed land uses (commercial, residential, etc.)
- Cut-through concerns and need for traffic calming
- Need for treatments at pedestrian/bicycle crossings and trail crossings – mid-block

-
- Lack of internal Collector streets
 - Aggressive future growth factors
 - Heavy truck percentage (site specific)
 - Proximity of site driveways to existing driveways or intersections
 - Other local issues that may be present

While an initial determination of TIA Level can be made based on estimated site trips generated, the Town of Johnstown will make the final determination.

C. ANALYSIS METHODS AND ASSUMPTIONS

Before initiating TIA work, the developer shall provide (and the Town of Johnstown approve) a written summary of methods and assumptions to be used in the study, including study area, need for other agency involvement, traffic parameter values, data collection methods, future time horizons for the development and forecasting methodology.

3. TIA REQUIREMENTS

A. LEVEL 1 TIA

The purpose of a Level 1 TIA is to evaluate the proposed vehicular and multimodal transportation connections associated with a development project. The study area for a Level 1 TIA is limited to the site access intersections.

For vehicular connections, the evaluation should:

- Address whether access spacing relative to current or future intersections is acceptable, providing sufficient sight distance and meeting applicable corner clearance criteria.
- Identify whether exclusive left and/or right turn lanes are needed to serve the access based on projected traffic levels. Section Three, Access Category Standards, starting on page 32 of the State Highway Access Code contains traffic volume criteria for auxiliary lanes.
- Address whether accesses will be full movement or limited movement and identification of turn lane needs based on projected traffic volume levels.

For non-motorized connections, the evaluation should:

- Describe the routes that bicyclists and pedestrians may use to reach the site and recommend on-site measures for accommodating efficient multimodal connections that maximize safety for non-motorized trips. On-site measures may include sidewalks, shared-use paths, signage and pavement markings to support multimodal access and circulation.

The following table of contents is suggested for a Level 1 TIA:

A. PROPOSED DEVELOPMENT

- i. Site location
- ii. Land use and intensity
- iii. Site plan
- iv. On-site circulation and access

B. ANALYSIS OF EXISTING CONDITIONS

- i. Roadway characteristics (number of lanes, functional classification, etc.)
- ii. Traffic control devices
- iii. Transit service
- iv. Pedestrian/Bicycle facilities
- v. Nearby driveways
- vi. Traffic volumes
 - a. Daily, morning and afternoon peak periods at proposed site access location(s)

C. PROJECTED VEHICULAR TRAFFIC

- i. Site traffic (each horizon year)
 - a. Trip generation
 - b. Trip distribution
 - c. Trip assignment
- ii. Non-site traffic forecasts (20-year horizon) and methodology
- iii. Total traffic (each horizon year)

D. TRAFFIC ANALYSIS

- i. Site access
 - a. Movements provided
 - b. Access spacing
 - c. Turn lane requirements
- ii. Traffic safety
 - a. Sight distance
 - b. Location and design of site access
- iii. Pedestrian/Bicycle considerations
- iv. Traffic control and connectivity needs

E. FINDINGS/RECOMMENDATIONS

A Level 1 TIA does not need to address intersection Level of Service, unless specified by Town of Johnstown Staff.

B. LEVEL 2 TIA

1. STUDY AREA

The minimum study area will be determined by project type and size. At a minimum, the intersections to be studied will include site access driveways, all signal-controlled intersections within 2 miles of the site and arterial street unsignalized intersections within 1 mile. The Town Traffic Engineer, or designee, may require expansion of the study area when the minimum study area identified in **Table 1** does not provide sufficient information to meet the intent of these guidelines. A scoping meeting may be required to define the study area, depending on which category is applicable to the development.

2. STUDY HORIZON YEARS

The study horizon year is the future year that should be studied for the development. The existing background vehicular traffic shall be adjusted to provide a reasonable estimation of future vehicular traffic without the site in the horizon years. The horizon years, at a minimum, will include the opening year and 20 years from current year. Additional interim years may be required to evaluate phased implementation of key project development milestones and are determined by the project type and size in accordance with the criteria in **Table 1**.

Assume full occupancy and build-out for single-phase developments. Multi-phase developments may require assessment of more than one horizon year corresponding to key phases of development as determined by the Town Traffic Engineer, or designee.

3. BACKGROUND (NON-SITE) TRAFFIC VOLUME FORECASTS

The future background vehicular traffic can be estimated using growth information available from available travel demand modeling; typically through the official North Front Range MPO Travel Demand Model. Other growth information that may be referenced includes growth rates provided by the Colorado Department of Transportation for state highways and available municipal transportation plans.

