Public Works

Standard Specifications and Drawings

Pleasant Grove

Utah's City of Trees

November 2017

J·U·B

Summary of the 2017 Revisions

CHAPTER 2 APPLICATIONS & SUBMITTAL REQUIREMENTS

- Section 1.06: Add seal coats to the list of public improvements that are the responsibility of the Developer.
- Section 1.07: Addition of a 3% Testing and Inspection Fee to the bonding requirements.
- Section 1.09: Modifications to address City ownership of street lights and the process for new development.
- Section 2.04: Revision of the Final Plat and Final Improvement Drawings requirements to clarify the maximum allowable spacing for manholes and UPDES permit requirements for facility inspections. Also revised the requirement for all culinary water lines to be C900 or C905 PVC unless approved otherwise by Public Works.

CHAPTER 3 DESIGN CRITERIA

- Section 3.02: Moved the existing section 3.02 to become a new section 3.03. Section 3.02 added as Gravity Flow Pipe Criteria to address that all gravity flow pipe through yards, or close to trees, needs to be of fused joint construction.

CHAPTER 4 STANDARD SPECIFICATIONS

- Div.2, Sect.2.05: Clarification that discharge permits are to be obtained from the state Department of Water Quality
- Div.3, Sect.3.04B: Clarification that discharge permits are to be obtained from the state Department of Water Quality
- Div.4, Sect.4.01: Add requirement that fused joint pipe be used in back and side yards or where trees exist or are planned.
- Div.4, Sect.4.07E: Update to pipe system televising requirements.
- Div.4, Sect.4A.01: Add requirement that fused joint pipe be used in back and side yards or where trees exist or are planned.
- Div.4A, Sect.4A.08E: Update to pipe system televising requirements.
- Div.4B, Sect.4B.01: Add requirement that fused joint pipe be used in back and side yards or where trees exist or are planned.
- Div.4B, Sect.4B.09B: Update to pipe system televising requirements.
- Div.4C, Sect.4C.01: Add requirement that fused joint pipe be used in back and side yards.
- Div.4C, Sect.4C.08E: Update to pipe system televising requirements.
- Div.5, Sect.5.01: Add updated requirement for the maximum allowable spacing between manholes.
- Div.5, Sect.5.05: Remove requirement for adjustable manhole frames and replace with industry standard frames
- Div.5, Sect.5.05A: Add requirement that adjustment of manholes to final grade shall be accomplished using the Whirlygig method and apparatus.
- Div.11, Sect.11.11: Replace existing asphalt specification with updated specification to more closely follow material requirements of the 2017 APWA asphalt specification.

- Div.11, Sect.11.12: Modify requirement that adjustment of manholes to final grade shall now be accomplished using the Whirlygig method and apparatus.
- Div.11, Sect.11.14: Remove Chip Seal specification as product is not used in the city.
- Div.11, Sect.11.17: Remove Plant Mix Seal Coat specification as product is not used in the city.
- Div.13, Sect.13.03: Add requirement that corrugated HDPE pipe shall be used in back and side yards with constant water presence.

CHAPTER 5 STANDARD DRAWINGS

- Standard Detail 1A: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 1B: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 1C: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 2: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 2A: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 2B: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 2C: Removed the note that street lights are installed by Rocky Mountain Power and changed to "City will coordinate installation of the light post and power to the light with their contractor. Developer to provide Rocky Mountain Power plan to the city."."
- Standard Detail 2D: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 3: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 4: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 4A: Clarified 3" cover under rebar in cross gutters.
- Standard Detail 4B: Updated extent of required roadbase under curb.
- Standard Detail 5: Updated drive approach to meet minimum ADA requirements for sidewalk slopes and clear width.
- Standard Detail 5A: Existing detail 5A changed to new detail 5B. New 5A is secondary option for drive approaches with adjacent sidewalk.
- Standard Detail 6: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 6A: Updated extent of required roadbase under curb, gutter and sidewalk.
- Standard Detail 8: Update property-line radius requirements for corner lots.
- Standard Detail 10: Update pipe bedding thickness requirements to distinguish between culinary mains and other piped utilities.
- Standard Detail 10A: Update pipe bedding thickness requirements to distinguish between culinary mains and other piped utilities.
- Standard Detail 10B: Modify to show geotextile required around the clay material.
- Standard Detail 11: Add concrete collar with steel reinforcement to drawing with note for use of Whirlygig in adjusting manholes to final grade.
- Standard Detail 12: Add concrete collar with steel reinforcement to drawing with note for use of Whirlygig in adjusting manholes to final grade.
- Standard Detail 13: Add concrete collar with steel reinforcement to drawing with note for use of Whirlygig in adjusting manholes to final grade.
- Standard Detail 14: Added concrete collar for valve to the drawing and two new accepted hydrant models to the list.
- Standard Detail 16: Added minimum thickness for the gravel drain beneath water meters and new setter information to be installed by developer.
- Standard Detail 16A: Added minimum thickness for the gravel drain beneath water meters and new setter information to be installed by developer.

- Standard Detail 16B: Added minimum thickness for the gravel drain beneath water meters.
- Standard Detail 19: Added requirement for utility boxes to be “Jumbo” boxes. Removed requirement to loop tracer wire.
- Standard Detail 19A: Changed the model of the required utility box. Removed requirement to loop tracer wire.
- Standard Detail 20: Added requirement for utility boxes to be “Jumbo” boxes. Removed requirement to loop tracer wire.
- Standard Detail 21: Added concrete collar for valve to the drawing. Removed requirement to loop tracer wire.
- Standard Detail 22: Added concrete collar for valve to the drawing.
- Standard Detail 28: Added new model of valve with a note about inspection requirements.

PLEASANT GROVE CITY
LAND DEVELOPMENT POLICIES, STANDARD SPECIFICIATIONS AND DRAWINGS

TABLE OF CONTENTS

CHAPTER 5 STANDARD DRAWINGS

DIVISION 1 ENGINEERING AND PUBLIC WORKS

15. THRUST BLOCK DETAILS
16. TYPICAL CULINARY WATER CONNECTION (1" SERVICE)

16A. TYPICAL CULINARY WATER CONNECTION 1" SERVICE LOCATED IN DRIVEWAY
16B. TYPICAL CULINARY WATER SERVICE CONNECTION (1 ½" TO 4" SERVICE)
17. TYPICAL SEWER LATERAL NEW CONSTRUCTION
17A. TYPICAL SEWER LATERAL EXISTING SEWER LINE
18. TYPICAL GREASE TRAP 1000 GALLON CAPACITY
19. SINGLE 1" SERVICE CONNECTION FOR PRESSURE IRRIGATION
19A. SINGLE 1 ½" & 2" SERVICE CONNECTION FOR PRESSURE IRRIGATION DOUBLE SERVICE CONNECTION FOR PRESSURE IRRIGATION
20. AIR INLET & REMOVAL FACILITY FOR PRESSURE IRRIGATION -
21. TEMPORARY PRESSURE IRRIGATION OR CULINARY WATER BLOWOFF FOR TEMPORARY DEAD END STREET
22. PRESSURE IRRIGATION DRAINS
23. 110' ROUNDABOUT FOR LOCAL STREET INTERSECTION
24. STUB STREET TEMPORARY TURN-AROUND
25. SUUB STREET TEMPORARY TURN-AROUND
26. TYPICAL STREET/STOP SIGN INSTALLATION DETAIL
27. POP-UP/ROTARY HEAD DETAILS
28. REMOTE CONTROL/DOUBLE CHECK VALVE DETAILS
29. QUICK COUPLER VALVE DETAIL & LAYOUT
30. STOP & WASTE/ISOLATION VALVES
31. TRENCH/SLEEVEING DETAIL
32. STAINLESS PEDESTAL CONTROLLER DETAIL
33 IRRIGATION FILTER DETAIL
34. TBOS CONTROL MODULE
35. TRASH ENCLOSURE
36. FLAG LOT REQUIREMENTS USING A COMMON STEM ACCESS
37. FLAG LOT REQUIREMENTS USING A COMMON STEM ACCESS
38. CITY SIGN MONUMENT

DIVISION 2 PLANNING AND ZONING

100. SETBACK REQUIREMENTS R-1 & R1-7 ZONES
101. SETBACK REQUIREMENTS A-1 & R-R ZONES
102. ADA PARKING & PASSENGER LOADING ZONE
103. PARKING STALL LAYOUT & DIMENSIONS
104. PARKING STALL LAYOUT & DIMENSIONS

APPENDICES

APPENDIX A-
STORM WATER TECHNICAL MANUAL & BEST MAGEMENT PRACTICES

CHAPTER 2
APPLICATIONS & SUBMITTAL REQUIREMENTS

PLANNING AND ZONING DIAGRAM, ORDINANCES AND POLICY

The following Diagrams can be found in Chapter 5, Standard Drawings and Specifications

36	Trash Enclosure Specifications
100-102	Building Setback Diagrams
103	ADA Parking Requirement Diagram

SECTION 1.01 THE DEVELOPMENT APPLICATION PROCESS

Any individual that desires to subdivide property, obtain a conditional use permit, apply for a variance, amend the general plan or zoning ordinance, apply for an appeal, or ask for a design review must apply for such by completing a Development Review Committee (DRC) application.

Development Review Committee meets each Tuesday at 10:30 A.M. and is made up of the following City staff: Community Development Director, Zoning Administrator, Assistant Public Works Director, Water and Sewer Superintendent, Street and Storm Drain Superintendent, Fire Marshal, Engineering Inspector, City Engineer, and representatives of the Utility Companies. This committee convenes to help all interested parties receive answers to their questions regarding land development issues. If no agenda items are scheduled the meeting is not held. Feel free to make copies and use this application. The fee schedule is set by Resolution of the City Council and could change at any time through the public hearing process.
Contact Community Development (785-6057) to schedule an appointment to meet with the Development Review Committee.

SECTION 1.02 THE DEVELOPMENT REVIEW COMMITTEE (DRC) PROCESS

1. File the DRC Application

The **filing deadline for DRC Applications is when ever the application is complete but no later than the Wednesday prior to the DRC meeting for which the application has been prepared.** Furnished with your DRC Application is a checklist that summarizes ordinance requirements. The checklist is provided for your convenience and in no way is intended to relieve you of the responsibility you have to comply with all applicable City Ordinances.

2. Filing Fee and Required Copies

The filing fee is required at the time the application is filed with the City. Fees vary with the different types of submittals. If you need assistance a Staff member will help you determine the fee.

The applicant shall submit with the application eight (8) legible reduced sized copies (preferred 11" x 17") of all drawings that are to be reviewed with the Committee. Drawings shall be drawn accurately and to scale. One of the Drawings shall be a Vicinity Map showing how surrounding undeveloped property could be developed as it relates to what the applicant is proposing to develop.

3. Development Review Committee

The Development Review Committee (DRC) meets every Tuesday morning at 10:30 a.m. in which the applicant is invited to attend as well as anyone else interested in developing property within the City whether they have filed an application or not. Applicants and interested parties are seen by making an appointment with the Community Development Administrative Staff the Wednesday prior the meeting. Members of DRC are Staff representatives from Planning, Public Works, Public Safety, Engineering, and Public Utility Companies. The Committee's objective is to determine if your project complies with ***all*** applicable City codes.

It is your responsibility to contact the Community Development Director (785-6057) after the Tuesday meeting if you are not able to attend to find out the status of your application.

a. Following Development Review Committee

Once the Applicant has met with the DRC and has met any requirements of that Committee they may proceed with the preparation of the appropriate applications, drawings, studies, documents, etc. necessary to continue the approval process required for the particular type of development. The next steps would generally be (but not limited to) the preparation of preliminary design drawings, geotechnical studies, wetland identification and mitigation, accurate description of the property to be developed, etc.

IMPORTANT

It is often helpful for developers to meet with the DRC prior to submitting DRC applications and drawings. This gives them an opportunity to make sure they understand the issues and concerns of City Staff prior to submitting drawings.

Engineering Review costs for two reviews of both the preliminary plans and the final plat/improvement plans/site plans are covered by the development application fees. Subsequent engineering review costs (after the second review) shall be paid by the developer before the City will release engineering review comments. The City recognizes the increased difficulty of developing land subject to the hillside ordinance. In such areas the development application fees cover the cost of three reviews, rather than two reviews.

4. Planning Commission Meeting

Your attendance at the Planning Commission is required. You may have a representative attend for you.

Once DRC has determined that your application can be forwarded to the Planning Commission, the Staff prepares a report that describes briefly your request and provides the Planning Commission with additional background information. This report is distributed to the Planning Commission five (5) working days prior to the Planning Commission Meeting.

No building permit applications will be approved for your project until all City approvals have been granted.

5. City Council Meeting

Your attendance at City Council is required. You may have a representative attend for you.

Some requests require City Council approval. If your request is one of these, the Staff will forward it to the City Council following the Planning Commission Meeting or if it does not go to the Planning Commission it will go directly to City Council. It could take as much as two weeks before the City Council can review your request. You may want to talk to the Community Development Director (785-6057) to see when your application will be reviewed by the Council.

6. Appeals

Final decisions regarding Conditional Uses and Site Plans of the Planning Commission may be appealed to the Board of Adjustment. All appeals and applications made to the Board shall be in writing, on forms prescribed by the Board and filed within ten (10) days of the action or decision appealed. A Notice of Appeal to the Board of Adjustment must be filed with the Community Development Director.

Any person aggrieved by or affected by any decision of the Board of Adjustment may have and maintain an appeal for relief from the District Court of competent jurisdiction, provided petition for such relief is presented to the court within thirty (30) days after the filing of such decision in the office of the Board of Adjustment or with the City Recorder.

Please Note: This is your application. It is your responsibility to follow-up with City Staff on the status of your request. The Community Development Director or staff is assigned to help you. If they are unavailable, contact Administrative Staff to schedule a meeting.

SECTION 1.03 CONDITIONAL USE PERMITS

The practice of allowing conditional uses in a zoning ordinance has been common throughout the United States for many years although the state enabling legislation did not provide for their use. The recent re-codification of the state enabling legislation, the *Utah Land Use Development and Management Act,* passed by the Utah Legislature in 1991, provides a definition of conditional use and establishes its use in the zoning process.

10-9-103 /17-27-103 Definitions, Utah State Code:

(1) As used in this chapter:

(c) "Conditional Use" means a land use that, because of its unique characteristics or potential impact on the municipality (county), surrounding neighbors, or adjacent land uses, may not be compatible in some areas or may be compatible only if certain conditions are required that mitigate or eliminate the detrimental impacts.

The term, conditional use, refers to a land use which would not be permitted under the normal regulations for the zoning district. The use in question, may, however, be made acceptable in the zoning district if construction or development of the use complies with specified additional development standards or special conditions provided, generally, by the Planning Commission. The standards or conditions are described on a conditional use permit which runs with the land and the use, provided the standards and conditions of the permit continue to be followed. The conditional use permit is revocable by the issuing agency if any of the standards or conditions are violated.

Many times a conditional use permit requires that a site plan be submitted. If this is the case then the application must be accompanied by a site plan that has included all the information that is provided on the Conditional Use/Site Plan Checklist.

SECTION 1.04 OBTAINING A CONDITIONAL USE PERMIT

A conditional use permit can be obtained by submitting a Development Review Committee Application. It will then go through the review process outlined above in "The Development Review Committee Process."

SECTION 1.05 PLANNING COMMISSION AND CITY COUNCIL

Planning Commission:

The Pleasant Grove City Planning Commission meets each second and forth Thursday of every month. They are a 7 member commission (with 2 alternates) and are appointed by the Mayor for 4 year terms. For any motion to carry in a Planning Commission meeting four members must vote in the affirmative. The Planning Commission in Pleasant Grove has approval authority over

conditional use permits and site plans, however the City Council reserves the right to review such applications when deemed necessary. They also consider changes to all zoning, sign, and general plan applications and make recommendations to the City Council.

City Council:
The Pleasant Grove City Council meets on the first and third Tuesday of every month. They are a 5 member council with a nonvoting mayor that acts as a 6th member. The council needs three members to vote in the affirmative for approval on any motion. The Council is the final approval authority for subdivision plats**.**

SECTION 1.06 RESPONSIBILITY FOR PUBLIC IMPROVEMENTS

The design and construction costs of public improvements within and required by land development are the responsibility of the Developer. The Developer must construct full street and utility improvements. These normally include grading, road base and pavement, seal coat, curb, gutter, sidewalk, traffic and street signs, sewer lines with appurtenances, storm drainage improvements, culinary water lines with appurtenances and secondary water lines with appurtenances. The Developer is also required to dedicate, to the public, land required for these improvements. The improvements listed below are required the full length of all subdivision streets, with the exceptions that follow. When oversized lines are required to serve areas other than the development, the City will share in the cost of improvements according to the "Sharing Cost of Improvements" section of the Land Use and Development Code. The following shows the sizes that are the responsibility of the Developer.

Improvement	**Size Developer is responsible to pay for**
Street (residential zone)	56' right-of-way (70' for large scale development)
Street (non-residential zone)	70' right-of-way
Sanitary Sewer	8"
Storm Drain	15"
Culinary Water	8"
Secondary Water	6"

The following exceptions apply:

1. Secondary water lines are not required generally west of State Street.
2. Storm drains are required the full length of all subdivision streets, unless in the determination of the Public Works Representative/Engineer, they will never be needed in a particular street. This means it is the responsibility of the Developer to bear the cost of extending storm drains to the end of all subdivision streets to service future areas, just as is required in the case of all other utilities.

"Large scale" developments are defined as those in which a traffic study requires a right-of-way cross-section larger than 56' to meet the requirements of that development alone.

In residential zones, when street right-of-ways wider than 56' are required (wider than 70' in large scale subdivisions), the City will reimburse the Developer the cost of the road base and surfacing for any additional asphalt width required in excess of 40' (44' in large scale development). The Developer still bears the cost of the land associated with any additional street width. In large scale subdivisions, or in zones other than residential, when streets wider than 70' are required, the city will reimburse the Developer the cost of the road base and surfacing for any additional asphalt width required in excess of 44'. The Developer still bears the cost of the land associated with any additional street width. Where the street borders the outside of the development, at the discretion of the Community Development Director and the City Engineer, the improvements and right-of-way dedication can be limited to the back of the curb on the side of the street opposite the development.

SECTION 1.07 BONDING REQUIREMENTS

Land developers are required to bond for all public improvements associated with their developments. A bond shall be posted with the City in a principal amount of 110% of the total estimated cost of any performance promised to or required by the City. The estimated cost shall be based on the average cost paid by the City in the past 12-months for the same type of performance. Also included in the bond shall be the estimated costs of street signs, stop signs, survey monuments, streetlights, televising sewer mains and materials testing. The City will release Bond monies upon acceptance of improvements. Release of Bond monies are limited to that allowed by the Land Use and Development Code.

A warranty amount of 10% of the estimated construction cost will be held for a period of at least 1 year from the date of the final acceptance of all improvements. The date for the beginning of the warranty period will be set by the final release of Bond monies for construction of improvements. Just prior to the date for the end of the warranty period the developer shall contact the Public Works Representative/Engineer so that the condition of the improvements can be inspected and any warranty work identified. The bond will not be released until all work covered by the warranty is completed. The Bond for the construction of improvements may be in the form of cash or an irrevocable letter of credit. The 10% warranty shall be cash deposited with the City.

In conjunction with the bonding requirements, a 3% Testing and Inspection Fee is required to be posted at the beginning of a development and prior to holding a pre-construction meeting. This fee must be a cash bond in an amount of 3% of the construction bond on the project. This cash bond amount will be used for reimbursement to the city for inspections, testing, GPS services, and mapping completed on their project. At completion of the warranty period, the developer may request to be refunded any unused portion of the 3% cash bond. In cases where the

inspection fees are higher than the pre-paid fees, the developer will be required to pay the additional amount prior to receiving final acceptance of the improvements.

A crack seal and seal coat fee is required in order to install a crack seal and seal coat on all new asphalt pavement and patches approximately 1 year after the end of the final inspection of the project. This fee must be a cash bond and is required prior to receiving final acceptance of the project and prior to the projects final construction bond release. The installation of the crack seal and seal coat will be coordinated by the city with the city's contractor(s). Depending on the date of final acceptance of the project, the crack seals and seal coats for development work will likely be done in the subsequent year in conjunction with other city projects being done that year. The crack seal and seal coat will be paid for by the developer in an amount equal to 125% of the current amount being charged by the city's contractor for installing seal coat material. For example, if the city's current bid to complete a seal coat is $1.60/SY, the required cash bond to be posted for the crack seal and seal coat on the project would be $2.00/SF). This money is non-refundable. This money will be placed in the city's street maintenance budget for completion of the project at a time coordinated by Public Works. Once the cash amount has been paid it will no longer be the developer's responsibility to complete the required seal coat.

SECTION 1.08 DEDICATION OF WATER SHARES

No subdivision of land or building permit shall be approved or issued, where such subdivision or permit is for residential, commercial, industrial, or institutional use where the supply of water is to be from the City water systems, unless and until the applicant(s) shall first deliver to the City irrigation water stock or other water rights acceptable to the City. The amount of water required is 3 acre-feet per acre of gross lot area for residential development and the amount of water required for inside use and 3 acre-feet per acre of landscaped area for multiunit residential, commercial, industrial, or institutional development. Upon delivery of the water stock provided for above, the applicant(s) shall have no further interest of any kind or nature in and to said water stock. The applicant(s) for commercial, industrial, or institutional developments shall provide the City with data of water use from existing developments of the same or similar type or the number of fixture units so that a calculation of the Equivalent Residential Units (ERU's) can be made. One Equivalent Residential Unit (1 ERU) requires 0.493 acre-feet of water. For multiunit residential developments the applicant shall provide the City with the number of units with one, two, and three or more bedrooms or fixture units by unit type, the landscaped area, fixture units of any community centers, the area of any swimming pools broken down into water surface area and deck area, and any other amenities that require water. The City will use this information to calculate the volume of water required. The City shall have sole authority for the final determination of the volume of water required.

Water dedication to the City shall be in accordance with section 11-2-12 of the City Municipal Code. Water other than Pleasant Grove Irrigation shares may be acceptable in limited circumstances as per the municipal code.

SECTION 1.09 PROCEDURE FOR STREET LIGHTING REQUESTS FOR NEW DEVELOPMENTS

All new development projects are required to have street lights installed per the standard drawings and as determined by the city engineer. The developer is responsible for the cost of the installation of street lights and all associated line extensions, conduits, junction boxes, etc. The City currently has under contract an electrical contractor for the installation and maintenance of all street lighting infrastructure. The process to have a city owned and maintained street light installed will largely be as follows:

At the time street lights are needing to be installed, the developer/applicant will fill out a street light application at public works. The application will require a plan showing the location of the proposed street light(s), a copy of the approved Rocky Mountain Power plan (if available), and a fee of $5,000 per street light paid in cash to the City. The city will then work with its electrical contractor to have the street lights and necessary infrastructure installed. If it is desired to save some cost of installation of the power conduit to the street lights and enough time for coordination is given, the City's contractor can work with the development contractor to install the conduits in the power trench for the development. The earlier the City is notified, the more likelihood this coordination can be done but it is not guaranteed. At the completion of the install, the City will receive an invoice for the work from its contractor. The developer/applicant will receive a copy of the invoice for the install. The developer/applicant may then request reimbursement for any remaining money available if the cost was less than the required $5,000 fee per light. In the event that the cost of the install exceeds the required fee, the developer/applicant will be required to pay the additional cost for the install.

SECTION 1.10 SUBMISSION OF AS-BUILTS

The final construction bond release shall not be granted on any development until the developer or contractor has submitted as-built drawings to Community Development. One Mylar copy of the as-builts with the engineer's stamp and signature, an electronic copy in .pdf format, and electronic drawings in one the following formats must be submitted to the City: MicroStation format (.dgn), AutoCAD format (.dwg) or Data Exchange Format (.dxf). These drawings shall locate with state plane coordinates all valves, manholes, inlets, boxes, air inlets, drains, blowoffs, and any other items of significance. Locations of utility laterals shall be provided by dimensioning the distance between the end of the lateral and the nearest property line. If significant changes have been made during construction to the approved design of the asphalt, curb, gutter and other improvements these changes shall be clearly and accurately represented on the drawings. These as-built drawings must be surveyed using standard surveying methods, and should be in the same sheet layout as the final construction drawings in order to be accepted.

The plans must include the coordinate system in which the state plane coordinates are given, the state plane coordinates of a known USGS Datum shown on the plans, and a basis of bearing.

DIVISION 2

SUBMITTAL REQUIREMENTS

SECTION 2.01 DRAWING STANDARDS

The following instructions are for the purpose of standardizing the preparation of drawings to obtain uniformity in appearance, clarity, size and style. Improvement Drawings and designs shall meet the standards defined in the Standard Specifications and Drawings. The requirements listed in this section are minimum requirements on drawings. The Public Works Representative/Engineer shall have authority to modify the requirements of this division, in terms of what plans are required, what must be shown on the plans, and what level of detail is needed.

All drawings and/or prints shall be clear and legible and conform to good engineering and drafting room practice. Size of drawings shall be 24" x 36" (trim line) with minimum borders of **½"** on top, bottom and right sides, and 1" on the left side.

Eight (8) full size sets (24" x 36") of plats, preliminary plans, improvement drawings and site plans, and one (1) reduced size set (11" x 17") shall be submitted as part of the original submittal, and four (4) full size sets (24"x36") and 1 reduced size set (11"x17") for all re-submittals during the review process. All submittals of these drawings (original and re-submittals) are to be made to the Community Development Office, 86 East 100 South, Pleasant Grove, Utah 84062. All resubmittals must be accompanied by a written response to the previous review comments. After the plats, improvement drawings, and site plans are finalized, five (5) full size sets and one (1) 11"x17" set (sets submitted for final review may be included in the seven) shall be submitted. These sets shall be stamped "Finalized Plans" and initialed by the City Engineer. These shall constitute the **Official Improvement Drawings** for the development. The distribution of these five (5) sets shall be two (2) for the City Engineer, one (1) for the Public Works Department, one (1) for the Developer, and one (1) for the Prime Contractor. The Prime Contractor shall keep the stamped set at the project site whenever work is in progress. These stamped sets must be made available prior to the Pre-Construction Conference so that they can be distributed at the meeting.

As installation of improvements proceeds three (1) set of improvement drawings and cut sheets shall be submitted and reviewed prior to construction of public sanitary sewers, storm drains, land drains, and curb & gutter. All submittals of these drawings and attached cut sheets are to be made to the Community Development Office.

In general, the following shall be included on drawings (some do not apply to final plats):

1. North arrow (plan)
2. Scale, no smaller than 1"=50' horizontal and 1"=5' vertical
3. Benchmark location and elevations (U.S.G.S. datum must be used)

4. Stationing and elevations for profiles
5. Size, location and, where applicable, elevation and slope of adjoining existing improvements. Existing improvements and proposed improvements shall be clearly distinguishable.
6. Title block to include:
   Name of City
   Project title and address (subdivision, etc.)
   Specific type and location of work
   Name and address of developer
   Name and address of engineer or firm preparing drawings with license number and seal of the engineer (must be licensed in the State of Utah)

SECTION 2.02 CONCEPT PLANS

A concept plan shall include the following:

1. The proposed name of the development.
2. A vicinity plan showing a simple sketch of the proposed layout of streets, lots, and other features including existing utilities and water courses in relation to the existing and planned streets adjacent to the proposed development or a distance as determined by the Community Development Director. The plan shall be prepared at a scale no smaller than one inch equals four hundred feet (1" = 400').
3. A proposed lot and street layout, indicating general scaled dimensions of lots to the nearest foot.
4. The acreage of the entire tract proposed for development.
5. Application fee and completed application form.

SECTION 2.03 PRELIMINARY PLANS

The following items shall be submitted with the Preliminary Plan Subdivision Application:

1. **Eight (8) full size sets (24" x 36") of the preliminary plans** at a scale of 1" = 100' or larger.
2. **One (1) reduced size set (11" x 17") of the preliminary plans**
3. Storm Drainage Calculations
4. Soils Report (2 copies)
5. Application fee
6. Under certain circumstances the following may be required:
   a. If the subdivision covers only a part of a larger un-subdivided area, the following shall be submitted:
      1. A plan showing the location of the subdivision as it forms part of the larger area

2. A sketch proposing a future street system that demonstrates how the balance of the surrounding un-subdivided areas could be developed.

b. If a lot is subject to "steep slope" conditions (as defined in Section 11.08.14(A1) of the City Code), the following shall be required:
   1. A grading permit from the City engineer as defined in Section 11.08.14(A)
   2. Drainage and erosion control plan as defined in Section 11.08.14(B) of the City Code
   3. Vegetation and re-vegetation plan as defined in Section 11.08.14(C) of the City Code
   4. Fire protection report as defined in Section 11.08.14(D) of the City Code
   5. Geotechnical and Geological study as defined in Section 11.08.07 of the City Code
   6. Compliance to all of the Hillside ordinance as defined in Section 11.08.14 of the City Code

c. If a Flag Lot (as defined in Section 10.15.14 of the City Code) is part of a development application, the following shall be required:
   1. Compliance with all dimension, setback, utility and improvement requirements as defined in Section 10.15.14 of the City Code
   2. Submittal of Covenants, Conditions, and Restrictions (CC&R's) as defined in Section 10.15.14(M) of the City Code

If the subdivision is within a Sensitive Area District (as defined in Section 11.08.03 of the City Code), the applicant needs to meet with the Development Review Committee to review the proposed development. The Development Review Committee determines the subsequent course of action as outlined in the Sensitive Lands section of the City Code.

The following shall be included on preliminary plans:

1. The location of the development as part of a larger tract with a vicinity plan showing the relative location of the development to adjacent streets and geographic features
2. Name and address of proposed development
3. Name, address, and phone number(s) of Developer
4. Name, address, and phone numbers(s) of engineer and surveyor
5. Names and addresses of the owners of land within and immediately adjoining the proposed development
6. The boundary lines of the tract to be subdivided in heavy lines and information sufficient to locate accurately the property shown on the plan, with reference to survey markers or monuments (i.e. legal description of property to be subdivided)
7. North point, scale, and date
8. The location, width, and other dimensions of all existing or planned streets, and other important features such as watercourses, exceptional topography and buildings within the parcel and within 200 feet of the proposed development

9. Location and size of existing sanitary sewers, storm drains, water supply mains, irrigation ditches and other waterways, and easements within the tract and within 100 feet of the boundary of the proposed development
10. The location, width, and other dimensions of the proposed lots, streets, alleys, easements, parks, and other open spaces, with proper labeling of spaces to be dedicated to the public, number of proposed dwelling units including square footage of each lot
11. Preliminary engineering drawings showing proposed streets (plan view), identify widths, horizontal curve radii, slope, and direction of slope, typical street(s) cross sections showing the width, type, and thicknesses of the pavement design as presented in the Geotechnical Report; location, size and type of proposed off-site and on-site water mains and sanitary sewers; drainage facilities, and other proposed improvements, such as sidewalks, curbs and gutters, parks, and fire hydrants
12. Preliminary grading plan with existing elevations shown by dashed contours and design elevations represented by solid contours using 2-foot intervals for average slopes less than 25% and 5-foot intervals for average slopes greater than 25%. In flat areas 1-foot intervals may be required
13. The location of any areas of potential flood hazard within the subdivision or within 200 feet of the subdivision
14. Geotechnical report of an original geotechnical investigation of the proposed subdivision site. The geotechnical report shall be certified by a Licensed Professional Engineer and include, with additions as deemed necessary by the City Engineer or Public Works Representative, the following information:
    a. A plot showing the location of all test borings and excavations
    b. Descriptions and classifications of materials encountered
    c. Elevations of the water table, if encountered
    d. Recommendations for pavement design (local, collector and arterial)
    e. Recommendations for foundation type and design criteria, including soil strength, bearing capacity, and provisions to mitigate the effects of expansive soils, liquefaction, and adjacent loads
    f. Expected total and differential settlement
15. Upon completion of the earthwork and prior to the placement of any structures, the Developer shall provide the City with a letter from the Licensed Professional Engineer certifying that the recommendations set forth in the geotechnical report were carried out. Upon completion of all improvements the Developer shall provide the City with a letter from the Licensed Professional Engineer certifying that density and materials testing has been completed in accordance with the recommendations set forth in the geotechnical report and the requirements of the Pleasant Grove Public Works Standard Specifications
16. A letter of agreement, addressed to the Community Development Director, from the owners of any ditches, canals or waterways specifying any required improvements, possible relocation, and permission for discharge of storm water into these ditches, canals, or waterways. All open ditches within or along the boundaries of a

development must be piped except for ditches identified to remain open in the Master Storm Water Management Plan. These open channels shall be designated on the final subdivision plat map prior to being recorded. Easements for piped irrigation or storm water facilities shall be labeled as such on the final plat

17. A letter from UDOT commenting on and/or approving proposed access and improvements if the development abuts a state road.
18. A preliminary title report.
19. A signed and stamped wetlands delineation report from a qualified wetlands delineator for potential wetlands on the site
20. A preliminary storm drainage plan in accordance with the applicable Pleasant Grove City Municipal Code and Storm Water Management Program. The plan shall show how the Developer proposes to control and discharge storm water runoff from a ten-year storm. The potential for upstream storm water flowing into the development area and the handling and ultimate disposal of the storm water leaving the development site must be considered. The Developer is responsible for controlling storm water runoff throughout all stages of construction of improvements. Pipe systems upstream and downstream of any storm water detention areas, on-site or off-site, shall be designed for a 25-year storm. The detention storage may be used when sizing the 25-year downstream conveyance system. Multi-unit, commercial, and other private developments are required to provide detention on site. Residential developments shall be required to provide detention only when deemed necessary by the City Engineering staff. Detention, whether on-site or approved off-site, shall be sized to limit the downstream 10-year storm water discharge from the site to 0.15 cfs per acre or as provided in the City Municipal Code, whichever is less. In addition, an addendum to the Storm Water Master Plan was made in August of 2006 which requires all developments within a specific area in the southwest portion of the city to provide detention sized to limit the downstream 100-year storm water discharge from the site to 0.05 cfs per acre. Refer to the Storm Water Master Plan for exact boundaries of this area. The drainage plan shall show in tabular form the percentage of the area to be developed that is impervious (by type), semi-pervious, and pervious.

21. Storm drainage calculations signed and stamped by a Professional Engineer (see Appendix A for criteria). These can be submitted on separate 8½" x 11" sheets (they do not have to be included on the preliminary plan).

The following shall be included in the storm drainage calculations (see Appendix A for criteria):

1. Hydrologic Calculations

a. A map showing drainage sub-basins, the location and drainage area any storm water that flows onto the area to be subdivided, and the piping system
b. Cumulative peak flow calculations for each sub-basin and off-site drainage area (submit all input data, calculations and results)

2. **Hydraulic Calculations**
   a. Capacity calculations for each segment of the pipe system
   b. Calculations demonstrating that flow rates in streets do not exceed maximums before being caught in storm drain inlets
   c. Calculations demonstrating that inlets are sufficiently designed to capture peak design flows
3. **Detention Calculations (Only if Required, See Item 21 of This Section)**
   a. Detention volume requirement—an analysis that identifies the storm whose duration creates the greatest detention volume requirement, given storm duration and stage storage curve and outlet discharge curve
   b. Stage storage curve
   c. Outlet discharge curve
   d. Orifice calculations showing the allowable discharge rate is not exceeded

SECTION 2.04 FINAL PLAT AND FINAL IMPROVEMENT DRAWINGS

The following items shall be submitted with the Final Plat Subdivision Application or prior to the recordation of the Final Plat:

1. **Eight (8) full size sets (24" x 36") of the final plat and final improvement drawings**
2. **One (1) reduced size set (11" x 17") of the final plat and final improvement drawings**
3. Water Stock. 3 acre-feet of water are required per acre of land area based on the gross area of the lots. The number of shares of Pleasant Grove Irrigation Company required is determined by dividing the gross area in acres by 1.666 acre-feet per share. The shares are to be turned into the City prior to recording the plat. (See Pleasant Grove City Code Section 11-2-12)
4. Engineers opinion of probable cost of improvements (for bonding purposes)--this is to contain an itemized listing of quantities, and should be submitted after approval of the final improvement drawings.

The following requirements apply to the final plat:

1. Said plat shall consist of a sheet(s) of Mylar in an approved form and recordable at the Utah County Recorder's Office. The sheet(s) shall have outside or trim line dimensions of twenty-four inches (24") by thirty-six inches (36"). The border line of the plat shall be drawn in heavy lines, leaving a margin of at least one and one-half inches on the left hand side of the sheet for binding, and at least one-half inch on the other three sides of the sheet. The plat shall be so drawn that the top of the sheet is either North or East, whichever accommodates the drawings best.
2. It shall be drawn with all lines, dimensions and markings made in approved waterproof black "India Drawing Ink", or equivalent.

3. Bearings, distances and curve data of all perimeter boundary lines shall be located outside the boundary line, not inside with the lot dimensions.
4. Consecutively number lots (do not repeat the use of lot numbers in subsequently lettered plats that have the same name).
5. Excepted parcels shall be marked "not included in this development".
6. Public streets shall have numeric names. In addition to the numeric name streets may have a "name" that is approved by the City Council upon petition or at the time of Final Plat approval. Street signs showing the "name" of the street shall include thereon the numeric name. ("Proctor Lane" shall also include "1300 West")
7. Any parcels to be dedicated to the public shall be noted as a "Public Area".
8. Easements shall be designated and shall specify to whom the easement is granted.
9. All lands within the boundaries of the plat shall be accounted for either as lots, public streets, private streets, common area, public area or excepted parcels.
10. Subdivision boundary lines shall be heavier than other lines on the drawing.
11. Parcels or streets not contiguous with the main body of the subdivision shall not be included on a single subdivision plat.
12. Lengths shall be shown to hundredths of a foot, areas to the square foot, and angles and bearings shall be shown to seconds.

The following shall be included on the final plat:

1. North arrow and scale.
2. Scale of 1"=100' or larger, unless otherwise approved by the Planning Commission. The scale shall be noted on the plat.
3. Subdivision name and Plat Letter.
4. A vicinity map showing the general location of the development to adjacent streets and geographic features.
5. Accurately drawn boundary properly tied in state plane coordinates to section monuments.
6. The bearings, distances and curve data of the exterior boundary of the subdivision, section corner tie lines, lot lines, street centerlines and widths, street right-of-way lines, alleys, portions within the development intended to be dedicated to the use of the public, excepted parcel boundaries and easements (those easements that cannot be adequately defined using dimensions from lot lines/corners)
7. Curve data sufficient to enable reestablishing the curves on the ground, which shall include as a minimum:
   a. Radius
   b. Central angle
   c. Chord length
   d. Chord bearing
   e. Arc length

8. Total area of the development in acres and areas of all lots in square feet (area in acres may be used if the lot is greater than 1 acre in size).
10. Street numbers or names in accordance with the street naming and numbering system of the City.
11. Lot numbers.
12. Address block showing the address of each unit or lot as assigned by the Engineering Division.
12. A notice of covenants, conditions and other restrictions if applicable.
13. Location of postal easements as required by the United States Postal Service. Contact the Pleasant Grove Post Office (785-5415) for the location of postal easements. The Developer must furnish a signed letter or reduced size plat showing the location of the easements as approved by an authorized representative of the Post Office.
14. Location of all required monuments.
15. The descriptions of all monuments set and established by the County or the United States Government that are adjacent to or near the proposed development
16. A notice of shallow groundwater or other potentially harmful conditions, where such conditions exist or where identified in the Geotechnical Report, as required by the City Engineer
18. An occupancy restriction notice, the form of which shall be substantially as follows:

OCCUPANCY RESTRICTION NOTICE

It is unlawful to occupy any building located within this subdivision without having first obtained a certificate of occupancy issued by Pleasant Grove City.

19. A lined block in the lower right hand corner of the map portion of the plat, in substantially the following format:

CONDITIONS OF APPROVAL

20. Culinary and sewer/storm drain signature lines must be provided on the plat. Format as follows:

CITY UTILITIES APPROVAL

Culinary Water/Pressure Irrigation	Sewer/Storm Drain
_____	_____
Director Public Works Date	Director Public Works Date

21. Utility companies with existing or proposed facilities (Comcast, Timpanogos Special Services District, Provo River Water Users Association, etc.) within or along the plat boundaries are required to sign the plat. The following utilities must always sign the plat regardless of existing facilities: Rocky Mountain Power, Qwest Communications, and Questar Gas. The signature lines should be in the following format:

PUBLIC UTILITIES APPROVAL

_____		_____	_____
Rocky Mtn. Power	Date	Qwest	Date

It is recommended that the utility companies review the finalized plat prior to City Council approving the development. If additional changes are required by the utility companies, these must be submitted and reviewed by the City Engineer before recording the plat.

22. Questar Gas requires the following note and signature line on the plat.

Questar approves this plat solely for the purpose of confirming that the plat contains public utility easements. Questar may require other easements in order to serve this development. This approval does not constitute abrogation or waiver of any other existing rights, obligations or liabilities provided by law or equity. This approval does not constitute acceptance, approval or acknowledgement of any terms contained in the plat, including those set forth in the Owners Dedication and the Notes and does not constitute a guarantee of particular terms of natural gas service. For further information please contact Questar's Right-of-Way department at 1-800-366-6532.

_____	_____
Questar Gas	Date

23. The following items are to be located along the right edge of the plat:
    a. A "Surveyor's Certificate" and "Boundary Description", with a metes and bounds description (including the total subdivision area, ~~and~~ basis of bearing, and coordinate system (NAD27 or NAD83)), and the signature and license number of a land surveyor licensed in the State of Utah. Provide enough information in the Boundary Description for it to stand on its own in correctly describing the boundary. The written description and boundary description shown on the map shall read the same and shall go in one direction around the boundary.
    b. "Owners Dedication" subdividing the property, with the signatures of all property owners.
    c. "Acknowledgment" in which a notary public acknowledges the signatures of the property owners, with the notary's signature and seal.
    d. "Acceptance by Legislative Body" with the date of approval, the signatures of the Mayor and up to 5 Council members, approving the plat and accepting public lands, and the signatures of the Clerk/Recorder, and the City Engineer. In the case

of condominium developments the heading shall read "Approval by Legislative Body" with language as required by the Utah Condominium Act and Pleasant Grove City.

e. "Planning Commission Approval" for developments greater than 5 acres or including flag lots with the date of approval and the signatures of the Director-Secretary and the Planning Commission Chairman. "Community Development Director Approval" for developments less than 5 acres, with the date of approval and the signature of the Community Development Director.
f. The subdivision name and letter designation of the plat (which must be a name unique in Utah
County), the location (", Utah County, Utah), and the scale are to appear near the bottom right hand corner of the plat.
g. The seals of the Land Surveyor, City Engineer, and Clerk-Recorder are to appear near the bottom right hand corner of the plat.
h. A space at least 2.5" wide and 1.5" high in the lower right corner of the plat for use by the Utah County Recorders Office for the recording number/information to be printed.

The following final improvement drawings are required. Drawings can be combined as conditions allow.

1. Curb, gutter & sidewalk and street surfacing drawings shall show:

a. The layout and design of streets, cul-de-sacs and intersections according to requirements defined in Section 11.03.04 of the City Code.
b. Plans and profiles for the centerline and the top back of curb on each side of the street with stations and elevations clearly indicated. Where the top back of curb elevations parallel the centerline elevations, appropriate notes can replace showing the top back of curb in the profile.
c. When designing curb and gutter along an existing road, show the cut line parallel to the proposed lip of gutter where existing asphalt is to be cut, prior to widening. Show spot elevations along the cut line to demonstrate that required cross slope (between 2 and 4%) from cut line to new lip of gutter is met. The cut line shall be located such that asphalt that is in poor condition will be removed.
d. Existing ground at centerline and at each side of the road (if they differ greatly).
e. Stationing and top back of curb elevations with curve data for all curb returns.
f. Street cross section showing cross slopes to gutter as shown in the Standard Drawings, standard utility line locations, the pavement section design, and showing a seal coat on the new pavement.
g. Flow direction and type of cross drainage structures at intersections with adequate flow line elevations.
h. ADA compliant ramps and drive approaches shown in appropriate and required locations.

i. Temporary turnarounds on stub streets where the stub street is required to access lots (see Standard Drawings #24 and #24A).
j. Striping plans for all intersections being affected by the development showing stop bars and crosswalks.
k. The location of street lights, street signs, and stop signs.

2. Sewer drawings shall show:

a. Plan and profile of all sewer mains.
b. Location, size, length and grade of mains.
c. Manhole size, location, invert elevation and rim elevation (maximum manhole spacing is 400').
d. Type of pipe.
e. Lateral locations or note specifying that all laterals are to be in standard location as stated in the Standard Specifications and Standard Drawings.

3. Storm drain drawings shall show:

a. Plan and profile of all storm drain lines (profiles of short lines connecting inlets to mains are not required).
b. Location, size, length and grade of all lines.
c. Manhole size, location, invert elevation and rim elevation (maximum manhole spacing is 400'for pipes 24" and under, 250' for larger than 24").
d. Inlet size, location, grate elevation, invert elevation, and bottom of box elevation.
e. Type of pipe.
f. Location of detention basins with the specified type of landscaping and sprinkling system.
g. Location of orifice used to control the discharge of storm water.
h. Provisions for areas with low points.
i. Cross gutters are generally not allowed as a means of handling storm water in an intersection if a storm drain is nearby.
j. Sumps are not allowed as part of the public storm drainage system without approval on a case-by-case basis by the Public Works Representative/Engineer. Draining groundwater into the city storm drainage system is not allowed unless approved otherwise by the City Engineer or Public Works Representative.
k. All open ditches or channels within the development will require piping and shall include:
    1. A plan and profile of all piped ditches.
    2. The location, size and length of all lines.
    3. Type of pipe (CMP is not allowed).
    4. Written permission is required from the Pleasant Grove Irrigation Company allowing the discharge of storm water into any irrigation company-owned ditches.

4. Culinary water drawings shall show:

a. Size and location of existing and proposed water mains, valves, fittings, flush valves and fire hydrants spaced so that the center of all lots are within 225 feet of a fire hydrant.
b. All lines that are to be maintained by the City shall be C900 or C905 PVC, unless otherwise approved by the Public Works Representative/Engineer.
c. Resolution of vertical conflicts with gravity lines.
d. Service locations or note specifying that all services are to be in standard location as stated in the Standard Specifications and Standard Drawings.

5. Pressure Irrigation drawings shall show:

a. Size and location of existing and proposed water mains, valves, fittings, air inlet and removal facilities, and drains.
b. Resolution of vertical conflicts with gravity lines.
c. Single or double service locations for all lots.

6. Grading plans shall show:

a. Existing and design contours shall be shown at 2-foot intervals in areas of slopes less than 25%, and at 5-foot intervals in areas of slopes greater than 25%. In very flat areas 1-foot contours shall be shown.
b. Existing contours shown by dashed lines and design contours represented by solid lines.
c. If there are lots within the area that are subject to "steep slopes", the plans must comply with all requirements in Section 11.08.14 Sensitive Lands of the City Code.

7. Erosion Control, Sediment Control, and Re-vegetation Plans shall show:

a. Location and type of erosion control devices.
b. Measures to prevent sediment from entering storm drainage facilities.
c. Location and type of re-vegetation proposed.
d. Specific times of implementation of the plan, both in terms of planting season and number of days following commencement of grading.
e. Duration that erosion control and re-vegetation measures are to be in place.
f. The individual or party responsible for implementation and maintenance of the plans.
g. Construction Storm Water Management Plan – See Section G, Construction Site

Storm Water Management Plan Contents, of Part 3, Storm Water Technical Manual of the Pleasant Grove City Storm Water Management Program in Appendix A of this manual.

h. Post Construction Storm Water Management Plan – See Section H, Construction Site Storm Water Management Plan Contents, of Part 3, Storm Water Technical Manual of the Pleasant Grove City Storm Water Management Program in Appendix A of this manual.

8. Structures Drawings

A separate sheet of details for structures that are to be constructed shall accompany each set of plans. All structures shall be designed in accordance with minimum requirements established by the Pleasant Grove City Standard Specifications, and shall be clearly dimensioned and described.

UPDES Permits

Developments having a disturbed area of 1 acre or more require an UPDES Storm water General Permit for construction activities from the Division of Water Quality of the Department of Environmental Quality of the State of Utah. Obtaining the permit includes preparation of a Storm Water Pollution Prevention Plan and a Notice of Intent. The permit form is available on the internet in a PDF format at http://www.deq.state.ut.us/eqwq/updes/swconst.pdf. The developer shall submit a copy of the Notice of Intent before the improvement plans or site plan will be considered finalized. Maintenance inspections shall be performed by a Registered Storm-water Inspector (RSI). Proof of RSI certification shall be submitted with the permit application. Note that when a development of over 1 acre is phased, the permit is required for each phase, even if each phase is less than 1 acre in size.

As-built Drawings

After completion of all public works improvements the Developer shall provide the City with as-built drawings **Final payment from the bond shall not be made until the as-built drawings are received. Please refer to Section 1.10 of this chapter for further requirements regarding as-built drawings.**

SECTION 2.05 SITE PLANS FOR PERMITTED AND CONDITIONAL USES

The following items shall be submitted with the Permitted and Conditional Use Applications:

1. Eight (8) full size sets (24” x 36”) of the site plan.
2. One (1) reduced size set (11” x 17”) of the site plan.
3. Meet the wastewater discharge criteria required by the Timpanogos Special Service District.

4. Landscape/Irrigation Plan.
5. Architectural Plan.
6. Application Fee.

If the site is within a Sensitive Lands District (as defined in Section 11.08.03 of the City Code), the applicant needs to meet with the Development Review Committee to review the proposed development. The Development Review Committee determines the approval process that is to be followed.

The following shall be included on site plans (as they apply):

1. A vicinity map showing the relative location of the plan to adjacent streets and geographic features
2. Project name and address
3. North point and Graphic scale (no smaller than 1"=100')
4. Name and address of adjoining property owners.
5. Name and address of Developer.
6. Name and address of surveyor and engineer.
7. Boundary lines of the site shown in heavy lines & sufficient information to define its location.
8. Dimensions and square footage of the site.
9. Names and locations of adjacent streets.
10. Locations, widths, and dimensions of existing and proposed buildings, structures, improvements, easements, platted streets, alleys, drive accesses, landscape areas, open spaces, parking areas and exceptional topography within the tract and within one hundred feet of the proposed site including the following:
    a. Clearly indicate which improvements are existing and which are proposed.
    b. Buildings—include a notation as to whether they will remain, be modified or be demolished; show finished floor elevation based on USGS datum.
    c. Building elevation—show dimensions and materials proposed.
    d. Indicate the IBC construction type of the building and square footage.
    e. Parking—show dimensions of stalls and isles, and the number of stalls provided. All parking areas are to be hard surfaced and must comply with ADA requirements. Parking areas are to provide the minimum number of parking spaces and satisfy all requirements as defined in the Off Street Parking Standards of the City Code.
    f. Show the pavement design.
    g. Grading—Show existing contours as dashed lines and design contours represented by solid lines. Show as many spot elevations on the asphalt surface as will be needed for construction. Show direction and magnitude of slopes.
    h. Curb and Gutter—show spot elevations and slopes in plan view.
    i. Sidewalks—show width and spot elevations in plan view.
    j. Solid waste disposal including a sight-obscuring enclosure.

k. Loading areas.
l. Street lights, street signs, and stop signs.