Current growth expectations within Johnstown translate to a 3 percent annual growth rate (both near-term and long-term); the use of lower annual growth rates will require additional supporting technical information and coordination with Johnstown staff.

4. ANALYSIS TIME PERIOD

Both the AM and PM weekday peak hours based on existing vehicular traffic are to be analyzed.

If the vehicular peak traffic hour in the study area occurs during a time period other than the normal AM and PM peak traffic periods, such as a weekend, or if the proposed project has unusual peaking characteristics, these peak hours must also be analyzed. For example, schools require an analysis of the peak period during school arrival and school

dismissal. For banquet or church facilities, an analysis of evening and/or weekends may be required.

5. DATA COLLECTION REQUIREMENTS

All data is to be collected in accordance with the latest edition of the Institute of Transportation Engineers (ITE) Manual of Transportation Engineering Studies or as directed by the Town Traffic Engineer, or designee, if not specifically covered in the ITE reference.

- Turning movement counts shall be obtained for all existing cross-street intersections to be analyzed during the morning and evening peak periods. Available turning movement counts may be extrapolated a maximum of two years with concurrence of the Town Traffic Engineer, or designee.
- The current and projected daily vehicular traffic volumes shall be presented in the report.
- Roadway geometric information shall be obtained, including roadway width, number of lanes, turning lanes, grade, and location of nearby driveways that are in the study area and included in the TIA analysis.
- The location and type of traffic controls shall be identified.

6. SEASONAL ADJUSTMENTS

The vehicular traffic volumes for the analysis hours should be adjusted for the peak season if appropriate. The Town Traffic Engineer, or designee, shall determine and approve use of seasonal adjustment factors. The intent is not to assess maximum peak hourly volumes, such as the day after Christmas for a retail development, but to address peak seasonal variations in vehicular traffic.

7. TRIP GENERATION

The current edition of ITE's Trip Generation shall be used for selecting trip generation rates. The guidelines contained in the Trip Generation shall be used to determine whether the average trip generation rate or the equations should be used.

Other rates may be used with the approval of the Town Traffic Engineer, or designee, in cases where Trip Generation does not include trip rates for a specific land use category, or includes only limited data, or where local trip rates have been proven to differ from the ITE rates.

For a mixed-use development, it may be acceptable to assume that some vehicular trips are internal to the site and do not impact the external street system. If appropriate for the development, this should be discussed with the Town Traffic Engineer, or designee, to agree on a percentage of internal trips.

8. TRIP DISTRIBUTION

The directions from which vehicular traffic will access the site can vary depending on many factors, including:

- The type of proposed development and the area from which it will attract vehicular traffic
- The presence or absence of competing developments within the same area
- The size of the proposed development
- The conditions on the surrounding street system

The influence area of the development shall be identified for the site. Ideally, the influence area should contain approximately 80 percent of the vehicular trip ends that will be attracted to the site. If a market study is available, it should be used in establishing the influence area. Otherwise, an influence area should be established based on a reasonable estimate.

The three most common methods for estimating vehicular trip distribution are by analogy, model, and surrogate data. In most cases, a surrogate data method can be used to develop the trip distribution. Using this procedure involves using socioeconomic data to establish population or employment land use distributions around the site. In most cases, population can be used as the basis for estimating distribution of office, retail, and entertainment trips; employment can be the basis for estimating residential trips.

9. TRIP ASSIGNMENT

Based on the vehicular trip distribution percentages, site vehicular traffic should be assigned to the street network using reasonable traffic patterns and existing traffic volumes. If the site use is conducive to pass-by trips, the ITE methodology can be proposed to obtain concurrence from the Town Traffic Engineer, or a designee. Vehicular pass-by trip reduction only applies to added external trips; the site driveway analysis shall include all site generated trips.

10. CAPACITY ANALYSIS

All level of service/capacity analysis methods shall be computed for signal controlled and non-signal-controlled intersections as identified in the Study Area in **Table 1**, in accordance with the current edition of the Highway Capacity Manual (HCM). Capacity analyses shall be performed for existing conditions, future base conditions for the study years, and future with site generated vehicular traffic for the study years.

For signal-controlled intersections, operational analyses shall be performed for time horizons up to five years. Operational analyses shall also be performed for street or intersection sizing. The operational analysis method can be used for horizons beyond five years.

11. TRAFFIC SIGNAL NEEDS

A traffic signal needs study shall be conducted for all arterial/arterial and arterial/collector intersections within the Study Area for the opening year. If the warrants are not met for the opening year, they should be evaluated for a five- and ten-year horizon for Level 2 TIA's.

Traffic Signal needs studies shall be conducted per the current Manual on Uniform Traffic Control Devices (MUTCD).

12. QUEUING ANALYSIS

A vehicular queuing analysis shall be conducted for all turn lanes and median openings within the study area. Queuing analysis should be supported by HCM methodologies and represent 95th percentile conditions with the exception of school sites as outlined herein. Examples for estimating queue lengths for signal controlled and non-signal controlled intersections are given below.

For signalized intersections, the peak number of vehicles arriving at the intersection during one cycle shall be determined. A vehicle length of 25 feet shall be used to calculate queue length.

For non-signalized intersections, use the number of vehicles per average 2-minute period per the American Association of State Highway and Transportation Officials (AASHTO) Green Book. A vehicle length of 25 feet shall be used to calculate queue length.

If the site contains a land use that has queuing potential, such as a drive-through service (e.g., fast food, coffee shop, car wash), then a trip generation for the peak hours should be provided along with a queuing analysis for internal, as well as external, site impacts.

13. SPEED CONSIDERATIONS

Vehicle speed is used to estimate safe stopping and cross-corner sight distances. Sight distance shall conform to the AASHTO standards. The design speed used shall be 10 miles/hour above the posted speed limit.

14. IMPROVEMENT ANALYSIS

The roadways and intersections within the study area shall be analyzed with and without the proposed development to identify any projected impacts in regard to level of service and safety. Where an intersection will operate at a level of service below D, E, or F, alternatives that mitigate these impacts shall be evaluated and included as part of the study.

Where a street section will operate at a level of service below E or F, alternatives that mitigate these impacts shall be evaluated and included as part of the study.

Other factors to be considered in the analysis are:

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- Number and location of driveways
 - On-site storage
 - Acceleration/deceleration lanes
 - Internal circulation
 - Pedestrian, bicycle, trail, and transit access

15. ADDITIONAL ANALYSIS

The Town of Johnstown may request additional analyses due to the type and location of the proposed development, such as weaving analyses, parking analyses, on-site circulation and queuing, pick-up and drop-off areas, the number of accesses, among others.

16. ADDITIONAL CRITERIA FOR SCHOOL SITES

The study for any public, charter, or private schools with students ranging in grades K-12 shall provide the following additional information:

i. Student Enrollment

The maximum student enrollment at build-out shall be indicated in the TIA Introduction and Summary. Partial student enrollment may be discussed for opening day conditions, but the final horizon year analysis shall include maximum build-out and build-out conditions and shall be used for on-site vehicular queuing requirements.

ii. Minimum Required Parent* (or other authorized person) Vehicle Queue Calculation

The site shall accommodate a minimum parent* vehicle queue for student drop-off and pick-up.

a. The minimum number of parent* vehicles to be accommodated shall be calculated by multiplying the school's maximum dismissal student enrollment by release time. A value of 0.10 shall be required for traditional public schools with walking and busing to school. A value of 0.15 shall be required for magnet, charter, and private schools that generate a greater number of parent* vehicles trips than an average neighborhood school. Values should be based on observations of existing comparable school sites, subject to the Town Traffic Engineer, or designee's, approval.

b. The minimum vehicle queue length shall be calculated by multiplying the number of parent* vehicles by 25 feet.

i) The entire vehicle queue should be contained within the school site and/or on a consenting adjacent shared-use site unless approved by the Town Traffic Engineer, or designee.

ii) The length of an adjacent right turn lane may be added to the minimum required queue if approved by the Town Traffic Engineer, or designee.

c. School Traffic Circulation Overview

A school traffic circulation overview with diagrams shall detail motor vehicle, bus, bicycle, and pedestrian circulation on site, including:

- i) Direction of traffic flow and number of lanes throughout diagram;
- ii) Ingress and egress from the site;
- iii) Vehicular drop-off/pick-up locations;
- iv) Minimum required parent* vehicle queue;
- v) School bus loading areas; and
- vi) Pedestrians and bicycle routes that avoid crossing school driveways.
- vii) On-site and off-site school-related traffic control.