11. Striping plans for all intersections being affected by the development showing stop bars and crosswalks.
12. Location of postal easement(s) as required by the United States Postal Service. Submit evidence of approval from the Postal Service.
13. The location of existing and proposed sanitary sewers, storm drains, water supply mains, irrigation ditches and waterways within the tract and within one hundred feet of the proposed site including the following:
    a. Clearly indicate which improvements are existing and which are proposed
    b. Location of existing and proposed fire hydrants – generally they are to be within 225 feet of structures. Valves are to be placed at the main line connection. On buildings requiring a fire suppression system, show the location of the fire department connection. A fire hydrant must be located within 100 feet of the fire department connection.
    c. Location of all valves for pressurized water systems.
    d. Storm drainage facilities—location, landscape, size and elevations of detention areas; locations, sizes, invert elevations and grate elevations of inlet boxes and manholes; locations, sizes, types, lengths, slopes, and elevations of pipes. Show and label elevations of maximum water surface contours in detention areas. Include details of any special structures, including outlet control structures including orifice plate(s).
    e. Clearly show where roof drainage will discharge
    f. Floor drains within buildings—if there are none, place a note on the site plan indicating that there will be no floor drains
    g. Utility service lines—show locations, fittings, types and sizes
    h. Water meters—place behind sidewalk (or curb); vaults are required when meter is in asphalt or concrete
    i. Irrigation ditches—size, direction of flow and any proposed changes to them. Changes or improvements to irrigation ditches will require a letter of approval from the owners of the ditch
    j. Grease traps—see Standard Drawings
    k. Sampling manholes—see Standard Drawings
14. Tabulations showing square footage of the following:
    a. Total site
    b. Landscaping
    c. Impervious area
    d. Undeveloped area (if applicable)
15. Landscaping and Irrigation Plan including the following:
    a. Drawn to a scale no smaller than 1” = 30’.
    b. Existing trees and vegetation and identification of those that are to remain.
    c. The location and labels of all proposed vegetation.
    d. Plant lists or schedules with the botanical and common name, quantity, spacing

and size of all proposed landscape material at the time of planting.

e. Location and description of other landscape improvements, such as earth berms, walls, fences, screens, sculptures, fountains, water features, street furniture, lights and courts.

f. The plans must indicate that the sprinkling system will be designed by a qualified landscape designer and state the anticipated peak usage rate (in gallons per minute).

g. The required landscape percentage, buffers and landscape units as required by the underlying zone of the proposed site.

16. Architectural plans including the following:
    a. At least two (2) elevations so that all sides of the development are presented. Perspectives, models or other graphic materials may be submitted at the option of the applicant and the Community Development Director.
    b. Proposed color scheme of entire building, including roof.
    c. Site photographs (snapshots) of the site and adjacent properties.
    d. Color and texture chips of actual samples of materials may be submitted at the option of the applicant and as required by the Community Development Director.
    e. Description of building materials being used.
17. Fencing locations, heights and types are to be shown according to the requirements of the underlying zone.
18. Traffic impact study, signed and stamped by a Professional Engineer, if required by the Community Development Director/City Engineer
19. Storm drainage calculations signed and stamped by a Professional Engineer (see Section 3.01 in this chapter for criteria). These can be submitted on separate 8½" x 11" sheets (they do not have to be included on the site plan)
    a. Hydrologic calculations—peak flow calculations for the site (submit all input data, calculations and results)
    b. Hydraulic calculations—capacity calculations for each segment of the pipe system
    c. Detention calculations
        1. Detention volume requirement—an analysis that identifies the storm whose duration creates the greatest detention volume requirement, given storm duration and stage storage curve and outlet discharge curve
        2. Stage storage curve - generally required only on large detention basins
        3. Outlet discharge curve - generally required only on large detention basins
        4. Orifice calculations showing the allowable discharge rate is not exceeded
20. Erosion and Sediment Control Plans showing the following:
    a. Location and type of erosion control measures to minimize erosion and prevent sediment on the site from being carried off-site
    b. Location and type of sediment control measures to prevent sediment from entering storm drainage facilities
    c. Description of when the measures are to be implemented and when they are to be removed

d. Construction Storm Water Management Plan – See Section G, Construction Site Storm Water Management Plan Contents, of Part 3, Storm Water Technical Manual of the Pleasant Grove City Storm Water Management Program in Appendix A of this manual.
e. Post Construction Storm Water Management Plan – See Section H, Construction Site Storm Water Management Plan Contents, of Part 3, Storm Water Technical Manual of the Pleasant Grove City Storm Water Management Program in Appendix A of this manual.

21. Include the following notes on all site plans and site plan amendments:
    1. The applicant is responsible for compliance with all requirements of the "Americans with Disabilities Act" (ADA).
    2. Detailed fire protection plans shall be submitted with the building plans. Additional requirements may be identified during the plan review by the Fire Department, which may be mandated by the International Fire Code. Plan reviews must be completed prior to the building permit being issued.
    3. All landscaped areas shall have an automatic, underground sprinkling system with a backflow prevention device and a backflow prevention device to the building, unless landscaping is served by the secondary water system.
    4. A sampling manhole and holding tank (grease trap) shall be installed in accordance with City standards as required by the City.
    5. Water meters are to be located behind back of walk or back of curb in an area that is accessible, not located behind fenced areas or under covered parking.

UPDES Permits

Developments having a disturbed area of 1 acre or more require a UPDES Storm water General Permit for construction activities from the Department of Environmental Quality of the Division of Water Quality of the State of Utah. Obtaining the permit includes preparation of a Storm Water Pollution Prevention Plan and a Notice of Intent. The permit form is available on the internet in a PDF format at http://www.deq.state.ut.us/eqwq/updes/swconst.pdf.The developer shall submit a copy of the Notice of Intent before the site plan will be considered finalized. Note that when a development of over 1 acre is phased, the permit is required for each phase, even if each phase is less then 1 acre in size.

As-built Drawings

After completion of all public works improvements the Developer shall provide the City with as-built drawings **Final payment from the bond shall not be made until the as-built drawings are received. Please refer to Section 1.10 of this chapter for further requirements regarding as-built drawings.**

DIVISION 3

DESIGN CRITERIA

This division contains design criteria that are to be used on designs in the City. The City Engineer shall have authority to modify the criteria as needed to meet changing or unusual needs or conditions.

SECTION 3.01 STORM DRAINAGE CRITERIA

See the Storm Water Performance Criteria and Design Guidelines located in the Storm Water Technical Manual of the Pleasant Grove Storm Water Management Program (See Section F of Appendix A in this manual).

SECTION 3.02 GRAVITY FLOW PIPE CRITERIA

Any gravity flow pipe installed through back or side yards of properties, or in locations where trees are proposed or exist in proximity to the pipe, must be of fused joint construction to prevent root intrusion.

SECTION 3.03 STREET DESIGN CRITERIA

The following street design criteria apply to all street designs in the City. Additional design criteria are specified in the City Code.

1. **Design Speed**

   a. Local streets shall be designed to at least 30 mph
   b. Collector streets shall be designed to at least 40 mph

2. **Street Profile Design**

   Streets shall be designed with vertical curves where grade changes greater than 1% occur.

3. **Intersection Design**

   Curb returns shall be designed such that there is a smooth transition from one leg of the intersection to another, using vertical curves where grade changes greater than 2% occur. The designer shall include enough information on the plans to demonstrate compliance. In most cases, this requires profiling the top back of curb through the curb returns.

CHAPTER 4
STANDARD SPECIFICATIONS
TABLE OF CONTENTS

DIVISION 3 PRESSURE PIPE PRESSURE IRRIGATION

DIVISION 3A PRESSURE PIPE CULINARY WATER

DIVISION 1

GENERAL REQUIREMENTS

Section 1.01 PURPOSE OF DOCUMENTS

The purpose of these Standard Specifications and Standard Drawings is to govern any work done or improvements installed in Pleasant Grove City. Construction work shall comply with Pleasant Grove City Code titled ZONING and Code titled LAND USE AND DEVELOPMENT. Developers/Contractors should thoroughly read and understand these specifications and standards before constructing public improvements.

The Developer/Contractor shall contact Public Works/Engineering at the Pleasant Grove City Community Development Office, 86 East 100 South, Pleasant Grove, Utah 84062 for all matters dealing with construction work within a City right-of-way or with any work connecting to a City utility. **SPECIAL PERMITS AND BONDING ARE REQUIRED FOR ALL SUCH WORK.**

Section 1.02 PERMIT, FEES AND BONDING REQUIRED

It shall be unlawful to do any construction, excavation work on any street, curb, gutter, sidewalk, sewer line, water line, pressure irrigation line, storm drain or other infra-structure addition or improvement in the City of Pleasant Grove without a Public Works' permit from the City to do so. The City of Pleasant Grove and all utility companies are bound by these standard specifications. No work shall be started until a permit is secured. In order to obtain a Public Work's Permit, the Developer's/Contractor's authorized signature is required. If a contract to do such work for the City has been finalized, the contract fulfills the permit requirement.

Sub-Section A. Permit Application:

All Public Works' permit applications shall include:

1) Start and completion dates of the project.
2) The exact address or location of the work to be done.
3) The type of work to be done.
4) A request to locate water and sewer lines, notification 48 hours previous to start date of work.
5) A request for all utility companies to be contacted through Blue Stakes 1-800-662-4111.

Sub-Section B. Fee Assessment:

Before a permit is issued, a permit fee and an inspection fee shall be paid to the City. These fees will be set by Council resolution. Fees shall be assessed on the following items:

1) Sewer and water lateral installation inspection.
2) Pressure irrigation service connection.
3) Re-inspection (When an inspection has been requested, the inspection is performed and the work is not complete, a re-inspection fee shall be assessed.)
4) Barricades (provided by, or called out by the City)
5) Bond

All public improvement projects done for Public Works shall be bonded. Each contractor doing work in the City is required to maintain a Surety Bond in the amount of $10,000.00 in favor of the City. Bond requirements are to guarantee the following:

a) Construction work is completed.
b) Final inspection is conducted.
c) Repairs and/or replacement of required public improvements are finished and accepted.

The bonds shall be in the form of an irrevocable letter of credit from a bank, a bond from a surety company, or a cash bond paid directly to the City. The City shall approve all bonds submitted. No bond shall be released until the required warranty period is met and any needed corrections completed.

Section 1.03 CONTRACTOR AND CONSTRUCTION PLAN APPROVAL

Before a Contractor performs any work within the City, the City shall approve the Contractor. Approval is granted for a period of one (1) year upon submission of the following:

a) A current Utah State Contractor's License. Work will be restricted to that authorized by the license.

b) Proof of comprehensive general liability insurance. Bodily injury insurance will be in an amount of not less than three hundred thousand dollars ($300,000.00) for any one occurrence. Property damage insurance will be in an amount of not less than two hundred thousand dollars ($200,000.00) for any one occurrence and shall include underground exposure. Combined liability insurance will be in an amount of not less than five hundred thousand dollars ($500,000.00) for any one occurrence.

c) A ten thousand dollar ($10,000.00) surety bond in favor of the City, that will be in effect for a period of one (1) year or one (1) year after the completion of work performed by the contractor, whichever is greater.

The Public Works Representative/Engineer shall approve improvement drawings and cut sheets before any work begins. Developers/Contractors proceeding with work without such approvals shall have the project shut down until such approvals are obtained. Repeated offenses may result in the Contractor losing its pre-qualification to perform work in the City. Review time for improvement drawings and cut sheets requires **72 hours** from the time submitted to when the Developer/Contractor may pick them up and begin work. Cut sheets may be submitted once **Finalized Plans** have been stamped and initialed by the Public Works Representative/Engineer.

Section 1.04 PRE-CONSTRUCTION CONFERENCE

A pre-construction meeting with the Developer, Developers Engineer, the Contractor(s) involved in the subdivision construction, and representatives of all utility companies that will provide service to the development shall be held with the Public Works Representative/Engineer, Public Works Inspector, and any other City Personnel deemed necessary prior to commencement of any work. The location of the meeting shall be at the Pleasant Grove City Community Development Office, 86 East 100 South, Pleasant Grove, Utah 84062. The date and time of the conference shall be set up by the Developer and the Public Works Representative/Engineer. A minimum of **72** hours prior to the date and time of the meeting are required to permit notification of all participants. The following items shall be furnished at the meeting:

a) A detailed outline showing the sequences of construction of principle items of work. The outline shall show the beginning and ending dates of the major items of work on the Project.

b) A list of names, titles, addresses, and telephone numbers of the Developer/Contractor's responsible personnel, indicating those who may be reached outside normal working hours.

c) A list of Sub-Contractors and Materials Suppliers to be involved with the project and the items of work they are going to perform or furnish materials for. The City will notify the Developer/Contractor of any concerns or pre-qualification deficiencies of the companies they plan to use.

d) The Developer is responsible to see that Developers Engineer, the Contractor(s), and representatives of each utility company are notified of the date, time and place of the pre-construction conference.

Other items may be discussed at this pre-construction conference as determined by the Public Works Representative/Engineer. Official minutes of this meeting as prepared by the Public Works Representative/Engineer shall become part of the project file for the project.

Section 1.05 TIMELY COMPLIANCE WITH THE ISSUED PERMIT

The Developer/Contractor shall perform in accordance with the terms of the permit and the Standard Specifications and Standard Drawings in effect at the date of the permit. The work shall be done in a timely manner. Time limits may be a condition of the permit and may be shortened because of safety concerns. Permits may be suspended if compliance is not met.

Sub-section A. Inspections:

All work covered by a Public Works permit shall be inspected by a Public Works Representative prior to the following:

1) Backfilling and compacting.
2) Placing concrete and asphalt
3) Placing any underground piping
4) Making any connection into a City utility line
5) Other work done in a public right of way.

Public Works shall also be notified prior to starting any Public Works project.

Sub-section B. Notification of Needed Inspections:

1) Inspection performed during regular working hours requires at least twenty-four (24) hours' notification.
2) Inspections needed on the weekend or City holidays, require that notification be given by 1:00 p.m. on the preceding Friday or day preceding holiday.
3) A charge shall be assessed for inspection call backs.

Sub-section C. Responsibility of the Developer:

The Developer is responsible for the complete development, including construction of the entire subdivision, until it is finalized and accepted by the City.

Sub-section D. Definition of "Public Works Representative/Engineer":

The term "Public Works Representative/Engineer" as used in these specifications refers to the Public Works Director, Public Works Inspector, City Engineer, Public Works staff and others as designated by the Public Works Director.

Sub-section E. Conflict:

These Standard Specifications and Standard Drawings are the minimum requirements of the City of Pleasant Grove. In the event that any provisions herein conflict with general industrial standards, or with other requirements specified by the City, the more stringent of the standards will apply.

Section 1.06 ELECTRONIC AND AS-BUILT DRAWINGS

After completion of all public works improvements the Developer shall provide the City with as-built drawings. **Final payment from the bond shall not be made until the as-built drawings are received. Please refer to Section 1.10 of Chapter 2 for further requirements regarding as-built drawings.**

Section 1.07 TEMPORARY SERVICES

Any temporary services and utilities such as telephone, electrical, water, toilet facilities, etc., shall be the responsibility of the Developer/Contractor.

Section 1.08 CODES AND STANDARDS

Where codes and standards are referred to they shall be current, approved copies. It shall be the duty of the supplier of any material on this work to submit evidence, if requested, that its material is in compliance with the applicable codes and standards.

Section 1.09 STATE AND LOCAL LAWS

The Developer/Contractor shall conform to all applicable state and local laws in carrying out its obligations for the Development or under the Contract.

This shall include, but is not limited to, compliance by the Developer/Contractor with the requirements of Chapter 30, of Title 34, of the Utah Code Annotated, 1953 as Amended. If the provisions of Section 34-30-1, of the Utah Code Annotated, 1953 as amended, are not complied with, further construction of improvements shall stop until compliance is met.

Section 1.10 COMPLIANCE WITH GOVERNMENTAL REGULATIONS

The Developer/Contractor's personnel, equipment, and operations shall comply fully with all applicable standards, regulations, and requirements of existing Federal, Utah State, and Local governmental agencies. This shall include, but not necessarily be limited to, the following:

Sub-section A. United States Occupational Safety and Health Administration Regulations:

Title 29 of the Code of Federal Regulations, Part 1926 (29 CFR Part 1926), Safety and Health Regulations for Construction.

Sub-section B. Utah State Industrial Commission Regulations:

The Utah Occupational Safety and Health Act (1973) and Employer-Employee Safe Practices for Excavations and Trenching Operations (Jan. 1, 1974), as published by the Utah State Industrial Commission, including any and all amendments or revisions effective prior to performance of the work.

Sub-section C. City Ordinances and Codes:

The Developer/Contractor shall be required to comply with all Pleasant Grove City Ordinances and Codes. This shall include, but not be limited to, International Building Code, International Plumbing Code, International Residential Code, International Mechanical Code, International Fire Code, and National Electrical Code – each the latest edition.

Sub-section D. UDOT Requirements:

When crossing or working within Utah Department of Transportation rights-of-way the Developer/Contractor shall be responsible to obtain all necessary permits and comply with all appropriate UDOT regulations including applicable sections in "State of Utah Standard Specifications for Road and Bridge Construction," latest edition.

Sub-section E. Permits:

The Developer/Contractor is responsible to obtain all required business licenses and building permits applicable to this project. Developer/Contractor shall be subject to the conditions of all permits and agreements between the Owner and the permitting agencies. See Division 14, Utah Department of Transportation Rights-of-Way.

Section 1.11 FEDERAL, STATE, AND LOCAL INSPECTING AGENCIES

The site of construction is to be open at all reasonable times and places for periodic observation by accredited representatives of the Federal, State, and local agencies who have regulatory or supervisory authority over any part of the work proposed or regulated thereto.

Section 1.12 PUBLIC SAFETY AND CONVENIENCE

The convenience of the general public and the protection of persons and property is of prime importance and shall be provided for by the Developer/Contractor during this project. The Developer/Contractor shall use every reasonable precaution to safeguard persons and property. Failure of the Owner or the Public Works Representative/Engineer to notify the Developer/Contractor of any deficiencies in providing for public safety and convenience shall not relieve the Developer/Contractor from its responsibility. The Developer/Contractor shall be required to comply with the requirements of the **Manual on Uniform Traffic Control Devices (MUTCD).**

Sub-section A. Compliance with Rules and Regulations:

The Developer/Contractor shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets, or highways, to the use of public traffic. If conditions justify, the Public Works Representative/Engineer may authorize the Developer/Contractor to close general traffic to not more than one (1) City block at any given time. No such closure shall be made without authorization of the Public Works Representative/Engineer. Closure of streets or highways shall be in conformance with the **(MUTCD)**.

Sub-section B. Road Closures and Obstructions:

No road shall be closed by the Developer/Contractor to the public except by express permission of the Public Works Representative/Engineer. The Developer/Contractor shall, at all times, conduct its work so as to insure the least possible obstruction to traffic and normal commercial pursuits.

Sub-section C. Protection of the Traveling Public:

All obstructions within traveled roadways shall be protected by signs, barricades, and lights where necessary for the safety of the traveling public. All barricades and obstructions shall be protected at night by signal lights that shall be suitably distributed across the roadway and kept lit from sunset to sunrise. Barricades shall be of substantial construction. Failure of the Owner or the Public Works Representative/Engineer to notify the Developer/Contractor to maintain barricades, barriers, lights, flares, danger signals, or guards shall not relieve the Developer/Contractor from its responsibility.

Sub-section D. Hazardous Conditions:

Whenever the Developer/Contractor's operations create a hazardous condition, it shall furnish flaggers and guards to give adequate warning to the public of any dangerous conditions to be encountered. It shall furnish, erect, and maintain fences, barricades, signs, lights, and other devices that may be necessary to prevent injury and damage to persons and property. Flaggers and guards shall be UDOT trained and shall hold current certification and shall be equipped with signs, flags, etc. as required by the UDOT regulations.

Sub-section E. Dust and Debris Control:

The Developer/Contractor shall control dust and debris that originates in the construction right-of-way or site. Dust, trash, and other debris shall be controlled on a daily basis by methods that shall include, but not be limited to, the use of a dust settling spray, a "pick-up broom" or street sweeper and trash disposal. Dust shall be controlled such that there will not be unnecessary dust blown into adjacent neighborhoods. The Developer/Contractor shall maintain on the project site a water truck with a minimum two thousand (2,000) gallon capacity. The Developer/Contractor shall be responsible to secure a source of water and shall obtain the necessary permission for its use. Failure by the Developer/Contractor to adequately control dust and debris may result in the Owner initiating dust and debris control measures and deducting the cost from payment due to the Developer/Contractor.

Section 1.13 CONFINEMENT OF WORK AND ACCESS TO RIGHT-OF-WAY AND EASEMENTS

The Developer/Contractor will be required to confine construction operations within the dedicated right-of-way for public thoroughfares or within areas for which construction easements have been obtained unless it has made special arrangements with the affected property owners in advance. The Developer/Contractor will be required to protect stored materials, lawn, trees, and other features located adjacent to the proposed construction site. During construction operations, the Developer/Contractor shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to their residences or places of business for a period exceeding eight (8) hours, unless the Developer/Contractor has made special arrangements with the affected persons prior to commencing work in the area.

Section 1.14 NOTIFICATION OF RESIDENTS

All property owners and residents adjacent to the streets or easements affected by the construction shall be notified by the Developer/Contractor at least forty-eight (48) hours in advance of time construction begins. The Developer/Contractor can satisfy this requirement by placing a written notice on the door of each residence or business reading "Notice of Construction Operation. (Developer/Contractor) will be working on the construction of street

improvements on your street starting about _____." The Developer/Contractor shall provide a copy of the notification form at the pre-construction meeting and the method to be used (hang on door, etc.)

Section 1.15 WEATHER CONDITIONS

In the event of temporary suspension of work, or during inclement weather, the Developer/Contractor will, and will cause its SubDeveloper/Contractors to, protect any project work or materials against damage from the weather. If, in the opinion of the Public Works Representative/Engineer, any Project work or materials become damaged, such work or materials shall be removed and replaced at the expense of the Developer/Contractor.

Section 1.16 LAND MONUMENTS

The Developer/Contractor shall preserve existing City, County, State, and Federal land monuments whenever possible. When these monuments cannot be preserved, the Developer/Contractor shall notify the Public Works Representative/Engineer at least two (2) weeks in advance of the proposed construction in order that the Public Works Representative/Engineer will have ample opportunity to reference these monuments for later replacement.

Section 1.17 SOURCE OF MATERIALS

All materials furnished or incorporated into the work shall conform to the requirements of these Specifications.

The Developer/Contractor shall acquire the necessary rights, at its own expense, to take material from aggregate sources and to use properties for plant site, hauling roads, and other purposes.

The Developer/Contractor may select areas for disposal of surplus materials; however, the Developer/Contractor will be responsible for acquiring the necessary right, at its own expense, to use the property for such purpose.

Section 1.18 CONSTRUCTION WATER

It is the responsibility of the Developer/Contractor to make arrangements for water needed during construction. Water will be needed for moisture conditioning of soil and/or granular materials that are to be compacted, flushing lines of various types, and filling and testing pressure lines. Water to be used in filling, testing and flushing culinary water lines shall come from Pleasant Grove City's culinary water system or other approved potable water source. The Developer/Contractor shall not obtain water from or operate any fire hydrant on the City's culinary water system without first obtaining approval from Pleasant Grove City's Water Department. They shall comply with all requirements of the City including metering or load counts and the time of day water can be taken.

Section 1.19 OPERATION AND MAINTENANCE MANUALS

The Developer/Contractor shall furnish the Public Works Representative/Engineer with two (2) sets of all operation and maintenance manuals, improvement drawings, diagrams, etc., for all pumps, motors, control panels, valves, meters, etc., for use in the Operation and Maintenance Manual.

Section 1.20 INTERFERING STRUCTURES, UTILITIES AND FACILITIES

The Developer/Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. While these structures and utilities may be shown on the improvements plans, the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented simply as a guide to possible difficulties. The Developer/Contractor shall notify all utility offices concerned at least forty-eight (48) hours in advance of construction operations in which a utility agency's facility may be involved. Notification to blue stakes does not necessarily cover all buried lines. This shall include, but not be limited to, irrigation, water, telephone, electric, sewer, storm drain, gas, and cable television. The Developer/Contractor shall be responsible for any and all changes to, relocation of, or re-connection to public utility facilities encountered or interrupted during the prosecution of the work, and all costs relating thereto shall be at the Developer/Contractor's expense. The Developer/Contractor shall contract with and pay Public Utility Agencies for work required in connection with all utility interference's and handle all necessary notifications, scheduling, coordination and details.

It shall be the responsibility of the Developer/Contractor to relocate and expose all existing underground structures and utilities in such a manner as to prevent damage to the same. Any structure or utilities damaged by the Work shall be repaired or replaced at the Developer/Contractor's expense.

If the Developer/Contractor encounters existing structures that will prevent construction, it shall notify the Public Works Representative/Engineer before continuing with the construction in order that the Developer's Engineer or Public Works Representative/Engineer may make such field revisions as necessary to avoid conflict with the existing structures.

Section 1.21 MATERIAL AND COMPACTION TESTING

During the course of the work, a Geotechnical Engineer/Testing Company that has a UDOT certified testing lab shall perform such tests as are required to identify materials and to determine gradation, compaction characteristics, moisture content, density of trench backfill and fills in place, density of imported granular material and road base, concrete strength, density and mixture of asphalt. These tests will be used to verify that the construction conforms to the requirements of the specifications. Such tests are not intended to provide the Developer/Contractor with the information required by it for the proper execution of the work and their performance shall not relieve the Developer/Contractor of the necessity of completing the construction in accordance with these specifications and Standard Drawings.

The estimated cost of such testing will be included in the Developer's bond posted with the City. The estimated cost of such testing shall be 0.5% of the total estimated cost of improvements. The Developer/Contractor shall contract with a geotechnical or certified testing company to perform the necessary tests. The Developer shall pay the actual cost of testing prior to final release of the bond. Copies of the tests will be furnished to the Public Works Representative/Engineer. Developer/Contractor will get copies of the test results from the company performing the tests. Before final release of the bond, the UDOT certified Geotechnical Engineer/Testing Company shall furnish the Public Works Representative/Engineer with a letter certifying that the test results have been in compliance with these Standard Specifications and Drawings and that the recommendations set forth in the geotechnical report were carried out. "Open tests" shall have been retested and/or the resolution thereof specifically addressed in the letter.

Section 1.22 TESTING AND PROCESS CONTROL

The Developer/Contractor has the responsibility to adequately test native materials and construction materials, and to furnish the City with manufacturer's certifications of material quality.

Sub-section A. Quality Assurance:

The Developer/Contractor shall be responsible for all sampling, delivery of samples to a qualified testing agency, testing, and delivery of test results or materials certifications to City at no charge to the City. Testing and certifications reports shall be approved by the City as to conformance to City standard specifications prior to final inspection and/or acceptance by the City of any materials or workmanship.

Sub-section B. Submittals:

Submittals shall consist of two types:

1) Field Test Report: When possible submit original report immediately to Public Works Representative/Engineer, but in no case later than end of the following day.
2) Laboratory Test Report: Submit original report to Public Works Representative/Engineer within 48 hours after test results are determined.

Sub-section C. Sampling:

1) Sampling of materials shall be as specified in each test.
2) The Public Works Representative/Engineer may require that sampling be performed in their presence, in which case the Developer of Contractor shall be notified of this requirement in writing at the time the building permit is issued, or at the Preconstruction meeting, or when construction drawings are released by the City for construction, as applicable.

3) The presence of a Public Works Representative/Engineer shall not relieve the Developer/Contractor of any requirements in this Section.
4) Each sample or test shall be accompanied by the following written data, which shall be reported to the City with test results:
   a) Name of Project
   b) Name of Developer/Contractor
   c) Project Street Address
   d) Appropriate Test Name
   e) Date of Sampling
   f) Sample Number (if more than one sample per day)
   g) Name of technician who performed the testing
   h) Location of sample

Sub-section D. Soil Classification Test:

1) The soil classification test shall be conducted to determine the suitability of native soils for road sub-grade and building foundations.
2) The soil shall be classified according to the Unified Soil Classification System and/or AASHTO soil classifications
3) The AASHTO soil classification test shall conform to AASHTO M-145 of latest revision
4) One soil classification test shall be required for each test area. A test area shall be limited to one parcel of one soil type, a maximum 1,000 feet long and maximum 5 acres. The Public Works Representative/Engineer may modify this requirement on a case by case basis.
5) The soil sample shall be taken from a test area at a minimum depth of 24-inches below the future design grades, of native soil, and shall be free from foreign material, asphalt, concrete, ice or manmade materials.
6) Where deep footings or pile foundations are proposed, soil classification tests at several depths may be required in each test area.
7) The results of all determinations shall be reported to the City in the form of a Geotechnical Report. The geotechnical report shall be certified by a Licensed Professional Engineer qualified in these types of investigations. The geotechnical report shall include, with additions as deemed necessary by the Public Works Representative/Engineer, the following information:
   a) A plot plan showing the location of all test borings and excavations.
   b) Descriptions and classifications of the materials encountered.
   c) Elevations of the water table, if encountered and an opinion of the seasonal fluctuation of the level.
   d) Evaluation of the subsurface soil conditions at the site.
   e) Assess the appropriate engineering characteristics of the subsurface soils.
   f) Provide geotechnical recommendations for general site grading, the design and construction of foundations, basements, concrete floor slabs, and asphalt pavement sections. The report shall include soil strength, bearing capacity, and

provisions to mitigate the effects of expansive soils, collapsible soils, liquefaction, and adjacent loads.

g) Expected total and differential settlement.

Sub-section E. Compaction Test of Soil and Untreated Base Course:

1) Laboratory test to establish maximum laboratory density shall be determined in accordance with AASHTO T-180, Method D or ASTM D 1557.
2) Samples to determine laboratory density shall be taken from the stockpiled backfill or from the un-compacted base course in place.
3) The acceptance of soil and base course with respect to compaction shall be based upon the average density of all density tests taken in any given day.
   a) Field density tests shall be taken as specified in AASHTO T-191 or by use of a portable nuclear density testing device. Field density tests shall be taken at a depth equal to ½ the maximum depth of the lift tested.
   b) Submitted trench test results should show that the tests were taken at different elevations in every trench and at frequent intervals along the trench. A test will be required at 100' intervals at the sub-base level along all trench alignments prior to placing the untreated roadbase.
4) The test results of all samples tested shall be reported to the City. The test results shall be accepted when the average of the density determinations is not less than the density required for that improvement in these specifications and when no one density determination is less than 95% of the density required by these specifications.
5) Compaction tests not meeting the required specifications may be rejected and re-compaction or related construction efforts to obtain compaction shall be at the Developer/Contractor's expense

Sub-section F. Test Roll of Roadway Sub-grade:

1) Roll Test shall be performed when required by the Public Works Representative/Engineer to determine the structural integrity of the sub-grade and street section.
2) The Roll Test shall be performed as follows:
   a) The Developer/Contractor shall provide a loaded 10 wheel dump truck or water truck to drive over the sub-grade material within the roadway.
   b) The loaded truck shall be driven slowly over the sub-grade to locate soft spots in the sub-grade surface.
   c) Soft spots in the sub-grade shall be identified and marked by the Public Works Representative/Engineer.
   d) It shall be the Developer/Contractor's responsibility to remove the rejected sub-grade material to depth determined by the Developer/Contractor's Geotechnical Engineer. The rejected material shall be replaced with A-1 granular backfill material approved by Public Works Representative/Engineer.

Sub-section G. Gradation Test of Untreated Base Course:

1) The gradation of untreated base course shall be determined in accordance with AASHTO T-27
2) The total amount of material passing the No. 200 sieve shall be determined by washing in water in accordance with AASHTO T-11.
3) The acceptance of road base with respect to gradation shall be based upon the average of all determinations in a lot. A lot shall be limited to one source of borrow and limited to one subdivision plat or one development. One sample shall be required for each 500 tons or any fraction thereof of untreated base course in a test lot. When the test lot is less than 100 tons, the requirement for the gradation test may be waived by the Public Works Representative/Engineer.
4) The location of sampling sites within the sub-lot shall be chosen on a random basis by use of a suitable random number table or at the locations designated by the Public Works Representative/Engineer.
5) All material not conforming to the specified gradations may be rejected and replaced with material conforming to the specified gradations at the Developer/Contractor's expense.

Sub-section H. Extraction – Gradation Testing of Bituminous Surface Course:

1) Samples of the bituminous surface course or asphalt concrete shall be tested with respect to gradation and bitumen content in accordance with Utah Department of Highways Test Procedure 8-946 and 8-947 if required by the Public Works Representative/Engineer.
2) Mix design shall be submitted to the Public Works Representative/Engineer for approval 5 working days before work is to begin.
3) Acceptance of bituminous surface course with respect to gradation and bitumen content shall be base upon the average of the determinations made in a lot.
   a) A lot shall equal the amount of bituminous surface course placed in each production day.
   b) When a lot exceeds 500 tons, a minimum of three (3) samples shall be taken in each lot.
   c) When a lot is 500 tons or less, a minimum of two (2) samples shall be taken.
   d) Samples shall be taken at the time of lay-down of bituminous surface course and before compaction. Samples shall be taken from the mat behind the lay-down machine.
   e) Sampling shall be timed to represent the entire production day. The time of day, date or sample, station and offset location shall be clearly marked with the sample.
   f) If the average asphalt is less than 2.5% of optimal content, the Contractor may be required to lay an additional lift, based on the Public Works Representative/Engineer recommendation.

Sub-section I. Compaction Testing of Bituminous Surface Course:

1) Laboratory tests to establish the maximum laboratory density of bituminous surface course shall be determined by the "Marshall Test" in accordance to ASHTM D-1559.
2) Samples to determine maximum laboratory density shall be taken at the time bituminous surface course is placed and before compaction.
3) Acceptance of bituminous surface course with respect to compaction shall be based upon the average determination of field density tests made in a lot.
   a) Field density test shall be by laboratory density analysis of core samples.
   b) A test lot shall be the quantity of surface course placed and compacted in each construction day.
   c) The test lot shall be subdivided into sub-lot(s) of approximately equal size and no larger than 2,000 square yards in area.
   d) The location of sampling sites within the sub-lot shall be chosen on a random basis by use of a suitable random number table or at the locations designated by the Public Works Representative/Engineer.
4) The test lot shall be accepted with respect to density when the average of all density determinations is not less than the density required by Division 11 Section 11.09.
5) Core Tests.
   a) Acceptance of the completed bituminous surface course with respect to thickness shall be based on the average thickness of a test lot.
      1) A test lot shall equal approximately 4,000 square yards of completed roadway.
      2) A lot shall be divided into sub-lots of approximately 2,000 square yards.
   b) One thickness test, randomly selected by use of a random number table or at the locations designated by the Public Works Representative/Engineer, shall be taken within each sub-lot. A minimum of three core tests will be taken.
   c) A lot shall be accepted when the average thickness of all sub-lots is less than 3/8-inch less than the total designated bituminous surface course thickness and when no individual sub-lot shows a deficient thickness of more than 1/2-inch.
   d) Lots or sub-lots that are not acceptable because of deficient thickness shall be brought into compliance by placing additional surface course as directed by the Public Works Representative/Engineer.
   e) The removed core will be replaced with hot asphalt or low strength concrete.

Sub-section J.Compressive Strength Testing of Concrete Cylinders:

1) Samples of concrete shall be taken at the construction site, molded in standard cylinder shapes, allowed to cure, and tested with respect to comprehensive strength.
2) All samples of concrete shall be taken in conformance to AASHTO T-141, latest revision.
3) Acceptance of concrete with respect to compressive strength shall be based upon the average determination of all "compressive strength tests" made in a lot.
   a) A test lot shall be the quantity of concrete placed at one job in a construction day.
   b) A minimum of one "compressive strength test" will be taken of three cylinders for each 50 cubic yards concrete in a test lot, or fraction thereof. If placement is less

than 5 cubic yards, proceed as directed by the Public Works Representative/Engineer.

c) The making and curing concrete test specimens in the field shall conform to AASHTO T-23. Compressive strength of cylindrical concrete specimens shall conform to AASHTO T-22.

4) Concrete may be rejected if desired strengths are not obtained. The concrete for which the tests failed shall be removed and replaced at the Developer/Contractor's expense.

Sub-section K. Additional Concrete Testing:

1) Slump Test: Determine slump in accordance with AASHTO T-27, (ASTM C-143). Use one test for each 50 cubic yards or fraction thereof. Reject concrete failing slump test (see Division 8 Section 8.04, Sub-section B).
2) Air Test: Determine normal weight concrete air content using AASHTO T-152 (ASTM C-231) for each 50 cubic yards or fraction thereof. Light weight concrete air content use ASTM C-173.
   a) If an air test fails, immediately retest the same load (do not mix or add water between tests).
   b) The concrete will be rejected if the second air test does not meet the specification.
   c) If the second air test meets the specification, a third test will be performed to establish concrete acceptance or rejection.
3) When requested by Public Works Representative/Engineer, test in-place concrete by impact hammer, sonoscope, or other nondestructive device.
   a) To determine relative strengths in various locations in Work.
   b) To aid in evaluating concrete strength.
   c) To select areas to be cored.

Sub-section L. Certifications:

1) When requested by the Public Works Representative/Engineer the Developer/Contractor shall obtain a manufacture's certificate certifying conformance to the applicable requirements of these Standard Specifications. Certifications that may be requested are but are not limited to those listed below:
   a) Valves: Gate, Butterfly, Specialty.
   b) Reinforcing Steel.
   c) Structural Steel.
   d) Pipe: Ductile Iron, AWWA C 900 or 905 PVC, Polyvinyl Chloride (Gravity, SDR 35), Concrete, Polyethylene Corrugated, Polyethylene (CTS), and Type K Copper.
   e) Fire hydrants.

Sub-section M. Summary Table of Tests and Certifications:

1) The following is a summary of the tests, number of samples per test, and certificates that are or may be required for construction work and developments in Pleasant Grove

City. This summary is provided as a reference guide. For details governing each item, refer to the appropriate test specification herein.

Test Subject	Specific Test	Number of Tests
Soil Classification	Unified Soil Classification System or AASHTO M-145	1 test per test area of uniform soil type and 5 acres maximum.
Compaction of Embankments, Soil, Trench Backfill and Base Course. Embankments, Soil, and Base Course field density. Trench Backfill field density.	Lab Density - AASHTO T-180 Method D or ASTM D-1557 as applicable. Portable Nuclear Equipment or AASHTO T-191 (ASTM D-2922-96) Portable Nuclear Equipment or AASHTO T-191 (ASTM D-2922-96)	As needed to establish laboratory density. 1 test per sub-lot plus minimum one test per 1,000 cu. Yards. 1 test per sub-lot plus minimum one test per 100 feet of trench.
Test Roll of Roadway Sub-grade	N/A	As required by Public Works Representative/Engineer.
Base Course Gradation	Sieve Analysis – AASHTO T-27 Passing No. 200 Sieve – AASHTO T-11	1 test per 500 tons.
Extraction-Gradation Test of Bituminous Surface Course	UDOT Test Procedure 8-946 & 8-947	If lot is > 500 tons, 3 tests per pavement construction day if lot is < 500 tons, 2 tests per pavement construction day.
Compaction of Bituminous Surface Course	Lab Density-Marshall Test, ASTM D-1559.	1 test per pavement construction day. 1 test per sub-lot (2,000 square yards).
Core Tests	4” Core Sample	1 test per pavement construction day. 1 thickness test per 2,000 square yards or 3 test minimum.
Concrete Test Cylinders	AASHTO T-23 and AASHTO T-22	Minimum of one “compressive strength test” of

Test Subject	Specific Test	Number of Tests
		3 cylinders for each 50 cubic yards in a test lot, or fraction thereof.
Slump Test	AASHTO T-27 (ASTM C-143)	One test for each 50 cubic yards or fraction thereof.
Air Test	AASHTO T-152 (ASTM C-231)	One test for each 50 cubic yards or fraction thereof.
Specialty Valves (Pressure Reducing, Regulating Valves, etc)	Manufacture's Certificate	1 for each valve.
Gate Valve	Manufacture's Certificate	1 for each valve.
Butterfly Valves	Manufacture's Certificate	1 for each valve.
Reinforcing Steel	Manufacture's Certificate	1 for each 1,000 pounds of one grade.
Structural Steel	Manufacture's Certificate	1 for each lot of one shape, one grade.
Pipe: Ductile Iron, AWWA PVC, Polyvinyl Chloride (SDR 25), Concrete, Polyethylene Corrugated	Manufacture's Certificate	1 for each 500 lineal feet of one size, one class.
Polyethylene (CTS) and Type K Copper.	Manufacture's Certificate	1 for each 500 lineal feet of one size, one class

Section 1.23 TELEVISING SEWER MAINS

Prior to the City accepting newly constructed sewers, storm drains, or other gravity flow pipe the Contractor/Developer must provide the City with a DVD of the televising of the line (performed in the presence of the Public Works Representative). The Contractor/Developer shall pay the cost of televising the line. If upon inspection of a manhole it is found that the plywood floor has not been installed, or if it appears that material has been introduced into the sewer pipe line, the Public Works Representative/Engineer may require additional televising of the line prior to final acceptance of the line. The televising equipment used must record on the DVD a continuous distance from the point of beginning.

Section 1.24 INSTALLATION OF UTILITY CONDUITS

Developers shall be responsible to install utility conduits at locations specified by utility companies and approved by the City.

a) Excavation shall be at depth and standards of utility companies.
b) Conduit Pipe shall be approved by each utility company. Utility company engineers shall establish the location of conduits. Conduits shall have bends attached to each end and placed vertically out of the ground for location verification. Conduits within street rights-of-way shall have a minimum of 18" cover below finished street grade. A brass cap stamped with "X" obtained at Public Works shall be installed in the top of the curb at the location where the conduit pipe crosses under the curb.

Section 1.25 PHOTOGRAPHS

It is recommended that the Contractor photograph existing surfaces along which Work may take place prior to construction in order to determine, after construction is completed, whether any damage of existing improvements existed prior to construction operations. The photographs will be an aid in determining the condition of existing facilities and the level of restoration to be made.

DIVISION 2

TRENCH EXCAVATION AND BACKFILL

Section 2.01 GENERAL

This section covers the requirements for trenching and backfilling for underground pipelines. Unless otherwise shown or ordered, pipe shall be laid in an open trench. All incidental clearing, preliminary grading, structure removal, and benching shall be considered a part of the trenching operation.

Section 2.02 BARRICADES

Barriers shall be placed at each end of all excavations, and at such places as may be necessary along excavations, to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from one hour before sunset each day to one hour after sunrise of the next day, until such excavations are entirely refilled, compacted, and surfaced or final graded. All excavations shall be barricaded in such a manner as to prevent persons from walking into, falling into, or otherwise entering those excavations.

Section 2.03 BLASTING

Blasting will not be allowed except by permission from the Public Works Representative/Engineer. The Developer/Contractor shall comply with all laws, regulations, ordinances, and safety codes relative to the handling, storage, and use of explosives. The Developer/Contractor shall be fully responsible for all damage to life and property attributable to its blasting operations. Excessive blasting or overshooting will not be permitted. The Developer/Contractor shall remove any material outside the authorized cross section, which may be shattered or loosened by blasting.

Section 2.04 SHEETING, BRACING AND SHORING OF EXCAVATIONS

Excavations shall be sheeted, braced, and shored as required to support the walls of the excavations. These measures shall be taken to protect the workers, the work in progress, existing utilities, structures, and improvements, from damage due to sliding and settling of trench walls. All such sheeting, bracing, and shoring shall comply with the regulations of the Utah State Industrial Commission, and accident prevention and safety provisions of the Contract.

The Developer/Contractor shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and other systems provided to protect workers. Injury to or death of workers resulting from inadequate trench safety measures shall be the full and complete responsibility of the Developer/Contractor. All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Developer/Contractor, and the Developer/Contractor shall affect all necessary repairs or reconstruction at its own expense resulting from such damage.

Sheeting or shoring that does not extend below the centerline of the pipe may be removed at the discretion and responsibility of the Developer/Contractor after the pipe embedment has been placed and compacted to a level twelve inches (12") above the top of the pipe. Following removal of the sheeting or bracing, the trench shall be immediately backfilled and compacted or consolidated.

Section 2.05 CONTROL OF GROUNDWATER

All trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater is above the bottom of any trench or bell hole excavation, such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. The discharge from excavation dewatering shall be conducted to natural drainage channels, gutters, drains, or storm sewers. Developer/Contractor shall obtain a discharge permit from the state Department of Environmental Quality. Discharge must meet UPDES requirements before entering any natural channel or storm drain system. Such discharge shall be temporary in nature for the construction of the underground utilities. No sanitary sewer shall be used for disposal of trench water. Surface water shall be prevented from entering trenches.

Section 2.06 TRENCH EXCAVATION

Excavation for pipelines shall be located as shown on the Improvement Drawings or as staked in the field. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

Sub-section A. Normal Excavation:

Except in ledge-rock, cobbles, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation four inches (4”) above the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually.

Sub-section B. Authorized Over-Excavation:

Where ledge-rock, cobble rock, stones or other material render the trench material unsuitable for pipe bedding, as determined by the Public Works Representative/Engineer, bedding material shall be imported and placed. The trench shall be excavated to a minimum of four-inches (4”) below the bottom of the pipe after placement in its final position.

Where unstable material is encountered in the excavation, foundation material may be required, as determined by the Public Works Representative/Engineer. In such cases, a

minimum of eight inches (8") below the bottom of the pipe after placement in its final position shall be removed. Over-excavation not ordered, specified, or shown shall be considered to be unauthorized excavation.

Sub-section C. Unauthorized Over-Excavation:

Any excavation carried below the elevation required to install the pipe as specified in these Specifications, or directed by the Public Works Representative/Engineer, shall be considered to be unauthorized. Such excavation shall be backfilled in accordance with these Specifications for "Imported Granular Material" and "Gravel Foundation for Pipelines and Pipeline Structures," all at the Developer/Contractor's expense.

Sub-section D. Trench Width:

The trench shall be excavated such that the pipe is always centered in the trench. The minimum clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus twelve inches (12"). The maximum clear width of trench at the top of the pipe must not be more than the outside diameter of the pipe plus eighteen inches (18"). If a trench is excavated to a greater width, the Developer/Contractor will be required to restore the trench to an acceptable condition by following the steps outlined in these Specifications for "Trenches in Embankments."

Trench width for pipeline structures, valves, or other accessories shall be sufficient to leave at least twelve inches (12") clear between their outer surfaces and the trench. Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with these specifications for "Imported Granular Materials," and "Gravel Foundation for Pipe & Pipeline Structures," at the Developer/Contractor's expense.

Sub-section E. Trenches in Embankments:

Before laying pipes that are to be in fill or embankment areas, the embankment shall first be placed and compacted to the specified density to a depth of not less than two feet (2') above the top of the proposed pipe. After placing and compacting the embankment, the trench for the pipe or conduit shall be excavated through the fill and fine graded and the pipe installed as specified.

Sub-section F. Placement of Excavated Material:

All excess material shall be hauled away from the construction site and disposed of in an area obtained by the Developer/Contractor and approved by the Public Works Representative/Engineer. The Developer/Contractor shall be responsible for all rights-of-way, easements, and access associated with the disposal of excess excavated material. It shall further be responsible to obtain permission from the property owner or person controlling the property where the Developer/Contractor plans to dispose of excavated material. No compensation will be made to the Developer/Contractor for disposal of excess excavated material.

Non-excess excavated material shall be stockpiled in a manner as to cause a minimum of inconvenience to public travel and provide for emergency traffic as necessary, will not endanger the work, and will avoid obstructing sidewalks and driveways. Maintain free access to all existing fire hydrants, water and gas valves, and meters. Maintain clearance for free flow of storm water in all gutters, conduits, and natural water courses. Gutters and irrigation ditches shall be kept clear or other satisfactory provisions shall be made for street drainage and continuity of irrigation.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations. Control of groundwater shall be as specified in section 2.05, Control of Groundwater.

Sub-section G. Fine Grading the Trench Bottom:

The bottom of the trench shall be accurately graded and prepared to provide uniform bearing and support on undisturbed soil or compacted granular bedding at every point along the entire length of the pipe. Bell holes shall be hand excavated after the trench bottom has been fine graded. Bell holes shall be only large enough to permit making the joints and to assure that any portion of the joint or bell does not support the pipe.

Section 2.07 TRENCH BACKFILL

Trench backfill for piping consists of four zones: foundation, bedding, initial backfill, and final backfill. “Pipe embedment” is a commonly used term that refers to the region including the bedding and initial backfill zones, or any region within one foot (1’) of any pipe, pipeline structure, or accessory. The foundation is defined as the region between twelve inches (12”) and four inches (4”) below the bottom of the pipe. The bedding is defined as the region between four inches (4”) below the bottom of the pipe and the bottom of the pipe. The initial backfill is defined as the region between the bottom of the pipe and twelve inches (12”) above the top of the pipe. The final backfill is defined as the region above twelve inches (12”) above the pipe.

All fill materials shall be compacted as specified in this section. The Developer/Contractor shall make arrangements for a source of water during construction and make arrangements for delivery

of water to the site. They shall comply with all local laws and regulations when securing water from a water utility company or other source. The Developer/Contractor shall be responsible for the cost of obtaining and delivery of the water to the site.

The Public Works Representative/Engineer shall determine the suitability of excavated materials for use as foundation, bedding, initial backfill, and final backfill. When the excavated materials are not satisfactory for foundation, bedding, or backfill, the Developer/Contractor shall provide imported granular material.

Sub-section A. Imported Granular Material:

Imported granular material for foundation, bedding, and backfill shall be clean, hard, durable, sound mineral aggregates that consist of crushed rock or gravel, free from sod, vegetation, and other organic or deleterious material. Slag will not be allowed in the pipe embedment. Imported granular material shall conform to the following gradation specifications when tested in accordance with AASHTO T-27 or ASTM C 136:

1) Foundation Material: Shall be 2-inch (2") minus with a maximum of five percent (5%) less than one-half-inch (1/2").

2) Embedment Material:

   i. Ductile-iron pipe - One hundred percent (100%) less than two-inch (2") and maximum of five percent (5%) passing a No. 200 sieve.
   ii. PVC or polyethylene pipe - One hundred percent (100%) less than one-inch (1") and maximum five percent (5%) passing a No. 200 sieve.
   iii. Concrete pipe - Refer to Section 4.06 (Concrete Pipe / Pipe Bedding)

3) Final Backfill Material: This shall be backfill material that is not mechanically graded. It shall be a bank run material free of shale, clay, slag, friable material and debris. It shall be reasonably uniformly graded with one hundred percent (100%) less than three-inch (3") and maximum of fifteen percent (15%) passing a No. 200 sieve.

Sub-section B. Foundation Placement:

When over-excavation is authorized by the Public Works Representative/Engineer, foundation material shall be placed in the foundation zone and below. The foundation material shall be placed so that the trench can be properly fine graded as specified. The foundation material shall be deposited over the entire trench width and compacted in layers. The layers shall have a maximum uncompacted thickness of six-inches (6").

The material shall then be fine graded in accordance with the specification for fine grading herein.

Sub-section C. Pipe Embedment:

Embedment material for other than PVC pipe may be excavated materials consisting of loose earth, sand, or gravel having no material larger than two-inches (2") in any dimension. For PVC pipe, the material must be no greater than-one inch (1") in any dimension. If the excavated materials are not satisfactory, the specified imported granular material shall be used for pipe embedment.

1) Bedding: The bedding material shall be deposited over the entire trench width to a compacted thickness of no less than four inches (4"). The material shall have a maximum uncompacted thickness of six inches (6").

2) Initial Backfill: After the pipe is in place, initial backfill material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe in un-compacted layers not to exceed ten-inches (10") or one-half the diameter of the pipe, whichever is less. Initial backfill material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Initial backfill material shall be scattered alongside the pipe and not dropped into the trench in compact masses.

   That section of the pipe zone from the mid-point of the pipe to twelve inches (12") above the top of the pipe shall then be filled with initial backfill materials and compacted.

Sub-section D. Final Backfill:

Final backfill shall be from twelve inches (12") above the top of the pipe to the level shown on the Standard Drawings. Excavated materials consisting of fines, sand, and gravel shall be used for final backfill. No oil cake, bituminous pavement, concrete, rock, or other lumpy material shall be used in the final backfill unless these materials are scattered and do not exceed six inches (6") in any dimension. Perishable or spongy material shall not be used in final backfilling.

Sub-section E. Clay Dams:

In all areas where ground water is encountered, clay dams shall be constructed at a minimum of every manhole, or more often in steep slopes, to prevent ground water from following the trenches. Clay dams shall be a minimum of two feet (2') thick and be keyed into the bottom and sides of the trench a minimum of one foot (1').

Sub-section F. Compaction:

Backfill shall be compacted by means of sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or mechanical tampers.

Under pavements or other surface improvements the in-place density shall be a minimum of ninety-five percent (95%) of laboratory standard the maximum dry density as determined by AASHTO T-180. In shoulders and other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-180.

Fill material shall be placed at a moisture content and un-compacted lift thickness such that after compaction the required relative densities will be produced. In no event will the material be placed in lifts that, prior to compaction, exceed six inches (6") for foundation and embedment and twelve inches (12") for final backfill.

Prior to compaction each layer shall be evenly spread, moistened, and worked by disk harrowing or other equivalent means.

If the required relative density is not attained, test sections will be required to determine any adjustments in compaction equipment, thickness of layers, moisture content and compactive effort necessary to attain the specified minimum relative density.

Approval of equipment, thickness of layers, moisture content, and compactive effort shall not be deemed to relieve the Developer/Contractor of the responsibility for attaining the specified minimum relative densities. The Developer/Contractor, in planning its work, shall allow sufficient time to perform the work connected with test sections and to permit the Public Works Representative/Engineer to make tests for relative densities.

Section 2.08 TRENCH CROSSINGS AND EASEMENTS

At road crossings or where existing driveways occur on a road, the Developer/Contractor shall make provisions for trench crossings either by means of backfill, tunnels, or temporary bridges.

Any disturbance to property caused by the Developer/Contractor's activity within easements shall be restored to the satisfaction of the owner of the property. If necessary, shrubs, fences, or other objects shall be removed carefully. If work must occur on a lawn, the lawn shall be cut to a width of two feet (2') wider than the intended work area (one foot (1') on each side). The lawn sod shall be stacked separately from and shall not be mixed with other excavated material.

After the sod is removed, if excavation is necessary, the topsoil shall be removed to a depth of twelve inches (12"), or the actual depth of the topsoil, whichever is less. The topsoil shall be stored separately from and shall not be mixed with other excavated material.

Following completion of the backfilling and the compaction of the trench, the Developer/Contractor shall replace topsoil, lawn sod, shrubs, fences, and other items that may have been removed from within the easement area and shall clean up and remove any rocks, dirt or any other debris that remain from the construction work. The Developer/Contractor shall obtain a release from the property owner stating that the repairs have been made to the satisfaction of the Owner. A copy of said release shall be delivered to the Public Works Representative/Engineer.

Section 2.09 RESTORATION OF CONSTRUCTION SITE

During the progress of the Work, the Developer/Contractor shall clean up all construction debris, excess excavation, and excess materials, and shall restore all fences, irrigation structures, ditches, culverts, and similar items. The Developer/Contractor shall stockpile the excavated trench material so as to do the least damage to adjacent grassed areas, or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from grassed and planted areas and these surfaces shall be left in a condition equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign materials.

Section 2.10 OPEN TRENCH IN PUBLIC THOROUGHFARES

Trenches in public thoroughfares, regardless of trench depth, the Developer/Contractor shall safely barricade and limit open trenches to a maximum of 200 lineal feet in the daytime. In traveled roadways a maximum of 80 lineal feet of open trench will be allowed. All pipeline excavations need to be backfilled and compacted within 24 hours. Trenches shall be closed during nighttime conditions by but not limited to backfill and place metal plates over the trench or backfill and place a fence along the trench.

Section 2.11 DEVELOPER/CONTRACTOR RESPONSIBILITY

The Developer/Contractor will be responsible to see that the backfilling and compaction are properly and adequately done. Settlement of trenches within a period of two- (2) years after final acceptance of the project shall be considered incontrovertible evidence of inadequate compaction, and the Developer/Contractor shall be responsible for correcting the condition in accordance with the provisions of these Specifications. This includes the replacement of sidewalk, curb and gutter, and other surface improvements.

DIVISION 3

PRESSURE PIPE
PRESSURE IRRIGATION

Section 3.01 GENERAL

This division covers furnishing and installing pressure irrigation pipe as shown on the Improvement Drawings or established in the field, and all flushing, testing, repairing, as required to ensure adequate and safe operation of the irrigation system.

Section 3.02 DUCTILE IRON PIPE

Sub-section A. Materials:

Ductile iron pipe shall conform to all requirements of ANSI/AWWA C151/A21.51, "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined molds, for Water or Other Liquids." The minimum Pressure Class will be 250. If thickness class pipe is used, the minimum shall be Thickness Class 51.

All pipe shall be made of good quality ductile cast iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the standard.

Install ductile iron pipe with a purple poly sleeve.

Sub-section B. Joints:

1) Mechanical Joints: All mechanical joints and gaskets shall meet the requirements of ANSI/AWWA C111/A21.11. All gaskets shall be smooth and free or porous areas, foreign materials, and visible defects. Gaskets shall be less than one (1) year old.

2) Push-on Joints: All push-on joints and gaskets shall meet the requirements of ANSI/AWWA C111/A21.11. All gaskets shall be smooth and free of porous areas, foreign materials, and visible defects. Gaskets shall be less than one (1) year old.

   Lubricants shall have no deteriorating effects on gasket materials. Lubricants shall conform to ANSI 21.11.

3) Flanged Joints: Flanges, when required, shall conform to ANSI/AWWA C115/A21.15-83. Flanged joints shall meet the requirements of ANSI/AWWA C110/A21.10, "American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch Through 48-inch for Water and Other Liquids." Flanged joints shall be bolted firmly with machine, stud, or cap bolts of proper size. Flanges may be cast integrally with the pipe or may be screwed on a threaded pipe. Flanges shall be faced and

drilled and dimensioned properly for the size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or steel, and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange, and when installed shall be of length so that no more than three-eighths inch (3/8") nor less than one-eighth inch (1/8") extends past the face of the nut. All buried metallic fittings and bolts shall be coated with a non-oxide wax and wrapped with polyethylene.

Gaskets shall be rubber, either ring or full face, and shall be one-eighth-inch (1/8") thick.

Sub-section C. Coatings and Linings for Ductile Iron Pipe:

All exterior surfaces of pipe and fittings shall be coated with hot coal tar at least one (1) mil thick. All interior surfaces shall be cement mortar lined with a standard thickness according to ANSI/AWWA C104/A21.4-80.

Sub-section D. Fittings:

Fittings for ductile iron pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. All fittings shall be Mechanical-Joint-(MJ)-type unless otherwise specified by the Public Works Representative/Engineer. FM grease shall be applied to the threads of the bolts on all fittings.

All fittings shall be incased in polyethylene wrap. Polyethylene encasement of ductile iron pipe shall meet the requirements of ANSI A21.5 or AWWA C105.

Sub-section E. Tracer wire:

All pipe shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The locator wire shall be installed in the pipeline trench approximately 6-inches above the top of pipe. The locator wire shall be brought up in the valve boxes to permit connecting to when doing line location.

Sub-section F. Caution Tape:

All pipe shall include a three-inch (3") caution tape installed in the pipeline trench approximately twelve inches (12") below the ground surface. This tape shall be prepared with white or black printing on a purple field, color Pantone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.

Section 3.03 PVC PIPE

Sub-section A. Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900 (latest revision), "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water" or in accordance with AWWA C909-02, “AWWA Standard for Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. through 24 In. (100 mm Through 600 mm), for Water Distribution.” PVC pipe fourteen-inches (14”) and larger shall be manufactured in accordance with AWWA C905 (latest revision), "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch." All PVC pipe four-inch (4”) and larger shall be dimension ratio (DR) 18 with a working pressure of 150 psi. The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. The pipe shall be “Purple” in color. If the pipe is not “Purple” in color then install it with a purple poly sleeve. Pipe smaller than four-inches (4”) shall be schedule 40 PVC.

Sub-section B. Joints:

Joints shall be the push-on rubber-gasket type. Lubrication shall be water soluble, non-supporting of bacteria growth, and have no deteriorating effect on the PVC pipe or rubber gaskets.

Sub-section C. Fittings:

All fittings to be used with the PVC pipe shall be the same as fittings for ductile iron pipe and shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. All fittings shall be Mechanical-Joint-(MJ)-type unless otherwise specified by the Public Works Representative/Engineer. FM grease shall be applied to the threads of the bolts on all fittings.

Sub-section D. Tracer Wire:

All pipe shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The locator wire shall be installed in the pipeline trench approximately 6-inches above the top of pipe. The locator wire shall be brought up in the valve boxes to permit connecting to when doing line location.

Sub-section E. Caution Tape:

All pipe shall include a three-inch (3”) caution tape installed in the pipeline trench approximately twelve inches (12”) below the ground surface. This tape shall be

prepared with white or black printing on a purple field, color Pantone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.

.Section 3.04 PIPE INSTALLATION

Installation of ductile iron pipe shall be in accordance with ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances. Installation of PVC pipe shall be in accordance with AWWA C900, C905, ASTM D2774, and PVC Pipe, AWWA Manual M23 and with applicable manufacturer's instructions.

Sub-section A. Cutting:

Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. After cutting, the pipe shall be beveled and filed to prevent gasket damage in joint assembly.

Sub-section B. Dewatering of Trench:

Where water is encountered in the trench, it shall be removed during pipe-laying operations until the ends of the pipe are sealed. Developer/Contractor shall obtain a discharge permit from the state Department of Environmental Quality. See "Control of Groundwater" in Division 2 Trench - Excavation and Backfill section 2.05.

Sub-section C. Laying of Pipe:

The pipe and pipe coating (where applicable) shall be inspected for defects before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the Public Works Representative/Engineer.

All pipe shall be laid and maintained to the required lines with fittings and valves at the required locations, as shown on the Improvement Drawings.

All pipe, fittings, and valves shall be moved carefully, either when lowering from the truck, or when placing in the trench. Under no circumstances shall materials be dropped or dumped from the truck or into the trench.

The Developer/Contractor shall take the necessary precautions to ensure that foreign materials do not enter the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed with a water tight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C600 of latest revision, or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by longitudinal bending of the barrel of the pipe rather than deflecting the pipe joints. Longitudinal bending shall be limited to eighty percent (80%) of the manufacturer's recommended minimum bending radius.

Sub-section D. Thrust Blocking and Megalug Joint Restraint:

Thrust blocking and megalug joint restraints shall be applied at all MJ tees, crosses, valves, plugs, caps, and at bends that deflect eleven and one-quarter (11-1/4°) degrees or more. The fitting shall be encased in a 12 mil protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete, having a compressive strength of not less than three-thousand (3000) psi at twenty-eight (28) days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Standard Drawings. The blocking shall be placed so that the pipe and the fittings will be accessible for repair.

Sub-section E. Connections to Existing Water Lines:

Information on the Improvement Drawings regarding existing water lines is taken from "Record Drawings" from the City or utility company files and may or may not be accurate as to size, type of material, or location of those lines. The Developer/Contractor will be responsible to determine the proper fittings and materials required, obtain the Public Works Representative/Engineer's approval of the planned connection, and perform the construction in a suitable fashion.

Section 3.05 PRESSURE IRRIGATION SERVICE CONNECTION

Pressure irrigation service laterals shall be constructed with materials specified and at the locations shown on the Standard Drawings or at the actual location established during construction. This section covers the installation of the service connection from the main to right-of-way line.

Sub-section A. Service Saddle Specifications:

(For use with AWWA C900 C1 O.D. for PVC plastic pipe.)

All service clamps shall be of a "Full encirclement design," and shall be I.D. controlled, which design will eliminate the possibility of pipe crushing due to the over torquing of the nuts upon installation.

A rigid liner shall be used inside of tubing at the compression fitting on a 1-inch single service connection. No rigid liner will be required inside of tubing at compression fittings on 1 1/2-inch or 2-inch service lines.

All service clamps shall be manufactured of brass cast in conformance to AWWA C800, General Section - 1, Paragraph 1.2 (ASTM B62).

The two sides of the clamp shall be held together by high quality Silicon Bronze Hex Bolts (in sizes 1" and over) or Silicon Bronze Slotted Screws (in sizes under 1"), no dissimilar metals shall be allowed at this point thus eliminating the possibility of galvanic corrosion.

All service clamps shall be Mueller Model H-13490 Series and Romac 305 Series for 14" or larger.

Sub-section B. Polyethylene Tubing:

Pipe for the transmission of irrigation water from main to utility box shall be Polyethylene CTS tube. Polyethylene CTS tube shall be manufactured in accordance with the standard specification for Polyethylene PEP plastic tubing as issued by the American Standard for Testing and Materials under ASTM D 2737 and AWWA C901.

Material designation code: Polyethylene
PE 3408

Plastic Extrusion Compound: Type III, class C, Grade 34,
as defined by ASTM D 1248

Standard pipe dimension ratio CTS (SDR) 9 - 200-psi pressure rating.

All tubing for service lines shall be cut and installed in a neat and workmanlike manner by a method recommended by the manufacturer.

Tubing shall be WESTFLEX PE 3408 Gold Label or equivalent.

Sub-section C. Compression Connection:

1) The interior surface of the coupling nut, including threads, shall have a baked on, fluorocarbon coating to reduce assembly friction and prevent the gasket from turning and twisting during tightening. The nut shall bottom on a cast or machined shoulder on the body when properly assembled. This design will provide a visual check to assure connection is properly assembled.

2) The sealing gasket shall be of molded synthetic rubber (ASTM D2000) with molded in place bronze spring (ASTM A134 Alloy #6) to eliminate the possible cold flow of the gasket between the pipe and fitting. A gripper band of hardened stainless steel (ANSI Type 401) shall be fitted into the gasket. When the gasket is compressed it will cause the gripper ring to distort the pipe giving the fitting a high resistance to

pull out. The gripper band shall overlap itself to prevent cold flow of the gasket into the cavity under the band.

3) When Mueller 110 compression fittings are used with P.E. Pipe, Stainless Steel pipe stiffeners are required to eliminate cold flow of plastic pipe.

4) All fittings are to be for CTS Polyethylene pipe.

5) The Minimum pull out load for the fitting when used with PE plastic pipe shall be as follows for each given size:

SIZE	MINIMUM PULL OUT (FT.LBS.)
1”	400
1½”	500
2"	500

MUELLER 110 COMPRESSION COUPLINGS AND FITTINGS OR EQUIVALENT ARE TO BE USED ON ALL P.E. PLASTIC PIPE INSTALLATIONS.

Sub-section D. Service Fittings:

All service fittings such as brass tees, and brass ells shall be Mueller Insta-Tite connections or equivalent.

Sub-section E. Ball Straight Service Valve:

All components shall be manufactured of brass cast in conformance to AWWA C-800, General Section -1, paragraph 1.2. The valve shall have a strong, reliable ball/stem connection that provides strong, reliable performance and resists breakage. The stem design must be totally blow-out-proof to prevent separation and assure dependable, safe operation. The stem shall have double O-ring seals supported in precision machined grooves and provide secure, leak-tight sealing. The end pieces shall be O-ring sealed to provide additional protection against leaking. The ball shall be manufactured of 85-5-5-5 waterworks brass; no other composition will be accepted. The ball shall be fluorocarbon coated for ease of operation. The valve shall be quarter turn valve and the fully open and closed positions shall be controlled by check lugs integrally cast on body to assure positive action. The valve shall have a lock wing to permit locking the valve in the closed position. The Inlet shall be a compression connection and the Outlet shall be F.I.P. thread.

All brass castings shall conform to ASTM B62, latest revision, Standards for composition brass or ounce metal castings of 85-5-5-5. The valve shall be manufactured and tested in accordance with ANSI/AWWA C800, latest revision. A notarized certificate stating compliance with the Standards may be required. All component parts,

body, key, washer, nut and tube nut, shall have the same metal analysis. The valve must maintain a working pressure of 300 PSIG.

All fittings are to be CTS (Copper Tube Size) size, used on CTS Polyethylene pipe. No IPS polyethylene pipe or fittings are to be used.

Ball straight service valve shall be MUELLER B-25172, 110 Conductive Compression Connection by F.I.P thread.

Sub-section F. Service Box:

Service box shall be an 11 3/4-inch by 16-inch standard green, fiberglass irrigation box with cover. Service box shall be installed over the Ori-Seal valve and hose bib. A sign shall be attached or embossed to or on the cover indicating as follows: "IRRIGATION." Box shall be Brooks 1419 series utility box with lid recessed and shall be provided with Waterworks Pentagon Head locking device or equivalent.

Sub-section G. PVC Pipe:

Pipe for the transmission of irrigation water from the PVC MIPT adapter to the homeowner's property line shall be Schedule 40 PVC pipe. Pipe shall be manufactured to meet the requirements of Materials - ASTM D1684, Product Design ASTM D1685, and Cell Class - ASTM D12454A. Joints shall be of solvent weld type recommended by the manufacturer of the pipe. A solvent weld cap will be installed on the end of the pipe near property line. No joints will be allowed under sidewalks or other paved surfaces.

Sub-section H. Hose Bib:

All hose bibs used in the service connection assembly shall be a 3/4-inch NIBCO, Figure No. 74, Boiler Drain or equal.

Sub-section I. Location of Stub Pipes:

A brass cap stamped with "PI" obtained at Public Works shall be installed in the top of the curb at the location where the pressure irrigation service crosses under the curb.

Sub-section J.Service Pipe Installation:

The polyethylene service pipe shall be installed by use of a "Hole Hog" or other similar device under all existing paved surfaces. Where subsurface materials or conditions will not permit installation by this method, open trenching will be permitted with the approval of the Public Works Representative/Engineer. Open trenching will be used in new streets not yet paved.

Section 3.06 TESTING AND FLUSHING

All newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure test. A leakage test shall be conducted concurrently with the pressure test. All new lines, and extensions therefrom, shall be flushed thoroughly before being placed into service.

Sub-section A. Pressure Test:

If the pipe section being tested includes concrete thrust blocking, the concrete shall be allowed at least twenty-four (24) hours to set before any testing is conducted.

1) Test Pressure Restrictions: Test pressures shall,

   i. Be at least 1.5 times the working pressure at the highest point along the test section, but not less than 200 psi.
   ii. Not exceed the pressure rating of the pipe.
   iii. Be of at least 2 hour duration.
   iv. Not vary by more than plus or minus five ($\pm$ 5) psi for the duration of the test.
   v. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
   vi. Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

2) Pressurization: Each valved section of pipe shall be filled slowly with water to the specified test pressure. Pressurization of the pipe shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Public Works Representative/Engineer.

3) Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Developer/Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.

4) Examination: All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the pressure test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the

pipeline and subsequent pressure testing shall be repeated as necessary for the pipeline to pass the pressure test.

Sub-section B. Leakage Test:

A leakage test shall be conducted concurrently with the pressure test.

1) Leakage defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2) Allowable leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{133{,}200}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure (gage) during the leakage test, in pounds per square inch. See Table 1.

i. Allowable leakage at various pressures is shown in Table 1.

TABLE 1
Allowable Leakage per 1000 ft of Pipeline - gph

Average Test Pressure psi	Nominal Pipe Diameter—in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	0.	0.	0.	0.	1.	1.	1.	1.	2.	2.	2.	3.	4.	4.	5.	6.

(16)	34	45	68	90	13	35	58	80	03	25	70	38	05	73	41	03
200	0.	0.	0.	0.	1.	1.	1.	1.	1.	2.	2.	3.	3.	4.	5.	5.
(14)	32	43	64	85	06	28	48	70	91	12	55	19	82	46	09	73
175	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	2.	2.	3.	4.	4.	5.
(12)	30	40	59	80	99	19	39	59	79	98	38	98	58	17	77	36
150	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	2.	2.	3.	3.	4.	4.
(10)	28	37	55	74	92	10	29	47	66	84	21	76	31	86	41	97
125 (	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	2.	2.	3.	3.	4.	4.
9)	25	34	50	67	84	01	18	34	51	68	01	52	02	53	03	53
100 (	0.	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	2.	2.	3.	3.	4.
7)	23	30	45	60	75	90	05	20	35	50	80	25	70	15	60	05

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

**To obtain leakage in liters/hour, multiply the values in the table by 3.785.

ii. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.

iii. When hydrants are in the test section, the test shall be made against the closed hydrant.

3) Examination: All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the leakage test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent leakage testing shall be repented as necessary for the pipeline to pass the leakage test.

4) Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than specified, the Developer/Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

Sub-section C. Flushing:

Flushing shall be accomplished through temporary flushing valves, or end of line blow-off assemblies at a minimum flushing velocity of two and one-half feet per second (2.5 fps). Flow volumes to produce this velocity are shown in the following chart:

FLOW RATE AND OPENINGS TO FLUSH PIPELINES (40 psi Residual Pressure)	
Pipe Size (inches)	Flow Required to Produce 2.5 fps velocity (gpm)
2	26
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525
30	5,507
42	10,800
48	14,100

DIVISION 3A

PRESSURE PIPE
CULINARY WATER

Section 3A.01 GENERAL

This Division covers furnishing and installing pressure pipe to the lines and grades shown on the Improvement Drawings and/or established in the field, and all flushing, testing, repairing required to ensure adequate and safe operation of the water system. Ductile iron pipe shall be used in all areas of the city unless a soil corrosivity evaluation, as reviewed and approved by the City Public Works Representative/Engineer dictates otherwise. All culinary water lines shall be a minimum of 8-inch diameter.

Section 3A.02 DUCTILE IRON PIPE

Sub-section A. Materials:

Ductile iron pipe shall conform to all requirements of ANSI/AWWA C151/A21.51, "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined molds, for Water or Other Liquids." Minimum rated working pressure will be 250 psi for pipes larger than 12-inch diameter. Pipes of 12-inch diameter and smaller shall have a rated working pressure of 350 psi. The Thickness Class for pipes of diameters from 4-inches through 20-inches shall be minimum 51 and pipe 24-inch diameter and larger shall be minimum 50.

All pipe shall be made of good quality Ductile Cast Iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the standard.

Sub-section B. Joints:

1) Mechanical Joints: All mechanical joints shall meet requirements of ANSI/AWWA C111/A21.11. All gasket surfaces shall be smooth and free from imperfections. Gaskets shall conform to tests in accordance with specifications and shall be less than one year old.

2) Push-on Joints: All push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11. Gaskets shall be free from defects and not over one year old.

   Lubricants shall be non-toxic and have no deteriorating effects on gasket materials. It shall not impart taste to water in a pipe. It shall conform in every way to ANSI 21.1

3) Flanged Joints: Flanges shall meet the requirements of ANSI/AWWA C110/A21.10, "American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch Through

48-inch for Water and Other Liquids." Flanged joints shall be bolted firmly with machine, stud or cap bolts of proper size. Flange maybe cast integrally with the pipe or may be screwed on threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or metal steel and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange and when installed shall be of length so that no more than 3/8-inch nor less than 1/8-inch extends past face of nut. All buried fittings having steel bolts shall be coated with a non-oxide wax and wrapped with polyethylene.

Gaskets shall be rubber, either ring or full face, and are 1/8th-inch thick. A gasket for each flanged joint of proper size as shown on the Improvement Drawings.

Sub-section C. Coatings and Linings for Ductile Iron Pipe:

All exterior surfaces of pipe and fittings shall be coated with hot coal tar approximately 1 mil thick. All interior surfaces shall be cement mortar lined with a standard thickness according to ANSI/AWWA C104/A21.4-80.

Sub-section D. Corrosion Protection and Soil Tests:

All pipe and fittings shall be incased in polyethylene wrap. Polyethylene encasement of ductile iron pipe shall meet the requirements of ANSI A21.5 or AWWA C105.

Sub-section E. Flanges:

Flanges when required shall conform to ANSI/AWWA C115/A21.15-83.

Sub-section F. Fittings:

Fittings for Ductile Iron Pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. FM grease shall be applied to the threads of the bolts on all fittings.

Sub-section G. Tracer wire:

All pipe shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The locator wire shall be installed in the pipeline trench approximately 6-inches above the top of pipe. The locator wire shall be brought up in the valve boxes, installed along lines to fire hydrants, and be fastened to each fire hydrant to permit connecting to when doing line location.

Sub-section H. Caution Tape:

All pipe shall include a three-inch (3") caution tape installed in the pipeline trench approximately twelve inches (12") below the ground surface.

Identification tape shall be furnished with white or black printing on a colored field having the words:

CAUTION: POTABLE WATER - BELOW.

Section 3A.03 PVC PIPE

Sub-section A. Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900-(latest revision), "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water". The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. PVC pipe 14 inches and larger shall be manufactured in accordance with AWWA C905 (latest revision), "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch". All PVC pipe 4-inch and larger shall be DR. 18 with a working pressure of 150 PSI. Pipe smaller than 4-inch shall be schedule 40 PVC.

Sub-section B. Joints:

Joints shall be push on rubber gasket type. Lubrication shall be water soluble, non-toxic, non-objectionable in taste and odor imparted to the water, non-supporting of bacteria growth, and have no deteriorating effect on the PVC pipe or rubber gaskets.

Sub-section C. Fittings:

All fittings to be used with the PVC pipe shall be the same as fittings for Ductile Iron Pipe and shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58.

Sub-section D. Tracer wire:

All pipe shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The locator wire shall be installed in the pipeline trench approximately 6-inch above the top of pipe. The locator wire shall be brought up in the valve boxes to permit connecting to when doing line location.

Sub-section E. Caution Tape:

All pipe shall include a three-inch (3") caution tape installed in the pipeline trench approximately twelve inches (12") below the ground surface.

Identification tape shall be furnished with white or black printing on a colored field having the words:

CAUTION: POTABLE WATER - BELOW.

Section 3A.04 PIPE INSTALLATION

Installation of ductile iron pipe shall be in accordance with ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances. Installation of PVC pipe shall be in accordance with AWWA C900, C905, ASTM D2774, and PVC Pipe, AWWA Manual M23 and with applicable manufacturer's instructions.

Sub-section A. Cutting:

Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. After cutting, the pipe shall be beveled and filed to prevent gasket damage in joint assembly.

Sub-section B. Dewatering of Trench:

Where water is encountered in the trench, it shall be removed during pipe laying operations and the trench so maintained until the ends of the pipe are sealed. See "Control of Groundwater" in Division 2 Trench - Excavation and Backfill.

Sub-section C. Laying of Pipe:

The pipe and pipe coating (where applicable) shall be inspected for defects before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the Public Works Representative/Engineer.

All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations. The bottom of the trench shall be cut flat, true and even to provide uniform bearing for the full length of the pipe barrel. The pipes shall be installed with a 48-inch minimum cover from finished road surface for culinary water. The Developer/Contractor shall be responsible to install the pipe line to the alignment set by the Public Works Representative/Engineer or as shown on the Improvement Drawings.

All pipes, fittings and valves shall be carefully lowered from the truck when unloading or when installing into the trench. This should be done one piece at a time in order to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped from the truck or into the trench.

The Developer/Contractor shall take the necessary precautions such that foreign materials do not enter into the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed by a watertight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C600, latest revision, or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by longitudinal bending of the barrel of the pipe rather than deflecting the pipe joints. Longitudinal bending shall be limited to eighty percent (80%) of the manufactures recommended minimum bending radius.

Sub-section D. Separation:

Maintain separation of water main from sewer piping in accordance with the current Plumbing Code and Utah Division of Drinking Water Standards. A minimum of eighteen-inch (18") vertical and ten-foot (10') horizontal separation shall be maintained unless the Division of Drinking Water R309-211-7 grants an exception.

Sub-section E. Pipe Bedding:

All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

In the event trench materials are not, in the judgement of the Public Works Representative/Engineer, satisfactory for pipe bedding, imported granular bedding will be required. See Division 2 of these specifications.

Sub-section F. Thrust Blocking and Megalug Joint Restraints:

Thrust blocking and megalug joint restraints shall be applied at all MJ tees, crosses, valves, plugs, caps and at bends deflecting 11 1/4º or more. The fitting shall be encased in a 12 mil protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete having a compressive strength of not less than 3000 pounds per square inch at 28 days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Standard Drawings. The blocking shall be so placed that the pipe and the fittings will be accessible for repair.

Sub-section G. Connections to Existing Water Lines:

Information on the Improvement Drawings regarding existing water lines is taken from "Record Drawings" from the City or utility company files and may or may not be accurate as to size, type of material or location. The Developer/Contractor will be responsible to determine the proper fittings and materials required, obtain the Public Works

Representative/Engineer's approval of the planned connection, and perform the construction in a suitable fashion. Where fitting sizes, such as tees and crosses, are shown on the plans, those sizes will be used. However, no attempt has been made to show all needed fittings or materials.

Section 3A.05 WATER SERVICE LATERALS

Water service laterals shall be constructed with materials specified and at the locations shown on Improvement Drawings, the Standard Drawings or at the actual location established during construction. The service line shall be 90^0 to the property line five feet (5') uphill of the center of the lot.

Pipe for water service laterals shall be one-inch (1") Type K-soft copper tubing or larger, complying with ASTM Specification B88, or one-inch (1") type PE 3408 polyethylene tubing complying with ASTM D2737. Pipe for water service laterals 3" and greater shall be Ductile Iron Pipe.

Sub-section A. Extent of Laterals:

New water service laterals shall extend from the water main to the property line, bend vertical and terminate eighteen inches (18") below finished grade. Water services shall not have any joints between the corporation stop at the main and the ball valve. The end of the service shall have a brass ball valve, Watts, Apollo or equivalent, installed. Care shall be taken in bending the copper tubing to form a smooth uniform bend. If the tubing is "kinked" it shall be removed and replaced. The open end of the ball valve shall be covered with electrical tape or duct tape. The handles shall be removed from each valve and given to the City Water Department. There shall be a minimum of one handle per ball valve.

The location of each service lateral shall be marked by placing a 2 x 4 marker at the end of the pipe and extending vertically from the end of the pipe to a minimum of 15-inches above the top back of sidewalk. The portion of the marker extending above ground shall be painted blue.

Existing water service laterals relocated during construction of new pipelines shall extend from the water main to the water meter.

Sub-section B. Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Division 2. Bedding shall meet the requirements of Division 2.

Sub-section C. Connection to Main:

Connections of services to main lines shall be direct tap on ductile iron mains and through a double strap cast iron service saddle on PVC mains, corporation type stop and 24-inch gooseneck formed with the tubing. All connections shall be made using pack joint (compression) type fittings. The service saddle shall be a Ford F-202 double strap, service saddle with one-inch (1") IPT outlet or equivalent. The corporation stop shall be a one-inch (1") Mueller H-15008 for copper tubing or a one-inch (1") Mueller H-15009 for polyethylene tubing "CC" thread for direct tap and a Ford Pack joint F-1100 for copper tubing or a Ford Pack joint F-1101 for polyethylene tubing for service saddle tap. All joints on the polyethylene tubing shall have a stiffener installed.

On existing services the existing connection to main will be used unless damaged or leaking.

Sub-section D. Meter, Meter Box and Cover:

The double check valve, meter, meter box and cover shall be furnished and installed by City Water Department crews. The service line shall be installed from the house to where the service line was stubbed from the water main, a thirty-inch (30”) diameter hole excavated where the meter is to be installed prior to City crews installing the meter. No meters shall be located in sidewalks or driveways.

The Developer/Contractor shall furnish the meter box and cover for meters larger than one-inch (1”). The materials and type of box shall be approved by the Public Works.

Sub-section E. Special Joints and Fittings:

1) Solder and Sweat Joints: Joints in copper tubing shall be made by the appropriate use of approved brass or copper fittings. The surface to be joined by soldering shall be thoroughly cleaned bright by manual or mechanical means. The joints shall be properly fluxed with an approved non-corrosive type flux and made up with approved solder. All solders and fluxes shall not have a lead content that exceeds current EPA guidelines.

2) Copper Tubing to Screw Pipe Joints: Joints from copper tubing to threaded pipe shall be made by the use of brass adapter fittings.

Sub-section F. Separation:

The water service line and sewer lateral shall be separated **horizontally** a minimum of ten-feet (10’). Where this separation is not possible water service lines may be laid in the same trench as the building sewer lateral only if the water service line is placed on a solid shelf excavated at one side of the common trench. At all locations there shall be at least twelve (12) inches of separation **horizontally and vertically** above the sewer lateral.

Sub-section G. Location of Stub Pipes:

A brass cap stamped with "W" obtained at Public Works shall be installed in the top of the curb at the location where the culinary water service crosses under the curb.

Sub-section H. Flushing, Testing and Disinfecting:

Flushing, testing and disinfecting shall be done at the time the water main is flushed, tested and disinfected. The ball valve shall be left exposed to allow for discharging water out of the service line for proper flushing and to insure that the line has been adequately disinfected. The line shall be flushed thoroughly following installation. Flushing, testing and disinfecting shall conform to the applicable paragraphs of this division.

On existing services the Developer/Contractor shall take precautions to prevent contamination of the pipe and connections during installation. The line shall be flushed thoroughly following installation.

Section 3A.06 DAMAGE AND REPAIR OF WATER MAINS AND APPURTENANCES:

The Developer/Contractor shall be responsible for any damage to water mains and water facilities caused by his operations. The Developer/Contractor may be relieved of the responsibility under the following conditions:

1) He has not excavated below or beyond the required excavation lines, and
2) He has given proper and timely notice of his work plans, and
3) He has used reasonable care, and cooperated, minimizing the damage.

Any damage to water lines, valves, valve boxes, hydrants, and other surface appurtenances that result from the Developer/Contractor's operation shall be its sole responsibility.

Section 3A.07 FLUSHING, DISINFECTING, AND TESTING

Sub-section A. Flushing:

All new water systems or extensions to existing systems shall be thoroughly flushed before being placed in service. Flushing shall be accomplished through hydrants, or end of line blow-off assemblies at a minimum flushing velocity of 2.5-feet per second. See chart below.

FLOW RATE AND OPENINGS TO FLUSH PIPELINES (40- psi Residual Pressure)

Pipe Size (inches)	Flow Required to Produce 2.5 fps velocity (gpm)
2	26
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525
30	5,507

Sub-section B. Disinfection:

After flushing, all culinary water lines shall be disinfected by chlorination. Chlorination shall provide a minimum of 25 ppm residual after 24 hours contact in the pipeline. This may be expected with an application of 50 ppm, although some conditions may require more. Chlorine in the form of a 1% slurry of high-test calcium hypochlorite (HTH, Perchloron, Pittchlor, etc. which are 70% available chlorine by weight) shall be fed into the pipeline in such a manner as to mix with the water flowing in the pipeline. (A 1% slurry - 10,000 ppm - results from mixing one pound of calcium hypochlorite with 8.40 gallons of water.) The following table provides information as to the required quantity of slurry to be used per 100 feet of pipe to provide a chlorine concentration of 50 ppm:

Pipe Size (in.)	Vol. of 100 ft. Length (gal)	Required Amount of 1 % Chlorine Slurry (gal)
1 ½	9.18	0.07
2	16.32	0.12
2 ½	25.50	0.18
3	36.73	0.26
4	65.28	0.47
6	146.90	1.05
8	261.10	1.87
10	408.10	2.92
12	587.60	4.20

During the process of chlorinating the pipeline, operate all valves and other pipeline appurtenances several times to provide sufficient contact with the chlorinating agent. Following chlorination, drain and thoroughly flush the water line according to Section A above.

Disinfection shall conform to the requirements of AWWA C651 (latest edition): AWWA Standard for Disinfecting Water Mains and Rule R309-550. Facility Design and Operation: Transmission and Distribution Pipelines of the Utah Division of Drinking Water.

The Developer/Contractor shall provide 3 copies of the Disinfection Report that includes:

1. Date issued.
2. Project Name and Location
3. Treatment Contractor's name, address, and phone number
4. Type and form of disinfectant used.
5. Time and date of disinfectant injection started.
6. Time and date of disinfectant injection completed.
7. Test locations.
8. Initial and 24 hour disinfection residuals in ppm for each outlet tested.
9. Time and date flushing started.
10. Time and date flushing completed.
11. Disinfectant residual after flushing in ppm for each outlet tested.

Sub-section C. Bacteriological Test:

The Developer/Contractor is responsible to submit and pay for the bacteriological test. Re-chlorinate the water line and retest the water, if necessary, until the results of the bacteriological test are satisfactory. Bacteriological tests shall be as follows:

1. No samples for testing shall be taken sooner than 24 hours after system flushing.
2. Sample water at each of the following locations, as applicable: where water enters system, ends of pipe runs, and remote outlets
3. Analyze water samples in accordance with State of Utah Requirements.
4. After final flushing and before the new water line is connected to the distribution system, two (2) consecutive sets of acceptable samples, taken at least 24 hour apart, shall be collected for the new line. At least one set of samples shall be collected from every 1200 feet of new water line, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show the absence of coliform organisms. Provide three (3) copies of the report to the Public Works Director.

The Bacteriological Report shall include:

1. Date issued.
2. Project name and location.
3. Laboratory's name, certification number, address, and phone number.
4. Time and date of water sample collection.
5. Name of person collecting samples.
6. Test location.
7. Time and date of laboratory test start.
8. Coliform bacteria test results for each outlet tested.
9. Certification that water conforms or fails to conform to bacterial standards of State of Utah Public Drinking Water Regulations.
10. Bacteriologist's signature.

Sub-section D. Pressure Test:

All newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure. A leakage test shall be conducted concurrently with the pressure test.

1) Test Pressure Restrictions: Test pressures shall,

   i. Be at least 1.5 times the static pressure at the highest point along the test section, but not less than 200 psi.
   ii. Not exceed pipe or thrust restraint design pressures.
   iii. Be of at least 2-hour duration.
   iv. Not vary by more than plus or minus five (± 5) psi for the duration of the test.
   v. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
   vi. Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

2) Pressurization: Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Public Works Representative/Engineer.

3) Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Developer/Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.

4) Examination: All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound materials and the test shall be repeated until it is satisfactory to the Owner.

Sub-section E. Leakage Test:

A leakage test shall be conducted concurrently with the pressure test.

1) Leakage Defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2) Allowable Leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{133{,}200}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gage.

i. Allowable leakage at various pressures is shown in Table 1.

ii. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.

iii. When hydrants are in the test section, the test shall be made against the closed hydrant.

TABLE 1
Allowable Leakage per 1000 ft of Pipeline - gph

Average Test Pressure psi	Nominal Pipe Diameter—in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

**To obtain leakage in liters/hour, multiply the values in the table by 3.785.

3) Examination: All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the leakage test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent leakage testing shall be repented as necessary for the pipeline to pass the leakage test.

4) Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than specified, the

Developer/Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

DIVISION 4

CONCRETE PIPE

Section 4.01 GENERAL

This section covers the requirements for concrete pipe materials and installation in sanitary sewer, storm drain, and other gravity line construction. Concrete Pipe Manufacturers supplying precast concrete pipe shall be certified by the American Concrete Pipe Association (ACPA) "Quality Cast" Plant Certification. Any pipe installed through back or side yards of properties, or in locations where trees are proposed or exist in proximity to the pipe, must be of fused joint construction to prevent root intrusion.

Section 4.02 PIPE

Concrete pipe used in sewer line, storm drain line and other gravity line construction that is under concrete or asphalt improvements within City right-of-ways shall be reinforced concrete pipe. Non-reinforced concrete pipe shall be allowed on projects outside the improved right-of-ways. The Public Works Director/Engineer can approve exceptions to the pipe specifications on a case by case basis.

Sub-section A. Reinforced Concrete Pipe:

All reinforced concrete pipe used in the construction shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C76 **(minimum Class III.)** Pipe class shall be as shown on the Improvement Drawings. The minimum joint length of all pipes provided shall be 7 1/2 feet.

Sub-section B. Non-Reinforced Concrete Pipe:

All non-reinforced concrete pipe used in the construction shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C14. Pipe class shall be as shown on the Improvement Drawings. The minimum joint length for pipe shall be four feet for pipe up to ten inches and seven and a half feet for all other pipe.

Sub-section C. Bell and Spigot Joints:

Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM Designation C443. The pipe joint shall be so designed as to provide for self-centering, and when assembled, to compress the

gasket to form a water tight seal. The gasket shall be confined in a groove on the spigot, so that pipe movement or hydrostatic pressure cannot displace the gasket.

Sub-section D. Minimum Size and Slope Requirements:

In no case shall sanitary sewer mains be less than eight inches in diameter. Sewers shall be laid with uniform slope between manholes. All sewers shall be designed and constructed to give mean velocities of not less than 2 feet per second when flowing full, based on Manning's formula using an n value of .013. Absolute minimum slope allowed shall be those published by the Utah Department of Environmental Quality, Division of Water Quality as Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal System, R317-3, **Table R317-3-2.3 (D)(4) Minimum Slopes**.

Whenever possible the slope should exceed 0.006 ft/ft. The pipe should be sized to meet anticipated hydraulic loads, increasing the pipe size to reduce the minimum slope requirements shall not be allowed. Sewer slopes shall not exceed 0.12 ft/ft, drop manholes shall be used when steeper slopes are needed, drop manholes shall be used to keep line grade below maximum grade allowed.

Section 4.03 PIPE LAYING

Concrete pipe shall be installed in accordance with ASTM C1479. All concrete pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted. Rubber gaskets shall be fitted properly in place, and care shall be taken in joining the pipe sections to avoid twisting of gaskets. Joints shall be clean and dry, and a joint lubricant as recommended by the pipe supplier shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

Section 4.04 GRAVEL FOUNDATION FOR PIPE

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, or where groundwater must be drained, the subgrade

shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for concrete pipe foundation shall be clean crushed rock or gravel with one hundred percent (100%) less than two-inch (2") and a maximum of five percent (5%) less than one-half-inch (1/2"). In areas where soil migration may occur, a filter fabric shall be installed to separate the gravel materials from the native soils.

Section 4.05 INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All concrete pipes shall be installed accurately to the defined line and grade with the following limits. No reverse grades or bellies are allowed:

Alignment Tolerances	
Design Grade	Max. Line & Grade Deviation
	inches/100 feet
> 1 %	1 1/2
≤ 1 %	1
< 0.5 %	± 0.5

The variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, shall not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (1/2) inch maximum.

Section 4.06 PIPE BEDDING

All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

The trench bottom shall be excavated or filled and compacted to an elevation such that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the mid-point of the pipe shall be deposited and compacted in layers not to exceed ten inches (10") in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench in such a manner that they will be scattered alongside the pipe and not dropped into the trench in

compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than two-inch (2") diameter. All materials shall be free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve inches (12") above the top of the pipe.

Modified bedding material shall be graded as follows: One-hundred percent (100%) passing a one and one-half inch (1-1/2") screen and a maximum of five percent (5%) passing a No. 4 sieve.

Section 4.07 TESTS

On all sewer main lines the Developer/Contractor will be required to conduct an air test and displacement test and televise the sewer main in the presence of the Public Works Representative/Engineer or his representative prior to any partial bond release. The lines must be televised again at the completion of the project before beginning of the warranty period. Also, if at the end of the warranty period concerns arise about the condition of the pipelines additional televising may be required prior to release of the warranty. If these tests prove to be inconclusive, any or all of the other required tests shall be conducted in the presence of the Public Works Representative/Engineer or his representative.

For storm drain and other gravity lines, the Developer/Contractor will be required to conduct a displacement test in the presence of the Public Works Representative/Engineer or his representative and televise the storm drain line or other gravity line prior to any partial bond release. The lines must be televised again at the completion of the project before the beginning of the warranty period. Also, if at the end of the warranty period concerns arise about the condition of the pipelines additional televising may be required prior to release of the warranty. If these tests prove to be inconclusive, any or all of the other required tests shall be conducted in the presence of the Public Works Representative/Engineer or his representative.

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If the pipe fails any of these tests it must be repaired or replaced and tested again. Tests shall be performed as follows:

Sub-section A. Displacement Test:

In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned or displaced pipe or other defects, the defects designated by the Public Works Representative/Engineer shall be remedied at the Developer/Contractor's expense.

Sub-section B. Infiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the Public Works Representative/Engineer in making infiltration tests of the completed line before it can be placed into service. The Developer/Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the Public Works Representative/Engineer. The maximum allowable infiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per twenty-four hours (24 hrs) for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer at the expense of the Developer/Contractor.

Sub-section C. Exfiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the Public Works Representative/Engineer in making ex-filtration tests of the completed line before it can be placed into service. The length of line to be tested at one time shall be limited to the length between adjacent manholes. The maximum allowable ex-filtration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per 24 hours for all installed pipe. The end of the line, which projects into the manhole, shall be plugged. The pipe shall then be filled with water from the upper manhole, and the line maintained under a light pressure of four feet (4') of head. The inflow of water necessary to maintain this head shall be recorded as the leakage of the system. If the quantity of ex-filtration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer at the expense of the Developer/Contractor.

Sub-section D. Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the Public Works Representative/Engineer and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the Public Works Representative/Engineer, air tests of the completed pipe before it can be placed in service.

As per ASTM C 924, the test time for the line to be tested shall be determined by using Table 1. Table 1 has been established using the criteria specified in Table 2, and the formulas contained in the Appendix of ASTM C 924. The test time is the time required for the pressure to drop from 3.5 psi to 2.5 psi.

NOTE - All test pressures are measured as gage pressure, which is defined as any pressure greater than atmospheric pressure. Since water produces a pressure of 0.43 psi for every foot of depth, air test pressures must be increased to offset the depth of ground water over the sewer line. If the ground water level is 2 ft or more above the top of the

pipe at the upstream end or if the air pressure required for the test is greater than 5-psi gage, the air test method shall not be used. In that event, the infiltration test, (see Practice C 969), shall be used.

TABLE 1 Minimum Test Time for Various Pipe Sizes			
Nominal Pipe Size, in.	T(time), min/100 ft	Nominal Pipe Size, in.	T(time), min/100 ft
4	0.3	15	2.1
6	0.7	18	2.4
8	1.2	21	3.0
10	1.5	24	3.6
12	1.8		

TABLE 2 Allowable Air Loss for Various Pipe Sizes			
D, Nominal Pipe Size, in.	Qft 3 /min D,	Nominal Pipe Size, in.,	Qft 3 /min
4	2	15	4
6	2	18	5
8	2	21	5.5
10	2.5	24	6
12	3		

Air shall be added until the internal air pressure of the sewer line is raised to approximately 4 psi. The air pressure must then be allowed to stabilize. The pressure will normally drop until the temperature of the air in the line stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, the test shall commence by allowing the gage pressure to drop to 3.5 psi at which point the time recording is initiated. The drop in pressure shall be recorded for the test period.

If the drop in pressure is 1 psi or less during the test period, the line shall be accepted. If the drop in pressure is more than 1 psi during the test period the contractor shall inspect, evaluate, and retest the line to determine the cause of excessive air loss.

Pipes greater than 24" in diameter shall be tested by other means. Other details relating to this specification are found in ASTM C 924.

Failure of the Developer/Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met.

Sub-section E. Televising

The Developer/Contractor or his representative shall furnish labor, equipment, and materials, and shall televise the completed line. The televising shall be recorded continuously through the entire length of each section of pipe, and a copy of the recording given to Public Works for review and approval before it can be placed into service. A pipe will be deemed unsatisfactory if there is excessive cracking, deflection or damage, if the pipe contains bellies (areas where water ponds due to poor grade control), excessive sediment and/or debris, or if the Public Works Representative/Engineer finds any other unsatisfactory conditions as a result of the test. All faulty, damaged, debris-laden, or otherwise unacceptable sections of pipe shall be repaired and/or cleaned to the satisfaction of the Public Works Representative/Engineer and re-tested as deemed necessary by the Public Works Representative/Engineer.

The Contractor/Developer must provide the City with a DVD of the televising of the line. The quality of the televising must allow the reviewer to be able to see clearly any pipe defects or damage. Unclear recordings will be required to be re-televised. The Contractor/Developer shall pay the cost of televising the lines. The televising equipment used must record on the DVD a continuous distance from the point of beginning.

Section 4.08 MANHOLE CONNECTIONS

Concrete pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, positive seal gasket system with 300 series nonmagnetic corrosion-resistant steel bands, or grouting a bell or spigot pipe at the appropriate locations. Connections shall meet the requirements of Division 5 MANHOLES.

Section 4.09 SEWER SERVICE LATERALS

New service laterals shall be constructed with materials and procedures as specified herein.

Existing service laterals shall be constructed with materials compatible with the existing laterals with appropriate connections for joining the ends of existing laterals. All laterals shall be four-inch (4") in diameter unless shown otherwise.

Sub-section A. Extent and Location of Laterals:

New sewer laterals installed to lots shall be located five feet (5') downhill from the center of the lot. Service laterals shall extend from the sewer main to a point ten feet (10') beyond the street right-of-way line unless shown or staked otherwise. A two-inch (2") by four-inch (4"), with the top twenty-four inches (24") painted green, shall be installed to clearly mark the end of each lateral line. The marker shall extend vertically from the end of the pipe to a minimum of thirty-six inches (36") above the ground surface. The depth to the sewer lateral shall be written on the marker with a permanent marking pen. In addition to the marker, the Developer/Contractor shall station (give a distance) the location of the lateral connection to the main from the nearest downstream manhole and show station on Record Drawings. Laterals shall be capped with a cap suitable to withstand test pressure and prevent any leakage into or out of the lateral.

When an existing sewer lateral is encountered along the line and grade of a new pipeline it shall be relocated using appropriate pipe and fittings and graded to insure adequate slope to drain properly. Minimum slope shall be one-quarter-inch (1/4") per foot, unless otherwise approved by Public Works.

Sub-section B. Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Division 2 and the bedding requirements of this Division.

Sub-section C. Pipe:

Pipe used for new service laterals shall be PVC Plastic Pipe conforming to ASTM D3034 SDR 35.

Sub-section D. Connection to Main:

Connection to a new main shall be made using a precast wye or tee installed in the main line at time of installation with a 4-inch PVC adapter or rubber gasket into which the 4-inch PVC lateral is inserted to form a water tight connection. In pipes 12 inches and larger the connection may be made using a cored hole in the pipe and a rubber boot. Recommendations of the manufacturer of the materials used shall be carefully followed.