NOTE: *Parent vehicle may mean "Responsible Person" or "Designated Person"

4. LEVEL 2 TRANSPORTATION IMPACT ANALYSIS (TIA) REPORT SUGGESTED OUTLINE

A. INTRODUCTION AND SUMMARY

- i. Purpose of report and study objectives
- ii. Executive Summary
 - a. Site location and study area, development description, principal findings
 - b. Conclusions and recommendations

B. PROPOSED DEVELOPMENT

- i. Site location
- ii. Land use and intensity
- iii. Site plan
- iv. On-site circulation and access
- v. Development phasing and timing

C. STUDY AREA CONDITIONS

- i. Study area conditions
- ii. Existing Land use
- iii. Site accessibility
- iv. Existing and future roadway system

D. ANALYSIS OF EXISTING CONDITIONS

- i. Physical characteristics
 - a. Roadway characteristics (number of lanes, classification, etc.)
 - b. Traffic control devices
 - c. Transit service
 - d. Pedestrian/Bicycle facilities
 - e. Nearby driveways
- ii. Vehicular Traffic volumes

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- Daily, morning and afternoon peak periods and others as required
 - iii. Level of service
 - Morning peak hour, afternoon peak hour, and others as required
 - iv. Safety related deficiencies, crash experience

E. PROJECTED VEHICULAR TRAFFIC

- i. Site traffic (each horizon year)
 - a. Trip generation
 - b. Internal trips (if applicable) Mode split (if applicable) Pass-by traffic (if applicable)
 - c. Trip distribution
 - d. Trip assignment
- ii. Non-site traffic forecasts (each horizon year) and methodology
- iii. Total traffic (each horizon year)

F. TRAFFIC ANALYSIS

- i. Site access
- ii. Level of service analysis
 - a. Without project (including programmed improvements for each horizon year)
 - b. With project (including programmed improvements for each horizon year)
 - c. Improvements necessary to accommodate site traffic
- iii. Traffic safety
 - a. Sight distance
 - b. Location and design of site access
- iv. Pedestrian/Bicycle considerations
- v. Traffic control and lane geometry needs

G. FINDINGS/RECOMMENDATIONS

H. APPENDICES

- i. Traffic counts
- ii. Capacity analyses worksheets
- iii. Traffic signal needs studies
- iv. Additional analysis as requested by Town of Johnstown TIA Guidelines

I. EXHIBITS

The following information shall be provided on clear and legible figures:

- i. Site location
- ii. Site plan
- iii. Existing transportation system(s) (number of lanes, traffic control, etc.)
- iv. Existing and future area development

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- v. Existing vehicular daily traffic volumes
 - vi. Existing vehicular peak hour turning volumes
 - vii. Estimated vehicular site traffic (AM and PM peak periods)
 - viii. Directional distribution of vehicular site traffic (AM and PM peak periods)
 - ix. Total vehicular traffic (peak periods)
 - x. Electronic PDF file of the project level of service/capacity analysis

APPENDIX A.
Initial Transportation Assessment Form

INITIAL TRANSPORTATION ASSESSMENT

This initial transportation assessment is required for all development proposed in the Town of Johnstown. The purpose of a Transportation Impact Analysis (TIA) is to provide preliminary vehicular trip generation information for the proposed development to determine the category of TIA required. Based on the proposed development, **Table 1** should be completed to provide preliminary vehicular trip generation data. The Town Traffic Engineer, or designee, will review the preliminary trip generation estimate provided by the developer and determine the category of TIA required. Other factors in addition to vehicular trip generation can affect the impact of a development; and based on these guidelines, the Town of Johnstown Traffic Engineer, or designee, will determine the final scope for the TIA.

Location of proposed development (location map must be attached)

TABLE 1: PRELIMINARY VEHICULAR TRIP GENERATION ESTIMATE

Types of land uses (e.g., Multi Family, Single Family residential, specific retail, etc.)	Size (thousands of sq. ft., acres, number of units, etc.)	AM peak hour trips per size/unit*	PM peak hour trips per size/unit*	Subtotal of trips AM/PM
GRAND TOTAL				

*The trip generation rates can be obtained from the Institute of Transportation Engineers, Trip Generation, current edition. Use of other rates must be justified and accepted by the Town Traffic Engineer, or designee.

Table 2 provides the criteria for each category of the TIA based on the estimated vehicular trip generation. This table is for information and guidance only. As noted previously, the Town Traffic Engineer, or designee, will make the final determination regarding the type of study.

TABLE 2: REQUIREMENTS FOR TRANSPORTATION IMPACT ANALYSIS (TIA)

TYPE OF STUDY	PEAK HOUR TRIPS
Level 1	<100
Level 2	>100