Connections onto existing sewer mains shall be made with field installed service saddles (gasketed and clamped). All connections by field installed service saddles on existing sewer mains shall be done with a sewer tapping machine and all required fittings and materials. Connections shall be made as shown on the Standard Drawing and at the location specified herein, shown on the improvement drawings or as staked in the field.

Sub-section E. Cover Over Sewer Lateral Lines:

There shall be a minimum of 3 feet of cover over all sewer lateral lines (3'6" minimum at property line.)

Sub-section F. Sewer Clean Outs:

There shall be a maximum distance of 5 feet from the foundation wall to the first exterior clean out with a maximum distance between clean-outs of one hundred (100) feet. There shall be a clean out when a combination of bends is ninety degrees (90°) or greater.

Sub-section G. Location of Stub Pipes:

A brass cap stamped with "S" obtained at Public Works shall be installed in the top of the curb at the location where the sewer service lateral crosses under the curb.

Sub-section H. Testing:

The service laterals shall be tested as a part of the sewer main to which they are connected.

Sub-section I. Damage and Repair of Sewers and Appurtenances:

The Developer/Contractor shall be responsible for the protection of existing improvements, and any damage resulting from its operations shall be its sole responsibility.

Damage to the sewers, laterals, or appurtenances shall be repaired by acceptable and approved methods.

DIVISION 4A

PVC PLASTIC PIPE

Section 4A.01 GENERAL

This section covers the requirements for PVC plastic sewer pipe materials and installation in sanitary sewer, storm drain, and other gravity line construction. Any main line pipe installed through back or side yards of properties, or in locations where trees are proposed or exist in proximity to the pipe, must be of fused joint construction to prevent root intrusion.

Section 4A.02 PIPE

PVC gravity sewer pipe and fittings shall conform to ASTM D3034, for diameters from four-inch (4") to fifteen-inch (15") and ASTM F679 for eighteen-inch (18") to twenty-seven-inch (27"), with integral bell gasket joints. Rubber gaskets shall be factory installed and conform to ASTM F477. Pipe shall be made of PVC plastic having a cell classification of 12454A or 13364B (with minimum tensile modulus of 500,000 PSI) as defined in ASTM D1784 and shall have a SDR of 35 and minimum pipe stiffness of 46PSI according to ASTM test D2412.

Pipe shall be installed in compliance with ASTM D2321 and the manufacturer's requirements.

Sub-section A. Minimum Size and Slope Requirements:

In no case shall sanitary sewer mains be less than eight inches in diameter. Sewers shall be laid with uniform slope between manholes. All sewers shall be designed and constructed to give mean velocities of not less than 2 feet per second when flowing full, based on Manning's formula using an n value of .013. Absolute minimum slope allowed shall be those published by the Utah Department of Environmental Quality, Division of Water Quality as Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal System, R317-3, **Table R317-3-2.3 (D)(4) Minimum Slopes**.

Whenever possible the slope should exceed 0.005 ft/ft. The pipe should be sized to meet anticipated hydraulic loads, increasing the pipe size to reduce the minimum slope requirements shall not be allowed. Sewer slopes shall not exceed 0.12 ft/ft, drop manholes shall be used when steeper slopes are needed, drop manholes shall be used to keep line grade below maximum grade allowed.

Section 4A.03 FITTINGS

Fittings shall be made of PVC plastic conforming to ASTM D1784 and a cell classification as outlined in ASTM D3034.

Section 4A.04 PIPE LAYING

All pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a joint lubricant as recommended by the pipe supplier shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Select material shall be compacted around the pipe to firmly bed the pipe in position. Haunching material (bed to springline) should be carefully worked under the haunches of the pipe and compacted from the pipe to the trench wall or two and one half (2-1/2) pipe diameters on each side of the pipe to ensure support. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When pipe laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.
In addition to the above requirements, all pipe installation shall rigidly adhere to the specific requirements of the pipe manufacturer.

Section 4A.05 GRAVEL FOUNDATION FOR PIPE

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for PVC pipe foundation shall be clean crushed rock or gravel with one hundred percent (100%) less than two-inch (2”) and a maximum of five percent (5%) less than one-half-inch (1/2”). In areas where soil migration may occur, a filter fabric shall be installed to separate the gravel materials from the native soils.

Section 4A.06 INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All PVC pipe shall be installed accurately to the defined line and grade with the following limits:

a) Variance from established line and grade shall not be greater than one-sixteenth (1/16) inch per inch of pipe diameter in ten feet, and not to exceed one-half inch in ten feet, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (1/2) inch maximum.

Section 4A.07 PIPE BEDDING

All pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the mid-point of the pipe shall be deposited and compacted in layers not to exceed ten inches (10") in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than one-inch (1") diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve inches (12") above the top of the pipe.

Modified bedding material shall be graded as follows: One-hundred percent (100%) passing a one inch (1") screen and less than five percent (5%) passing a No. 4 sieve.

Section 4A.08 TESTS

On all sewer main lines the Developer/Contractor will be required to conduct an air test and displacement test and televise the sewer main in the presence of the Public Works Representative/Engineer or his representative prior to any partial bond release. The lines must be televised again at the completion of the project before the beginning of the warranty period. Also, if at the end of the warranty period concerns arise about the condition of the pipelines additional televising may be required prior to release of the warranty. If these tests prove to be inconclusive, any or all of the other required tests shall be conducted in the presence of the Public Works Representative/Engineer or his representative.

For storm drain and other gravity lines, the Developer/Contractor will be required to conduct a displacement test in the presence of the Public Works Representative/Engineer or his representative and televise the storm drain line or other gravity line prior to any

partial bond release. The lines must be televised again at the completion of the project before the beginning of the warranty period. Also, if at the end of the warranty period concerns arise about the condition of the pipelines additional televising may be required prior to release of the warranty.. If these tests prove to be inconclusive, other required tests shall be conducted in the presence of the Public Works Representative/Engineer or his representative.

If the pipe fails any of these tests it must be repaired or replaced and tested again. Tests shall be performed as follows:

Sub-section A. Displacement Test:

In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned or displaced pipe or other defects, the defects designated by the Public Works Representative/Engineer shall be remedied at the Developer/Contractor's expense.

Sub-section B. Infiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the Public Works Representative/Engineer in making infiltration tests of the completed line before it can be placed into service. The Developer/Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the Public Works Representative/Engineer. The maximum allowable infiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per twenty-four hours (24 hrs) for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer at the expense of the Developer/Contractor.

Sub-section C. Exfiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the Public Works Representative/Engineer in making ex-filtration tests of the completed line before it can be placed into service. The length of line to be tested at one time shall be limited to the length between adjacent manholes. The maximum allowable ex-filtration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per 24 hours for all installed pipe. The end of the line, which projects into the manhole, shall be plugged. The pipe shall then be filled with water from the upper manhole, and the line maintained under a light pressure of four feet (4') of head. The inflow of water necessary to maintain this head shall be recorded as the leakage of the system. If the quantity of ex-filtration is in excess of the maximum allowable, the

leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer at the expense of the Developer/Contractor.

Sub-section D. Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the Public Works Representative/Engineer and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the Public Works Representative/Engineer, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the four-inch service laterals (and plugs) have been installed. Each test section shall be pressurized to 4.0 psi. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two-minute period. Each test section shall then be re-pressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Developer/Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met.

Sub-section E. Televising

The Developer/Contractor or his representative shall furnish labor, equipment, and materials, and shall televise the completed line. The televising shall be recorded continuously through the entire length of each section of pipe, and a copy of the recording given to Public Works for review and approval before it can be placed into service. A pipe will be deemed unsatisfactory if there is excessive cracking, deflection or damage, if the pipe contains bellies (areas where water ponds due to poor grade control), excessive sediment and/or debris, or if the Public Works Representative/Engineer finds any other unsatisfactory conditions as a result of the test. All faulty, damaged, debris-laden, or otherwise unacceptable sections of pipe shall be repaired and/or cleaned to the satisfaction of the Public Works Representative/Engineer and re-tested as deemed necessary by the Public Works Representative/Engineer.

The Contractor/Developer must provide the City with a DVD of the televising of the line. The quality of the televising must allow the reviewer to be able to see clearly any pipe defects or damage. Unclear recordings will be required to be re-televised. The Contractor/Developer shall pay the cost of televising the lines. The televising equipment used must record on the DVD a continuous distance from the point of beginning.

Sub-section F. "Go/No-Go" Mandrel Proof Testing

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the Developer/Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID).

This proof test shall establish that the Developer/Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Developer/Contractor, with Inspector present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the Public Works Representative/Engineer, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Developer/Contractor through one hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

The Public Works Representative/Engineer may require, if deemed appropriate or necessary, additional proof testing of designated lengths of the buried flexible pipe approximately one year (1 yr.) after installation but prior to the expiration of the Developer/Contractor's Maintenance Bond. The flexible pipeline shall be cleaned adequately prior to performing the "Go/No-Go" Mandrel ring deflection proof test. The Developer/Contractor, with Inspector present, shall pull a Mandrel, approved by the Public Works Representative/Engineer, through the designated length of pipeline without using mechanical equipment. Failure of the Mandrel to pass through the pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications and the pipeline shall be removed and replaced at the developer/contractor’s expense.

Section 4A.09 MANHOLE CONNECTIONS

PVC pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, or positive seal gasket system with 300 series nonmagnetic corrosion-resistant steel bands. PVC may not be grouted directly to concrete. Connections shall meet the requirements of Division 5 MANHOLES.

Section 4A.10 SEWER LATERAL CONNECTIONS

All sewer lateral connections onto new sewer mains shall be made through preformed tee fittings installed in the main line at the time of main line installation.

Connections onto existing sewer mains shall be made with field installed service saddles (gasketed and clamped). All connections by field installed service saddles on existing sewer mains shall be done with a sewer tapping machine and all required fittings and materials.

Connections shall be made as shown on the Standard Drawing and at the location specified herein, shown on the improvement drawings or as staked in the field.

Section 4A.11 SEWER SERVICE LATERALS

New service laterals shall be constructed with materials and procedures as specified herein.

Existing service laterals shall be constructed with materials compatible with the existing laterals with appropriate connections for joining the ends of existing laterals. All laterals shall be four inch (4") in diameter unless shown otherwise.

Sub-section A. Extent of Laterals and Location of Laterals:

New sewer laterals installed to lots shall be located five feet (5') downhill from the center of the lot. Service laterals shall extend from the sewer main to a point ten feet (10') beyond the street right-of-way line unless shown or staked otherwise. A two-inch (2") by four-inch (4"), with the top twenty-four inches (24") painted green, shall be installed to clearly mark the end of each lateral line. The marker shall extend vertically from the end of the pipe to a minimum of thirty-six inches (36") above the ground surface. The depth to the sewer lateral shall be written on the marker with a permanent marking pen. In addition to the marker, the Developer/Contractor shall station (give a distance) the location of the lateral connection to the main from the nearest downstream manhole and show station on Record Drawings. Laterals shall be capped with a cap suitable to withstand test pressure and prevent any leakage into or out of the lateral.

When an existing sewer lateral is encountered along the line and grade of a new pipeline it shall be relocated using appropriate pipe and fittings and graded to insure adequate slope to drain properly. Minimum slope shall be one-quarter-inch (1/4") per foot.

Sub-section B. Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Division 2 and the bedding requirements of this Division.

Sub-section C. Pipe:

Pipe used for new service laterals shall be PVC Plastic Pipe conforming to ASTM D3034 SDR 35.

Sub-section D. Connection to Main:

Connections to the main shall be made as specified in Section 4A.10 SEWER LATERAL CONNECTIONS. Recommendations of manufacturer of the materials used shall be carefully followed.

Sub-section E. Cover Over Sewer Lateral Lines:

There shall be a minimum of 3 feet of cover over all sewer lateral lines (3'6" minimum at property line.)

Sub-section F. Sewer Clean Outs:

There shall be a maximum distance of 5 feet from the foundation wall to the first exterior clean out with a maximum distance between clean-outs of one hundred (100) feet. There shall be a clean out when a combination of bends is ninety degrees (90^{o}) or greater.

Sub-section G. Location of Stub Pipes:

Stamping an "S" in the top of the curb before the concrete final set shall mark the location where the sewer service pipe crosses the curb.

Sub-section H. Testing:

The service laterals shall be tested as a part of the sewer main to which they are connected.

Sub-section I. Damage and Repairs of Sewers and Appurtenances:

The Developer/Contractor shall be responsible for the protection of existing improvements, and any damage resulting from its operations shall be its sole responsibility.

Damage to the sewers, laterals, or appurtenances shall be repaired by acceptable and approved methods.

DIVISION 4B

POLYETHYLENE CORRUGATED PIPE

Section 4B.01 GENERAL

This section covers the requirements for high-density polyethylene corrugated pipe with integrally formed smooth interior for use in storm drains. HDPE Pipe is not allowed under concrete or asphalt improvements within the city right-of-ways unless written approval is given by the City Engineer/Public Works Director. Any pipe installed through back or side yards of properties, or in locations where trees are proposed or exist in proximity to the pipe, must be of fused joint construction to prevent root intrusion.

Section 4B.02 PIPE

This specification is applicable to nominal sizes 12 - 48 inch diameter and larger if or when available. Requirements for test methods, dimensions, and markings are those found in AASHTO Designation M-294 Type S.

Pipe and fittings shall be made of polyethylene compounds that meet or exceed the requirements of ASTM F 405 or ASTM F 667, Type III, Category 4 or 5, Grade P33 or P34, Class C as defined by ASTM D 1248.

Minimum parallel plate pipe stiffness values at 5% deflection shall be as follows:

Diameter	Pipe Stiffness*
12"	50 psi
15"	42 psi
18"	40 psi
24"	34 psi
30"	28 psi
36"	22 psi

*As Described in ASTM Test Method D 2412 with exceptions stated in M 294

The pipe and fittings shall be free of foreign inclusions and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely effect joining.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Corrugated fittings maybe either molded or fabricated by the manufacturer. Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Public Works Representative/Engineer.
A manufacturers' certification that the product was manufactured, tested, and supplied in accordance with this specification shall be furnished to the Public Works Representative/Engineer upon request.

Pipe installation shall be in accordance with ASTM Recommended Practice D 2321 and the manufacturer's requirements.

Section 4B.03 JOINTS

Joints shall be made with split couplings, corrugated to match the pipe corrugations, and shall engage a minimum of 6 corrugations for 12" - 24" diameter and 4 corrugations for 30" and 36" diameter pipe.

Section 4B.04 PERFORATIONS

All perforated pipe used in the construction shall have either circular or slotted perforations. Circular perforations shall not be more than 5/16 in. nor less than 3/16 in. in diameter, and arranged in rows parallel to the axis of the pipe. Perforations shall be 3 in. center-to-center, along rows. The spigot or tongue end shall not be perforated for a length equal to the depth of the socket, or depth of the groove plus 3/4 in. and perforations shall continue at uniform spacing along the entire length of the barrel. There shall be a total of 8 rows for an 18-inch pipe. The rows shall be spaced over not more than 165 deg of circumference. Rows shall be symmetrically arranged with respect to the intended top of bottom of the pipe.

Slots shall be circumferential in direction, not more than 3/16 in. or less than 1/8 in. in width, and 3 in. long. The slots shall be spaced 6 in. apart. There shall be two rows of slots, spaced 120^{o} apart. The distance from the spigot end or from the shoulder of the tongue end, to the first pair of slots shall be not more than 1 in. greater than the specified slot spacing, nor less than 1 in. less than the specified slot spacing. Slots shall continue at uniform spacing along the entire length of the barrel.

A Mirafi cloth fabric (or approved equal) must be installed around the trench boundary of the perforated pipe. The pipe must then be backfilled using a washed drain rock with the minimum rock size being at least twice the diameter of the perforations. The maximum drain rock size must be less than 2”. The fabric on the top of the trench must be overlapped at least 18” in order to prevent material from migrating into the drain rock. All fabric joints along the pipe must be overlapped a minimum of 2’.

Section 4B.05 PIPE LAYING

All pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe joints.

Select material shall be compacted around the pipe to firmly bed the pipe in position. Haunching material (bed to springline) should be carefully worked under the haunches of the pipe by hand as

per ASTM D2321. The bedding shall be compacted from the pipe to the trench wall, or two and one-half (2-1/2) pipe diameters on each side of the pipe, to ensure support. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When pipe laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall rigidly adhere to the specific requirements of the pipe manufacturer.

Section 4B.06 GRAVEL FOUNDATION FOR PIPE

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for pipe foundation shall be clean crushed rock or gravel with one hundred percent (100%) less than two-inch (2") and a maximum of five percent (5%) less than one-half-inch (1/2"). In areas where soil migration may occur, a filter fabric shall be installed to separate the gravel materials from the native soils.

Section 4B.07 INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All pipe shall be installed accurately to the defined line and grade with the following limits. No reverse grades or bellies are allowed:

Alignment Tolerances	
Design Grade	Max. Line & Grade Deviation
	inches/100 feet
> 1 %	1 1/2
≤ 1 %	1
< 0.5 %	± 0.5

The variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, shall not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (1/2) inch maximum.

Section 4B.08 PIPE BEDDING

All pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

Pipe bedding materials placed at any point in the pipe embedment zone (i.e., foundation to one foot above the crown of the pipe) shall be deposited and compacted in layers not to exceed six inches (6”) in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Material shall be worked and compacted under the haunches of the pipe by hand to ensure proper compaction in this critical area, and material shall be compacted elsewhere in the embedment zone with hand or vibratory compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than one and one-half inch (1-1/2") diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve inches (12") above the top of the pipe.

Bedding material shall be a Type 1B material as per ASTM D2321, graded as follows: A manufactured, processed, aggregate, dense graded and clean: One-hundred percent (100%) passing a 1-1/2 inch sieve, less than or equal to fifty percent (50%) passing a No. 4 sieve and less than five percent (5%) passing a No. 200 sieve. Type 1A or Type II materials per D2321 could also be proposed for the bedding and may be approved by the Engineer.

Section 4B.09 TESTS

For storm drain and other gravity lines, the Developer/Contractor will be required to conduct a displacement test in the presence of the Public Works Representative/Engineer or his representative and televise the storm drain line or other gravity line prior to any partial bond release. The lines must be televised again at the completion of the project before beginning of the warranty period. Also, if at the end of the warranty period concerns arise about the condition of the pipelines additional televising may be required prior to release of the warranty. If these tests prove to be inconclusive, any or all of the other required tests shall be conducted in the presence of the Public Works Representative/Engineer or his representative.

If the pipe fails any of these tests it must be repaired or replaced and tested again. The test(s) shall be performed as follows:

Sub-section A. Displacement Test:

In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned, or displaced pipe or other defects, the defects designated by the Public Works Representative/Engineer shall be remedied at the Developer/Contractor's expense.

Sub-section B. Televising

The Developer/Contractor or his representative shall furnish labor, equipment, and materials, and shall televise the completed line. The televising shall be recorded continuously through the entire length of each section of pipe, and a copy of the recording given to Public Works for review and approval before it can be placed into service. A pipe will be deemed unsatisfactory if there is excessive cracking, deflection or damage, if the pipe contains bellies (areas where water ponds due to poor grade control), excessive sediment and/or debris, or if the Public Works Representative/Engineer finds any other unsatisfactory conditions as a result of the test. All faulty, damaged, debris-laden, or otherwise unacceptable sections of pipe shall be repaired and/or cleaned to the satisfaction of the Public Works Representative/Engineer and re-tested as deemed necessary by the Public Works Representative/Engineer.

The Contractor/Developer must provide the City with a DVD of the televising of the line. The quality of the televising must allow the reviewer to be able to see clearly any pipe defects or damage. Unclear recordings will be required to be re-televised. The Contractor/Developer shall pay the cost of televising the lines. The televising equipment used must record on the DVD a continuous distance from the point of beginning.

Sub-section C. "GO/NO-GO" MANDREL PROOF TESTING

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the Developer/Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Developer/Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Developer/Contractor, with Inspector present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the Public Works Representative/Engineer, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Developer/Contractor through one-hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

The Public Works Representative/Engineer may require, if deemed appropriate or necessary, additional proof testing of designated lengths of the buried flexible pipe

approximately one year (1 yr.) after installation but prior to the expiration of the Developer/Contractor's Maintenance Bond. The flexible pipeline shall be cleaned adequately prior to performing the "Go/No-Go" Mandrel ring deflection proof test. The Developer/Contractor, with Inspector present, shall pull a Mandrel, approved by the Public Works Representative/Engineer, through the designated length of pipeline without using mechanical equipment. Failure of the Mandrel to pass through the pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications and the pipeline shall be removed and replaced at the developer/contractor's expense.

Section 4B.10 MANHOLE CONNECTIONS

Corrugated polyethylene pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber boots with 300 series nonmagnetic corrosion-resistant steel bands, or grouted directly to concrete.

DIVISION 4C

POLYETHYLENE CORRUGATED PIPE WITH WATER TIGHT JOINTS

Section 4C.01 GENERAL

This section covers the requirements for high density polyethylene corrugated pipe (HDPE) with integrally formed smooth interior for use in storm drains and irrigation. HDPE Pipe is not allowed under concrete or asphalt improvements within the city right-of-ways unless written approval is given by the City Engineer or Public Works Director. Any pipe installed through back or side yards of properties, or in locations where trees are proposed or exist in proximity to the pipe, must be of fused joint construction to prevent root intrusion.

Section 4C.02 PIPE

This specification is applicable to nominal sizes 12 to 24 inch and 30 to 48 inch diameter. Requirements for test methods, dimensions, and markings are those found in AASHTO Designation M-252 and M-294 and ASTM F405 and F-667.

Pipe shall be made of polyethylene compounds that meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM Designation D 1248 with the applicable requirements defined in ASTM D 1248. Clean reworked material may be used.

Minimum parallel plate pipe stiffness values shall be as follows:

Diameter	Pipe Stiffness*	
4"	50 psi	
6"	50 psi	
8"	50 psi	
10"	50 psi	
12"	45 psi	
15"	42 psi	
18"	40 psi	
24"	34 psi	
30"	28 psi	*As Described in ASTM Test Method
36"	22 psi	D 2412 with exceptions stated in M 294

The pipe shall be free of foreign inclusions and visible defects. For pipe sizes 12" diameter and greater, holes of any kind in the corrugation crests or sidewalls shall be considered unacceptable. The ends of the pipe shall be cut squarely and cleanly so as not to adversely effect joining. The nominal size for the pipe is based on the nominal inside diameter of the pipe.

A manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification shall be furnished to the Public Works Representative/Engineer upon request.

Section 4C.03 FITTINGS

Fittings shall be molded from SDR-35 PVC pipe manufactured in accordance with the applicable requirements defined in ASTM D3034. Fittings shall be free of foreign inclusions and visible defects. The nominal size for the fittings is based on the nominal inside diameter of the pipe. Fittings shall be molded by the manufacturer. Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted.

Section 4C.04 PIPE LAYING

Pipe installation shall be in accordance with ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity Flow Applications and the manufacturer's requirements.
All pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted.
Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe joints.

Select material shall be compacted around the pipe to firmly bed the pipe in position. Haunching material (bed to springline) should be carefully worked under the haunches of the pipe by hand as per ASTM D2321. The bedding shall be compacted from the pipe to the trench wall or two and one half (2-1/2) pipe diameters on each side of the pipe to ensure support. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall rigidly adhere to the specific requirements of the pipe manufacturer.

Section 4C.05 GRAVEL FOUNDATION FOR PIPE

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, or where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for pipe foundation shall be clean crushed rock or gravel with one hundred percent (100%) less than two-inch (2”) and a maximum of five percent (5%) less than one-half-inch (1/2”). In

areas where soil migration may occur, a filter fabric shall be installed to separate the gravel materials from the native soils.

Section 4C.06 INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All pipe shall be installed accurately to the defined line and grade with the following limits. No reverse grades or bellies are allowed:

Alignment Tolerances	
Design Grade	***Max. Line & Grade Deviation***
	inches/100 feet
> 1 %	***1 1/2***
≤ 1 %	***1***
< 0.5 %	***± 0.5***

a) The variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, shall not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (1/2) inch maximum.

Section 4C.07 PIPE BEDDING

All pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

Pipe bedding materials placed at any point in the pipe embedment zone (i.e., foundation to one foot above the crown of the pipe) shall be deposited and compacted in layers not to exceed six inches (6”) in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Material shall be worked and compacted into the haunches of the pipe by hand to ensure proper compaction in this critical area, and material shall be compacted elsewhere in the embedment zone with hand or vibratory compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than one and one-half inch (1-1/2") diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve inches (12") above the top of the pipe.

Bedding material shall be a Type 1B material as per ASTM D2321, graded as follows: A manufactured, processed, aggregate, dense graded and clean: One-hundred percent (100%) passing a 1-1/2 inch sieve, less than or equal to fifty percent (50%) passing a No. 4 sieve and less than five percent (5%) passing a No. 200 sieve. Type 1A or Type II materials per D2321 could also be proposed for the bedding and may be approved by the Engineer.

Section 4C.08 TESTS

For storm drain and other gravity lines, the Developer/Contractor will be required to conduct a displacement test in the presence of the Public Works Representative/Engineer or his representative and televise the storm drain line or other gravity line prior to any partial bond release. The lines must be televised again at the completion of the project before the beginning of the warranty period. Also, if at the end of the warranty period concerns arise about the condition of the pipelines additional televising may be required prior to release of the warranty. If these tests prove to be inconclusive, any or all other required tests shall be conducted in the presence of the Public Works Representative/Engineer or his representative.

If the pipe fails any of these tests it must be repaired or replaced and tested again. Tests shall be performed as follows:

Sub-section A. Displacement Test:

In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned or displaced pipe or other defects, the defects designated by the Public Works Representative/Engineer shall be remedied at the Developer/Contractor's expense.

Sub-section B. Infiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the Public Works Representative/Engineer in making infiltration tests of the completed line before it can be placed into service. The Developer/Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the Public Works Representative/Engineer. The maximum allowable infiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per twenty-four hours (24 hrs) for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer at the expense of the Developer/Contractor.

Sub-section C. Ex-filtration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the Public Works Representative/Engineer in making ex-filtration tests of the completed line before it can be placed into service. The length of line to be tested at one time shall be limited to the length between adjacent manholes. The maximum allowable ex-filtration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per 24 hours for all installed pipe. The end of the line, which projects into the manhole, shall be plugged. The pipe shall then be filled with water from the upper manhole, and the line maintained under a light pressure of four feet (4') of head. The inflow of water necessary to maintain this head shall be recorded as the leakage of the system. If the quantity of ex-filtration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the Public Works Representative/Engineer at the expense of the Developer/Contractor.

Sub-section D. Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the Public Works Representative/Engineer and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the Public Works Representative/Engineer, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the four-inch service laterals (and plugs) have been installed. Each test section shall be pressurized to 4.0 psi. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two-minute period. Each test section shall then be re-pressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Developer/Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met.

Sub-section E. Televising

The Developer/Contractor or his representative shall furnish labor, equipment, and materials, and shall televise the completed line. The televising shall be recorded continuously through the entire length of each section of pipe, and a copy of the recording given to Public Works for review and approval before it can be placed into service. A pipe will be deemed unsatisfactory if there is excessive cracking, deflection or damage, if the pipe contains bellies (areas where water ponds due to poor grade control), excessive sediment and/or debris, or if the Public Works Representative/Engineer finds any other unsatisfactory conditions as a result of the test. All faulty, damaged, debris-laden, or otherwise unacceptable sections of pipe shall be repaired and/or cleaned to the satisfaction of the Public Works Representative/Engineer and re-tested as deemed necessary by the Public Works Representative/Engineer.

The Contractor/Developer must provide the City with a DVD of the televising of the line. The quality of the televising must allow the reviewer to be able to see clearly any pipe defects or damage. Unclear recordings will be required to be re-televised. The Contractor/Developer shall pay the cost of televising the lines. The televising equipment used must record on the DVD a continuous distance from the point of beginning.

Sub-section F. "Go/No-Go" Mandrel Proof Testing

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the Developer/Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Developer/Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Developer/Contractor, with Inspector present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the Public Works Representative/Engineer, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Developer/Contractor through one-hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications.

The Public Works Representative/Engineer may require, if deemed appropriate or necessary, additional proof testing of designated lengths of the buried flexible pipe approximately one year (1 yr) after installation but prior to the expiration of the Developer/Contractor's Maintenance Bond. The flexible pipeline shall be cleaned adequately prior to performing the "Go/No-Go" Mandrel ring deflection proof test. The Developer/Contractor, with Inspector present, shall pull a Mandrel, approved by the Public Works Representative/Engineer, through the designated length of pipeline without using mechanical equipment. Failure of the Mandrel to pass through the pipeline shall be deemed evidence of inadequate installation by the Developer/Contractor not in compliance with the Project Specifications and the pipeline shall be removed and replaced at the developer/contractor's expense.

Section 4C.09 MANHOLE CONNECTIONS

Corrugated polyethylene pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber boots with 300 series nonmagnetic corrosion-resistant steel bands, or grouted directly to concrete.

Section 4C.10 MINIMUM COVER

In the absence of an engineering evaluation, the following minimum cover requirements should be used. For embedment materials installed to the minimum densities given in ASTM D2321, provide cover (that is, depth of backfill above top of pipe) of at least 24 in or one pipe diameter (whichever is larger) for Class IA and IB embedment (See ASTM D2321), and a cover of at least 36 in. (0.9 m) or one pipe diameter (whichever is larger) for Class II embedment (See ASTM D2321), before allowing vehicles or construction equipment to traffic the trench surface, and at least 48 in. (1.2 m) of cover before using a hydrohammer for compaction

DIVISION 5

MANHOLES

Section 5.01 GENERAL

This division covers the requirements for manhole materials and installation. Manholes shall be installed at the locations and at the depth shown on the Improvement Drawings. Maximum manhole spacing shall be 400' for pipes size 24" and under, 250' for larger than 24". Manholes shall be furnished complete with cast-iron frames and covers.

Section 5.02 CONCRETE BASE

Unless otherwise noted manhole bases shall be precast and shall have pipe inverts and a resilient connection between pipe and manhole for each pipe connecting to the manhole.

Where sewer lines pass through or enter manholes, the invert channels shall be smooth and semi-circular in cross section, conforming to the details shown on the Standard Drawings. Changes of direction of flow within the manholes shall be made with a smooth curve with as long a radius as possible. The slope of the inlet pipe(s) and outlet pipe shall be carried through the manhole with the intersection of the slope being in the center of the manhole. The floor of the manhole outside the flow channels shall be smooth and slope toward the channel at not less than one-half inch (1/2") per foot.

Concrete pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, positive seal gasket system, or grouting a bell or spigot pipe at the appropriate locations. Rubber gaskets or boots shall be made of rubber compound meeting ASTM C923 Specifications for resilient connections between pipe and manhole. They shall meet all other applicable ASTM specifications, including ASTM F477.

Positive seal gasket systems boot shall have a wall thickness of three-eighths inch (3/8"). The boot shall either be "cast-in-place" in the precast base or attached to the precast base by means of an internal expanding band. When the boot is attached to the precast base, a water tight seal between the boot and the precast base must be accomplished. An external band (take-up clamp) shall be supplied and used to clamp and seal the boot to the pipe. The band shall be made of 300 series nonmagnetic corrosion-resistant steel. After the band has been placed, it shall be completely coated with a bituminous material approved by the Public Works Representative/Engineer. The gap between the pipe and the manhole shall be filled with grout to form a smooth surface even with the interior wall of the manhole.

PVC pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, or positive seal gasket system. PVC may not be grouted directly to concrete.

The maximum size pipe that can be used in a 48-inch manhole is twenty-four (24") inch PVC or twenty-one (21") inch concrete. For pipes larger than these require a 60-inch manhole or concrete box.

Concrete for manhole bases shall comply with the requirements of Division 8, Concrete, of these Specifications.

Section 5.03 WALL AND CONE SECTIONS

All manholes shall be precast, sectional, reinforced concrete pipe of forty-eight-inch (48") or sixty-inch (60”) diameter as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM Designation C478-88 (or latest revision) for Precast Reinforced Concrete Manhole Sections with the following exceptions:

a) The throat section of the manhole shall be adjustable, by use of manhole sections, up to forty-eight inches (48") in height.

b) The taper section shall be a maximum of thirty-six inches (36”) in height for 48-inch manholes and thirty-nine inches (39”) for 60-inch manholes, shall be of eccentric conical design, and shall taper uniformly to thirty inches (30") inside diameter.

c) The pipe used in the base section shall be furnished in section lengths of one, two, three, and four-feet (1, 2, 3, and 4 feet) as required.

All joint surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned and wet prior to setting precast sections. All joints, including grade rings, shall be set in mortar or butyl rubber gasket. The mortar shall consist of one (1) part cement and one and one-half (1-1/2) parts sand with sufficient water added to bring the mixture to workable consistency or the joints shall be sealed with a butyl rubber gasket that is permanently flexible and non-shrinking. All joints shall be water tight and free from appreciable irregularities in the interior wall surface.

Sub-section A. Manholes Shall Be Furnished With Steps:

All manholes are to be furnished with steps made of co-polymer polypropylene. The co-polymer polypropylene used shall conform to ASTM D4101-82 PP200B33450Z02. The steel used in manufacturing of this product shall be a deformed ½” reinforcing rod. This material shall be grade 60 and conform to the requirements of ASTM A615.

Section 5.04 DROP MANHOLES

When the difference in elevation of an incoming sewer is 12 inches or greater a drop manhole shall be used. The drop manhole shall be constructed as shown in the Standard Drawings. The piping from the wye to the manhole on both legs shall be ductile iron or PVC pipe with appropriate fittings. If the sewer main that the drop manhole is a part of is concrete, then a transition coupling (Fernco) shall be used to connect the main with the drop pipe assembly.

The drop pipe assembly shall be encased in flowable fill. The flowable fill shall be placed to the minimum thickness as shown on the Standard Drawing Number 13. The flowable fill shall meet the following criteria.

Sub-section A. Cement:

Use Portland Cement, Type II per Division 8, Portland Cement Concrete.

Sub-section B.Fly Ash:

Supply fly ash that complies with ASTM C618 Class F except that the loss on ignition must be 3 percent or less.

Sub-section C. Fine Aggregate:

Use natural sand. The sand shall meet the following gradation when tested in accordance with AASHTO T-27.

Fine Aggregate

Sieve Size	Percent Passing
No. 3/4	100
No. 100	0-10

Sub-section D. Mix Design:

The mix design shall meet the following requirements:

1) Mix design compressive strength (28 day) – between 50 to 150 psi.
2) Portland Cement – at least 50 pounds per cubic yard.
3) Fly Ash – at least 300 pounds per cubic yard.
4) Slump – 6 to 10 inches maximum.

Section 5.05 MANHOLE FRAMES AND COVERS

Industry standard frames and covers are required for all manhole installations.

All iron casting shall conform to the requirements of ASTM Designation A48 (Class 35) for grey iron castings, and ASTM Designation A-536 for ductile iron castings. Castings shall be free from blowholes and shrinkage defects, free from fins and burrs and shall be shot-blasted to remove sand and other foreign matter. The castings shall also meet the applicable requirements of AASHTO M105 and M306 and shall be designed for H-20 and HS-20 loading.

Industry Standard frames and covers shall be equal to the twenty-four inch (24") Standard circular, with machined bearing surfaces, gravity, solid, non-rocking type. The minimum weight of the cover shall be one hundred sixty (160) pounds. The minimum weight of the ring shall be

two hundred eighty (280 lbs.). No flat frames and covers shall be allowed. **Each cover shall contain one (1) pick hole and shall contain air vent holes unless directed otherwise by Public Works Representative/Engineer**. The tops of the cover and ring shall be flush and there shall be 1/8-inch clearance between the cover and the ring. In addition to the foundry name and year of manufacture, the cover shall be marked "SEWER," "STORM DRAIN," "DRAIN," or "IRRIGATION" as appropriate.

The CONTRACTOR shall take steps necessary to protect and preserve the system for future adjustment of the manhole frame. In addition to the foundry name and year of manufacture, the cover shall be marked "SEWER," "STORM DRAIN," "DRAIN," or "IRRIGATION" as appropriate.

Sub-section A. Setting of Manhole Frames and Covers:

Industry Standard manhole frames shall be set in place with the shaft in a bed of cement sand mortar, which mix shall be one part cement to two parts sand or Kent Seal.

Frames and covers shall be raised to final grade in accordance with Section 11.12, Adjusting Manholes and Valve Boxes to Final Grade.

Frames and covers shall be protected during backfilling and compaction of the soil and during the placing or replacing of road surfaces. Any frames or covers loosened from the manhole sections shall be reset in cement mortar and any frames or covers damaged or broken shall be replaced by the Developer/Contractor at its expense. Manholes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement grade. No cast iron ring shall be less than one-sixteenth (1/16") nor greater than one-half inch (1/2") lower than the pavement. Brick shall not be used to raise the manhole. Cones shall not be broken out to lower the ring to meet the road grade. Sections shall be removed and the Whirlygig method and apparatus used.

Section 5.06 CONNECTIONS TO EXISTING SEWER

Manholes used to connect the sewer to the existing sewer shall be plumb and centered on the existing pipe at the elevation designated and the base placed as specified. Care shall be taken not to disturb the alignment of the existing sewer.

The cutting of the existing sewer pipe shall be done in the presence of the Public Works Representative/Engineer. The cut shall be full area of the new pipe and shall be finished so as to leave no projections that will restrict the flow or catch solids.

Every precaution shall be taken to prevent any material from entering the sewer main. Any such materials entering the sewer shall be removed.

The annular space created when connecting the pipe to a manhole shall be grouted to create a smooth surface even with the interior wall of the manhole.

Section 5.07 INCOMING SEWER LINES

In no case shall an incoming sanitary sewer be allowed to drop more than 12 inches to the base. In Sewer lines where the grade is higher than 12 inches above the existing base, a drop manhole connection shall be used. In all cases the base shall have a channel for the incoming wastewater.

The annular space created when connecting the pipe to a manhole shall be grouted to create a smooth surface even with the interior wall of the manhole.

Section 5.08 PREVENTING MATERIALS FROM ENTERING THE SEWER, STORM DRAIN OR OTHER GRAVITY MAIN

After installation of the manhole and connection of sewer, storm drain, or other gravity lines, a plywood floor (hinged) shall be placed inside the manhole to prevent materials from entering the pipeline and shall not be removed until the street is paved or the project is complete.

DIVISION 6

VALVES, COUPLINGS, AND FIRE HYDRANTS

Section 6.01 GENERAL

This section covers distribution valves to be used in the water system, couplings, and fire hydrants.

Section 6.02 RESILIENT SEATED GATE VALVE

Valves in sizes 4" through 12" shall be of the iron body, non rising bronze stem, resilient seated type, manufactured to equal or exceed all applicable AWWA standards of C509 latest revision and all specific requirements outlined in these specifications.

a) Valves shall open left and be provided with 2" square operating wrench nuts unless otherwise specified.

b) When valves have Mechanical Joints, they shall be furnished with all necessary glands, followers, and bolts and nuts to complete installation.

c) The disc shall have integrally cast ASTM B62 bronze stem nut to prevent twisting, binding or angling of the stem. Designs with loose stem nuts are not acceptable.

d) Bronze valve stems shall be interchangeable with stems of the double disc valves of the same size, direction of opening and manufacture.

e) All internal ferrous surfaces shall be coated, holiday free, to a minimum thickness of 4 mills with a two part thermo setting epoxy coating. Said coating shall be non-toxic, impart no taste to the water, formulated from materials deemed acceptable in the Food and Drug Administration Document Title 21 of the Federal Regulations on food additives, Section 121.2514 entitled Resins and Polymeric Coatings. It shall protect all seating and adjacent surfaces from corrosion and prevent build-up of scale or tuberculation.

f) The sealing element shall be secured to the disc with self-locking stainless steel screws, and it shall be field replaceable, and shall be such that it cannot be installed improperly.

g) Stem failure from over torquing in either the open or closing position shall occur externally at such a point as to enable the stem to be safely turned by use of a readily available tool after exposure of the valve through excavation.

h) Valve design shall incorporate a positive metal-to-metal stop to prevent over-compression of the sealing element.

i) A full-faced composition gasket placed between machined body and bonnet flanges is required to eliminate cold flow or creep action present with "O" ring gasketed bodies.

j) Valves shall have a test plug in the bonnet area to vent air and allow line pressure testing.

k) The exterior of the valves shall be Asphalt Varnish, JAN-P-450. If exterior epoxy is used, all bolts and nuts shall be made of Stainless Steel to prevent galvanic corrosion of said nuts and bolts due to insulation from the ferrous valve and line.

Section 6.03 BUTTERFLY VALVE

Valves in sizes greater than 12" shall be butterfly valves shall conform to the latest revision of AWWA Standard C504, Class 150-B, and comply with the following:

a) Valve bodies shall be cast iron, ASTM A126 Class B. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125; or mechanical joint in accordance with AWWA C111. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets, and glands). All valves shall conform to AWWA Standard C504, Table 3, Laying Lengths for Flanged Valves and Minimum Body Shell Thickness for all Body Types.

b) Valve disc shall be ductile iron ASTM A536, grade 65-45-12. Valve disc shall be of the offset design providing 360-degree uninterrupted seating.

c) The resilient seat shall be natural rubber bonded to an 18-8, Type 304 stainless steel retaining ring secured to the disc by 18-8, Type 304 stainless steel screws. The seat shall be capable of mechanical adjustment in the field and field replaceable without the need for special tools. Valve body seat shall be 18-8, Type 304 Stainless Steel.

d) Valve shafts shall be 18-8, Type 304 stainless steel. Shafts shall be of the two piece stub design and attached to the disc by means of "O" ring sealed taper pins with lock nuts.

e) The valve assembly shall be furnished with a non-adjustable factory set thrust bearing designed to center the valve disc at all times.

f) Shaft bearings shall be contained in the integral hubs of the valve body and shall be self-lubricated sleeve type.

g) Valve shaft seal shall consist of "O" Rings. Where the valve shaft projects through the valve body for actuator connection, the "O" Ring packing seal shall be field replaceable as a part of a removable bronze cartridge.

h) When manual actuators are required they shall be of the traveling nut design capable of withstanding 450 foot pounds of input torque against the open and closed stops. All actuators shall have adjustable mechanical stop limits. The closed position stop shall be externally adjustable. Valves shall be installed with the shaft horizontal unless otherwise

directed by the Public Works Representative/Engineer and shall be provided with a 2-inch square operating nut for manually operating the valve with a "T" handle wrench.

i) All valves shall be coated with epoxy in conformance to AWWA Standard C550, latest revision. Interior wetted ferrous surfaces shall be coated nominal 10 mils thick for long life; and body exterior shall have a minimum of 3 to 4 mils coating thickness in order to provide superior base for field-applied finish coats.

Section 6.04 VALVE BOXES

All buried valves shall be installed complete with two-piece, cast iron, sleeve type, 5-1/4-inch shaft valve box with locking lid. The lid shall have the words "WATER" or “IRR.” cast in the metal depending on the application.

Valves and valve boxes shall be installed where shown on the Improvement Drawings. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve. Culinary water valves shall be installed at the tee or cross and shall be FLG X MJ. Pressure Irrigation valves shall be aligned with property lines where possible. Earth fill shall be carefully tamped around the valve box to a distance of four (4) feet on all sides of the box, or to the undisturbed trench face if less than four (4) feet. Valves shall have the interiors cleaned of all foreign matter before installation. All valve boxes located in streets shall be installed to grade. Valves placed in asphalt surfacing shall be constructed such that the cast iron ring is one-sixteenth inch (1/16”) lower than the pavement.

Valve boxes in off-road areas shall extend six (6) inches above grade.

Section 6.05 COUPLINGS

Couplings shall be equal to the product of Smith-Blair or Dresser with ductile iron couplings being used on all ductile iron and PVC pipe. Couplings shall be of the straight, transition, or reducing style as required by the specific installation. Where the coupling is used to join a ductile iron line to a steel line appropriate transition gaskets will be used. All steel fittings and bolts shall be coated with a non-oxide coating and wrapped with 12 mil polyethylene.

Section 6.06 FIRE HYDRANTS

Fire hydrants shall be "traffic model" type designed to conform to AWWA Specification C502 and shall be of either the compression or toggle joint type. Hydrants shall be Mueller "Super Centurion 250", Waterous "Pacer", or AVK Series 27.

Hydrant valves shall be a minimum of 6-inch size. Hydrants shall be supplied complete with two 2 1/2-inch hose nozzles and one 4 1/2-inch pumper nozzle. All nozzles shall be provided with National Standard threading. A one cubic yard gravel sump shall be provided at each hydrant. All hydrants shall be mechanical joint end and shall be connected to the main by means of a mechanical joint by flanged tee and flanged by mechanical joint auxiliary gate valve and box as shown on the Standard Drawings. Each hydrant shall also be supplied with O-ring seals, a

National Standard pentagon operating nut which is designed for clockwise rotation closing, and a 6-inch mechanical joint inlet. The color of the hydrant shall be red.

Set hydrants plumb with the pumper nozzle perpendicular to and facing roadway. The hydrant shall be set so the flange is one-tenth of a foot (0.10') above the back of the sidewalk. Hydrants shall be located in planter strips or at property lines where possible.

Section 6.07 BLOWOFF VALVE

A blow-off valve is required on the culinary system in cul-de-sacs and in temporary dead-end streets. The installation in cul-de-sacs shall be permanent and shall come off near the end of the culinary water line. On temporary dead-end streets the installation shall also come off near the end of the culinary water line and the blowoff shall be placed just beyond the edge of asphalt at the end of the street.

Blow-off valves at the end of cul-de-sacs shall be Eclipse Model 85 blow-off hydrants. On temporary dead-end streets the blow-off should consist of a gate valve, brass pipe, brass 90 degree bend(s) with 3/16" hole for drainage, gravel and 30" manhole section with ring and cover.

Section 6.08 2-INCH AIR INLET AND REMOVAL FACILITY

The connection to the main for the air inlet and removal facility shall be by a line size by 2-inch tapped tee for line sizes 4-inch through 12-inch and by a bronze service clamp, Mueller Model H-13490 for line sizes 14-inches and larger. Air inlet and removal facilities shall be placed at high points or uphill end points in the system. Tapping the main through the service clamp will be accomplished with standard tapping equipment before the system is put into service.

Connection to the tapped tee or service clamp shall be by a 2-inch PVC MIPT adapter. Piping and bends shall be 2-inch Schedule 40 PVC pipe with solvent weld joints. This piping shall extend from the main to the utility box. The utility box shall house a 2-inch brass ball valve with screwed ends, 2-inch brass nipples, 2-inch brass 90^{o} elbow, 2-inch by 2 1/2-inch brass reducer, 2 1/2-inch brass nipple and 2 1/2-inch fire hose connection. All threads except the fire hose connection shall be standard pipe threads. The fire hose connection shall have standard fire hose connection threads for a 2 1/2-inch fire hose. A fire hose cap with chain secured to the standpipe shall be installed at the end of the vertical standpipe. For units installed near curb and gutter a 11 3/4-inch by 17-inch standard green fiberglass irrigation box with cover shall be installed over the 2-inch gate valve and 2-inch stand pipe. A sign shall be attached to or embossed on the cover indicating as follows: "IRRIGATION AIR RELEASE". Box shall be Brooks 1419 series utility box and lid with recessed standard waterworks pentagon head locking device. For Units installed where there is no curb and gutter, the irrigation box shall be a 30-inch by 2-foot (30" X 2') concrete pipe section with a 24-inch CI manhole ring and grate equal to D&L Supply C2670 as shown on Standard Drawing Number 21.

The Developer/Contractor shall provide smooth bore, circular woven suction hose reinforced with spring steel wire. The rubber friction cover shall be durable and resistant to wear and abrasion. The fire hose shall be two and one-half inch (2 1/2") National Fire hose 55-HD-77 or

equivalent. Each hose shall be fitted with a two and one-half inch (2 1/2") male end adapter and a two and one-half inch (2 1/2") female end adapter firmly attached to withstand working pressures of 200 PSI. Each hose furnished for a unit with a fiberglass box shall also be provided with an Akron swivel elbow #632 or equivalent for connection of the fire hose to the air inlet and removal valve.

Section 6.09 PRESSURE IRRIGATION DRAINS

When system drains are necessary to be installed on extensions of the pressure irrigation system they shall be constructed as a system drain to a curb inlet box or system drain to a storm drainpipe**.** The drain shall be constructed as shown on the Standard Drawings. The materials used shall meet the requirements of Division 3, Pressure Pipe Pressure Irrigation. The connection to the box or pipe shall be by coring a hole and grouting the drainpipe in. A non-shrink grout shall be used.

When a section of pressure irrigation pipeline has to be laid such that there is a belly in it then a local drain sump will need to be constructed. The drain shall be constructed as shown on the Standard Drawings. The materials used shall meet the requirements of Division 3, Pressure Pipe Pressure Irrigation, Division 4, Concrete Pipe, and Division 5, Manholes.

DIVISION 7

EARTHWORK

Section 7.01 GENERAL

This section defines the requirements for excavation and backfill for structures, construction requirements of earth embankments and earth fills, and subgrade preparation required by the Standard Drawings and Specifications.

Section 7.02 EXCAVATION FOR STRUCTURES

Where suitable subgrade soils exist, structures shall be founded on undisturbed original subsoil. All unauthorized excavation below the specified subgrade shall be replaced with concrete; monolithic with that of the slab above or with coarse gravel thoroughly compacted into place.

Subgrade soils for structures not suitable for proper support shall be replaced with firm, dense, thoroughly compacted and consolidated material free from mud and muck. Coarse gravel or crushed stone may be used for subsoil reinforcement if satisfactory results can be obtained thereby. Such material shall be applied in thin layers, each layer being embedded in the subsoil by thorough tamping. All excess soil shall be removed to compensate for the displacement of the gravel or crushed stone and the finished elevation of any subsoil reinforced in this manner shall not be above the specified subgrade elevation.

Section 7.03 GRANULAR FOUNDATION BORROW

Granular foundation borrow shall be compacted to not less than 95% of maximum dry density as determined by ASTM D1557.

Section 7.04 BACKFILL AROUND STRUCTURES

No backfilling around or behind structures shall be initiated until the concrete is fully cured for **seven days**. Backfill around structures shall be placed to the lines shown on the Improvement Drawings, or as directed. After completion of foundation footings and walls and other construction below the elevation of the final grades, and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Hand compacted fill, including fill compacted by manually directed power tampers, and shall be placed in layers whose thickness before compaction is not greater than four (4) inches. Material for backfilling shall consist of suitable excavated material or imported sand, gravel, or other suitable material with no rocks whose greatest dimension is larger than two (2) inches.

Fill shall be placed in a manner that will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure. Each layer shall be compacted by hand or machine tampers or by other suitable equipment to a density equal to 95% of maximum dry density as measured by ASTM D1557.

Section 7.05 CONSTRUCTION OF EMBANKMENTS AND FILLS

Sub-section A. Foundation Preparation:

Foundations for earth fill shall have unsuitable materials, such as weeds, sod, roots larger than 1/4-inch in diameter, vegetation, or other organic material shall be removed by clearing, stripping, and/or grubbing. Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of six inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to affect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earth fill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Sub-section B. Placement:

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Public Works Representative/Engineer and any Regulatory Agency having authority over the project. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually-directed power tampers, shall be placed in layers whose thickness before compaction is not greater than four (4) inches. All rock whose greatest dimension is larger than two-inch (2") shall be removed from the material receiving compaction by manually directed power tampers.

Earth fill designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

1) The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material.

2) If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill, to a depth of not less than 2 inches before the next layer is placed.

3) The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than 2 percent shall be maintained to ensure effective drainage, and except as otherwise specified for drain fill zones. If the Improvement Drawings or specifications require or the Public Works Representative/Engineer directs that fill be placed at a higher level in one part of the embankment than another is, the top surface of each part shall be maintained as specified above.

4) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction of inlet and outlet pipes are specifically authorized in the contract.

5) Embankments built at different levels as described in 3 and 4 shall be constructed so that the slope of the bonding surfaces between the embankment in place and embankment to be placed is not steeper than 2 feet horizontal to 1-foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, scarified, moistened and recompacted when the new fill is placed against it. This is needed to ensure a good bond with the new fill, to obtain the specified moisture content and specified density at the junction of the in-place and new fill.

Sub-section C. Borrow:

When the embankment or fill exceeds the amount of excavation, sufficient additional material shall be obtained from borrow pits provided by the Developer/Contractor. All material proposed to be imported shall be subject to the review and approval of the Public Works Representative/Engineer prior to starting of hauling operations.

The materials used for embankment and fill construction shall be free from sod, grass, roots larger than 1/4-inch diameter, trash, clods, rocks larger than six inches in diameter, and all other material unsuitable for construction of compacted fills. Rotomilled asphalt meeting the large rock requirement may be used as borrow.

Grading of completed embankments and fills shall bring the surfaces to a smooth, uniform condition with final grades being within 0.1 foot of the design grade.

Section 7.06 COMPACTION OF MATERIALS

The material shall be deposited in horizontal layers having a thickness of not more than eight inches (8") prior to being compacted as hereinafter specified. The distribution of materials shall be such that the compacted material will be homogeneous and free from lenses, pockets, or other imperfections.

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range, and the moisture content shall be uniform throughout the layers. Discing, blading or other approved methods prior to compaction of the layer shall obtain uniform moisture distribution. The moisture shall be controlled at a level to permit compaction of the fill as specified; at the time of compaction the moisture content shall be plus or minus 2 percent (i.e. optimum 15.2%, range 13.2% to 17.2%) of the optimum moisture as determined by AASHTO T-180.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary.

Material that is too wet when deposited on the fill shall either be removed or dried to specified moisture content prior to compaction.

If the top surface of the preceding layer, a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to the required moisture content prior to placement of the next layer of fill.

When the material has been conditioned as here in before specified the backfill or embankment shall be compacted to a minimum of 95% of maximum dry density as determined by AASHTO T-180. Densification of earth fill shall be performed by equipment designated solely for that purpose. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Sub-section A. Under Roadways:

Under roadways and extending one foot beyond the proposed curb-line the fill or embankment material shall be compacted to a minimum of 95% of maximum density specified above.

Sub-section B. Under Sidewalks and Driveways:

Under sidewalks and driveways extending one foot each side of the edge of slab the fill or embankment material shall be compacted to a minimum of 95% of maximum density specified above.

7.07 REMOVE AND REPLACE DEFECTIVE FILL

Fill placement at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced with acceptable fill. The replaced fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

DIVISION 8

PORTLAND CEMENT CONCRETE

Section 8.01 GENERAL

The work shall consist of furnishing, forming, placing, finishing, and curing Portland cement concrete, as required.

Section 8.02 MATERIALS

Sub-section A. Portland Cement:

Portland cement shall be Type II and shall comply with the Standard Specification for Portland Cement, ASTM C150.

If air-entraining cement is to be used, the Developer/Contractor shall furnish the manufacturers written statement giving the source, amount and brand name of the air-entraining addition.

Cement shall be stored in such a manner as to be protected from weather, dampness or other destructive agents. Cement that is partially hydrated or otherwise damaged will be rejected.

Sub-section B. Aggregate:

Aggregates shall conform to Tentative Specifications for Concrete Aggregates, ASTM C33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when: (1) the specified alternate conditions of acceptance can be proved prior to the use of the aggregates on the job and within a period of time such that no work under the contract will be delayed by the requirements of such proof; or, (2) the specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C33, Appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used, except under one of the following conditions:

1) Applicable test results of mortar bar tests, made according to ASTM Method C227, are available which indicate an expansion of less than 0.10 per cent at six months in

mortar bars made with cement containing not less than 0.8 per cent alkalies expressed as sodium oxide; or

2) Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with "low alkali" cement, containing less than 0.60 per cent alkalies expressed as sodium oxide.

Aggregate of each class and size shall be stored and handled by methods that prevent segregation of particle sizes or contamination by intermixing with other materials.

Sub-section C. Water:

Water shall be cleaned and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances and shall meet the requirements of ACI Standard Code (ACI 318 latest edition), paragraph 3.4.

Sub-section D. Air-Entraining Agent:

Air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designation C150 and C260, except that the relative durability factor in the freezing and thawing test shall be not less than 95.

Sub-section E. Steel Reinforcement:

Refer to Division 9 (Reinforcing Steel) for specifications.

Sub-section F. Water-Reducing and Set-Retarding Admixtures:

Water-reducing and set-retarding admixtures shall conform to the requirements of ASTM Specification C494, except that resistance to freezing and thawing shall be determined in all cases, and the minimum relative durability factor shall be 95.

Admixtures shall be Type A, Water-Reducing or Type D, Water-Reducing and Retarding, as defined in ASTM Specification C494.

When added, in the manner and amount recommended by the manufacturer, to the concrete used on the job, with no change in the cement content or proportions of the aggregates, admixtures shall have the following effects:

Type A or Type D: The water content at the required slump shall be at least 5 percent less with the admixture than without. The air content shall remain within the range specified, but shall not exceed 8 per-cent in any case.

Type D: The time of initial setting, determined as prescribed in ASTM C494, shall be from 1 to 3 hours longer with the admixture than without.

Sub-section G. Curing compound:

Concrete shall be cured using a membrane forming compound that meets the criteria of ASTM C 1315, Type ID Class A (clear with fugitive dye), or Type II Class A or B (white pigmented.) The following requirements apply:

1) Meet applicable Volatile Organic Compounds (VOC) air-pollution control requirements.
2) Submit a manufacturer certificate that shows product meets performance criteria.
3) Follow product manufacturer's recommendations for preparing surfaces.
4) Deliver the curing compound in ready-mixed form with the pigment uniformly disbursed without diluting or altering the compound.
5) Apply membrane-curing compound at the manufacturer's recommended rate.

Section 8.03 CLASS OF CONCRETE

For the purpose of practical identification, concrete has been divided into four classes: Class AA(AE), A(AE), B(AE) and C(AE). The specific use for each Class is identified in the Division in which the concrete is used. The symbol (AE) designates air-entrainment. Basic requirements for each class are as follows:

Class of Concrete	Maximum Net Water Content (gallons/bag)	Minimum Cement Content (bags/cubic yard)	Minimum 28-day Compressive Strength (psi)
AA(AE)	5	6 1/2	4000
A(AE)	6	6	3500
B(AE)	7	5	2500
C(AE)	8	4	2000

Section 8.04 COMPOSITION OF CONCRETE

Sub-section A. Aggregate:

Aggregates maximum size shall be not larger than one-fifth (1/5) of the narrowest dimension between forms within which the concrete is to be cast, nor larger than three-fourths (3/4) of the minimum clear spacing between reinforcing bars or between

reinforcing bars and forms. For un-reinforced concrete slabs, the maximum size of aggregates shall not be larger than one-fourth (1/4) the slab thickness.

Sub-section B. Water:

Water shall be added to the mix to produce concrete with the minimum practicable slump. The slump of mechanically vibrated concrete shall not exceed four-inches (4").

Sub-section C. Air-Content:

Air-Content for air-entrained concrete shall comply with the following:

Course Aggregate Size (in.)	Air Content (percent)
1 1/2 to 2 1/2	5 ± 1
3/4 or 1	6 ± 1
3/8 or 1/2	7 ± 1

The air-entraining agent shall be added as liquid to the mixing water by means of mechanical equipment capable of accurate measurement and control.

Sub-section D. Admixtures:

Water Reducing and/or Set Retarding admixtures shall not be used except with previous approval from the Public Works Representative/Engineer and shall in such a case, conform to the standards of materials set forth in the specification.

Section 8.05 DESIGN OF THE CONCRETE MIX

The proportions of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exclude free water during consolidation.

Prior to placement of concrete, the Developer/Contractor shall furnish the Public Works Representative/Engineer, for approval, a statement of the materials and mix proportions (including admixtures, if any) it intends to use. The statement shall include evidence satisfactory to the Public Works Representative/Engineer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After the job mix has been reviewed for conformance to specification by the Public Works Representative/Engineer, neither the source, character, grading of the aggregates, the type and brand of cement, nor admixture shall be changed without prior notice to the Public Works Representative/Engineer. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Public Works Representative/Engineer has approved a revised job mix.

Section 8.06 OBSERVATION AND TESTING

The Public Works Representative/Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Public Works Representative/Engineer to observe the materials, equipment and processes and to obtain samples of the concrete. All tests and observations will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

Section 8.07 HANDLING AND MEASUREMENT OF MATERIALS

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Except as otherwise provided in Division 8, cement and aggregates shall be measures as follows:

a) Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

b) Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

c) Water shall be measured by weight, to accuracy within one per cent of the total quantity of water required for the batch.

d) Admixtures shall be measured within a limit of accuracy of 3 per cent of the total quantity of each admixture required for the batch.

Section 8.08 MIXERS AND MIXING

Concrete shall be uniform and thoroughly mixed when delivered to the work site. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means. For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1 1/2 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 or more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site will be permitted if approved by Public Works Representative/Engineer. The batching and mixing equipment shall conform to the requirements of ASTM Specification C685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

Section 8.09 FORMS

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a non-staining form oil before being set in place.

Metal ties or anchors within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete.

All edges that will be exposed to view when the structure is completed shall be chamfered by placing molding in the forms, unless finished with molding tools.

Section 8.10 PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

Unless otherwise specified, when concrete is to be placed over drain fill, the contact surface of the drain fill shall be covered with a layer of asphalt-impregnated building paper or polyvinyl sheeting prior to placement of the concrete. Forms for weepholes shall extend through this layer into the drain fill.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weep holes in walls or slabs shall be formed with nonferrous materials.

Section 8.11 CONVEYING

Concrete shall be delivered to the site and discharged into the forms within 1 1/2 hours after the introduction of the cement to the aggregates. In hot weather (90° F and above) or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The Public Works Representative/Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation.

Section 8.12 PLACING

Concrete shall not be placed until the sub-grade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the Public Works Representative/Engineer. The Developer/Contractor shall give 48-hour notice to the Public Works Representative/Engineer each time it intends to place concrete. Such notice will give the Public Works Representative/Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcements and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layers being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tramping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer shall be consolidated to insure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Developer/Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

Section 8.13 CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the Improvement Drawings. If construction joints are needed which are not shown on the Improvement Drawings, they shall be placed in locations approved by the Public Works Representative/Engineer.

Where a featheredge would be produced at a construction joint, as in the top surface of a sloping wall, an inset form shall be used so that the resulting edge thickness on either side of the joint is not less than six inches (6").

In walls and columns, as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardening concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Public Works Representative/Engineer. The surfaces shall be kept moist for at least one hour prior to placement of the new concrete.

Section 8.14 EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made at locations specified in Division 12 and shown on the Standard Drawings. Contraction joints shall be a minimum of t/4 where t is the thickness of the concrete.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

Open joints, when specified, shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints shall be finished with an edging tool prior to removal of the joint strips.

Section 8.15 WATERSTOP

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

Section 8.16 REMOVAL OF FORMS

Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

Section 8.17 FINISHING FORMED SURFACES

Immediately after the removal of the forms:

a) All fins and irregular projections shall be removed from exposed surfaces.

b) On all surfaces, the holes produced by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted and filled with a dry-pack mortar consisting of one part Portland cement, three parts sand that will pass a No. 16 sieve, and water just sufficient to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

Section 8.18 FINISHING UNFORMED SURFACES

All exposed surfaces on the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screeded concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

Section 8.19 CURING AND PROTECTION

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Sprinkling, flooding or fog spraying shall maintain moisture or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

As soon as the concrete has hardened sufficiently to prevent damage, the finished surface shall be protected for curing one of the following ways:

a) Ponding of water on the surface or continuous sprinkling.

b) Application of absorptive mats such as three-inches (3") of cured hay, clean straw or fabric kept continuously wet.

c) Application of two-inches (2") of moist earth or sand uniformly distributed on the surface and kept saturated by spraying with water.

d) Application of light colored waterproof plastic materials, conforming to "Specifications for Waterproof Sheet Materials for Curing Concrete" ASTM C171, placed and maintained in contact with the surface of the concrete.

e) Application of a curing compound, conforming to "Specification for Liquid Membrane - Forming Compounds Having Special Properties for Curing and Sealing Concrete" ASTM C 1315. The compound shall be light in color and shall be applied in accordance with the manufacturer's recommendations immediately after any water sheen, which may develop after finishing, has disappeared from the concrete surface.

Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be re-sprayed at the rate of application specified above.

Section 8.20 REMOVAL OR REPAIR

When concrete is honey combed, damaged or otherwise defective, the Developer/Contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective concrete. Prior to starting repair work the Developer/Contractor shall obtain the Public Works Representative/Engineer's approval of its plan for affecting the repair. The Developer/Contractor shall perform all repair work in the presence of the Public Works Representative/Engineer.

Section 8.21 CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40° F unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed. The contractor shall be responsible to insure the protection of the concrete regarding these requirements.

Section 8.22 CONCRETING IN HOT WEATHER

The Developer/Contractor shall apply effective means to maintain the temperature of the concrete below 90° F during mixing, conveying and placing. The contractor shall be responsible to insure the protection of the concrete regarding these requirements.

DIVISION 9

REINFORCING STEEL

Section 9.01 GENERAL

Furnish and place reinforcing steel and epoxy-coated reinforcing steel. Steel reinforcement shall be free from rust, oil, grease, paint or other deleterious matter. Use deformed billet-steel bars as specified. All reinforcing bars shall be Grade 40 or Grade 60 as required. Wire Fabric shall conform to ASTM A185-70.

Before supply of steel, the Developer/Contractor shall provide all order lists and bending diagrams for approval of the Public Works Representative/Engineer. The approval of such lists and diagrams shall in no way relieve the Developer/Contractor of responsibility for the correctness of reinforcing supplied and all expenses incidental to revision of furnished reinforcing steel shall be carried by the Developer/Contractor.

All steel to conform to ACI Standard Code (ACI 318 latest edition), Section 3.5. Gages, spacing and arrangement of wires in welded steel wire fabric shall be as defined in ACI Standard Code (ACI 315 latest edition) for the specified style designations.

Steel reinforcement stored at the site of the work shall be stored above the ground surface on platforms, skids or other supports and shall be protected from mechanical injury and corrosion.

Section 9.02 FABRICATION AND PLACING REINFORCEMENT

Sub-section A. Fabrication:

Reinforcement shall be cold bent to the shapes shown in accordance with ACI Standard Code (ACI 318 latest edition), Section 7.1.

Sub-section B. Clearances:

All bars shall be of the size specified and shall be placed in the positions shown on the Improvement Drawings in such a manner as to be firmly held during the placing of the concrete. Where not otherwise indicated, minimum clearance and cover as required by the ACI Standard Code (ACI 318 latest edition), Section 7.7 shall be maintained.

Reinforced Clearances	Minimum Cover Inches
Cast In Place Concrete (Non Prestressed)	
Concrete cast against and permanently exposed to earth	3
Concrete exposed to earth or weather:	
No. 6 through No. 18 Bar	2
No. 5 Bar, W31 or D31 wire, and smaller	1 1/2

Reinforcement Clearances	Minimum Cover Inches
Concrete not exposed to weather or in contact with ground:	
No. 14 and no. 18 Bar	1 1/2
No. 11 Bar and smaller	3/4
- Beams, Columns:	
Primary reinforcements, ties, stirrups, spirals	1 1/2
- Shells, Folded Plate Members:	
No. 6 Bar and larger	3/4
No. 5 Bar, W31 or D31 wire, and smaller	1/2
Precast Concrete (Manufactured Under Plant Controlled Conditions)	
Concrete exposed to earth or weather:	
- Wall Panels:	
No. 14 and No. 18 Bars	1 1/2
No. 11 Bar and smaller	3/4
-Other Members:	
No. 14 and No. 18 Bars	2
No. 6 through No. 11 Bars	1 1/2
No. 5 Bar, W31 or D31 wire, and smaller	1 1/4
Concrete not exposed to weather or in contact with ground:	
- Slabs, Walls, Joists:	
No. 14 and No. 18 Bars	1 1/4
No. 11 Bar and smaller	5/8
- Beams, Columns:	
Primary reinforcement	1 1/2
Ties, stirrups, spirals	3/8
- Shells, folded plate members:	
No. 6 Bar and larger	5/8
No. 5 Bar, W31 or D31, and smaller	3/8

Sub-section C. Support:

Bars shall be tied at all intersections except where the spacing is less than twelve inches (12") where alternate intersections shall be tied. Distance from supports shall be by means of ties, hangers, or other approved supports. Metal chairs of approved design shall be used to hold reinforcement from contact with the forms. Metal chairs that are in contact with the exterior surface of the concrete shall be galvanized. Layers of bars or when placing concrete directly on a prepared subgrade reinforcing shall be separated by precast mortar blocks or by other equally suitable devices. The use of stones, pieces of broken brick, metal pipe, or wooden blocks shall not be permitted. Reinforcement in any member shall be placed and then inspected and approved by the Public Works Representative/Engineer before the placement of concrete begins. Concrete placed in violation of this provision may be rejected in which case removal will be required.

If the fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

Sub-section D. Splicing:

All splices shall be staggered so that splices in adjacent bars shall be not less than four feet (4') apart, and shall conform to ACI Standard Code (ACI 318 latest edition), Section 12.15.

Section 9.03 EPOXY COATING

Sub-section A. Prequalify all Coatings:

Ensure that epoxy coating applicator has Concrete Reinforcing Steel Institute (CRSI) fusion bonded epoxy coating applicator plant certification. Furnish a copy of the Prequalification Test Report to the Public Works Representative/Engineer. Provide an 8-ounce sample of the coating material from each batch.

Sub-section B. Coat Bars as Specified:

The following requirements shall be followed:

1) Maintain the coating thickness between 8 and 12 mils.

2) Coat bars after bending, unless the fabricator can show that satisfactory results can be obtained by coating before bending

3) Reject any bent bars with visible cracks or damage in the coating.

Sub-section C: Handling:

Do not damage the bars or the coating during handling and storage.

1) Use systems with padded contact areas when handling coated bars.
2) Pad all bundling bands.
3) Lift all bundles with strong back, multiple supports, or a platform bridge.
4) Do not drop or drag bars.
5) Repair damaged bars or coating at no additional cost to the Owner.
6) Use patching material per manufacturer’s recommendation to repair damaged coating.
7) Have the coated bars inspected for damage to the coating after the bars are in place and immediately before concrete placement.
8) Repair all visible defects using the specified patching or repair material.

Section 9.04 FIELD CUTTING EPOXY-COATED BARS

Sub-section A. Cutting:

Saw or shear epoxy-coated bars that are specified to be cut in the field. Do not flame cut.

Sub-section B. Repairing:

Repair the sawed or sheared end using the specified patching or repair material.

DIVISION 10

RESTORATION OF SURFACE IMPROVEMENTS

Section 10.01 GENERAL

The Developer/Contractor shall be responsible for the protection and the restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work.

Existing improvements shall include but not be limited to permanent surfacing, curbs, gutters, sidewalks, planted areas, ditches, driveways, culverts, fences, and walls. All improvements shall be reconstructed to equal or better, in all respects, than the existing improvements removed.

Section 10.02 FIELD VERIFICATION OF IMPROVEMENTS

The Developer/Contractor will be deemed to have carefully examined the site of the work and to have acquainted itself with all conditions relating to the protection and restoration of existing improvements. The Public Works Representative/Engineer does not guarantee that all improvements are shown on the Improvement Drawings, and it shall be the Developer/Contractor's responsibility to provide for the protection and restoration of all existing improvements whether or not each is provided for specifically on the Improvement Drawings.

Section 10.03 REMOVAL OF PAVEMENT, SIDEWALKS, CURBS, ETC.

The pavement, sidewalk, curb and gutter, driveway, etc. shall be cut vertically along the lines forming the trench, or nearest full joint, in such a manner as to not cause damage to adjoining pavement, sidewalk, curb and gutter, driveway, etc. An undercut level at the rate of one inch (1") per foot of thickness or an underlap joint will be provided at the proposed junction between old and new surfaces. The portion to be removed shall be broken up in a manner that will not cause damage to the pavement or concrete outside the limits of the trench; however, any pavement damaged by operations outside the limits of the trench shall be replaced at the Developer/Contractor's expense. Broken paving materials shall be removed immediately from the site of the work.

Section 10.04 MATERIALS

Materials used for repair or replacement of surface improvements shall be equal to or better than the material removed

Sub-section A. Untreated Base Course:

Untreated base course shall comply with the requirements of Division 11, Section 11.08, Base Course. The Public Works Representative/Engineer shall take samples of the untreated base course on a random basis. All materials not meeting the tolerance requirements shall be removed from the project and replaced with specification material.

Sub-section B. Bituminous Surface Course:

The bituminous surface shall be hot-rolled plant mix in accordance with Division 11, Bituminous Asphalt Cement Pavement or Plant Mix Seal Coat, as applicable.

Sub-section C. Concrete:

Concrete shall comply with Division 8 of these Standard Specifications. Concrete shall be Class AA(AE).

Section 10.05 RESTORING BITUMINOUS, CONCRETE, OR ASPHALT STREET SURFACES

Where trenches are in or cross bituminous or concrete surfaced roads, traffic lanes, driveways, parking areas, etc., the bituminous or concrete surface shall be cut, restored as quickly as there is sufficient quantity to make it practical, weather permitting, and maintained as follows:

Sub-section A. Before Excavation:

All existing asphalt or concrete surfaces shall be saw cut or roto-milled to a square edge before excavation.

Sub-section B. Temporary Graded Surface:

Until resurfacing can be done in paved areas a temporary gravel surface shall be placed deep enough to provide a minimum of eight inches (8") below the bottom of the bituminous surface and shall be brought flush with the paved surface.

The untreated base shall be placed in the trench at the time it is backfilled. Excess material shall be removed from the premises immediately. The Developer/Contractor will maintain the temporary gravel surface until the asphalt is placed.

Sub-section C. Preparation for Paving:

The area over trenches to be resurfaced shall be graded and rolled with a roller weighing not less than 12 tons, or with the rear wheels of a five-yard truck loaded to capacity, until the subgrade is firm and unyielding. Mud or other soft or spongy material shall be removed and the void filled with gravel and rolled and tamped thoroughly in layers not exceeding six inches in thickness. The edges of trenches, which are broken down during the making of subgrade, shall be removed and trimmed neatly before resurfacing.

Before any permanent resurfacing is placed, the Developer/Contractor shall trim the existing paving to clean straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be thirty feet minimum lengths and no deviations from such lines shall be made except as specifically permitted by the Public Works

Representative/Engineer.

Existing bituminous paving shall be saw cut or roto-milled back a minimum of twelve-inches (12") beyond the limits of any excavation or cave-in along the trench so that the edges of the new paving will rest on at least twelve-inches (12") of undisturbed soil.

Sub-section D. Bituminous Surface:

The bituminous surface over trenches shall be restored by standard paving practices to a minimum thickness of three inches (3"). Bituminous Asphalt shall meet the requirements of Division 11 ROADWAY CONSTRUCTION Section 11.10.

Pavement restoration shall include priming of pavement edges with SS-1 or SS-1h or equivalent bituminous material and placing rolled plant hot mix bituminous material to the level of the adjacent pavement surfaces with allowance for shrinkage or settling. No priming of pavement edges (tacking) shall be done more than 24-hours prior to paving.

Section 10.06 GRAVEL SURFACE

Where trenches are excavated through gravel-surfaced areas such as roads and shoulders, parking areas, unpaved driveways, etc., the gravel surface shall be restored and maintained as follows:

Sub-section A. Layer Thickness:

The gravel shall be placed deep enough to provide a minimum of six inches of material.

Sub-section B. Placement:

The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe, uniform surface. Excess material shall be removed from the premises immediately.

Sub-section C. Gradation:

Material for use on gravel surfaces shall be obtained from sound, tough, durable gravel or rock meeting the following requirements for gradation:

Sieve Size	Percent Passing
1-inch sieve	100%
1/2-inch sieve	79-91%
No. 4 sieve	49-61%
No. 16 sieve	27-35%
No. 200 sieve	7-11%

Section 10.07 MISCELLANEOUS IMPROVEMENTS

It shall be the Developer/Contractor's responsibility to restore to their original condition all irrigation canals, levees, culverts, gates, fences, drainage ditches, and all such improvements, which are cut or disturbed during construction. Topsoil in farming areas or along road edges shall be stored separate from subsoil during pipe trench excavation. Topsoil shall be replaced during backfill operations as nearly as possible to its original condition, thereby assuring suitable soil for reseeding.

Section 10.08 RESTORATION OF SURFACES

Unless otherwise directed, all street surfacing, curbs, gutters, sidewalks, driveways, or other hard surface that must be removed in the performance of the work shall be restored in kind by the Developer/Contractor in accordance with the Specifications contained herein. Deviation of more than one-fourth inch (1/4") between old and new work or within new construction shall be corrected. Such measurement shall be made from a ten-foot (10') minimum length straight edge. Adjoining surfaces between old and new must be flush.

Section 10.09 CLEANUP

At the completion of each area of work all equipment, barricades, and similar items shall be removed from the area. All excess material will be removed. All rocks larger than two inches (2") shall be removed from the surface. Adjacent borrow pits and road shoulders used for storage of excavating materials will be smoothed and returned to its original contour.

Section 10.10 PAVEMENT MARKINGS

The Developer/Contractor shall be responsible for restoration of pavement markings on all City and/or County roadways. Restoration of pavement markings shall conform to the applicable local and state specifications.

On roadways under UDOT jurisdiction temporary pavement markings shall be provided for any removed or obliterated markings. The temporary markings shall conform to UDOT standards and specifications. Permanent pavement markings will be replaced by UDOT.

DIVISION 11

ROADWAY CONSTRUCTION

Section 11.01 GENERAL

This Division covers roadway construction, including work consisting of pulverizing existing asphalt, earthwork, and roadway excavation. It also includes imported subgrade preparation, granular borrow, granular backfill borrow, flowable backfill, untreated base course, asphalt surface, tack coat, adjusting manholes and valve boxes to final grade, pavement crack seal and chip seal, and pavement marking materials.

Section 11.02 PULVERIZING

The Developer/Contractor may pulverize the existing asphalt and road base to a depth of 6 to 8 inches. The limits of the area to be pulverized will be as shown on the Improvement Drawings. This material will be used for granular borrow or untreated road base. The Developer/Contractor has the option of methods he feels will result in the least work and best product in breaking up the existing asphalt, provided that the maximum size for a single piece of asphalt does not exceed 3 inches. Placing, grading and compacting of this material shall comply with the requirements of borrow or road base. The existing asphalt edges where the pulverizing terminates shall be saw cut following or prior to being pulverized.

Section 11.03 EARTHWORK

The earthwork needed for roadway construction shall meet the requirements of Division 7, Earthwork.

Section 11.04 ROADWAY EXCAVATION

Following completion of the curb and gutter improvements the roadway between lips of gutter shall be excavated to the lines and grades shown on the Improvement Drawings. Materials not suitable for use as granular borrow or roadbase shall be removed from the road section. Excavation may be done on one-half of the road at a time.

Section 11.05 SUBGRADE PREPARATION

This work shall consist of the shaping and compacting of the subgrade in accordance with these specifications and in conformity with the lines, grades, and typical cross sections shown on the Improvement Drawings and Standard Drawings or as established by the Public Works Representative/Engineer.

Following roadway excavation the subgrade shall be proof rolled by running moderate-weight rubber tire-mounted construction equipment uniformly over the surface at least twice. During the rolling operation moisture content of the subgrade layer shall be maintained at a level to permit compaction of the subgrade, but in no case greater or less than plus or minus two percent (i.e.

optimum 15.2%, range 13.2% to 17.2%) of the optimum moisture as determined by AASHTO T-180. Rolling shall be continued until the entire roadbed is compacted to the specified density to a minimum depth of 8-inches.

Section 11.06 GRANULAR BORROW

Granular borrow (foundation or roadway) material shall consist of well graded granular bank run natural aggregate material with a maximum size of 3 inches and less than 15% passing a No. 200 sieve. The material shall meet the following gradation:

Sieve Size	Percent Passing
No. 10	50 max.
No. 40	30 max.
No. 200	15 max.

The granular borrow material shall be compacted to not less than 95% maximum dry density as determined by AASHTO T-180. Granular foundation borrow shall be compacted to not less than 95% of maximum dry density as determined by ASTM D1557. Surfaces shall be true to the established grade with thickness being not less than 1/4-inch from the required layer thickness and with the surface elevation varying not more than 3/8-inch in ten feet from the true profile and cross section.

Section 11.07 GRANULAR BACKFILL BORROW

Granular backfill borrow shall be backfill material that is not mechanically graded. It shall be a bank run material free of shale, clay, slag, friable material and debris. It shall be reasonably uniformly graded with one hundred percent (100%) less than three-inch (3") and maximum of fifteen percent (15%) passing a No. 200 sieve. It shall reasonably meet the requirements of AASHTO M 145 classification A-1. Slag may be permitted with approval by the Public Works Representative/Engineer.

Section 11.08 FLOWABLE BACKFILL

When required by UDOT, required as part of the Contract, or directed by the Public Works Representative/Engineer, flowable backfill shall be used in place of native backfill or granular backfill borrow. The flowable backfill shall meet the following requirements:

Sub-section A. Cement:

Use Portland Cement, Type II per Division 8, Portland Cement Concrete.

Sub-section B. Fly Ash:

Supply fly ash that complies with ASTM C-618 Class F except that the loss on ignition must be 3 percent or less.

Sub-section C. Fine Aggregate:

Use natural sand. The sand shall meet the following gradation when tested in accordance with AASHTO T-27.

Fine Aggregate

Sieve Size	Percent Passing
No. 3/4	100
No. 100	0-10

Sub-section D. Mix Design:

The mix design shall meet the following requirements:

- Mix design compressive strength (28 day) – between 50 to 150 psi.
- Portland Cement – at least 50 pounds per cubic yard.
- Fly Ash – at least 300 pounds per cubic yard.
- Slump – 6 to 10 inches maximum.

Section 11.09 BASE COURSE

Base for all streets shall consist of clean, hard, tough, durable, and sound mineral aggregates that consist of crushed stone, gravel, or crushed recycled concrete and shall be graded as follows:

Sieve Size	Percent Passing
3/4 inch	100
3/8 inch	78-92
No. 4 sieve	55-67
No. 16 sieve	28-38
No. 200 sieve	7-11

The crushed recycled concrete shall have 75 to 100% passing the 3/4 inch sieve. Slag may be permitted with approval by the Public Works Representative/Engineer.

The material shall be deposited and spread in a uniform layer, without segregation of size, with such depth that when compacted, the layer will have the required thickness as stated below.

Developer/Contractor shall be required to set red heads to ensure that the road is crowned to give 2% cross slope. Red heads shall be set every 25 feet. Any other spacing shall require approval by the Public Works Representative/Engineer.

Each layer shall be compacted for the full width and depth. Alternate blading and rolling will be required to provide a smooth, even and uniformly compacted course true to cross section and grade. Places inaccessible to rolling shall be compacted with mechanically operated hand tampers.

The gravel base shall be compacted to not less than 95% maximum dry density as determined by AASHTO T-180. Surfaces shall be true to the established grade with thickness being not less than 1/4-inch from the required layer thickness and with the surface elevation varying not more than 3/8-inch in ten-feet from the true profile and cross section.

Section 11.10 TACK COAT

The Developer/Contractor shall apply asphaltic material to existing asphalt concrete or Portland cement concrete edges and surfaces that will be in contact with the bituminous surface course. Apply tack coat only to area covered with bituminous surface course in the same day. The following criteria shall be followed:

1) Certificate showing asphaltic material complies with these Specifications.
2) Identify water/asphalt dilution ratio.
3) Identify tack coat application rate (typically 0.05 to 0.15 gallons per square yard).
4) All existing asphalt shall be saw cut to remove fractures, cracked, or damaged asphalt. Developer/Contractor shall trim the existing pavement to clean straight lines as nearly perpendicular or parallel to the centerline of the street as practicable. Said straight lines shall be thirty feet minimum lengths and no deviations from such lines shall be made except as specifically permitted by the Public Works Representative/Engineer.
5) Apply tack coat only when air and roadbed temperatures in the shade are greater than 40 degrees F. The temperature restrictions may waived only on written authorization from Public Works Representative/Engineer.
6) Do not apply tack coat during rain, fog, dust, or other unsuitable weather. Do not apply coat to wet surfaces.
7) Follow notification requirements stated in these Specifications.
8) Tack coat shall be SS-1 or SS-1h or equivalent.
9) Clean the surface to be treated free of dust and other foreign material. If flushed, allow surface to dry. If leaves from trees, blow clean.
10) Prevent pedestrian, vehicles, pets, etc. access to tack surfaces.
11) The tack shall be applied under pressure using a spray bar or hose and nozzle. The tack shall be evenly spread with 100% coverage. Other methods of application may be used only upon approval of the Public Works Representative/Engineer.
12) Protect all surfaces exposed to public view from being spattered or marred. Remove spattering, over-coating, or marring.
13) Do not discharge bituminous material into borrow pits or gutters.
14) Do not permit traffic to travel over the tacked surface until bituminous tack coat is cured or is not picked up by traffic.

Section 11.11 BITUMINOUS ASPHALT CEMENT PAVEMENT

Over the dry, dust-free compacted base course, the Developer/Contractor shall place and compact a bituminous asphalt cement surface course. The surface course shall consist of a mixture of a mixture of mineral aggregate and binder.

Sub-section A. Submittals:

The Developer/Contractor shall establish and submit the mix design to the Public Works Department for approval at least ten working days prior to paving. The following information shall be included:

1) Date of mix design
2) Mix design method used
3) Traffic criteria used
4) Additives in the mix, including cement, hydrated lime, recycled asphalt pavement (RAP), liquid antistrip and including pertinent information for each.
5) Asphalt binder type
6) Source of the aggregate
7) Target aggregate gradation and bands
8) Theoretical maximum (Rice) density (G_{mm}) of the mix
9) Percent asphalt content (P_b)
10) Effective percent asphalt content (P_{be})
11) Percent air voids in the mix (VA)
12) Percent air voids in the mineral aggregate (VMA)
13) Percent air voids filled with asphalt (VFA)
14) Marshall stability and flow
15) Temperature of the mix at source and site for optimum compaction

Sub-section B. Mix Design Method:

The mix design shall follow the Marshall mix design methods outlined in Asphalt Institute MS-2 Asphalt Mix Design Methods, current edition:

Sub-Section C. Marshall Mix Design Criteria

Mix designs must have been from the current or previous calendar year.

Use design criteria for medium traffic.

Used a ½" mix design for a local streets and either a ½" or ¾" mix design for collector or arterial streets, as approved by Public Works.

Use a design mix consisting of crushed aggregate conforming to the following gradations (for both roadways and trails):

	Percent Passing	
Sieve Size	**½" Mix Design**	**¾" Mix Design**
3/4 inch	-	100
½ inch	100	-
3/8 inch	-	75-91
No. 4	60-80	46-62
No. 8	-	-
No. 16	28-42	22-34
No. 50	11-23	11-23
No. 200	3-7	3-7

Aggregate shall consist of clean, hard, durable, angular, sound crushed stone/gravel, slag, or sand, or combinations of these.

Course aggregate shall have the following characteristics:

1) Angularity: minimum of 90% by weight of particles with at least two fractured faces (ASTM D 5821)
2) Hardness: maximum of 35% wear of aggregate retained above the No. 4 sieve (ASTM C 131)
3) Flat or elongated particles: maximum of 20% retained above 3/8 inch sieve has a 3:1 length to width ratio (ASTM D 4791)

Fine aggregate shall have the following characteristics:

1) Angularity (uncompacted void content): minimum of 40% (AASHTO T 304)
2) Sand equivalent: minimum of 45% (ASTM D 2419)
3) Plastic limit: 0% maximum (ASTM D 4318)

The target air voids (VA) in the mix shall be 3.5% (ASTM D 6927)

The target voids in the mineral aggregate (VMA) shall be 14% for ¾" mix and 15% for ½" mix.

The target voids filled with asphalt (VFA) shall be 75% to 77%.

The bituminous material shall be PG 58-28 (or higher grade) performance graded asphalt cement conforming to the requirements of ASTM D 6373.

The effective asphalt content (P_{be}) of the mix shall be no less than 5% of the mix (by weight).

Recycled asphalt pavement (RAP) may be used in the mix. Modify the asphalt binder grade as necessary to account for the effect of the RAP on viscosity. RAP content in the mix is subject to the following:

1) Up to 15% (by weight): no change in the asphalt binder grade is required as long as the mix meets gradation, viscosity, VMA and VFA requirements.
2) Over 15% and up to 20% (by weight of RAP or binder, whichever is lesser): allowed if binder grade is modified according to AASHTO M323 to meet the specified binder grade; so long as the mix meets the following requirements of the Hamburg rut test (AASHTO T 234):
    a) The test is performed at temperatures that correspond to the specified asphalt binder grade.
    b) The average rut depth is less than 15 mm at 10,000 passes for local streets and 15 mm at 20,000 passes for collector or arterial streets.
3) Over 20% (by weight): not allowed

Sub-Section D. Pavement Placement

The bituminous mixtures shall be spread with self-propelled mechanical spreading and conditioning equipment capable of distributing at least a 12-foot width. The mixture shall be spread and struck off in such a manner than the finished surface shall result in a uniform smooth surface. The longitudinal joints in succeeding sources shall be offset at least 12 inches transversely to avoid a vertical joint through more than one course.

No bituminous surface course shall be placed unless the temperature of the air or roadbed is 50 deg F and rising, during rainy weather, when the base is wet, or during other unfavorable weather conditions as determined by the Public Works Representative/Engineer. The air temperature shall be measured in the shade.

Provide continuous forward paver movement so temperature 10 feet behind paver is as follows:

1) Warm Mix Placement: 200 deg F minimum.
2) Hot Mix Placement:

Minimum Pavement Temperature in Degrees F						
Air Temperature Deg F	Compacted Mat Thickness					
	3/4"	1"	1-1/2"	2"	3"	4"+
45 - 50	-	-	-	-	280	265
50 - 59	-	-	-	280	270	255
60 - 69	-	-	285	275	265	250
70 - 79	285	285	280	270	265	250
80 - 89	280	275	270	265	260	250
90 +	275	270	265	260	250	250

After the mixture has been spread, the surface shall be rolled in the longitudinal direction, commencing at the outside edge or lower side and proceeding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half the width of the roller. Rolling shall continue until 95% of the laboratory density, as determined in accordance

with ASTM D 1559, for the bituminous mixture being used has been obtained. Density tests shall be done following the procedures of ASTM D2950.

Check thickness with a probe and density with a nuclear density gage during placement of the asphalt. However, resulting information is for information only, and shall not be used for acceptance.

Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller. For asphalt thicknesses greater than 3", asphalt shall be placed in lifts of approximately equal thickness and each lift shall not exceed 3".

The finished asphalt surface shall be ½" higher than the lip of gutter.

It is the responsibility of the Developer/Contractor to control traffic. All traffic shall be kept off the completed surface for a minimum period of 24 hours.

Replace removed cores with hot mix asphalt or low strength concrete within two days.

Sub-Section E. Acceptance

Acceptance in terms of thickness and density shall be based on core samples as described below, not on measurements from probes or nuclear density gages.

The surface of the pavement, after compaction, shall be uniform and true to the established grade. When tested with a ten-foot straight edge placed on the surface of the pavement, at any point, the surface shall not deviate more than 1/8" from the lower edge of the straight edge. All high and low spots shall be remedied immediately by removing the wearing course material over the affected areas and replacing it with fresh, hot wearing course and surface finish material and immediately compacting it to conform with surrounding area.

Test the mat for density as follows:

1) Acceptance of bituminous surface course with respect to compaction of the mat shall be based upon density tests on core samples in a test lot.
2) A test lot shall be the quantity or surface course placed and compacted in each construction day.
3) Test one (1) core sample per 1,000 square yards of paved area, with a minimum of one test per lot.
4) Take samples to determine theoretical maximum (Rice) density (G_{mm}) at the time bituminous surface course is placed and before compaction as determined in accordance with ASTM D 2041 or AASHTO T 209.
5) Take 4" diameter core samples at random locations selected per ASTM D 3665 and ASTM D 5361; however, if a random location is within one foot of a longitudinal joint, move to a point one foot away from the joint.

6) Determine field density of core samples per ASTM D 1188 or ASTM D 2726/AASHTO T 166, as appropriate.
7) The test lot shall be accepted with respect to density when the average of all density determinations is a minimum of 93% and a maximum of 97% of the theoretical maximum (Rice) density (G_{mm}), with no single test less than 91%.

Test longitudinal joints for density as follows:

1) At the location (ie. station) of each random mat density core, take one 6" core sample over the nearest longitudinal joint. Determine field density of core samples per ASTM D 1188 or ASTM D 2726/AASHTO T 166, as appropriate.
2) Acceptance of bituminous surface course with respect to longitudinal joint compaction shall be based upon density tests on core samples in a test lot.
3) A test lot of longitudinal joint core samples consists of those samples taken adjacent to the set of mat density core samples that constitute a test lot.
4) Longitudinal joint density shall be accepted when the average of all longitudinal joint determinations is a minimum of 91% of the theoretical maximum (Rice) density (G_{mm}), with no single test less than 89%.

Test for thickness as follows:

1) Acceptance of the completed bituminous surface course with respect to thickness shall be based on thickness tests of core samples in a test lot.
    a. A test lot consists of all mat density core samples within a test lot, and
2) The thickness of each core shall be determined per ASTM D 3549.
3) A lot shall be accepted with the average thickness of all samples is less than ¼-inch less than the total designated bituminous surface course thickness and when no individual sample shows a deficient thickness of more than 3/8-inch.

Select one random core sample per lot to test the composition of the bituminous surface course. Determine the following characteristics of the bituminous surface course:

1) Theoretical Maximum (Rice) Density (G_{mm})
2) Stability (Marshall, 50 blows) must be at least 750 lb
3) Flow (Marshall, 0.01in.) shall be between 8 and 18
4) Aggregate: must be within the gradation band of the mix design
5) Binder: asphalt binder content and effective asphalt binder content must be within +/- 0.35% of the mix design.
6) Voids:
    a. Air voids (VA) in the mix must be between 2.5% and 5%
    b. The voids in the mineral aggregate (VMA) must be +/- 1.25% from the designed target.
    c. The voids filled with asphalt (VFA) must be 63% to 77%

Section 11.12 ADJUSTING MANHOLES AND VALVE BOXES TO FINAL GRADE

This section covers the requirements for adjusting manholes and valve boxes to final grade.

Where the existing manhole/valve collar is permitted by the City to remain in place; adjustment to final grade shall be made with cast-iron ring inserts. Inserts shall be used to raise covers no more than 2 inches. Adjustment shall be made after the asphalt surface has been placed.

Where the existing manhole/valve collar is required to be removed; adjustment to final grade shall be made using the Whirlygig method and apparatus, in accordance with manufacturer's instructions and guidelines.

Where manholes are to be raised, this is to be done as specified in Division 5 MANHOLES.

Rings and covers shall be protected during backfilling and compaction of the soil and during the placing or replacing of road surfaces. Any ring or cover loosened from the manhole section shall be reset in cement mortar and any ring or cover damaged or broken shall be replaced by the Developer/Contractor at its expense.

Section 11.13 PAVEMENT CRACK SEAL

This section covers filling and sealing cracks in asphalt concrete pavements. Crack filling and sealing shall comply with the requirements of ASTM D 5078: Standard Specification for Crack Filler for Asphalt Concrete and Portland Cement Concrete Pavements and ASTM D 3405: Joint Sealant, Hot-Applied, for Concrete and Asphalt Pavements. Crack filling is defined as the placement of materials into cracks to substantially reduce infiltration of water and to reinforce the adjacent pavement. The crack receives no special preparation other than cleaning. Crack sealing is the placement of specialized materials in cracks or above to prevent the intrusion of incompressible material and water into the crack. The crack receives unique crack configuration preparation. Potholes are cracks wider than 1-inch. The Developer/Contractor shall submit manufacturer's certification of compliance at least 5-days prior to doing the crack sealing.

Sub-section A. Quality Assurance:

The following guidelines shall be followed to assure the quality of the work:

2) Deliver packaged material in unopened packages with labels clearly indicating the following:
    a) Name of manufacturer
    b) Manufacturer's product name or product number
    c) Manufacturer's batch or lot number
    d) The application temperature range
    e) The recommended application temperature and the safe heating temperature range
3) Do not use crack repair product that has been over-heated, suffered prolonged heating or which ravels or can be pulled out by hand after placement.
4) Do not mix different manufacturer's brands or different types of crack repair material.

5) Do not depress crack repair product temperature at the wand tip below the manufacturer's recommended application temperature when loading product into product tank.
6) Rework defective work.

Sub-section B.Filler and Sealer Material:

The filler shall be asphalt emulsion. The sealer shall be hot applied rubber or hot applied rubberized asphalt. Crack treatment materials shall meet the following requirements:

Material Type	ASTM	Application
Hot-applied Thermoplastic Materials		
Asphalt Rubber	D 5078	Sealing (possibly filling)
Rubberized Asphalt	D 1190, D 3405	Sealing
Cold Applied Thermoplastic Materials		
Asphalt Emulsion	D 977, D 2397	Filling

Sub-section C. Equipment:

The following equipment shall be used to apply the materials.

1) Sealant heating equipment shall be indirect heating using double boiler or circulating hot oil heat transfer for heating the product. Unit must have means of constant agitation.
2) Do not use direct heat transfer units (tar pots).
3) Hot compressed air lance that provides clean, oil-free compressed air at a volume of 100 cubic feet per minute at a pressure of 120-pounds per square-inch at the lance tip.

Sub-section D. Advanced Preparation:

Prior to the crack repair the Developer/Contractor shall;

1) With the Public Works Representative/Engineer identify the locations that are to have crack repair.
2) Notify neighborhood of the date and time that crack repair will take place at least 48-hours in advance of when the repairs will begin.
3) Allow at **least one week** for repaired cracks to cure and harden before placing thin overlays.
4) Repair potholes or failed spots full depth.

Sub-section E. Application:

1) Immediately before sealing the joints, blow cracks clean, clean 6-inches on both sides of the joint, remove foreign matter, loosened particles, and weeds.

2) Use a HCA (hot compressed air) heat lance when surfaces are wet or when air temperature is less than 40 degrees F. Do not burn the surrounding pavement. Fill cracks immediately after heating with the air lance or reheat.
3) Fill each crack to within 1/4-inch of the existing surface.
4) If a thin pavement (chip seal) is to be applied, remove crack overfill by squeegee.
5) Use an appropriate backer rod in the joint opening where the depth and width of the joint opening are greater than 2-inches and 1/2-inch respectively.
6) Place sand on surface of crack product if traffic or construction activities are likely to cause pull out. The sealant material picked up or pulled out shall be replaced by the Developer/Contractor at their expense.
7) The Developer/Contractor will remain liable for any damage to the traveling public resulting from sealant application or sealant pull-out. Developer/Contractor shall repair vehicles or other property damaged by the crack repair operation.

Sub-section F. Backer Rod:

Use closed-cell, polyethylene-foam rods conforming to the following requirements:

Backer Rod Requirements and Test Methods		
Diameter	Joint width + 1/8-inch	
Density	2 lbs/ft^3	ASTM D 1622
Tensile Strength	25 psi	ASTM D 1623
Absorption	0.5 percent by volume	ASTM D 509
Compression Deflection	25 percent at 8 psi	ASTM D 1621

Section 11.15 MICRO-SURFACING

Sub-section 1. General:

1.1 SECTION INCLUDES

1) Products and procedures for mixing and spreading a properly proportioned mixture of aggregate, mineral filler, additives, polymer-modified asphalt emulsion, and water.
2) Products and procedures for a cured mixture with a homogeneous appearance, a firm surface adhesion, and a skid resistant texture.
    a) Provide a micro-surface mixture that is capable of being spread in variable thickness cross-sections, ruts, scratch courses, and surfaces.

1.2 RELATED SECTIONS

1) Section 11.16 Hydrated Lime

1.3 REFERENCES

1) AASHTO M 17: Standard Specification for Mineral Filler for Bituminous Paving Mixtures
2) AASHTO M 208: Standard Specification for Cationic Emulsified Asphalt
3) AASHTO T 11: Materials Finer Than 75 μm (No. 200) Sieve in Mineral Aggregate
4) AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates
5) AASHTO T 49: Penetration of Bituminous Materials
6) AASHTO T 53: Softening Point of Bitumen
7) AASHTO T 59: Testing Emulsified Asphalts
8) AASHTO T 96: Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
9) AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
10) AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
11) AASHTO T 278: Surface Frictional Properties Using the British Pendulum Tester
12) AASHTO T 279: Accelerated Polishing of Aggregates Using the British Wheel
13) AASHTO T 316: Viscosity Determination of Asphalt Binder Using Rotational Viscometer
14) ASTM D 6372: Standard Practice for Design, Testing and Construction of Micro-Surfacing
15) ISSA A 143 Guidelines (Current edition)
16) UDOT Minimum Sampling and Testing Requirements

1.5 SUBMITTALS

1) Provide the Engineer with Mix Design 10 days prior to beginning construction.
    a) Meet requirements of this Section, article 2.6.
2) Provide the Engineer with the following for asphalt/polymer emulsion with job-mix design.
    a) Test report: Meet the requirements of this Section, article 2.1.
    b) A sample of asphalt/polymer emulsion with job-mix design.
    c) A certificate of analysis and compliance from the manufacturer for each shipment
    d) Target gradation for combined aggregate and mineral filler.
    e) Verify asphalt/polymer emulsion supplier adheres to UDOT Minimum Sampling and Testing Requirements Section 508 Asphalt Emulsion Quality Management Plan.
3) Provide test reports for mineral aggregate.
    a) Meet the requirements of this Section, article 2.2.
4) Provide verification that Hydrated Lime meets. Refer to Section 11.16.
5) Provide a Manufacturer's Certificate of Compliance for Mineral Filler.
6) Provide calibration documentation for each mixing unit that includes an individual calibration for each material at various settings, which can be related to the machines metering devices.
7) To make changes in the job-mix gradation:
    a) Submit a written request for a change in the job-mix gradation.

b) Submit a new job-mix design if any changes in gradation are outside the gradation band allowed by the stockpile tolerance in Table 2.

Sub-section 2. Products:

2.1 EMULSIFIED ASPHALT

1) Use a CSS-1h, quick-set polymer-modified asphalt emulsion conforming to AASHTO M 208; delete the cement mixing test requirements.
2) Mill or blend the polymer material into the asphalt or emulsifier solution prior to the emulsification process.
3) The asphalt/polymer emulsion must parallel the standard from an established infrared spectrum characterizing the asphalt/polymer emulsion.
4) Modified Emulsion Residue, meet Table 1:

Table 1

MODIFIED EMULSION RESIDUE		
TEST	**DESCRIPTION**	**SPECIFICATION**
AASHTO T 49	Penetration, 77°	40-90
AASHTO T 53	Softening point	135° Min
AASHTO T 59-modified (a)	F Residue by distillation	62% Min.
AASHTO T 316	Rotational Viscosity 275° F	650 CPS
(a) Modified distillation procedure: Heat emulsion residue to 270 ± 10 degrees F and maintain that temperature for 20 minutes. Perform the distillation within 60 ± 15 minutes		

2.2 MINERAL AGGREGATE

1) Use 100 percent manufactured mineral aggregates that meet the following requirements:
   a) Clean and free from organic matter, clay balls, or other detrimental substances.
   b) Maximum weighted sodium sulfate soundness loss of 15 percent. Refer to AASHTO T 104.
   c) Maximum loss by abrasion of 30 percent. Refer to AASHTO T 96.
   d) Sand equivalent of sixty or greater. Refer to AASHTO T 176.
   e) Minimum polishing value of 31. Refer to AASHTO T 278 and T 279.
      i) Performed on aggregate prior to crushing.
      ii) Predominantly limestone or dolomite aggregates will not be accepted.
2) Select a job mix or target gradation within the gradation band. Base the mix design on this gradation. The percent passing each sieve will not vary by more than the stockpile tolerance and still remain within the gradation band after the target gradation has been submitted. Refer to AASHTO T 11, AASHTO T 27, and Table 2.

Table 2

Job-Mix Gradation Design Limits

Sieve Size	Broad Band Gradation Percent Passing	Stockpile Tolerances
⅜	100	0
#4	70-90	±5
#8	45-70	±5
#16	28-50	±5
#30	19-34	±5
#50	12-25	±4
#100	7-18	±3
#200	5-15	±2

2.3 MINERAL FILLER

1) Use portland cement, hydrated lime, or aluminum sulfate as specified in AASHTO M 17

2.4 WATER

1) Use water that is potable and free from harmful salts, reactive chemicals, and any other contaminants.

2.5 ADDITIVES

1) Use additives as required to accelerate or retard the break-set of the micro-surface mix, to improve the resulting finished surface, or to increase adhesion.
    a) Determine the initial additive quantities from the mix design for the micro-surface mix or individual materials.
    b) Use additives that are compatible with the other components of the mix.
    c) Obtain Engineer approval for use of additives.

2.6 JOB-MIX DESIGN

1) Design according to ASTM D 6372-99a.
    a) Show each ingredient amount:
        i) Residual asphalt cement content, within 7.5 ± 2 percent by dry total weight of aggregate.
        ii) Aggregate gradation (target) within the job-mix gradation design limits in Table 2.
        iii) Mineral filler, percentage by total dry weight of aggregate.
        iv) Polymer modifier 2.5 percent minimum polymer solids based on the residual asphalt content.
    b) Identify additives as determined by design testing to control mix set times and adhesion.

i) Provide acceptable percent limits for additives.

c) Conform to the ISSA A143 specifications listed in Table 3.

d) Use the same materials and aggregate gradation to be used on the project.

Table 3

ISSA Specifications		
ISSA TEST NO.	**DESCRIPTION**	**SPECIFICATION**
ISSA TB-139	Wet Cohesion @ 30 Minutes Minimum (Set) @ 60 Minutes Minimum (Traffic)	 12 kg-cm Minimum 20 kg-cm Minimum or Near Spin
ISSA TB-109	Excess Asphalt by LWT Sand Abrasion	50 g/ft^2 Maximum (538 g/m^2 Maximum)
ISSA TB-114	Wet Stripping	Pass (90% Minimum)
*ISSA TB-100	Wet-Track Abrasion Loss One-hour Soak Six-day Soak	 50 g/ft^2 (538 g/m^2) Maximum 75 g/ft^2 (807 g/m^2) Maximum
ISSA TB-147	Lateral Displacement Specific Gravity after 1,000 Cycles of 125 Pounds	5% Maximum 2.10 Maximum
ISSA TB-144	Classification Compatibility	11 Grade Points Minimum (AAA, BAA)
ISSA TB-113	Mix Time @ 77 degrees F	Controllable to 120 Seconds Minimum

* Perform the wet track abrasion test under laboratory conditions as a component of the mix design process.

2.7 EQUIPMENT

1) Use mixing equipment specifically designed and manufactured to mix and place micro-surfacing.
   a) Mix the material by an automatically sequenced, self-propelled micro-surfacing mixing machine that will be a continuous flow mixing unit, able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving multi-blade double shafted mixer and discharge the mixed product on a continuous flow basis.
   b) Use a machine with sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive, and water to maintain an adequate supply to the proportioning controls.
   c) Use a machine capable of self-loading materials while continuing to place micro-surfacing.
   d) Equip the machine to allow the operator to have full control of the forward and reverse speed during applications of the micro-surfacing material.
      i) Use original equipment manufacturer design for the self-loading device, opposite side driver stations, and forward and reverse speed controls.

e) Use proportioning devices with individual volume or weight controls for proportioning each material, such as aggregate, mineral filler, emulsified asphalt, additive, and water to be added to the mix.
    i) Use proportioning devices with controls properly marked that calibrate and determine the material output at any time.

2) Use spreading equipment that will agitate and spread the mixture uniformly by means of twin-shafted paddles or spiral augers fixed in the spreader box.
    a) Provide a front seal that results in no loss of mixture at the road contact point.
    b) Provide an adjustable rear seal that acts as final strike-off.
    c) Use a spreader box with the rear strike-off designed and operated to produce a free flow of uniformly consistent materials to the rear strike-off.
    d) Use a spreader box with a suitable means provided to side shift the box to compensate for variations in the pavement geometry.
    e) Provide a secondary strike-off to improve surface texture and with the same adjustments as the spreader box.
    f) Use a rut filling spreader box specifically designed to fill ruts when filling ruts with an average depth greater than one-half inch.
        i) Apply micro-surface as a scratch-coat pass when required to fill ruts less than ½ inch at the direction of the Engineer.
        ii) Make multiple passes with the rut filling spreader box for ruts of over ½ inch at the direction of the Engineer.
        iii) Allow a 24-hour cure time after filling ruts before placing final micro-surfacing layer.
3) Calibrate each mixing unit in the presence of the Engineer as follows:
    a) Prior to using on the project.
    b) After repairs or as directed by the Engineer.

Sub-section 3. Execution:

3.1 LIMITATIONS

1) Do not apply micro-surface during rain, when road surface moisture is present, or during other adverse weather conditions.
2) Do not apply micro-surface if either the pavement or air temperature is below 50 degrees F.
3) Do not apply micro-surface when the temperature is projected below 33 degrees F within 24 hours of placing micro-surface.
4) Cease micro-surface operations when the weather or other conditions prolong opening road surface to traffic beyond two hours.
5) Keep traffic off roadway surface until the micro-surface has cured.

3.2 STOCKPILE

1) Construct individual 500-ton stockpiles of micro-surface aggregates.
    a) Engineer approves stockpiles a minimum of one and a maximum of seven days prior to use.

2) Notify the Engineer a minimum of seven calendar days prior to micro-surface placement in order for the initial stockpiles to be sampled and tested for acceptance.
3) Obtain the Engineer's written acceptance of a stockpile prior to its use in micro-surface.
4) Remove material not meeting specifications from the stockpile area.
5) The Department will retest corrected material for acceptance.

3.3 PREPARATION

1) Clean the surface of all dirt, sand, dust, oil, and other objectionable material immediately prior to applying micro-surface.
2) Allow un-sealed cracks to dry thoroughly prior to applying micro-surface when using water to clean the road surface.
3) Cover manholes, valve boxes, drop inlets, and other service utility entrances prior to surfacing.

3.4 APPLICATION

1) Pre-wetting the surface is allowed when required by local conditions by fogging ahead of the micro-surface box.
    a) Do not over apply causing free water to sit on the pavement in front of the micro-surface box.
2) Place micro-surface mix that meets the job-mix design.
    a) Control the ingredients proportions by metering or measuring devices on the micro-surfacing equipment.
        i) Use readings from the metering or measuring devices to determine compliance with limits stated in the approved job-mix design.
    b) Limit any increase or decrease in the amount of mineral filler added to the mix during production to ±1 percent of the job-mix design.
    c) The emulsion submitted with the job-mix design will serve as the standard to assure the same emulsion is used throughout the project.
        i) Engineer may request a new job-mix design and re-approval of the micro-surfacing if large disparities occur.
3) Pass the mineral aggregate over a scalping screen prior to transfer to the micro-surfacing mixing machine to remove oversize material.
4) Carry a sufficient amount of micro-surface in all parts of the spreader so that full width and complete coverage is obtained with no streaks or narrow spots.
    d) Avoid overloading the spreader.
5) Apply micro-surface of proper consistency at an average rate of 24 to 30 lb/yd^2.
    e) Apply micro-surface for rut filling as required.
6) Do not add additional water for any reason once the mixture has been placed onto the road surface.
7) Remove and replace the micro-surface if any of the following occurs:
    f) Lumping, balling, or unmixed aggregates.
    g) Separation of the coarse aggregate from the emulsion and fines.
    h) Excessive breaking of emulsion inside the spreader box.

i) Streaking caused by oversized aggregate.
j) Flushing or excessively rich areas appearing in the micro-surfacing after two hours from the time of placement.
k) Any measurable rutting, shoving, or other evidence of premature deformation when exposed to traffic with re-approved micro-surfacing materials and procedures.

3.5 TEST STRIP

1) Apply a test strip of at least 500 ft in length on the roadway before initial placement commences.
    a) Achieve initial set within 30 minutes and show no visual signs of distress when exposed to traffic action after curing for 2 hours.
    b) Become part of the completed item if the above conditions are present and all other requirements are met.
    c) Remove and replace the micro-surfacing at no expense to the Department if the test strip fails to meet the conditions stated above.
2) Make necessary adjustments if test strip does not pass.
    a) Obtain approval from the Engineer prior to repeating the test strip process.
    b) The Engineer may require a new job-mix design if failures indicate an ingredient problem.

3.6 FINISHING DETAILS

1) Place the micro-surface so the depth of each course does not exceed twice the maximum aggregate size.
2) Do not create build-up when constructing longitudinal and transverse joints.
3) Place micro-surface adjacent to concrete pavements or concrete curb and gutter with a straight longitudinal edge.
    a) Do not allow over-lap in these areas.
4) Maintain straight lines at all locations.
5) Place micro-surface at side streets and intersections out to right-of-way line.
6) Use hand squeegees to spread micro-surface in areas that cannot be reached with micro-surface machine.
    a) Lightly dampen areas prior to mix placement.
    b) Provide complete and uniform coverage.
    c) Avoid unsightly appearance from handwork.
    d) Use the same type of finish in hand worked areas as applied by the spreader box.
7) Use construction paper or comparable products so all beginning and ending joint lines from each construction pass are straight.

Section 11.16 HYDRATED LIME

Sub-section 1. General:

1.1 SECTION INCLUDES

1) Products and procedures for incorporating hydrated lime into all asphalt mixes.

1.2 REFERENCES

1) AASHTO M 303: Lime for Asphalt Mixtures
2) ASTM C 110: Physical Testing of Quicklime, Hydrated Lime, and Limestone
3) ASTM C 1097: Hydrated Lime for Use in Asphaltic-Concrete Mixtures
4) ASTM C 1602: Mixing Water Used in the production of Hydraulic Cement Concrete
5) UDOT Quality Management Plan

1.3 SUBMITTALS

1) Verification that the supplier is pre-qualified.

1.4 QUALITY ASSURANCE

1) Prequalification: Hydrated Lime, through UDOT Quality Management Plan for Hydrated Lime, Section 510.

Sub-section 2. Products:

2.1 HYDRATED LIME

1) Hydrated Lime: Meet AASHTO M 303, Type I, as specified.
    a) Conform physical requirements to ASTM C 1097, subparagraph d.1.
    b) Use test method ASTM C 110, paragraph 5.4.

2.2 WATER

1) Use potable water or water meeting ASTM C 1602.

Sub-section C. Execution:

3.1 APPLICATION

1) Add hydrated lime to all asphalt pavement mixes.
    a) Add the determined quantity of lime, following mix design.
    b) Base the amount of hydrated lime used on the dry weight of the aggregate.
    c) Use either Method A or B, unless Method B is called for in the bid schedule.
2) Method A: Lime Slurry – One part lime and three parts water by weight.
    a) Add lime at a minimum of 1 percent by weight.
    b) Maintain the lime slurry mix in a malted milk consistency.
    c) Deliver lime slurry to the twin shaft pugmill for mixing with aggregate.

d) Adjust quantity (percent) of lime as necessary, based on results of Hamburg Wheel Tracker test.

3) Method B: Lime and Aggregate Stockpile Marination:
   e) Provide sufficient free moisture to thoroughly wet the aggregate and activate the lime before introducing hydrated lime.
   f) Add lime at a minimum of 1 ½ percent by weight.
   g) Thoroughly mix wet aggregate/lime mixture in a twin shaft pugmill.
   h) Marinate the aggregate/lime mixture in the stockpile for a minimum of 48 hours.
   i) Adjust quantity (percent) of lime as necessary, based on results of Hamburg Wheel Tracker test.
   j) Use the wet cured aggregate within 60 days.
4) Mixing Methods A and B: Provide a horizontal twin shaft pugmill.
   k) Adjust mixing paddles in the pugmill so that the aggregate being discharged is completely coated by the lime slurry.
   l) Do not allow volume of material in the pugmill to extend above the vertical position of the blade tips.

3.2 CONTROL AND MONITOR

1) Control the lime batching operation by the Program Logic Control (PLC) System based upon production set up data.
2) Monitor the following aspects and record on the computer data log printout:
   a) Display target and actual rates.
   b) Belt weight bridge for lime.
   c) Locked-in water meter.
   d) Meter to transfer lime slurry.
   e) Closed end loop to mainframe computer.

3.3 QUALITY CONTROL

1) Tolerance Controls
   a) Tolerance lime weight vessel static calibration ± 1.5 percent.
   b) Dynamic delivery calibration ± 1.5 percent.
   c) Inlet flow meter ± 2 percent.
   d) Discharge flow meter ± 1.5 percent.

Section 11.18 SLURRY SEAL - TYPE II

The Contractor shall apply a Emulsified "Type II, Asphalt Slurry Seal" as specified by the Performance Guidelines of the International Slurry Surfacing Association, A 105 (Revised), November 2005.

Emulsified Asphalt

The emulsified asphalt shall conform to Grade CQS-1h (Quick-Set Mixing Grade) as specified in ASTM D977, ASTM D2397, AASHTO M140 and AASHTO M208. The cement mixing test is waived.

Section 11.19 PAVEMENT MARKING MATERIALS

This section covers striping and other pavement markings on public right-of-ways. All pavement markings for crosswalks, stop bars and symbols shall use thermoplastic materials meeting the requirements stated below.

Sub-section A. Service Life Testing:

1) City performs service life testing.
2) Performance measures: Retro-reflectivity, color contrast and stability, and durability under all traffic volumes and wear conditions, unless stated otherwise.
3) Retro-reflectivity is measured using a federally approved instrument (30 m geometry).
4) When performing Service Life Testing, take readings on clean surface areas free of debris.

Sub-section B.Preformed Thermoplastic Pavement Marking

1) Used for crosswalks, stop bars and symbols and for use on all pavement surfaces.
2) Minimum Service Life for longitudinal lines, legends and symbols under all traffic volumes and wear conditions:
   a) Crosswalks, stop bars and symbols: 24 months.
3) Performance Measures for Retro-reflectivity, and Durability.
   a) Minimum Level of Retro-reflectivity: 125 millicandelas.
   b) Minimum Durability: 90 percent of the each crosswalk, stop bar or symbol must be present.
   c) Failure to meet any of the specified performance measures on at least 90 percent of the crosswalk, stop bar or symbol is considered a complete failure of that crosswalk, stop bar or symbol.
4) Hot-melt Thermoplastic:
   a) Remove and replace crosswalks, stop bars and symbols that are below 80 wet mils in thickness.
   b) No payment for materials placed in excess of 100 wet mils in thickness.

Sub-section C. Preparation:

1) Conduct surface preparations in accordance with manufacturer's recommendations.

Sub-Section D. Application:

1) Apply Pavement Marking Materials according to manufacturer's specifications.

DIVISION 12

CONCRETE CURB, GUTTER AND SIDEWALK

Section 12.01 GENERAL

This section covers installation of curb and gutter, sidewalk, combination of curb, gutter and sidewalk, cross gutter, drive approaches, handicap ramps and curb returns. All improvements shall be constructed to the dimensions and thickness shown on the Standard Drawings.

Section 12.02 CONCRETE

Concrete shall be Class AA(AE) and shall meet all of the requirements of Division 8, Portland Cement Concrete. Under no condition shall the water cement ratio exceed 0.53.

Section 12.03 GRADE

Minimum flow line grade shall be 0.5 percent. Grade stakes for curb, gutter and/or sidewalk shall be placed every 25-feet around curves, 50-feet on tangent sections and at ¼ deltas on curb returns. Grade stakes shall be placed at all PC's, PT's, PCR's, VPC's, and VPT's. Grade stakes shall also be set at the point of change in grade not requiring a vertical curve. Grade stakes and cut sheets shall have the centerline station of the street written on them that are the same as the stationing shown on the improvements drawings.

After construction, gutters shall be checked by flowing water. The Public Works Representative/Engineer shall be present during the flow test. Any high spots or depressions (which exceed 0.02 feet) shall be repaired by grinding high spots to the correct grade and/or removing concrete and replacing to the correct grade. Puddling shall not stand from flow line past lip of gutter.

Section 12.04 FORMS

All forms shall be steel, except at curves with a radius smaller than 200 feet. They shall be of a size to match the sections shown on the Standard Drawings. Forms shall be held firmly in place with stakes or other approved means and shall be true to line and grade.

All forms shall be clean and coated with a light oil to prevent the concrete from adhering to them. Clamps, spreaders and braces shall be used where required to insure rigidity in the forms.

Forms shall not vary from vertical grade by more than 0.02 feet and from horizontal alignment by more than 0.02 feet. All forms shall have smooth even lines in both the horizontal and vertical plane.

Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviate from the arc of the curve.

Section 12.05 SUBGRADE PREPARATION

The Developer/Contractor shall grade to the line and grade approved by the City. **No concrete shall be placed without approved cut sheets**. The sub-grade shall be properly shaped to conform to the cross section shown on the Standard Drawings, graded and compacted. Compaction shall meet the requirements of Division 7 Earthwork.

All excess material excavated by the Developer/Contractor shall be removed from the site. Removal of the excavated material shall be done before or immediately after the concrete is placed. The Developer/Contractor shall maintain adequate barricades and other devices to protect the public until excavated material is removed.

Placement of concrete on unsuitable materials shall not be permitted. The subgrade surface shall have a 6-inch road base foundation as shown on the Standard Drawings. Prior to the placing of concrete, the subgrade shall be compacted using a mechanical foot compactor, with compaction being at least ninety-five percent (95%) of the maximum dry density as determined by AASHTO T-180. The surface shall be proof rolled prior to placing any concrete and no concrete shall be placed until the surfaces have been inspected and approved by the Public Works Representative/Engineer.

Section 12.06 CONSTRUCTION OF CURB, GUTTER AND SIDEWALK

Concrete curb, gutter and sidewalk may be constructed by first constructing the curb and gutter and then constructing the sidewalk behind it. If this method is used the joint between the back of curb and front edge of sidewalk shall be sealed. The curb and gutter may be placed using stationary forms or the slip method of forming.

Monolithic curb, gutter and sidewalk may only be constructed with approval by the Public Works Representative/Engineer. Stationary forms can be used to place combination curb, gutter and sidewalk. The slip form method can be used if it can be demonstrated that the tolerances specified herein can be met.

Curb and gutter to be installed with bituminous asphalt cement pavement shall have contraction joints placed every 10 feet by use of 1/8-inch steel template of the exact cross section of the curb and gutter. Where dividing plates are used joints shall have a minimum of 2-inches of concrete under the plate, or the joint will be sealed with an approved sealant. Remove the templates as the concrete takes initial set. Cut the joint 1-1/2 inches deep when using the slip form method to place the concrete. Use 1/2-inch thick, pre-molded, expansion joint filler at curb and gutter radii, where the curb and gutter abuts a solid object and at intervals not to exceed 50 feet, unless otherwise specified by the Public Works Representative/Engineer.

Joints in sidewalk, when placed separately and adjacent to the curb shall match the contraction and expansion joints in the curb and gutter as well as where the sidewalk abuts a solid object. Sidewalks not placed adjacent the curb shall have contraction joints at 10-foot intervals. The joints shall be approximately 3/16 inch wide and approximately one-half of the total slab

thickness in depth. Expansion joints shall be 1/2-inch thick, shall be placed every 50 feet, adjoins existing sidewalks, or abuts a solid object.

Material for 1/2-inch expansion joints shall be as specified in AASHTO M-153 and AASHTO M-213, and shall be installed with its top approximately 1/4-inch below the concrete surface.

After the concrete placed for a sidewalk has been brought to the established grade and screeded, it shall be float finished, edged and then given a light broom finish. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or hasten hardening. Surface edges of all slabs shall be rounded to a radius of 1/2 inch.

After concrete has been placed in curb and gutter forms, it shall be consolidated so as to insure a thorough mixture, eliminate air pockets, and create uniform, smooth sides. As the concrete takes its initial set the forms shall be removed and all exposed surfaces shall be float finished, edged and broomed lightly. The curb and gutter shall be constructed to the dimensions shown in the Standard Drawings.

The top and face of the curb and also the top of the apron on combination curb and gutter must be finished true to line and grade and without any noticeable irregularities of surface. The surface or face of the curb and gutter shall not vary more than 1/4 inch from a straight edge ten feet in length, placed on the curb parallel to the street center line nor shall any part of the exposed surface present a wavy appearance.

Testing for curb, gutter, and sidewalk must be conducted prior to its placement. One compaction test must be taken on the compacted road base material for every 50’ of curb, gutter or sidewalk installed. If under 25’ of curb, gutter or sidewalk is being placed, no compaction testing is required, however, the city inspector must inspect the road base prior to concrete placement. Work installed without the required testing may be rejected outright.

Section 12.07 CONCRETE CURB WALL

Concrete curb wall shall be Class AA(AE) and shall meet all of the requirements of Division 8, Portland Cement Concrete.

Reinforcing steel shall meet the requirements of Division 9, Reinforcing Steel.

Excavation for and backfill around the curb walls shall meet all the requirements of Division 7, Earthwork.

The curb walls shall be constructed to the dimensions and grades shown on the Standard Drawings or improvement drawings or as determined by the Public Works Representative/Engineer.

Section 12.08 6-INCH CONCRETE DRIVE APPROACH

The concrete to be used for the drive approach shall be Class AA(AE) and shall meet the requirements of Division 8, Portland Cement Concrete.

The drive approach shall be a minimum of 6-inch thick. They shall be constructed to the dimensions shown on the Standard Drawings. The concrete shall be finished as described above for sidewalks.

The drive approaches shall have a compacted 6-inch untreated base course under them.

Section 12.09 AMERICAN DISABILITIES ACCESSIBILITY STANDARDS IN PUBLIC STREET RIGHT-OF-WAYS

This section sets guidelines for accessibility in public rights-of-way. These guidelines are to be applied during the design, construction, and alteration of improvements in public rights-of-way. These guidelines are to be followed insomuch as they are technically feasible.

The construction of curb ramps and drive approaches shall conform to the Standard Drawings.

The following definitions apply:

a) The pedestrian access route is an accessible corridor for pedestrian use within the public right-of-way.

b) Pedestrian crossings are those locations in which pedestrians cross streets.

c) A ramp is a portion of the pedestrian access route that makes a vertical transition between two flatter surfaces. It is sloped in the direction of travel. It does not include the side flares that exist on a perpendicular curb ramp.

d) The side flare is the portion of a perpendicular curb ramp that transitions between the plane of the ramp surface and the plane of the flatter adjacent sidewalk.

e) The term perpendicular curb ramps refers to all features associated with a ramp whose running slope is perpendicular to the curb line.

f) The term parallel curb ramps refers to all features associated with a ramp whose running slope is in the direction of sidewalk travel.

g) Blended transitions are locations along the pedestrian access route in which the street and the sidewalk are at the same level.

h) Detectable warning is a surface feature built in or applied to walking surfaces or other elements to warn of hazards on a circulation path.

The pedestrian access route shall not be less than 4 feet wide, not including the curb, and shall have a cross slope of not more than 2%.

Concrete surfaces shall have a broom finish to increase slip resistance.

Sub-section A. Sidewalks:

The cross slope shall not exceed 2%.

Changes in level/elevation (vertical rises between adjacent surfaces) shall meet the following requirements:

1) Differences of up to ¼ inches can remain without beveling.

2) Differences of over ¼ inch but no more than ½ inch must be beveled with a maximum grade of 2:1 (50%).

3) Differences of over ½ inch must be removed or a ramp must be created having a maximum grade of 12:1 (8.33%).

Sub-section B. Curb Ramps:

Curb ramps shall be provided wherever a pedestrian access route crosses a curb.

The ramp grade shall not exceed 12:1 (8.33%).

The cross slope of the ramp shall not exceed 50:1 (2%), except that on perpendicular curb ramps at midblock crossings, the cross slope may match the slope of the adjacent street.

The minimum ramp width shall be 48 inches.

No lip shall exist at the bottom of curb ramps.

Sub-section C. Landings:

A landing shall exist at the top of curb ramps. The landing shall not have a slope in excess of 2% in any direction, and shall be a minimum of 48 inches by 48 inches in size. Parallel curb ramps and blended transitions shall have a landing at the bottom of the ramp (still in the sidewalk, not in the street) meeting the same criteria.

At the foot of diagonal curb ramps (ramps located in the curb return, whose running slope is directed diagonally into the intersection), a 48-inch by 48-inch landing of clear space must exist, beyond the curb line, entirely contained within the crosswalks, and outside of the vehicular travel lanes.

Sub-section D. Side Flares:

The slope of side flares on perpendicular curb ramps shall not exceed 10:1 (10%).

If it is not technically feasible to achieve a 4-foot landing (measured in the direction of the running slope of the ramp) at the top of a perpendicular curb ramp, the landing may be reduced to 3 feet, in which case the slope of the side flares shall not exceed 12:1 (8.33%).

Sub-section E. Built up Curb Ramps:

Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes.

Sub-section F. Obstructions:

Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

Sub-section G. Location of Marked Crossings:

Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides.

Sub-section H. Diagonal Curb Ramps:

If diagonal (or corner type) curb ramps have returned curbs or other well defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have a forty-eight (48) inch minimum clear space. If diagonal curb ramps are provided at marked crossings, the forty-eight (48) inch clear space shall be within the markings. If diagonal curb ramps have flared sides, they shall also have at least a twenty-four (24) inch long segment of straight curb located on each side of the curb ramp and within the marked crossing.

Sub-section I. Detectable Warnings:

Detectable warning panels shall be placed at ramps and other locations in which the pedestrian access route crosses streets. They are intended to warn visually-impaired people of potential hazards by indicating the transition from sidewalk to street.

The detectable warning panels shall be cast-in-place and shall have the following characteristics:

1) Cast Iron construction in public right-of-ways. Other ADA compliant inserts may be used for private developments.
2) Skid and abrasion resistant

They shall consist of truncated domes aligned in a square grid pattern having the following characteristics:

1) Base diameter of 0.9 inch – 1.4 inch
2) Top diameter of 50%-60% of base diameter
3) Height of 0.2 inch
4) Center-to-center spacing of 1.6 inch – 2.4 inch

The detectible warning shall be 2 feet deep (measured in the direction of pedestrian travel). They shall run across the full width of ramps or blended transitions. They should be set back 6" to 8" from the flowline of the gutter.

The detectable warning panel shall be installed so that it is flush (at the base of the truncated domes) with the adjacent concrete.

Sub-section J. Islands:

Any raised islands in crossing shall be cut through level with the street or have curb ramps at both sides and a level area at least forty-eight (48) inches long between the curb ramp in the part of the island intersected by the crossing.

Sub-section K. Pedestrian Crossings:

Where crosswalks are marked, they shall be at least 8 feet wide.

The foot of a curb ramp shall be wholly contained within the crosswalk markings.

The cross slope (measured perpendicular to the direction of pedestrian travel) of marked or unmarked crosswalks is limited to 2%, except at mid-block crossings.

The counterslope of the gutter or street surface at the bottom of a ramp or blended transition (measured in the direction of pedestrian travel) shall not exceed 5%.

The maximum running slope (measured in the direction of travel) for crosswalks is 5%.

Section 12.10 LANDSCAPE RESTORATION

Areas of new construction that cover or disturb existing landscaped areas with fills and cuts or areas disturbed by construction of retaining walls shall have the landscape restored. Areas that have lawn or flower beds shall be restored including sprinkling systems that might be damaged or relocated because of construction. Lawn covered or removed shall be replaced by sod.

The topsoil shall be fertile, sandy loam topsoil, obtained from well-drained areas. It shall be without admixture of subsoil or slag and shall be free of stones, lumps, sticks, plants or their roots, toxic substances or other extraneous matter that may be harmful to plant growth and would interfere with future maintenance. Topsoil pH range shall be 5.3 to 6.0.

DIVISION 13

STORM DRAINS

Section 13.01 GENERAL

This section covers installation of storm drainpipe, manholes, and curb face inlet boxes. All improvements shall be constructed to the dimension and thickness shown on the Standard Drawings.

Section 13.02 PIPE INSTALLATION

Installation of pipe shall be in an open trench unless otherwise shown. Trench and backfill shall meet the requirements of Division 2, Trench Excavation and Backfill.

Section 13.03 PIPE

Pipe and pipe laying shall meet the requirements of Division 4, Concrete Pipe, Division 4A, PVC Plastic Pipe, Division 4B, Polyethylene Corrugated Pipe, Division 4C, Polyethylene Corrugated Pipe with Water Tight Joints. Pipe shall be laid with the bells up grade. The minimum size pipe used in a storm drain shall be fifteen inches (15”). Corrugated HDPE shall be used for storm drain installations in backyards and side yards with constant water from springs or irrigation.

Section 13.04 MANHOLES

Manholes shall meet the requirements of Division 5, Manholes. Where the size of the storm drain does not permit use of manholes, precast or cast-in-place reinforced concrete boxes shall be used. Concrete used in precast or cast-in-place boxes shall be Class AA(AE).

Section 13.05 CONCRETE

Concrete shall meet the requirements of Division 8, Portland Cement Concrete.

Section 13.06 REINFORCING STEEL

Reinforcing steel shall meet the requirements of Division 9, Reinforcing Steel.

Section 13.07 STORM DRAIN INLET BOXES

This section covers the types of inlet boxes and grates that may be used. Combinations of single inlets may be required depending on the design capacity of each inlet.

Sub-section A. Concrete inlet boxes:

The concrete to be used for the storm drain inlet boxes shall be Class AA(AE). The boxes shall be built to the dimensions and reinforced as shown on the Standard Drawings.

The boxes may be precast or cast-in-place. Pipes connecting to the inlet boxes shall be flush with the inside wall of the box and grouted inside and outside of the boxes. The grout and pipe inside the box shall be flush with the inside wall.

Excavation and backfill of the boxes shall meet the requirements of Division 7, Earthwork.

The storm drain inlet grate and frame shall be a D & L Supply I-3518 single unit with curb box with type "V" grate or equal. Grates and frames are to be dipped in cold tar epoxy following fabrication. Following construction of the curb and gutter improvements and before the final inspection each inlet box shall have a decal mounted on the curb face adjacent to the inlet box. The decal shall be purchased from the City by the Developer.

Sub-section B. PVC inlets:

PVC surface drainage inlets shall be of the road and highway structure type. The **ductile iron frame, grate** for each of these structures are considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The road and highway structure shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc. or prior approved equal.

Materials: The road and highway structure shall be manufactured from PVC stock, utilizing thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the main body of the structure. The pipe stock used to manufacture the main body and pipe stubs of the curb inlet basin shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Stand for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.

The grate and frame for all road and highway structures shall be ductile iron and shall be made specifically for each so as to provide a round bottom flange that closely matches the diameter of the PVC basin body. The grate and frame shall be capable of supporting H-25 wheel loading for heavy-duty traffic. The metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.

Installation: The specified PVC road and highway structure shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of Class 1 or 2 materials as defined in ASTM D2321. The road and highway structure shall be bedded and backfilled uniformly in accordance with ASTM D2321. An 8-inch to 10-inch thick concrete ring will be poured under the frame and grate as recommended by details provided by the manufacturer. The road and highway structure body will be cut at the

time of final grade so as to maintain a one piece, leak proof structure. No brick, stone, or concrete block will be used to set the frame and grate to the final grade height.

Section 13.08 PIPE CONNECTING INLET BOXES TO EXISTING STORM DRAINS

The pipe to be used for connecting a new inlet box to an existing storm drain shall be of the same type of pipe as the existing pipe to which it is being connected. Where possible such connections shall be made by installation of a manhole. The Public Works Representative/Engineer shall approve connection locations and methods.

Connections to concrete pipe shall be by coring a hole in the pipe and then grouting the connecting pipe to the concrete pipe. Connections to PVC or HDPE pipe shall be as per manufacture's recommendations. These recommendations will be reviewed with the Public Works Representative/Engineer prior to construction.

DIVISION 14

UTAH DEPARTMENT OF TRANSPORTATION RIGHTS-OF-WAY

Section 14.01 GENERAL

Work to be performed within UDOT rights-of-way shall be done in accordance with "SPECIFICATIONS FOR EXCAVATION ON DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY", latest revision. The Developer/Contractor shall be responsible to obtain all necessary permits and meet any bond requirements imposed by that agency.

Section 14.02 UTILITY LINE AGREEMENT

The improvements to be placed along or across UDOT rights-of-way are subject to the conditions of Utility Line Agreements between the UTAH DEPARTMENT OF TRANSPORTATION and PLEASANT GROVE CITY. The Developer/Contractor is bound by all conditions of the Agreement. The Developer shall be responsible for completing the Utility Line Agreement and furnishing the necessary Improvement Drawings and other information, including meeting with UDOT to insure requirements are met, required by UDOT. The Developer shall then submit the completed agreement to the City for signature and forwarding to UDOT. The Developer/Contractor shall not proceed with any work in a UDOT right-of-way until it has obtained a permit from UDOT, posted the required bond (if one is required) and provided any other information, such as traffic control plans, required by UDOT.

Section 14.03 INSPECTION FEES

The Developer/Contractor will pay UDOT fees for any UDOT inspectors.

DIVISION 15

CASINGS

Section 15.01 GENERAL

This division defines the materials and construction requirements for steel casings under canals, railroad tracks, highways and Interstates. All construction operations shall be subject to the approval of the Canal Company, Railroad Company or UDOT whose facility is being crossed. The Developer/Contractor shall make application to and secure permission from the canal, Railroad Company or UDOT before commencing work within the right-of-way. The Developer/Contractor shall provide all insurance and the services of all watchmen and flagmen required by the Canal Company, Railroad Company or UDOT. The Developer/Contractor will pay the Canal Company, Railroad Company and UDOT for their inspection services.

Section 15.02 MATERIALS

The pipe shall be welded steel pipe conforming to ASTM Designation A139, Grade A. The minimum pipe wall thickness shall be as shown below, or as specified on the project drawings, which ever is greater.

Casing Diameter	Minimum Wall Thickness	
12” or less	.3750”	3/8”
Over 12” – 18”	.3750”	3/8”
Over 18” – 22”	.3750”	3/8”
Over 22” – 28”	.4375”	7/16”
Over 28” – 34”	.5000”	1/2”
Over 34” – 42”	.5625”	9/16”
Over 42” – 48”	.6250”	5/8”

Section 15.03 CONSTRUCTION METHODS

The steel pipe casing shall be jacked under the railroad tracks, highway or Interstate using methods submitted to the Public Works Representative/Engineer for review by the Public Works Representative/Engineer. Circular pipe joints shall be field welded as the jacking process progresses. The pipe interior shall be completely excavated and cleaned prior to installation of the carrier pipe.

Steel pipe casing shall be installed by open cut or jacking under canals. These installations shall be as per details approved by the canal company.

All required approach trenches or working pits shall be excavated and shored as defined in Division 2, Trench Excavation and Backfill. Provisions shall be made for a drain sump in one corner of the working pit to allow for the accumulation and pumping of seepage water, if ground water is expected to be encountered.

Section 15.04 LINE AND GRADE

Casings shall be installed accurately to the line and grade shown on the Improvement Drawings. Casings shall be installed to grade with sufficient accuracy to permit installation of the carrier pipe to the design grade shown on the Improvement Drawings or to the cover depth required. The Developer's Engineer will provide base lines and bench marks at each casing location. Instrument checks of the line and grade shall be made by the Developer/Contractor at intervals sufficient to maintain the casing on line and grade.

Section 15.05 CARRIER PIPE INSTALLATION THROUGH CASINGS

The carrier pipe shall be installed to the grade shown on the Improvement Drawings. Casing insulators or chocks shall be fastened to the carrier pipe as per the manufacturer's recommendations. For ductile iron pipe or PVC pipe, insulators shall be installed within one foot on each side of the bell and one in the center of the joint when 18' or 20' long joints are used. Metal components of the insulators or chocks shall be manufactured from 14 Ga. Steel, hot rolled and pickled and plastic coated or Type 304(18-8) stainless steel. The liner shall be polyvinyl chloride or Neoprene Rubber with antioxidant and antiozonant properties for extended service life. Runners shall be glass-reinforced plastic or UHMW polyethylene. Runners shall have high abrasion resistance and a low friction coefficient. Following installation of the carrier pipe the annular space between the inside of the casing and the outside of the carrier pipe shall be blown full of sand. The sanding operation shall be carried out such that sand is placed in the center of the casing first and the annular space filled as the placing pipe is withdrawn. The Developer/Contractor shall not be allowed to wash sand in from the end of the casing.

DIVISION 16

DETENTION BASINS

Section 16.01 GENERAL

This section covers the construction of detention basins primarily used for storm water detention. Basins shall be constructed, have sprinkler systems installed, and landscaped according to the requirements of this section.

Section 16.02 EARTHWORK

This work shall consist of the shaping and compacting of the subgrade in accordance with these specifications and in conformity with the lines, grades, and typical cross sections shown on the Improvement Drawings or as established in the field by the Developers Engineer. Earthwork shall be performed in conformance with Division 7 Earthwork. No part of the bottom of the basin shall have a slope of less the 3%. Within 10-feet of the outlet, the slope of the basin bottom must not be flatter than 5% unless a concrete apron is constructed around the outlet. Excluding the area within 10-feet of the outlet the maximum depth of the basin is 3-feet. Side slopes shall not be steeper that 3-feet horizontal to 1-foot vertical (3:1) except where retaining structures are used.

Section 16.03 CONCRETE AND REINFORCING STEEL

Concrete used for any structures in the basin shall be Class AA(AE) and shall meet the requirements of Division 8 Portland Cement Concrete. Reinforcing steel shall be Grade 60 reinforcing steel meeting the requirements of Division 9 Reinforcing Steel.

Section 16.04 PIPING

Storm drain pipes are to continue through detention areas to allow low flows to pass through the storm drainage system without having to come to the surface. These low flows must still pass through the outlet restriction that limits runoff rates. Pipe shall meet the requirements of Division 4 Concrete Pipe, Division 4B PVC Plastic Pipe, or Division 4C Polyethylene Corrugated Pipe with Water Tight Joints. Trenching shall meet the requirements of Division 2 Trench Excavation and Backfill.

Section 16.05 TOPSOIL REQUIREMENTS AND PLACEMENT

The topsoil shall be fertile, sandy loam topsoil, obtained from well-drained areas. It shall be without admixture of subsoil or slag and shall be free of stones, lumps, sticks, plants or their roots, toxic substances or other extraneous matter that may be harmful to plant growth and would interfere with future maintenance. Topsoil pH range shall be 5.3 to 6.0. The native topsoil at the site may be of adequate quality for use as the final topsoil layer. The Contractor shall remove the top 6-inches of soil, after clearing the area for the basin, and stockpile it for later use as the finished surface. Following removal of the topsoil, the site shall be graded to the grades shown

on the Improvement Drawings. These grades are final surface. The Contractor shall make allowance in the grading for 6-inches of topsoil to be added as the finished surface. Any excess material from the grading of the site will be the responsibility of the Developer/Contractor to dispose of properly. Scarify subsoil to a depth of 3-inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted the sub-soil.

Following site grading and placing of topsoil the surface shall be smoothed to eliminate uneven areas, low spots and raked ready to have sod placed on it or to be hydro-seeded. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas. The subgrade shall be firm, but not compacted to a specified density. Place topsoil during dry weather and on dry unfrozen subgrade. Remove any vegetable matter and foreign non-organic material from topsoil while spreading.

Section 16.06 IRRIGATION SYSTEM – MATERIALS

The following are minimum requirements and shall govern, except that all local, state and/or federal codes and ordinances shall govern when their requirements are in excess hereof.

Sub-section A. Basic Irrigation Requirements:

This criterion applies to the entire system, per plans and specifications. The irrigation system shall be under fully automatic operation prior to any planting. The irrigation installation work shall be carefully correlated with other site developments so as not to damage any irrigation system components .

The Developer/Irrigation Contractor is required to install, adjust and maintain his finished work at his expense before final acceptance. A qualified irrigation contractor regularly engaged in landscape construction is preferred to complete all work.

Provide labor, materials, equipment and services necessary to complete the irrigation work as defined in these specifications and as indicated on the Improvement Drawings. Work shall include, but is not limited to:

1. Complete irrigation system as shown on the Improvement Drawings.
2. Verify underground utility locations.
3. The Contractor shall coordinate work of this section with work of all related trades and subcontractors to assure smooth progression of work.
4. Protection and/or restoration of all existing improvements.
5. Trenching and backfilling for all pipes, valves and drain pits specified.
6. Furnishing and installing all filter mains, laterals, risers and fitting, heads, quick-coupling valves, gate valves, control valves, controllers, electric wire, controls, etc., and all necessary specialties and accessories.
7. Furnishing and installing all sleeves beneath walkways, roads, and driveways where required.
8. Testing of irrigation system.

9. Regulating and adjusting all heads, and programming controller.
10. Warranty of system (materials and installation) for two years.

Sub-section B. Pipe:

All piping shall be from virgin parent material. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents. All pipes shall be National Sanitation Foundation (NSF) approved.

1. Pipe shall be Polyvinyl Chloride (PVC) 1120 Schedule 40, sized as shown on the Improvement Drawings.
2. Type I, Grade I, Pressure Rated Pipe.
3. Materials shall meet the requirements set forth in ASTM D-1784-60T.
4. Outside diameter of pipe shall be the same size as iron pipe.
5. Pipe shall be marked at intervals (not to exceed 5') with the following information:

   Manufacturer's name or trade mark, nominal pipe size, schedule, PVC type and grade (i.e. PVC 1120), SDR rating class, working pressure at 73 degrees F. and (NSF) approval.
6. PVC Type I shall not be threaded.
7. Caution should be utilized in handling Type I pipe due to the possibility of cracking or splitting when dropped or handled carelessly.
8. When connection is plastic to metal, male adapters shall be used.
9. Piping for Sleeving shall be high impact type pipe, polyvinyl chloride (PVC) 2110, minimum schedule 40.
10. Joint primer shall meet the requirements of ASTM F-656 and the joint glue shall meet the requirements of ASTM D-2564.

Sub-section C. Fittings:

Fittings for pipe shall meet the following requirements:

1. Fittings for solvent-weld PVC pipe shall be Schedule 40 or 80 polyvinyl chloride (PVC), Type 1, to meet ASTM D2466 and D2467 (latest revisions) NSF approved.
2. Threaded PVC nipples shall be Schedule 80.
3. Flexible swing pipe elbows as per Standard Drawing No. 29.
4. Pre-manufactured swing joint for Quick Couplers.

Sub-section D. Automatic Controller:

The Developer will check with the Leisure Services Director (785-6172) prior to purchasing an automatic controller. Unless directed otherwise the automatic controller will be a Hunter – controller with stainless steel pedestal mount – ICC, with TBOS battery operated module. The controller shall be housed in a NEMA Type 4, weatherproof, watertight enclosure with lockable access door, pedestal mounted.

Sub-section E. Automatic Control Valve:

Automatic control valves shall be Rainbird scrubber valves – PESB meeting the following criteria:

1. Slow and smooth opening and closing with a flow control and bleed screw.
2. Highly efficient, totally encapsulated 24 VAC solenoid.
3. High – strength rubber of synthetic rubber diaphragm.

Sub-section F. Rotary Sprinkler:

Check with Leisure Service Director (785-6172) prior to installation of sprinkler. The rotary sprinkler shall be a Hunter – I-20-ADV Series with bodies made of plastic and stainless steel materials meeting the following criteria:

1. Pop-up risers of 4-inches.
2. Stainless steel retraction spring.
3. Ratcheting mechanism.

Sub-section G. Plastic Nozzles:

Plastic nozzles shall meet the following criteria:

1. Radius pattern fixed for full circle or Variable Arc Nozzle (VAN) for any pattern less than 360 degrees.
2. Matched precipitation rates.
3. Stainless steel adjustment screw.
4. Filter screen.

Sub-section H. Valve Box:

Valve boxes are to be injection-molded of polyesters and fibrous inorganic temperature resistant components. Box and lid are to be green, rectangular, with a snap lock tab on cover. The box shall have an attached sign or embossed to or on the cover the words "IRRIGATION". A Brooks 1419 box meets these requirements.

1. For Remote Control Valve: Shall be rectangular in shape and sized to provide adequate clearance to operate and service valve.
2. For Shut-off Valves: Shall be round approximately nine inches (9") inside diameter by ten inches (10").

Sub-section I. Control Wire, Wire Connectors and Sealing Cement:

Wire: Solid copper wire, UL Approved for direct burial in ground. Minimum gauge: #14 UF. (#12 UF for runs over 1,000 LF>). Common ground wire shall be white. All other

wire shall be yellow, red, or orange. Splicing materials: 3M Direct Bury (DBY) splice kits as manufactured by 3M Corporation, Austin, TX (512) 984-5657.

Sub-section J. Valves and Couplers:

Isolation valves shall be full port 3-piece ball valve of heavy duty bronze construction rated to 150 psig.
The manual main line isolation valve shall be a bronze bodied stop and waste valve of a size matching the service line. Gate valves shall be bronze solid wedge F.I.P. thread, both ends, 150 psig maximum working pressure, cold water, non-shock service and wheel handle.

Quick couplers shall be constructed of heavy-duty brass with a one-inch two-piece body design.

Sub-section K. Main Line Connections:

If the water supply is from the secondary water system the service connection shall meet the requirements of Division 3 Section 3.05, Pressure Irrigation Service Connection. The service line shall have a 30 micron inline filter.

If the water supply is from the culinary water system the service connection shall meet the requirements of Division 3A Section 3A.05 Water Service Laterals. In addition the service shall have a double check valve assembly for installation below ground. This service shall also have a water meter.

Section 16.07 IRRIGATION SYSTEM – INSTALLATION

All landscape and irrigation Improvement Drawings shall be checked and approved by the Leisure Service Director or Park Superintendent before work can begin. The location of the pedestal mount controller or TBOS controller will be determined by Pleasant Grove City. The Developer/Contractor shall verify and have marked the location of all utilities and underground obstructions. Full and complete coverage is required. Developer/Contractor shall make any necessary minor adjustments to layout as required to achieve full coverage of irrigated area. Sleeves are required only when shown or called for on the Improvement Drawings. Sleeves are required for electrical wire placed under paved surfaces. Install sleeves prior to commencement of paving. Layout and stake locations of system components prior to beginning installation. Make any changes in routing necessary to avoid obstructions and obstacles.

Where called for piping shall be installed at location shown on the Improvement Drawings. Do not install pipe directly over another line in the same trench. It shall be the Contractor's responsibility to install all sprinkler heads in the location shown in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distance shown on the Improvement Drawings and/or those specified. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved.

All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection. Install irrigation system after completion of site grading.

Sub-section A. Trenching:

Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installation, etc., damaged or cut as a result of the excavations, to there original condition.

Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify Engineer for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising form his operations subsequent to discovery of such utilities. Indicate such utility crossings on the record drawings promptly.

Trenches shall be open, vertical sided construction wide enough to provide free working space around work installed and to provide ample space for backfilling and compacting.

When Two (2) pipes are to be placed in the same trench, a two-inch (2") minimum space is to be maintained between the pipes. The Contractor shall not install two pipes with one directly above the other. Depth of trenches shall be sufficient to provide a minimum cover of 12-inches above the top of the pipe (see Standard Drawing 32.) Trenches located under sidewalk, curb, and gutter, or paving shall be compacted in layers of 95% compaction.

The Contractor shall cut trenches for pipe to required grade lines and compact trench bottom to provide accurate grade and uniform bearing for the full length of the line. All laterals and mainline shall be sufficiently sloped to provide positive drainage through drain valves.

The Developer/Contractor shall be held responsible for any damages caused by these operations and shall immediately repair or replace damaged parts.

Sub-section B. Pipe Installation:

Install pipes and fittings in accordance with manufacturers latest printed instructions. Clean all pipes and fittings of dirt, scales and moisture before assembly. All pipe, fittings, and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be closed by approved means. Lay pipe in the trench in a snake-like manner with bell ends facing upstream. All lateral connections to the mainline as well as all other connections shall be made to the side of the mainline pipe.

1. Solvent-Welded Joints for PVC Pipes.

Use solvents and methods by pipe and solvent manufacturers.

Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty-four (24) hours before placing the joint under water pressure, unless otherwise specified by manufacturer.

2. Threaded Joints for PVC Pipes.

   Use Teflon tape on all threaded PVC fittings. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench.

3. Laying of Pipe.

   Pipes shall be bedded in at least two inches (2") of finely divided material with no rocks or clods over one inch (1") diameter to provide a uniform bearing.

   Plastic pipes shall be cut with PVC pipe cutters or saw, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

   All plastic-to-plastic joints will be solvent-weld joints or slip seal joints. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

4. PVC Sleeves

   All PVC sleeves shall be a minimum of twice (2x) the diameter of the pipe to be sleeved.

   All PVC control wire conduit shall be of sufficient size to hold the required quantity of control and common wires. Electrical wires are not to be placed in the same sleeve with water pipes.

5. Thrust Blocks.

   Concrete thrust blocks must be provided on the thrust side of the mainline pipe wherever the pipe line:
   a. Changes direction, as at tees or bends.
   b. Dead ends.
   c. Any other spot where thrust is to be expected.

6. Shut-off Valves.

Shall be located per Improvement Drawings. All shut-off valves shall be located in valve boxes.

7. Irrigation Control Valves.

   Install control valves in valve boxes grouping together where practical. Place no closer than twelve inches (12") to walk edges, buildings and walls.

   Valves shall be installed as shown in details and in accordance with manufacturer's instructions and the specifications.

8. Valve Boxes.

   Valve boxes shall be set with grade and flush with top of turf in lawn areas and three inch (3") above soil grade in ground cover and shrub bed areas (to allow for 3" of bark mulch). Place them parallel or perpendicular to adjacent curbs, sidewalks, or driveways. Place aggregate sump as shown on Standard Drawing 29.

9. Sprinkler Heads.

   All sprinkler heads shall be adjusted for the proper application of water. Make adjustments where possible to prevent over-spraying onto walks, pavement or buildings.

   Sprinkler heads shall be set perpendicular to finished grade unless otherwise designated on the Improvement Drawings (see Standard Drawings.)

10. Drain valves.

    All laterals shall be provided with King Brother automatic drain valves.

    Drain valves are to be provided at sufficient intervals to provide complete drainage of all piping. Place one cubic foot of gravel under drain.

11. Control Wiring.

    All electrical equipment and wiring shall comply with local and states codes and be installed by those skilled and licensed in the trade. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible, and shall have a minimum of twelve-inch (12") cover. Control wires shall be installed to the side of the main line whenever possible. Placement over pipes is not permitted.

    Where more than one (1) wire is placed in a trench, the wiring shall be taped together at intervals of ten feet (10'). Use a white wire for the common

connection and different wire for the control wires. Coil an additional 12-inches of wire at each automatic control valve. An expansion curl shall be provided within three feet (3') of each wire connection and at least every one hundred feet (100') of wire length. Expansion curls shall be formed by wrapping at least five (5) turns of wire around a one-inch (1") diameter pipe, then withdrawing pipe.

Only slice wires inside a valve box. Control wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than 500 feet. The connector shall be 3MDBY splice kit by 3M Corporation. Use one splice per connector sealing packs. The main line shall have two (2) spare wires installed its entire length and to the automatic controller. Label each end "spare wire".

12. Closing of Pipe, Flushing of Lines, and Testing.

    Thoroughly flush out all water lines under a full head of water before installing heads, valves, quick coupler assemblies, etc. Flush main lines before installing control valves. Flush laterals before installing sprinklers. Maintain flushing for a minimum of three (3) minutes at the valve located furthest from water supply. After flushing, cap or plug all openings to prevent entrance of materials that would obstruct the pipe or clog heads. Leave in place until removal is necessary for completion of installation.

    Notify the Leisure Services Director 24 hours in advance of pressure testing the main line. Before backfilling and after air pockets have been vented from the lines, subject all supply and pressure irrigation lines to a hydrostatic pressure test by maintaining full water pressure for 3 consecutive hours.

    Upon completion of testing, completely assemble and adjust sprinkler heads for proper distribution. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the Improvement Drawings, or otherwise specified. Sprinkler heads adjacent to walls, curbs and other paved areas, shall be set to grade. Sprinkler heads, which are to be installed in lawn areas where the turf has not yet been established shall be set one inch (1") above the proposed finish grade. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. The Developer/Contractor shall do such lowering of heads.

13. Irrigation Installation Inspection.

    Notify Pleasant Grove City Leisure Services Director to schedule the Inspection after the irrigation system is completely installed and functional.

Section 16.08 SEEDING OR TURF

This section covers the seeding or turf placement on the surface of the detention basin. The Developer/Contractor has the choice of which material to use.

Sub-section A. Seeding:

The Developer/Contractor may revegetate the areas on which topsoil has been placed by hydro-seeding with mulch. Do not sow immediately following rain, when ground is too dry, too hard, or during windy periods without first loosening the surface. The hydro-seeding mix shall meet the following requirements:

Park seed/mulch mixture:

1. Limousine Kentucky Blue Grass: 20 percent
2. Liberty Kentucky Blue Grass: 20 percent
3. Marquis Kentucky Blue Grass: 20 percent
4. Washington Kentucky Blue Grass: 20 percent
5. Two types of Perennial Rye: 20 percent
6. 15 pounds per 1,000 square feet of 16-16-8 fertilizer.
7. 2,000 pounds per acre mulch.

Seed: Furnish grass seed that is fresh, clean, and new crop composed of the varieties shown above and tested to have minimum of 90-percent purity and minimum of 80-percent germination. Do not use wet, moldy or otherwise damaged seed.
Fertilizer: Recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: Nitrogen 16 percent, phosphoric acid 16 percent, soluble potash 8 percent.

Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

Mulch Material: Wood or wood cellulose fiber free of growth or germination inhibiting ingredients.

Grading: Till soil to a depth of 2-inches and remove rocks and debris over 2-inches in diameter and any vegetation and weeds. Fine grade entire site to a smooth, loose, and uniform surface. When subgrade has been established, roll areas to remove ridges and depressions so surface is parallel with finished grade. Limit weight of rolling equipment to 110-pounds minimum or 250-pounds maximum per square foot.

Site tolerances: Total topsoil depth – minimum of 5-inches. Elevation of topsoil relative to walks, hard surfaces or edges – 2-inches below. Make sure basin is sloped as specified.

One step hydro seeding: Unless indicated otherwise, apply seed at the rate of 5-pounds per 1,000 square feet of area. Mix the seed and fertilizer with the specially prepared dyed wood cellulose fiber and water to form a slurry. Mix the slurry in tanks having continuous agitation so that a homogenous mixture is discharged hydraulically on the area being seeded. Apply evenly.

Sub-section B. Sodding:

Sod shall be well-rooted, 2 year old stock, containing a blend approved by the Owner. The sod shall be top quality certified sod, free of weeds, undesirable native grasses, insects, and diseases. The sod shall be machine cut and vigorously growing (not dormant). Maximum time from stripping to planting shall be 24- hours.

Provide sod of uniform pad sizes with maximum 5 percent deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10 percent of pad will be rejected.

Areas to sodded shall be raked to a smooth surface free of all clods, roots or stones ¾" or larger. Planting sod shall be done as specified herein and in strict accordance with standard horticultural practices. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen. Do not plant any sod that has dried out.

Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. The first row of sod shall be laid in a straight line with subsequent rows placed parallel to each other. Lateral joints shall be staggered to promote more uniform growth and strength. Sod is not to be stretched or overlapped. Fill all holes greater than 2 square inches with sod plugs.

In sloping areas sod shall be laid with the long edges parallel to the contours and with joints staggered. In all drainage swales, regardless of degree of slope, the sod shall be laid with the long edges parallel to the contour lines and with staggered joints.

As sodding is completed in any one section, the entire area shall be rolled or tamped. Sod shall be watered immediately after placement until the underside of the new sod pad and soil surface below are thoroughly moistened. Do not allow sod to dry out. Hand water if necessary. Fertilize with 16-16-8 at a rate of 8 lbs. per 1,000 square feet. Place one half of the fertilizer (4 lbs, per 1,000 sq. ft.) in one direction and one half of the fertilizer in the opposite direction.

Sod shall be watered several times a day during the first week and in sufficient quantities to maintain moist soil to a depth of four inches (4"). After the first week sod shall be watered as necessary to maintain adequate moisture, to prevent wilting or browning, and to insure establishment. Begin maintenance immediately after planting. Sod shall be maintained by the Developer/Contractor for 60-days, or longer if necessary to provide a healthy stable turf, firmly knitted to the soil and free of any areas of erosion or washout

damage. First mowing should not be attempted until sod is firmly rooted. Mow at 2-1/2-inches.

Sub-section C. Maintenance:

The following maintenance requirements shall be followed by the Developer until a homeowner, in the case of private detention basins, can take over the maintenance responsibilities. In public detention basins the Developer shall maintain it until accepted by the City, but no less than the time shown below:

1. General: Maintain surfaces until Work is accepted and maintenance responsibilities are taken over by others, but in any event for a period of not less than 60-days after planting. Supply additional topsoil where necessary, including areas affected by erosion or settlement.
2. Watering: Water to ensure uniform seed germination and to keep surface of soil damp. Apply water slowly so soil will not puddle and crust. Unless indicated otherwise, the Developer shall pay the cost of water supplied.
3. Fertilizing: Fertilize during seeding and 2 weeks after seeding and sodding.
4. Mowing: Cut grass first time when it reaches a height of 2-1/2-inches and maintain to minimum height of 2-inches. Do not cut more than 1/3 of blade at any one mowing. Remove clippings. After first mowing, water to moisten soil from 3-inches to 5-inches deep. Allow a minimum of 5-days between mowings.
5. Grading: Roll when required to remove minor depressions or irregularities.
6. Control Growth of Weeds: When using herbicides, apply in accordance with manufacture's recommendations. Remedy damage from improper use.
7. Protection: Protect planted areas with warning signs during maintenance period. Erect when necessary, temporary fences, or barriers, to control pedestrians.

CHAPTER 5

STANDARD DRAWINGS

INTRODUCTION: Chapter 5 of this manual encompasses standard drawings, forms, and applications necessary to develop property in Pleasant Grove. They are listed by number and division according to the chapter of this manual they apply to. They are all suitable for copying and can be used to make applications except building permit applications, or give to contractors, builders, developers, etc. for instruction on how to design, build or develop property in Pleasant Grove.

DIVISION 1 ENGINEERING AND PUBLIC WORKS

1. STANDARD STREET INTERSECTION AND UTILITY LOCATIONS
1A. 56' STANDARD STREET CROSS SECTIONS AND UTILITY LOCATIONS
1B. 70' STANDARD STREET CROSS SECTIONS AND UTILITY LOCATIONS
1C. 60' STANDARD STREET CROSS SECTION WITH MEANDERING SIDEWALK & UTILITY LOCATIONS
1D. 56' STREET CROSS SECTION WITH NO STREET PARKING
2. STANDARD STREET CROSS SECTION & UTILITY LOCATIONS
2A. STANDARD STREET CROSS SECTION & UTILITY LOCATIONS
2B. STANDARD STREET CROSS SECTION & UTILITY LOCATIONS
2C. STANDARD STREET LIGHTING LOCATIONS
2D. MEANDERING SIDEWALK AND PLANTER STRIP DETAIL
3. CURB, GUTTER & SIDEWALK DETAILS
4. CURB & GUTTER AND CONCRETE CURB DETAILS
4A. CROSS GUTTER DETAILS
4B. 30" CURB & GUTTER AND 30" MOUNTABLE CURB
4C. MEDIAN CURB & PLOWABLE END SECTIONS
5. TYPICAL DRIVEWAY APPROACH – PREFERRED OPTION
5A. TYPICAL DRIVEWAY APPROACH – WHERE APPROVED BY CITY
5B. TYPICAL DRIVEWAY APPROACH WITH PLANTER
6. CURB RETURN AT INTERSECTION A.D.A. REQUIREMENT
6A. CURB RETURN AT INTERSECTION A.D.A. REQUIREMENT
6B. MID-BLOCK PEDESTRIAN RAMP DETAIL
6C. MID-BLOCK PEDESTRIAN RAMP DETAIL
7. CURB FACE INLET DETAIL
7A. DETENTION BASIN ORIFICE AND OVERFLOW DETAIL
8. STANDARD CUL-DE-SAC
9. STANDARD KNUCKLE
10. TYPICAL TRENCH SECTIONS
10A.TYPICAL TRENCH SECTIONS
10B.CLAY DAM DETAIL
11. TYPICAL MANHOLE DETAIL
12. TYPICAL SAMPLING MANHOLE
13. TYPICAL DROP MANHOLE
14. FIRE HYDRANT & WATER VALVE DETAIL
14A. TYPICAL FIRE RISER DETAILS
14B. REMOTE FIRE DEPARTMENT CONNECTION
15. THRUST BLOCK DETAILS
16. TYPICAL CULINARY WATER CONNECTION (1" SERVICE)
16A. TYPICAL CULINARY WATER CONNECTION 1" SERVICE LOCATED IN DRIVEWAY
16B. TYPICAL CULINARY WATER CONNECTION (1 1/2" TO 4" SERVICE)
17. TYPICAL SEWER LATERAL NEW CONSTRUCTION

DIVISION 1

ENGINEERING AND PUBLIC WORKS

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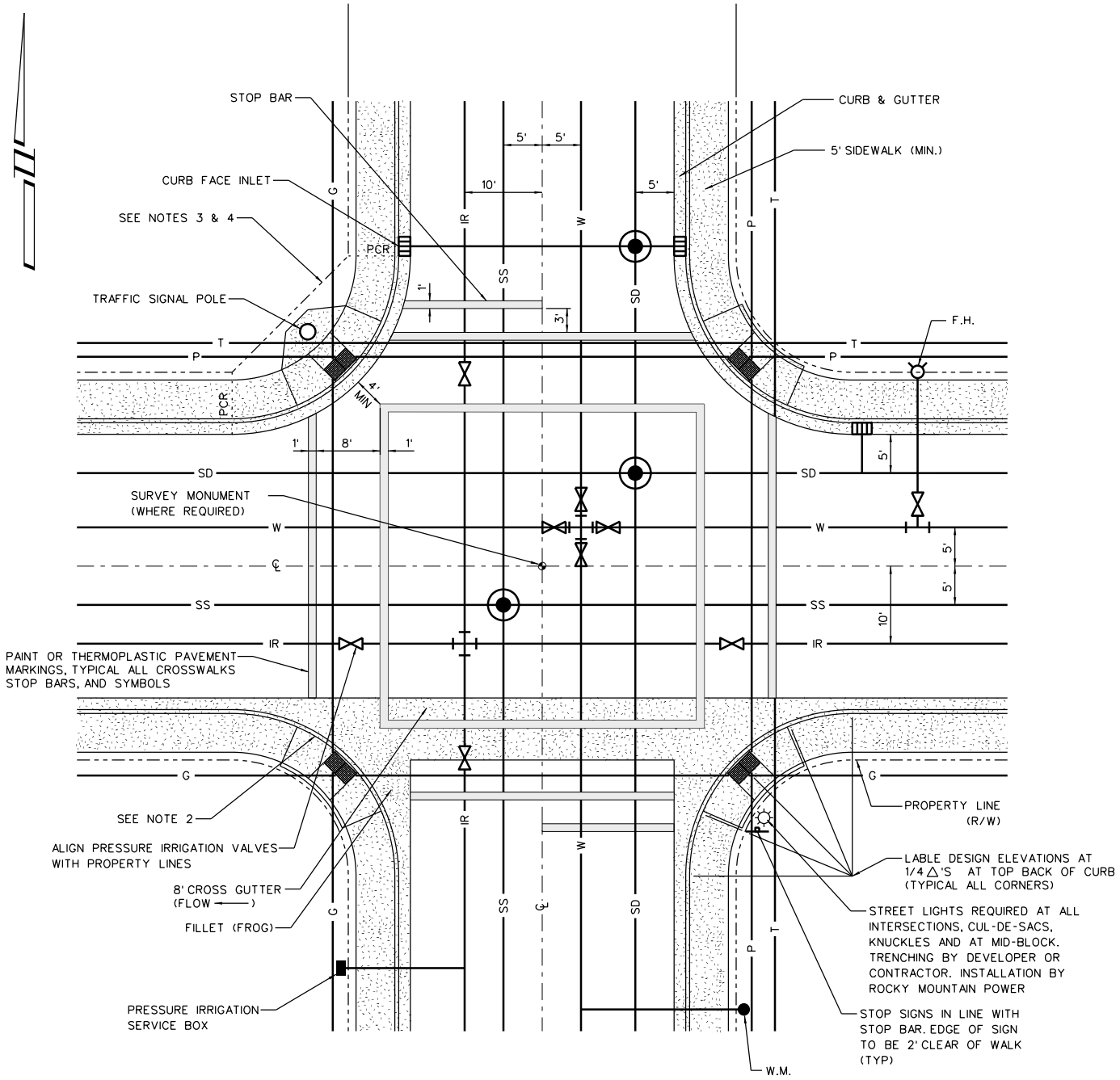


STREET INTERSECTION WITH COMBINATION SIDEWALK

NOTES:
1. CROSS GUTTERS ARE NOT TO BE CONSTRUCTED EXCEPT AS APPROVED OR REQUIRED BY PLEASANT GROVE CITY.
2. THE RADIUS AT THE TBC SHALL BE AS FOLLOWS:
   LOCAL STREET - 21'
   COLLECTOR STREET - 31'
   ARTERIAL STREETS - 45'.
3. RIGHT-OF-WAY TO BE SQUARED OFF FOR TRAFFIC SIGNAL INSTALLATION. TYPICAL FOR ALL CORNERS WHEN FUTURE SIGNAL IS ANTICIPATED BY THE TRANSPORTATION MASTER PLAN OR THE CITY ENGINEER.
4. ADDITIONAL AREA IN THE CORNER IS TO ACCOMMODATE THE SIGNAL POLES, WIRING, SIGNAL CONTROLLER, AND OTHER ASSOCIATED SIGNAL EQUIPMENT.

J·U·B

0 20'

REVISION

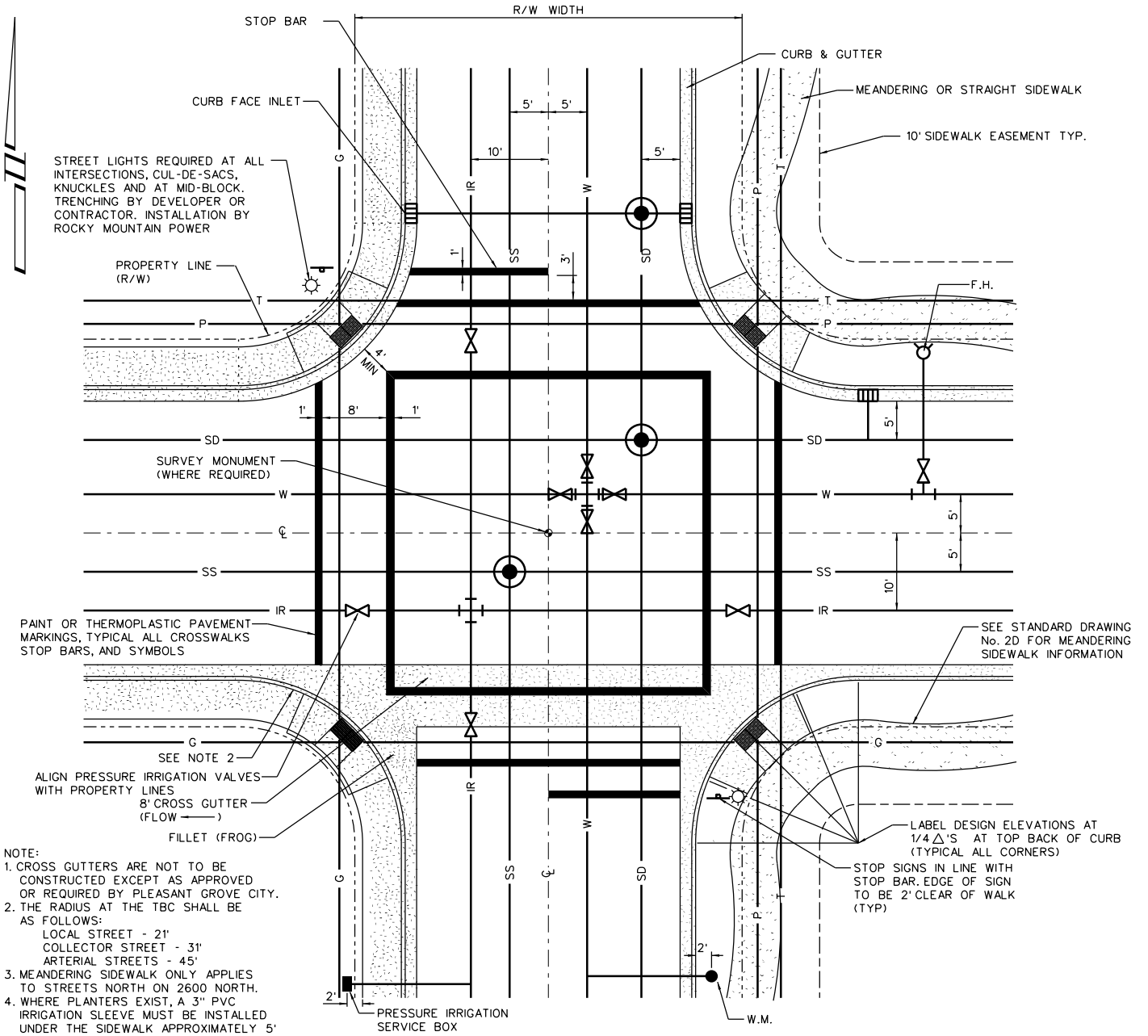
NO.	DESCRIPTION	BY	APR.	DATE
1	REDESIGN OF ADA RAMP & ADDED TRUNCATED DOME DETECTABLE WARNING	EEA	HJC	16DEC04

Pleasant Grove
Utah's City of Trees

STANDARD STREET INTERSECTION AND UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	1
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



NOTE:
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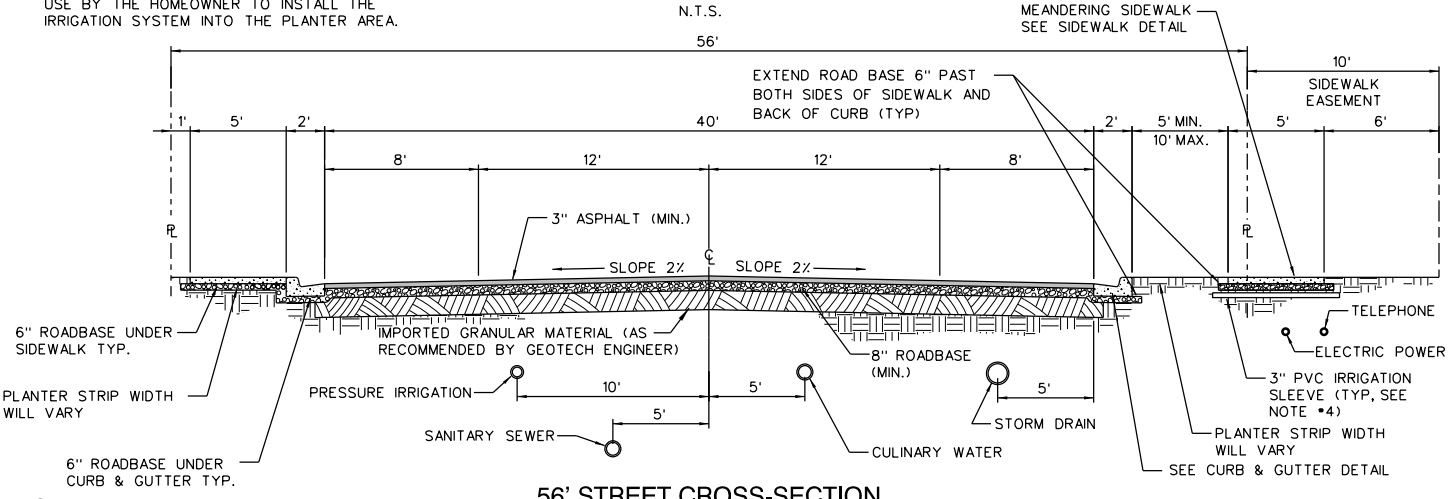
2. THE RADIUS AT THE TBC SHALL BE AS FOLLOWS:
   LOCAL STREET - 21'
   COLLECTOR STREET - 31'
   ARTERIAL STREETS - 45'
3. MEANDERING SIDEWALK ONLY APPLIES TO STREETS NORTH ON 2600 NORTH.
4. WHERE PLANTERS EXIST, A 3" PVC IRRIGATION SLEEVE MUST BE INSTALLED UNDER THE SIDEWALK APPROXIMATELY 5' FROM EACH PROPERTY LINE FOR FUTURE USE BY THE HOMEOWNER TO INSTALL THE IRRIGATION SYSTEM INTO THE PLANTER AREA.

INTERSECTION
N.T.S.



56' STREET CROSS-SECTION LOOKING NORTH OR WEST

J-U-B

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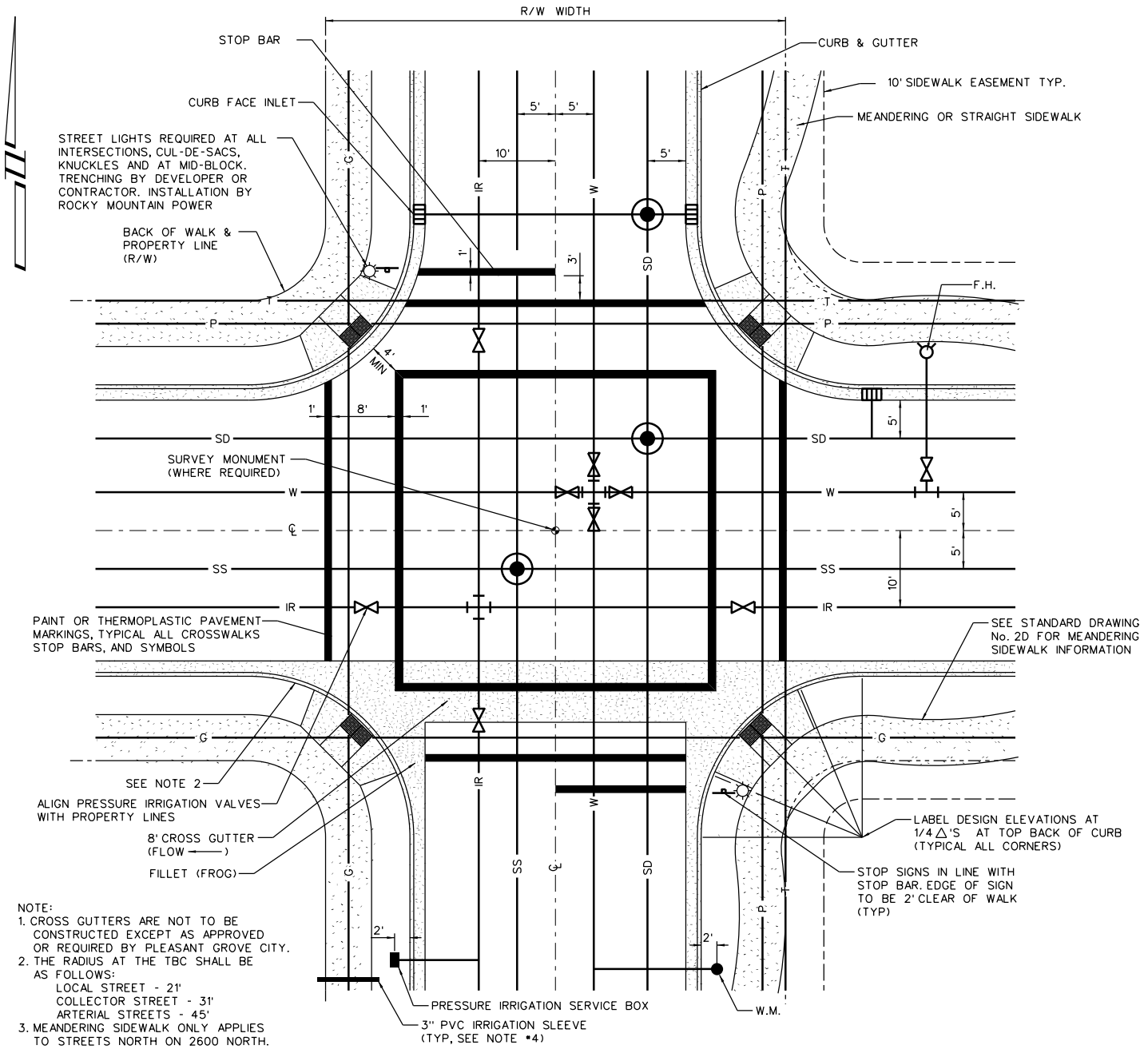
Pleasant Grove
Utah's City of Trees

56' STANDARD STREET CROSS SECTION WITH UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	1A
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



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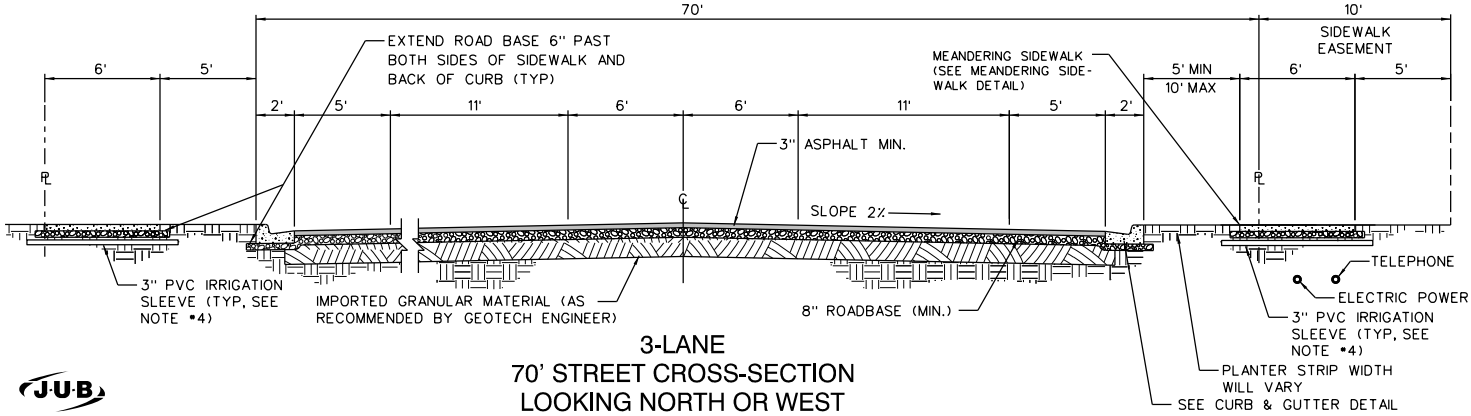
INTERSECTION
N.T.S.



3-LANE
70' STREET CROSS-SECTION
LOOKING NORTH OR WEST

J·U·B

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Utah's City of Trees

70' STANDARD STREET CROSS SECTION UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	1B
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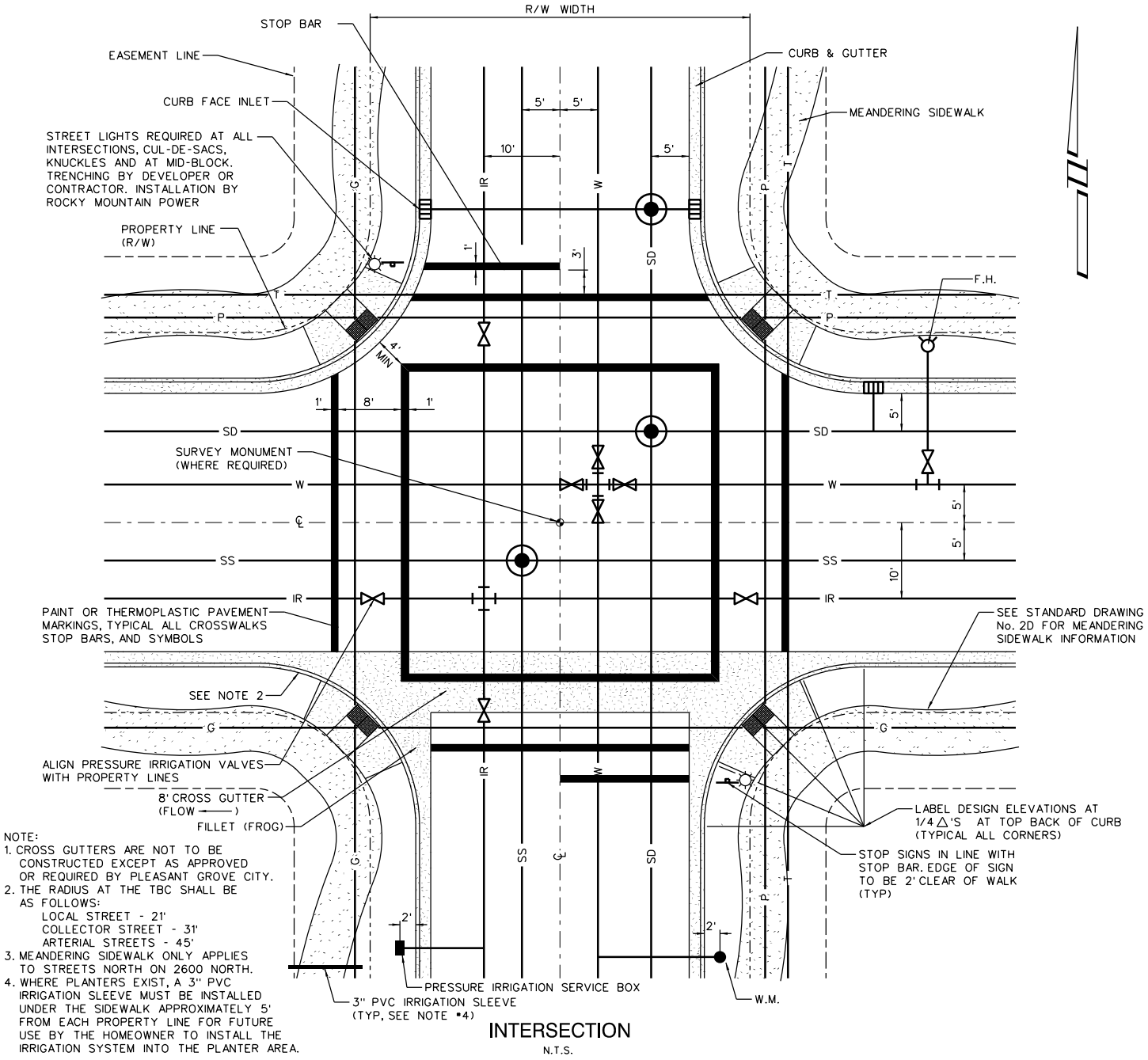

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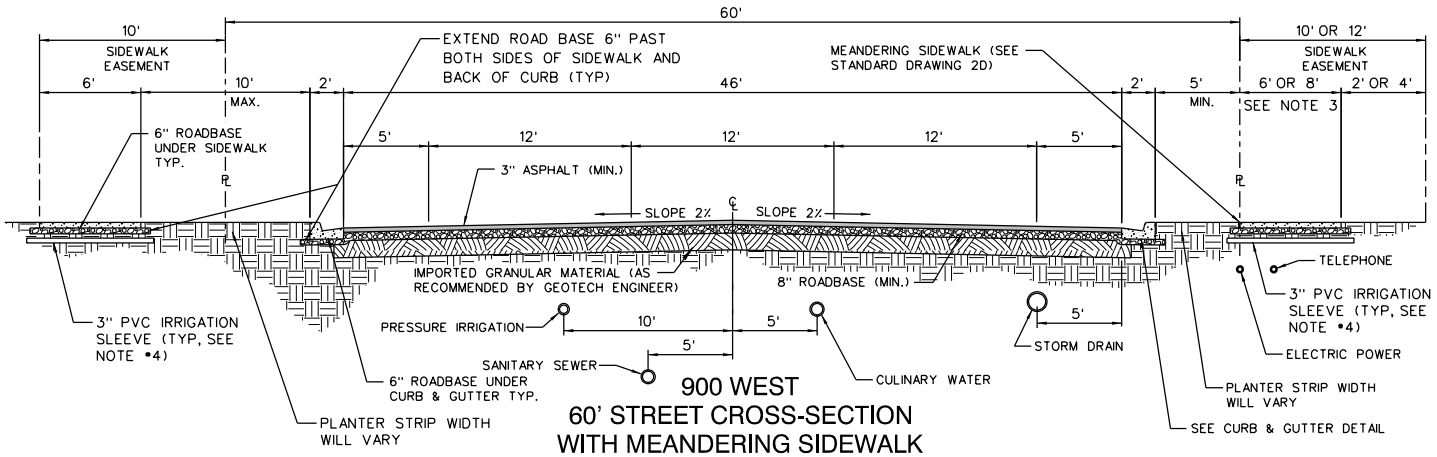
INTERSECTION
N.T.S.



900 WEST
60' STREET CROSS-SECTION WITH MEANDERING SIDEWALK LOOKING NORTH OR WEST
(3300 NORTH TO CEDAR HILLS DRIVE)

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

60' STANDARD STREET CROSS SECTION WITH MEANDERING SIDEWALK & UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	1C
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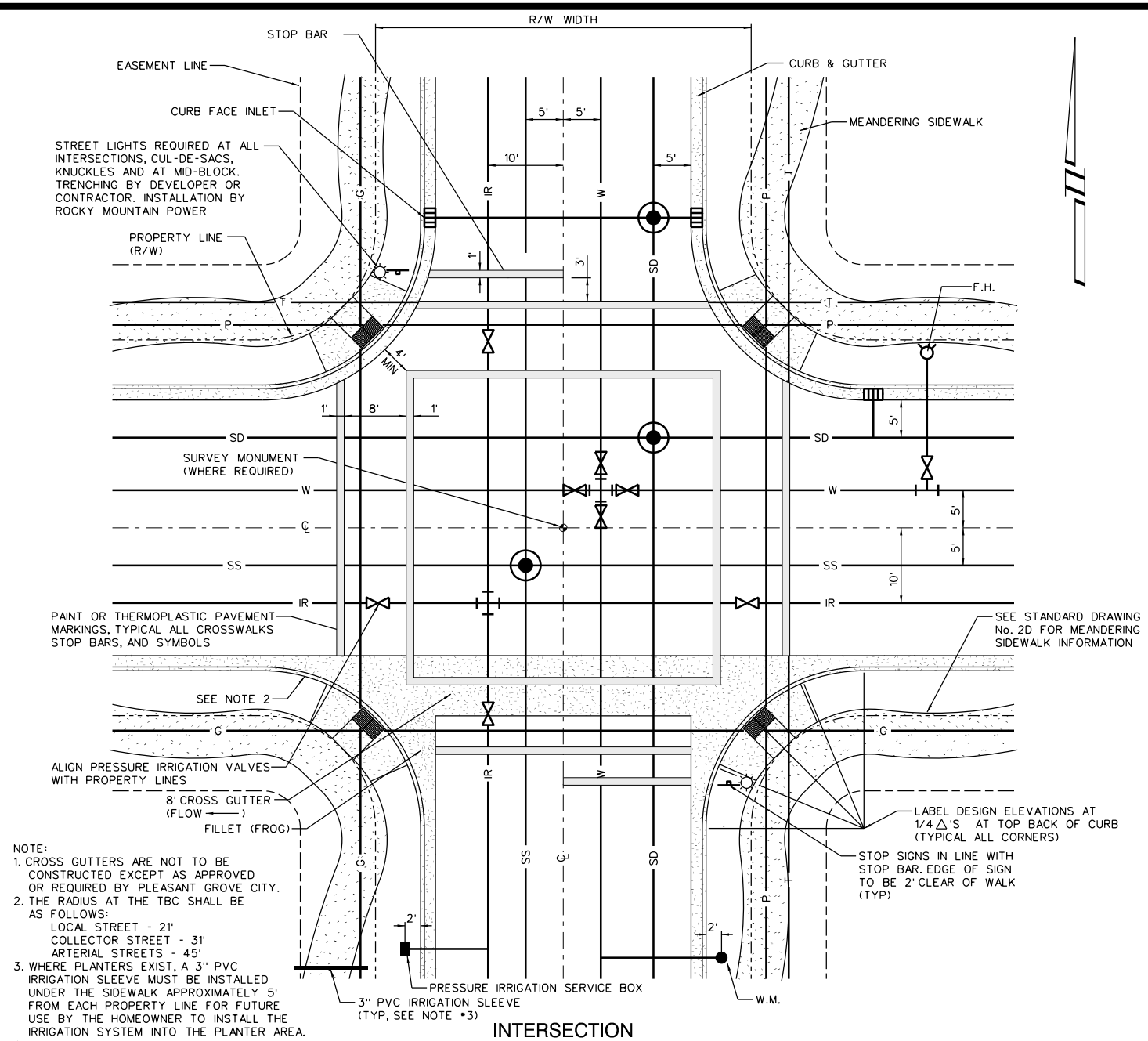
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



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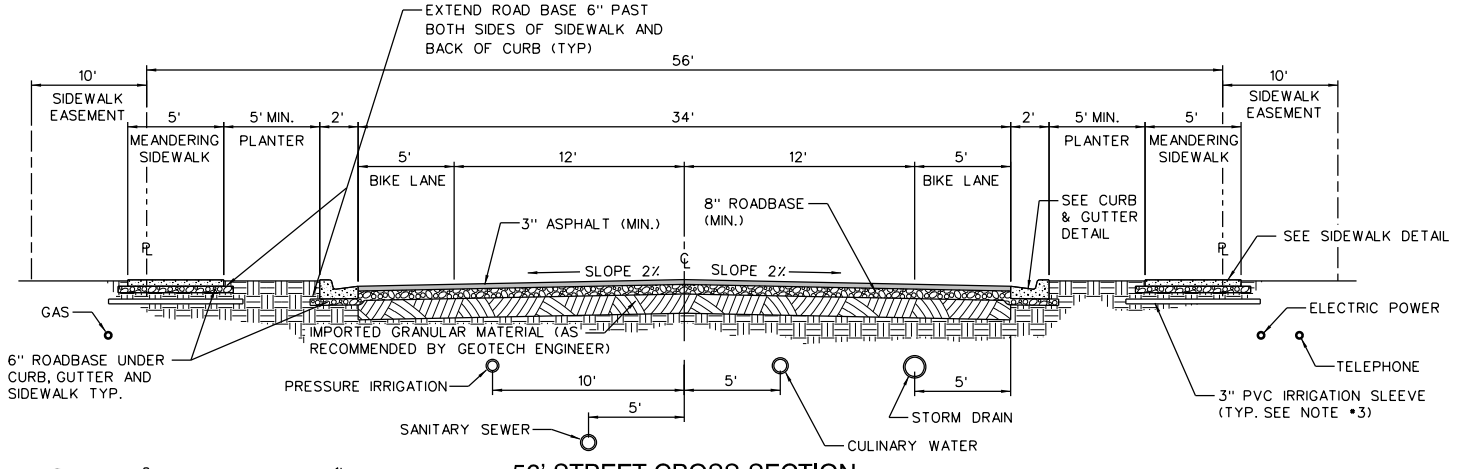
4. **ONLY PERMITTED IN NON-RESIDENTIAL ZONES WITH APPROVAL FROM THE CITY ENGINEER**

INTERSECTION
N.T.S.



56' STREET CROSS-SECTION LOOKING NORTH OR WEST

JUB 0 1'

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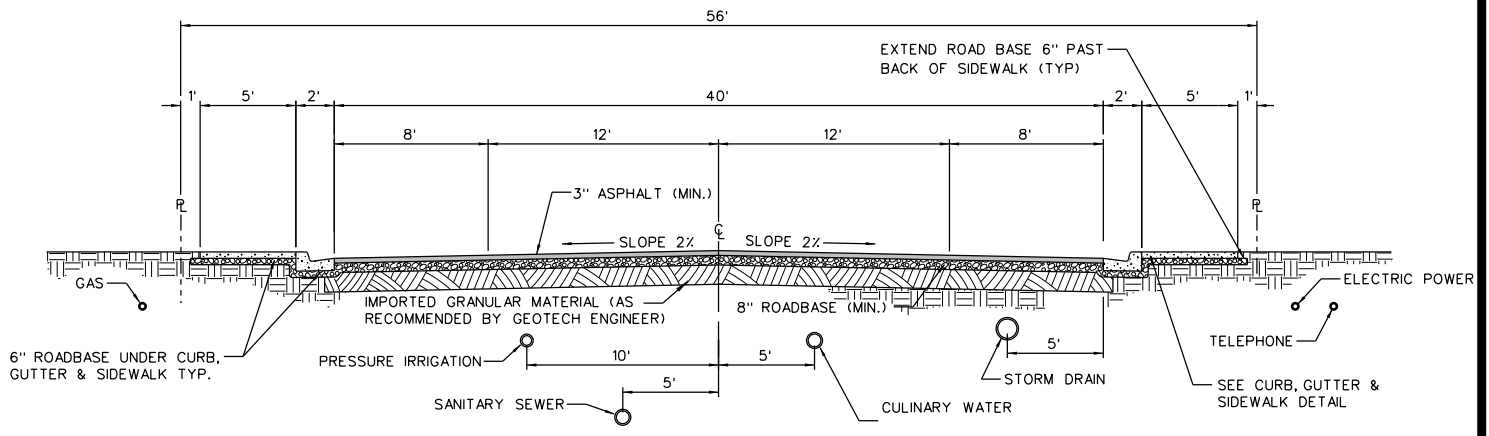
NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

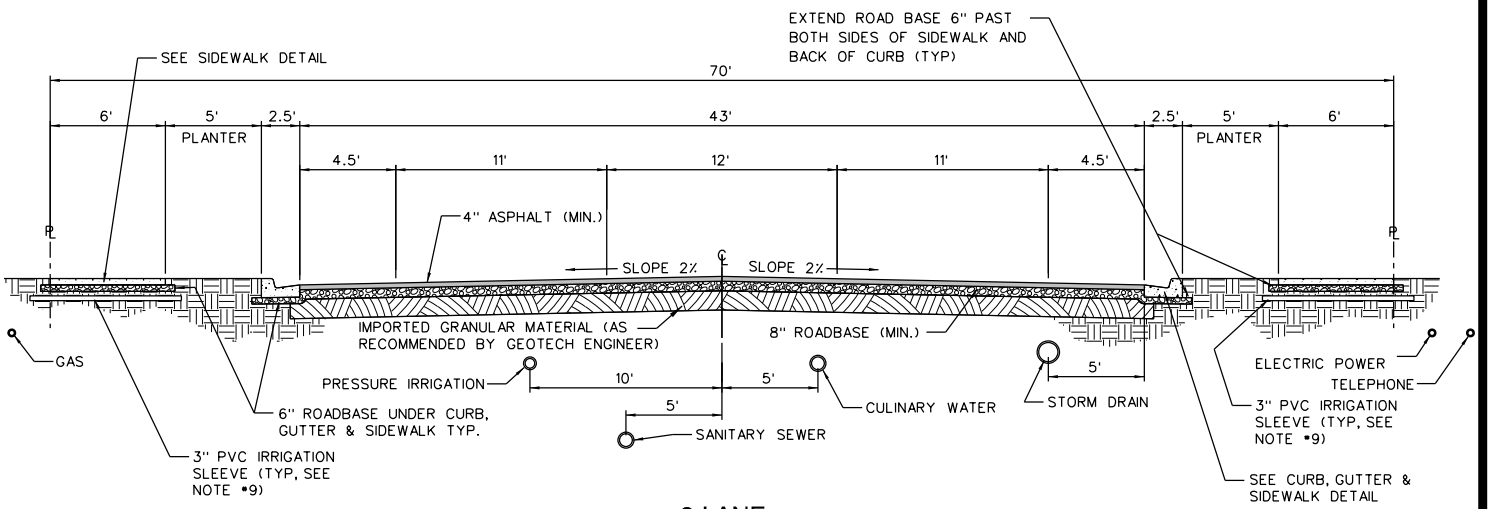
56' STREET CROSS SECTION WITH NO STREET PARKING

PLEASANT GROVE CITY
86 EAST 100 SOUTH

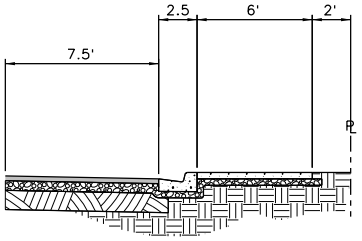
STANDARD DRAWING NUMBER:	1D
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



56' STREET CROSS-SECTION
LOOKING NORTH OR WEST



3-LANE
70' STREET CROSS-SECTION
LOOKING NORTH OR WEST
(NO STREET PARKING)



3-LANE
70' STREET CROSS-SECTION
(ALTERNATE SIDE TREATMENT
WITH STREET PARKING)

NOTES:
1. WHEREVER POSSIBLE, CULINARY WATER LINES SHALL BE INSTALLED ON THE NORTH AND EAST SIDE OF THE STREET
2. FIRE HYDRANTS SHALL BE LOCATED EVERY 450 FEET AND ON THE SAME SIDE AS THE CULINARY WATER LINES OR AS APPROVED BY THE CITY.
3. CULINARY WATER VALVES SHALL BE BOLTED TO THE FITTING IN A STREET INTERSECTION
4. PRESSURE IRRIGATION VALVES SHALL BE ALIGNED WITH PROPERTY LINES WHERE POSSIBLE.
5. NO CULINARY WATER LINE SMALLER THAN 8" DIA. SHALL BE INSTALLED WITHOUT APPROVAL OF PUBLIC WORKS.
6. NO PRESSURE IRRIGATION LINE SMALLER THAN 6" DIA. SHALL BE INSTALLED WITHOUT APPROVAL OF PUBLIC WORKS.
7. IMPORTED GRANULAR MATERIAL, ROADBASE AND WHERE NECESSARY ASPHALT THICKNESS WILL BE DETERMINED BY PAVEMENT DESIGN.
8. REQUIRED COVER OVER UTILITY LINES ARE AS FOLLOWS:
   - CULINARY WATER - 48" MINIMUM
   - PRESSURE IRRIGATION - 24" MINIMUM
   - SANITARY SEWER - PER DESIGN
   - STORM DRAIN - PER DESIGN
   - ALL OTHERS - PER UTILITY REQUIREMENTS
9. WHERE PLANTERS EXIST, A 3" PVC IRRIGATION SLEEVE MUST BE INSTALLED UNDER THE SIDEWALK APPROXIMATELY 5' FROM EACH PROPERTY LINE FOR FUTURE USR BY THE HOMEOWNER TO INSTALL THE IRRIGATION SYSTEM INTO THE PLANTER AREA.
10. WHERE A PLANTER STRIP IS LOCATED ON A SIDE YARD OR BACK YARD, THE DEVELOPER WILL PROVIDE A 1" PRESSURE IRRIGATION SERVICE BOX AND INSTALL A SPRINKLER SYSTEM IN THE PLANTER AREA. THE PLANTER STRIP WILL BE MAINTAINED BY THE CITY.

J·U·B

0 10'

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Pleasant Grove
Utah's City of Trees

STANDARD STREET CROSS SECTIONS AND UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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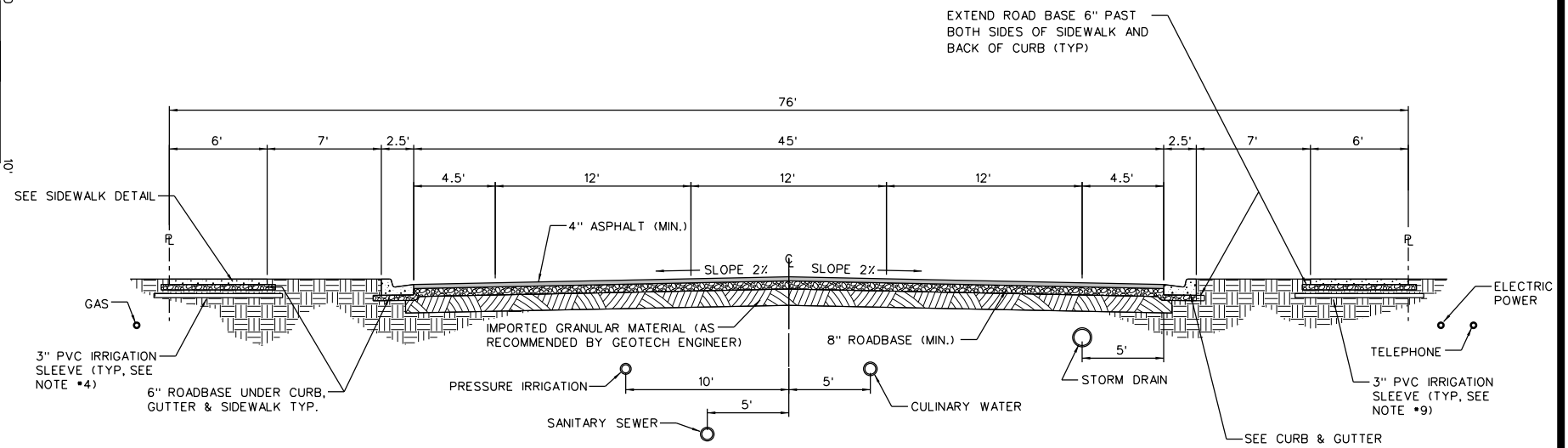
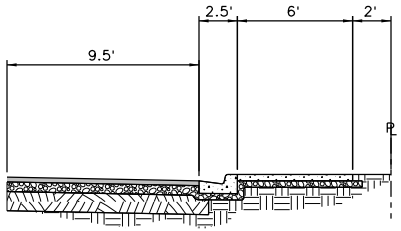


3-LANE
76' STREET CROSS-SECTION
700 SOUTH
FROM PG BLVD TO GENEVA RD
(NO STREET PARKING)



3-LANE
76' STREET CROSS-SECTION
(ALTERNATE SIDE TREATMENT
WITH STREET PARKING)

NOTES:
1. WHEREVER POSSIBLE, CULINARY WATER LINES SHALL BE INSTALLED ON THE NORTH AND EAST SIDE OF THE STREET
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3. CULINARY WATER VALVES SHALL BE BOLTED TO THE FITTING IN A STREET INTERSECTION
4. PRESSURE IRRIGATION VALVES SHALL BE ALIGNED WITH PROPERTY LINES WHERE POSSIBLE.
5. NO CULINARY WATER LINE SMALLER THAN 8" DIA. SHALL BE INSTALLED WITHOUT APPROVAL OF PUBLIC WORKS.
6. NO PRESSURE IRRIGATION LINE SMALLER THAN 6" DIA. SHALL BE INSTALLED WITHOUT APPROVAL OF PUBLIC WORKS.
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10. WHERE A PLANTER STRIP IS LOCATED ON A SIDE YARD OR BACK YARD, THE DEVELOPER WILL PROVIDE A 1" PRESSURE IRRIGATION SERVICE BOX AND INSTALL A SPRINKLER SYSTEM IN THE PLANTER AREA. THE PLANTER STRIP WILL BE MAINTAINED BY THE CITY.

NO.	DESCRIPTION	BY	APPR.	DATE
	REVISION			

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Pleasant Grove
Utah's City of Trees

STANDARD STREET CROSS SECTIONS AND UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	2A
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	DESCRIPTION			

Pleasant Grove
Utah's City of Trees

STANDARD STREET CROSS SECTIONS AND UTILITY LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	2B
CAD:	Pgdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
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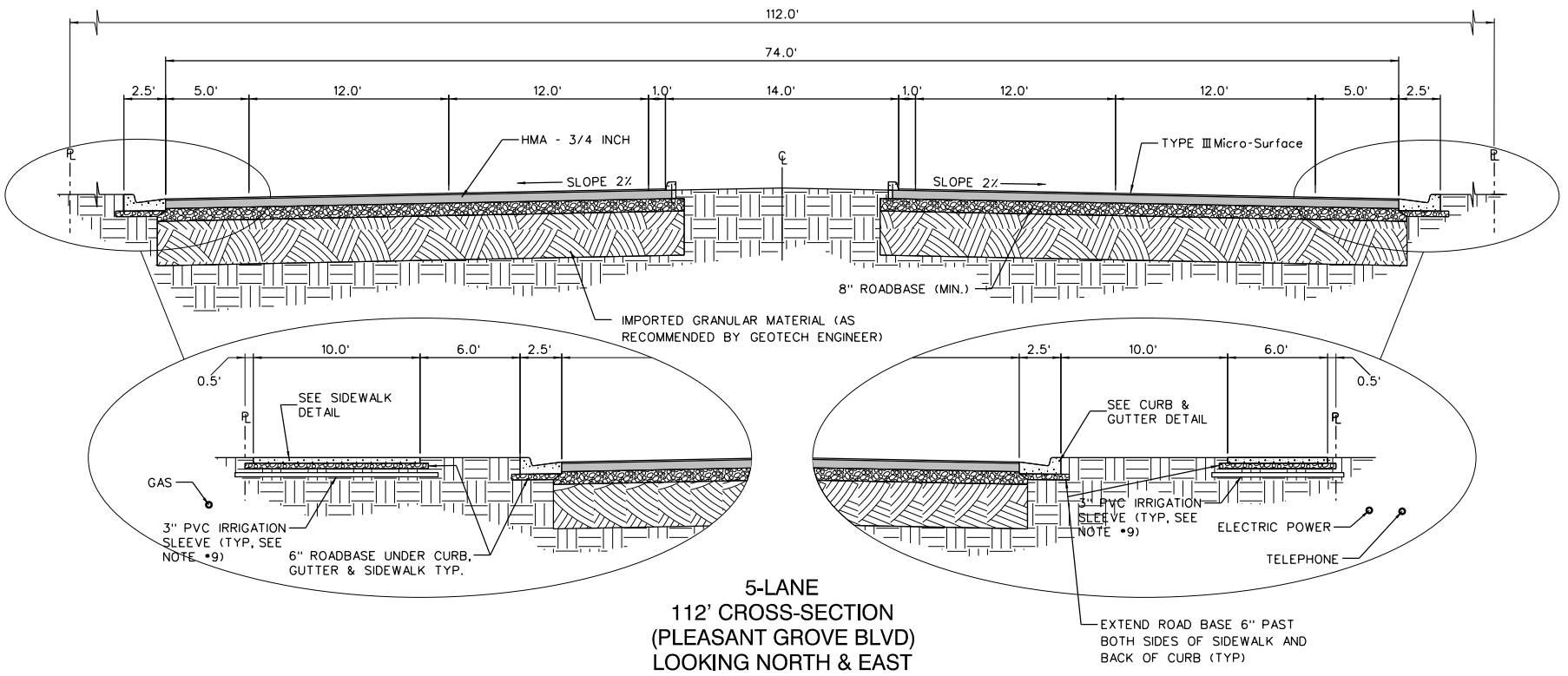

5-LANE
112' CROSS-SECTION
(PLEASANT GROVE BLVD)
LOOKING NORTH & EAST

NOTES:
1. WHEREVER POSSIBLE, CULINARY WATER LINES SHALL BE INSTALLED ON THE NORTH AND EAST SIDE OF THE STREET
2. FIRE HYDRANTS SHALL BE LOCATED EVERY 450 FEET AND ON THE SAME SIDE AS THE CULINARY WATER LINES OR AS APPROVED BY THE CITY.
3. CULINARY WATER VALVES SHALL BE BOLTED TO THE FITTING IN A STREET INTERSECTION
4. PRESSURE IRRIGATION VALVES SHALL BE ALIGNED WITH PROPERTY LINES WHERE POSSIBLE.
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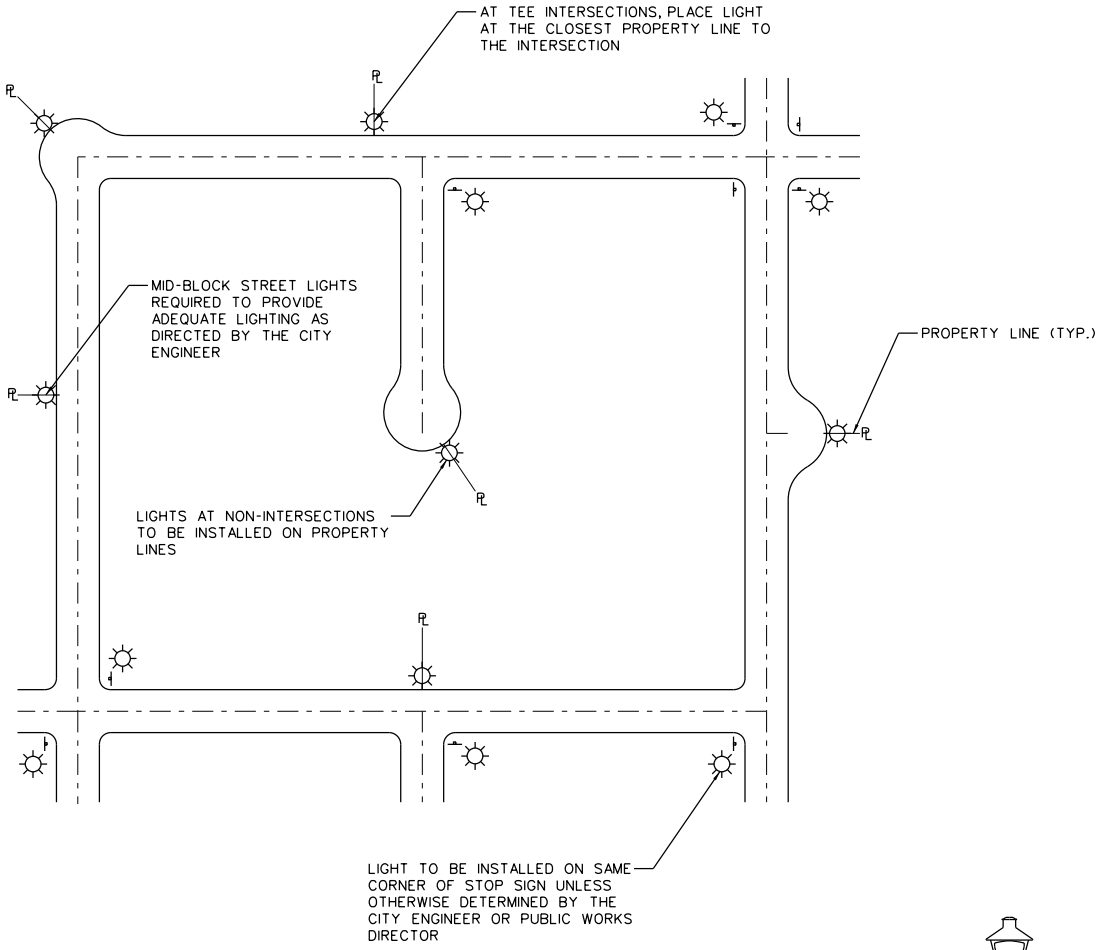
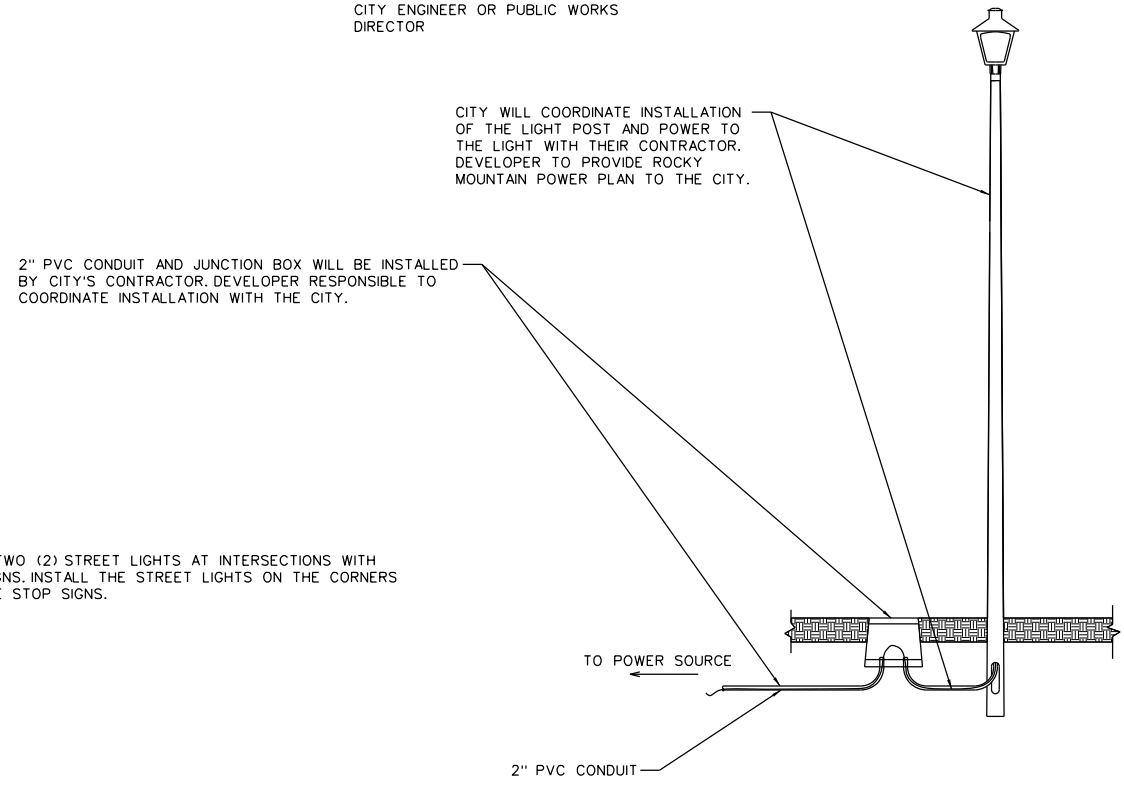
10. WHERE A PLANTER STRIP IS LOCATED ON A SIDE YARD OR BACK YARD, THE DEVELOPER WILL PROVIDE A 1" PRESSURE IRRIGATION SERVICE BOX AND INSTALL A SPRINKLER SYSTEM IN THE PLANTER AREA. THE PLANTER STRIP WILL BE MAINTAINED BY THE CITY.

PAVEMENT SECTIONS

MATERIAL	PG BLVD (THICKNESS)
TYPE III MICRO-SURFACE	MATCH EXISTING
HMA - 3/4 INCH	6"
UNTREATED ROADBASE	6"
IMPROTED GRANULAR MATERIAL	34"





SPACING:

1. INSTALL TWO (2) STREET LIGHTS AT INTERSECTIONS WITH STOP SIGNS. INSTALL THE STREET LIGHTS ON THE CORNERS WITH THE STOP SIGNS.

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Pleasant Grove
Utah's City of Trees

STANDARD STREET LIGHTING LOCATIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 2C

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PLOT SCALE:	1.000
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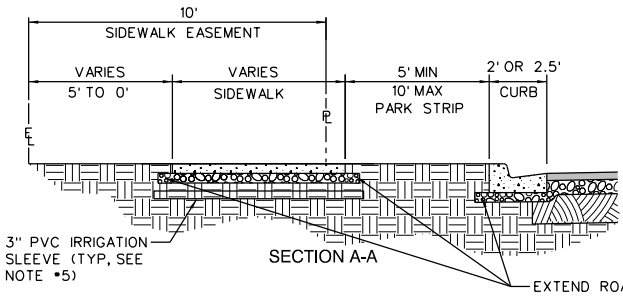
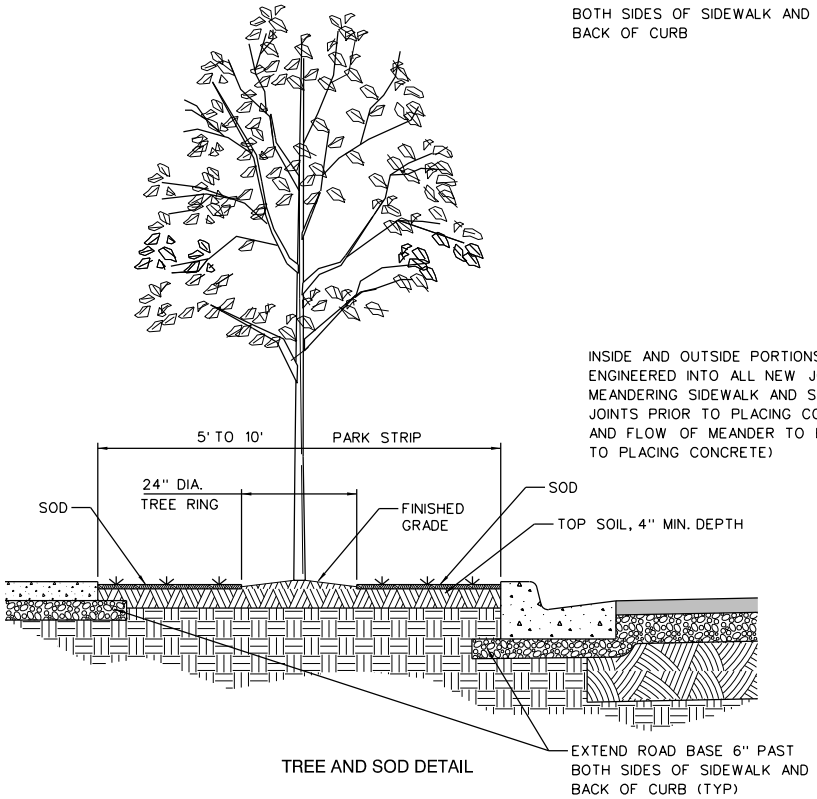
ADOPTED DATE:	NOVEMBER 2017

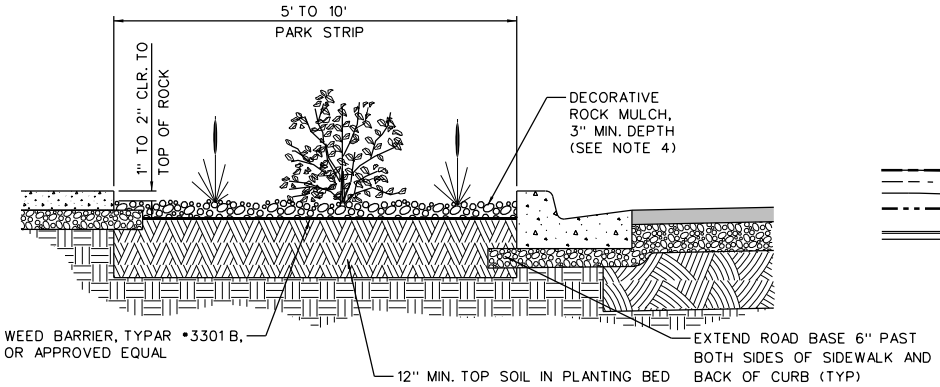
NOTES:

1. MEANDERING SIDEWALK ONLY APPLIES TO STREETS NORTH OF 2600 NORTH.
2. THE RADIUS OF THE SIDEWALK CENTERLINE IN THE MEANDER SHALL BE APPROXIMATELY 200'
3. EACH MEANDERING SIDEWALK SEGMENT BEGINNING AT THE MINIMUM DISTANCE FROM CURB TO MAXIMUM DISTANCE FROM CURB IS EQUAL TO A 13:1 TAPER.
4. DECORATIVE ROCK MULCH SIZE AND COLOR WILL DEPEND ON THE DESIRED LOOK. THE ROCK MULCH DEPTH DEPENDS ON THE SIZE OF ROCK SELECTED, BUT TYPICALLY IS NO LESS THAN 3". THE FINISHED GRADE OF ROCK IS 1" TO 2" BELOW THE TOP OF ANY HARD SURFACE.
5. INSTALL A 3" PVC IRRIGATION SLEEVE UNDER THE SIDEWALK APPROXIMATELY 5' FROM EACH PROPERTY LINE FOR FUTURE USE BY THE HOMEOWNER TO INSTALL THE IRRIGATION SYSTEM INTO THE PLANTER AREA.
6. WHERE THE PLANTER STRIP IS ON A SIDE YARD OR BACK YARD, THE DEVELOPER WILL PROVIDE A 1" PRESSURE IRRIGATION SERVICE BOX AND INSTALL A SPRINKLER SYSTEM IN THE PLANTER STRIP AREA. THE PLANTER STRIP WILL BE MAINTAINED BY THE CITY.

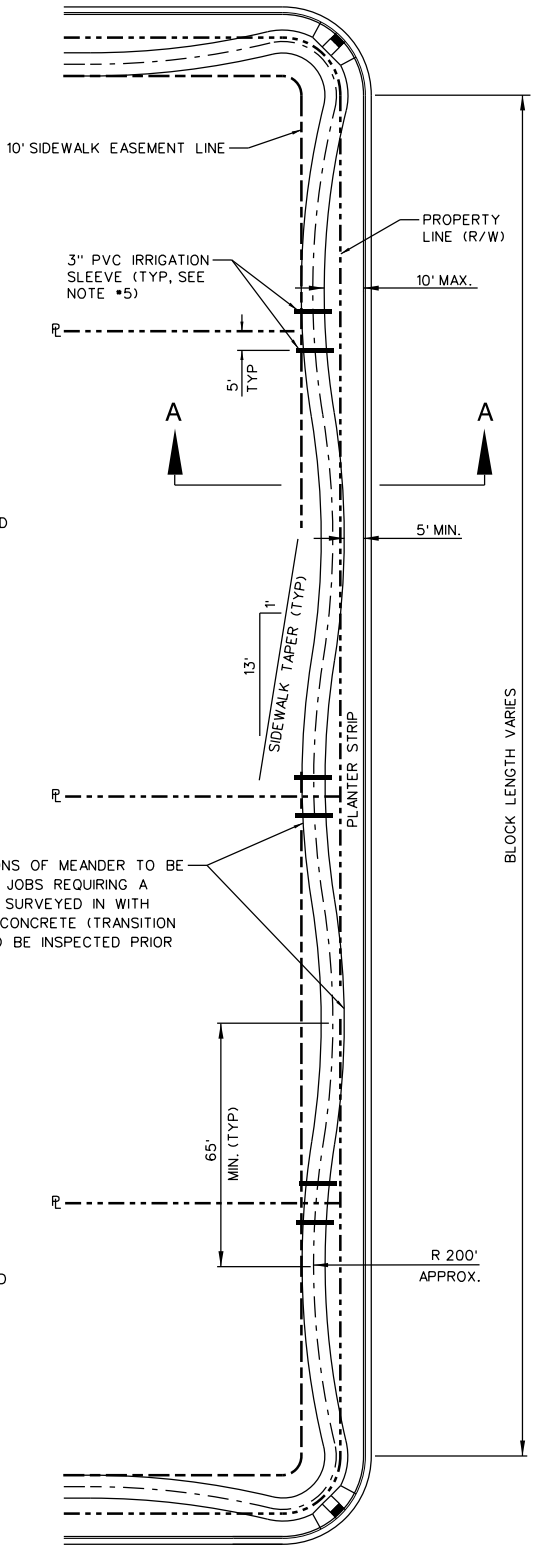




TREE AND SOD DETAIL



DECORATIVE ROCK MULCH AND SHRUB / GROUND COVER DETAIL



PLAN VIEW

PLANTER STRIP LANDSCAPING DETAILS

TYPICAL MEANDERING SIDEWALK

STATEMENT OF USE

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Pleasant Grove
Utah's City of Trees

MEANDERING SIDEWALK AND PLANTER STRIP DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	2D
CAD:	PGdetails_2017.dgn
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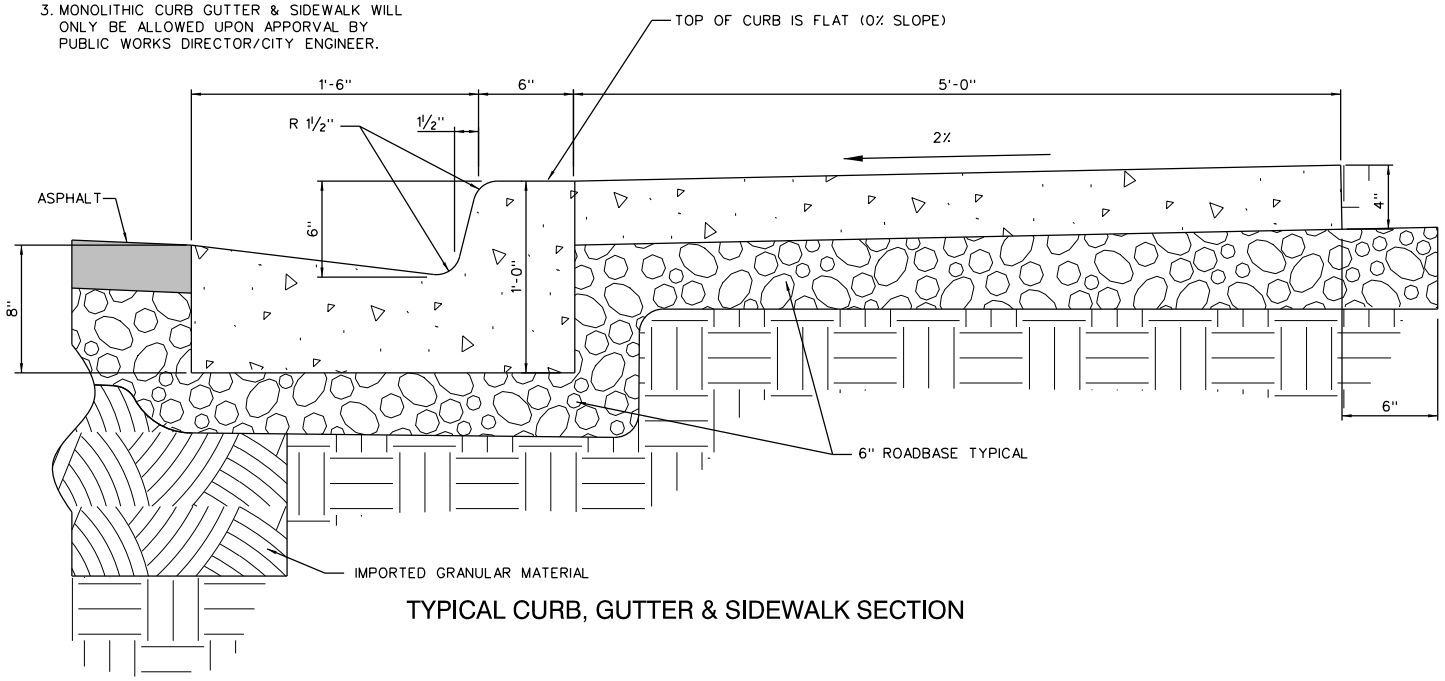
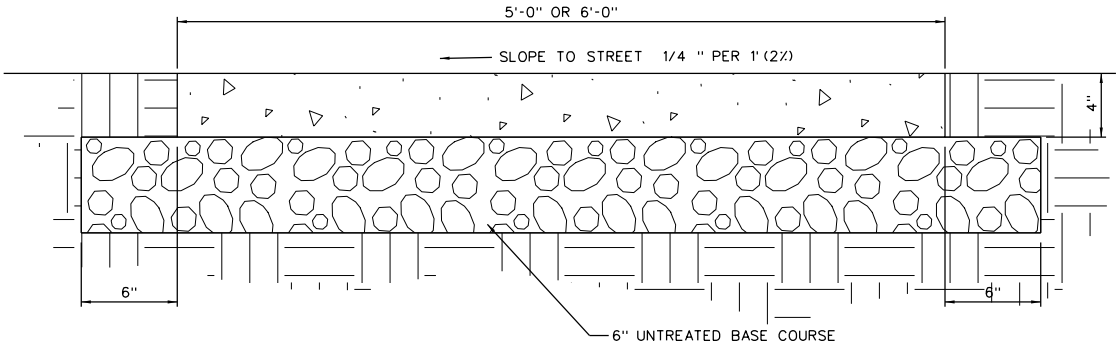
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017

NOTES:
1. CONTRACTION JOINTS EVERY 10' MAXIMUM AND EXPANSION JOINTS EVERY 50' MAXIMUM
2. WHERE DIVIDING PLATES ARE USED JOINTS SHALL HAVE A MINIMUM OF 2- INCHES OF CONCRETE UNDER THE PLATE, OR THE JOINT WILL BE SEALED WITH AN APPROVED SEALANT.
3. MONOLITHIC CURB GUTTER & SIDEWALK WILL ONLY BE ALLOWED UPON APPORVAL BY PUBLIC WORKS DIRECTOR/CITY ENGINEER.

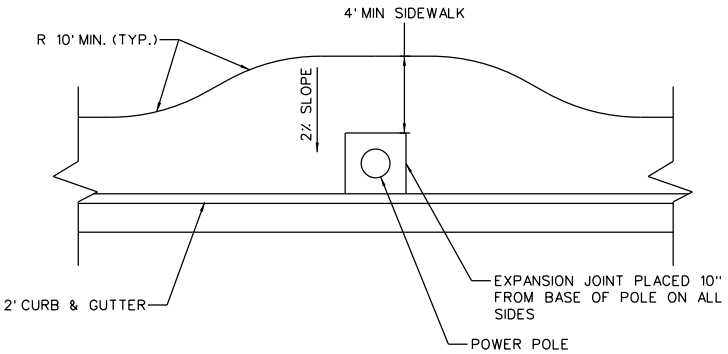


TYPICAL CURB, GUTTER & SIDEWALK SECTION



NOTES:
1. CONTRACTION JOINTS EVERY 10' MAXIMUM AND EXPANSION JOINTS EVERY 50' MAXIMUM
2. WHERE DIVIDING PLATES ARE USED JOINTS SHALL HAVE A MINIMUM OF 2- INCHES OF CONCRETE UNDER THE PLATE, OR THE JOINT WILL BE SEALED WITH AN APPROVED SEALANT.

SIDEWALK DETAIL



NOTE: ONLY ALLOWED IF APPROVED BY CITY ENGINEER/ PUBILC WORKS DIRECTOR

POWER POLE/SIDEWALK CONFLICT DETAIL

NTS

J-U-B

0 1'

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Pleasant Grove
Utah's City of Trees

CURB, GUTTER & SIDEWALK DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
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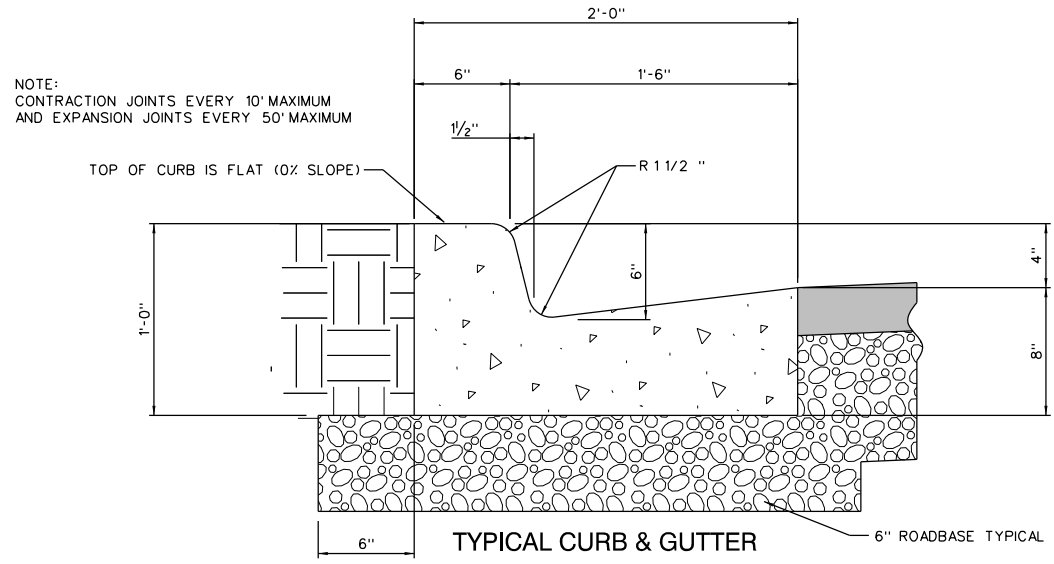
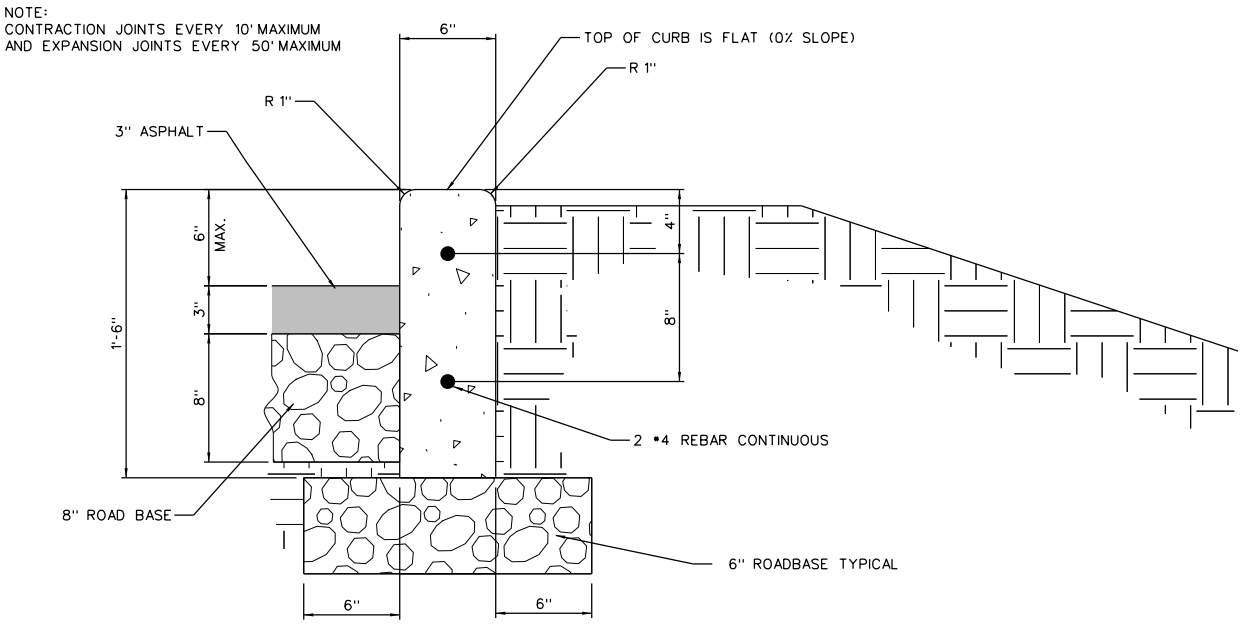
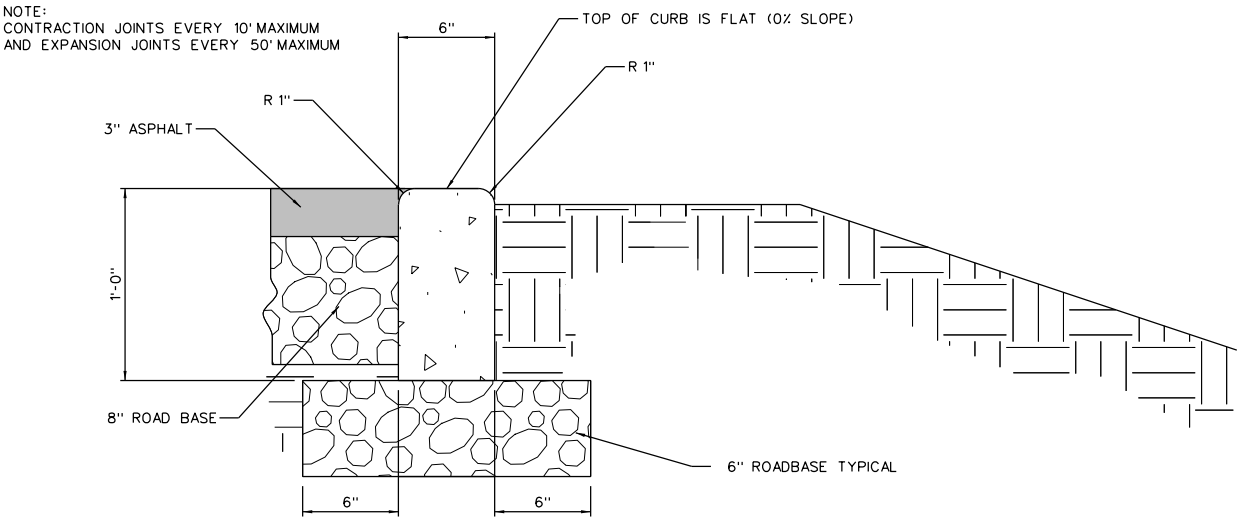


TYPICAL CURB & GUTTER



TYPICAL 18" CONCRETE CURB



TYPICAL 12" CONCRETE CURB

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Pleasant Grove
Utah's City of Trees

CURB & GUTTER, CONCRETE CURB, AND CROSS GUTTER DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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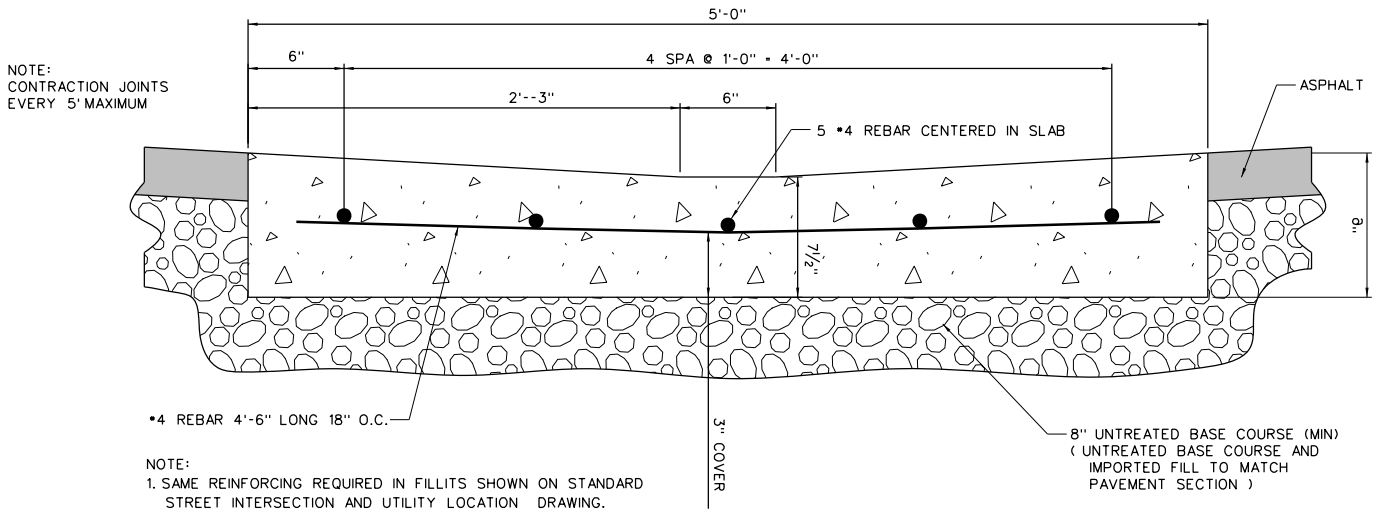
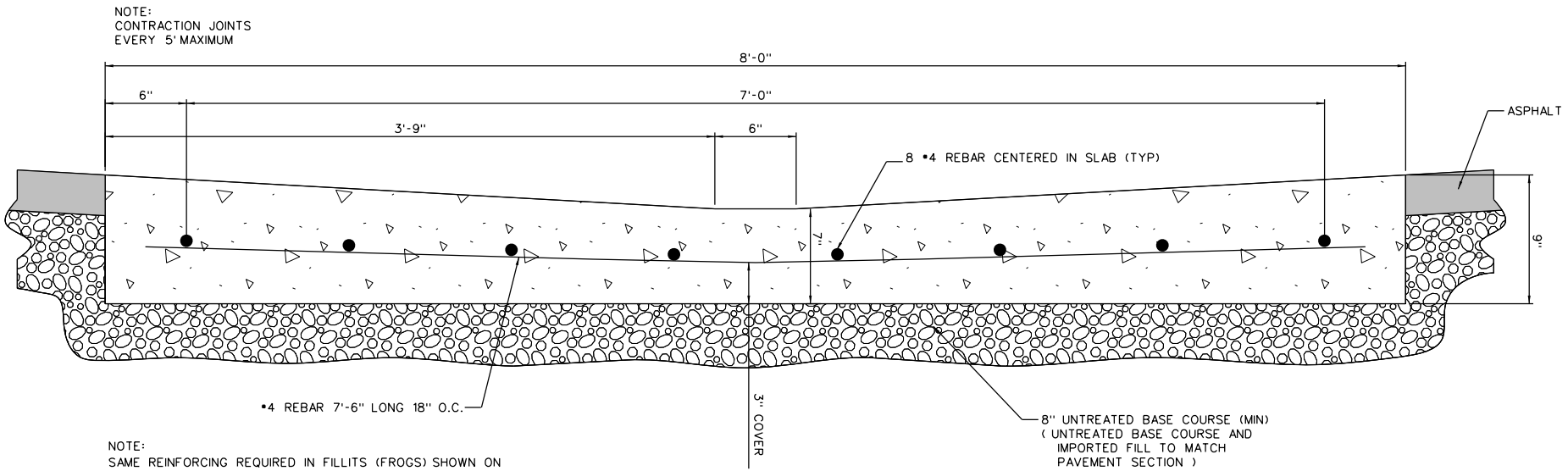


NOTE:
1. SAME REINFORCING REQUIRED IN FILLITS SHOWN ON STANDARD STREET INTERSECTION AND UTILITY LOCATION DRAWING.
2. 5' CROSS GUTTER ALLOWED ONLY WITH APPROVAL OF THE CITY ENGINEER.

5' CROSS GUTTER SECTION



NOTE:
SAME REINFORCING REQUIRED IN FILLITS (FROGS) SHOWN ON STANDARD STREET INTERSECTION AND UTILITY LOCATION DRAWINGS

8' CROSS GUTTER SECTION

NO.	DESCRIPTION	BY	APPR.	DATE
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0 1"

Pleasant Grove
Utah's City of Trees

CROSS GUTTER DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 4A

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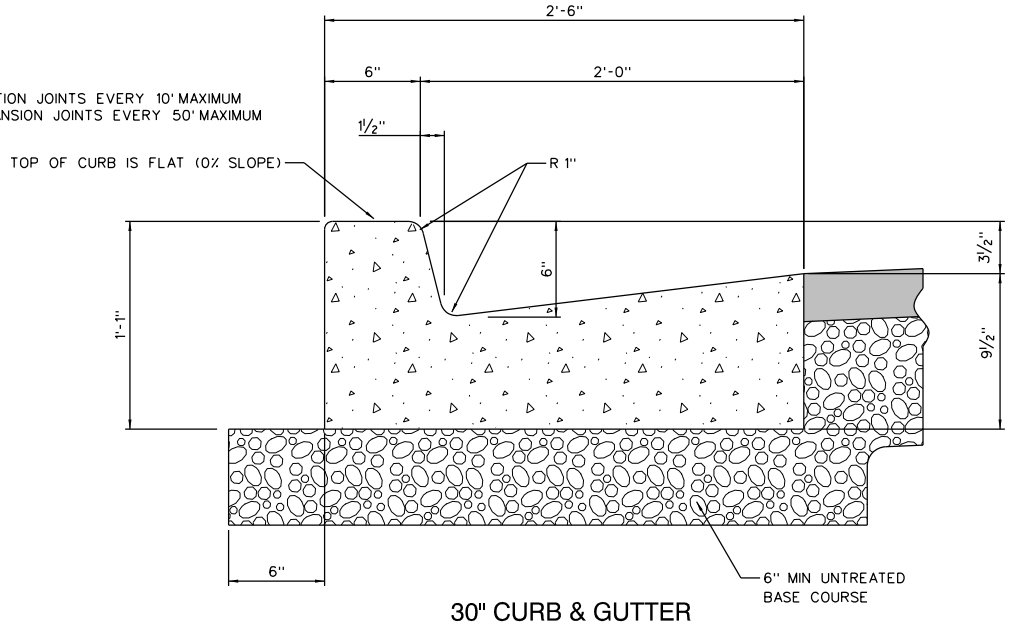
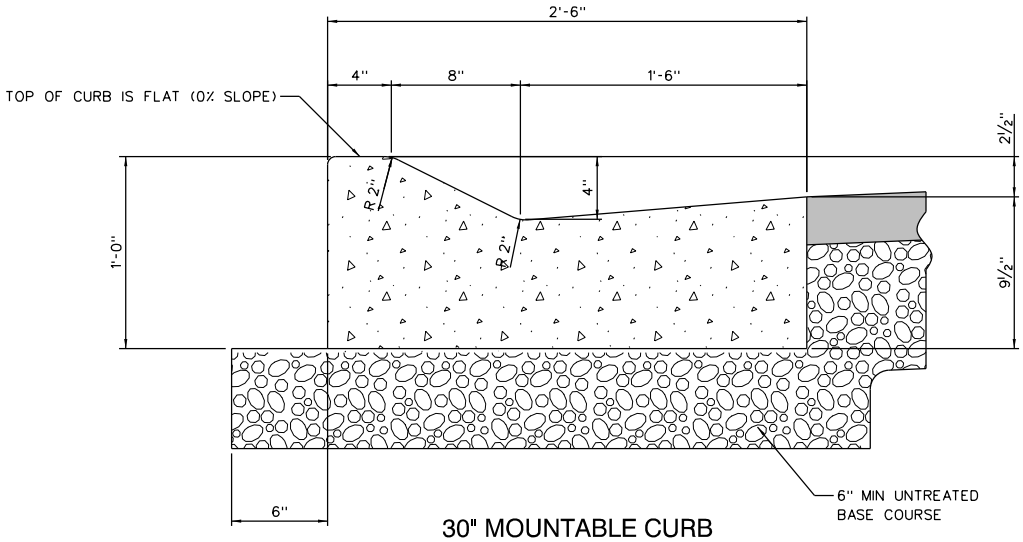
NOTE:
CONTRACTION JOINTS EVERY 10' MAXIMUM
AND EXPANSION JOINTS EVERY 50' MAXIMUM



30" CURB & GUTTER



30" MOUNTABLE CURB

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0 1'

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Pleasant Grove
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30" CURB & GUTTER AND 30" MOUNTABLE CURB

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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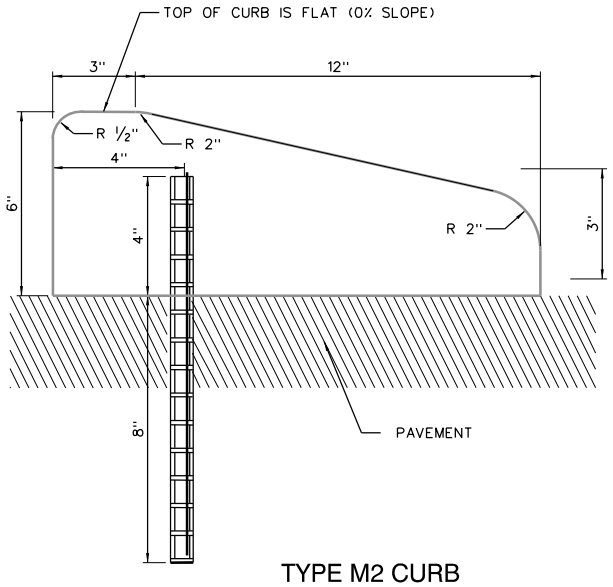
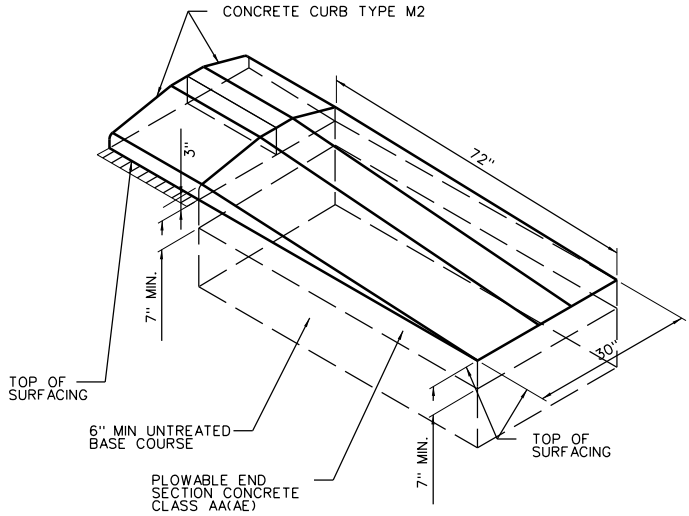
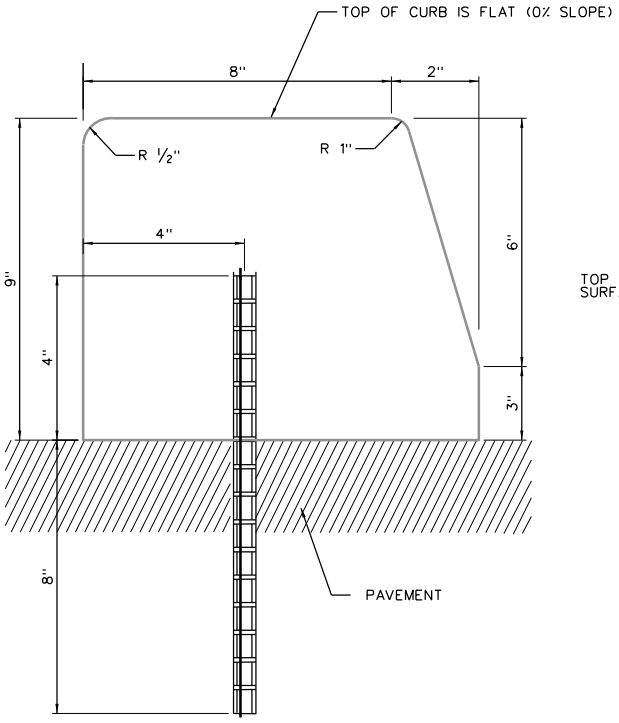


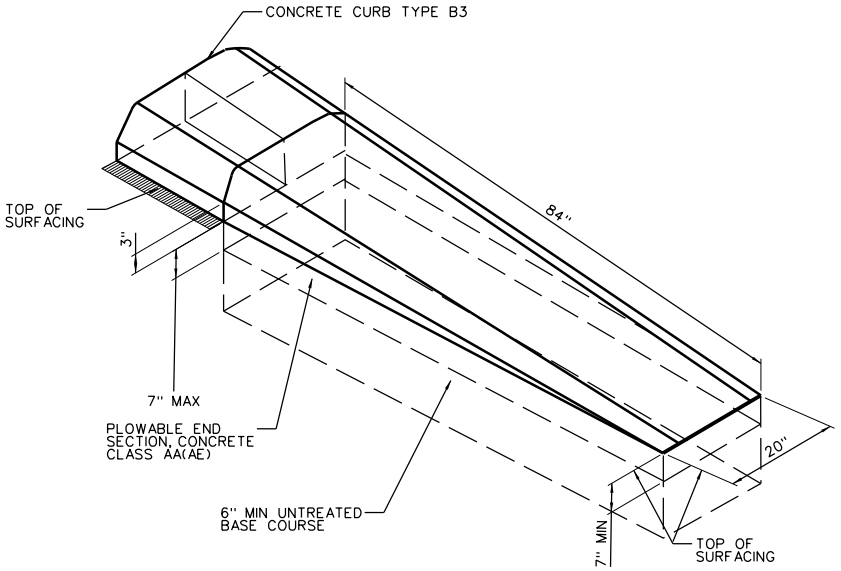
TYPE M2 CURB
UDOT STANDARD



PLOWABLE END SECTION
TYPE M2 CURB
UDOT STANDARD



TYPE B3 CURB
UDOT STANDARD



PLOWABLE END SECTION
TYPE B3 CURB
UDOT STANDARD

JUB

REVISION

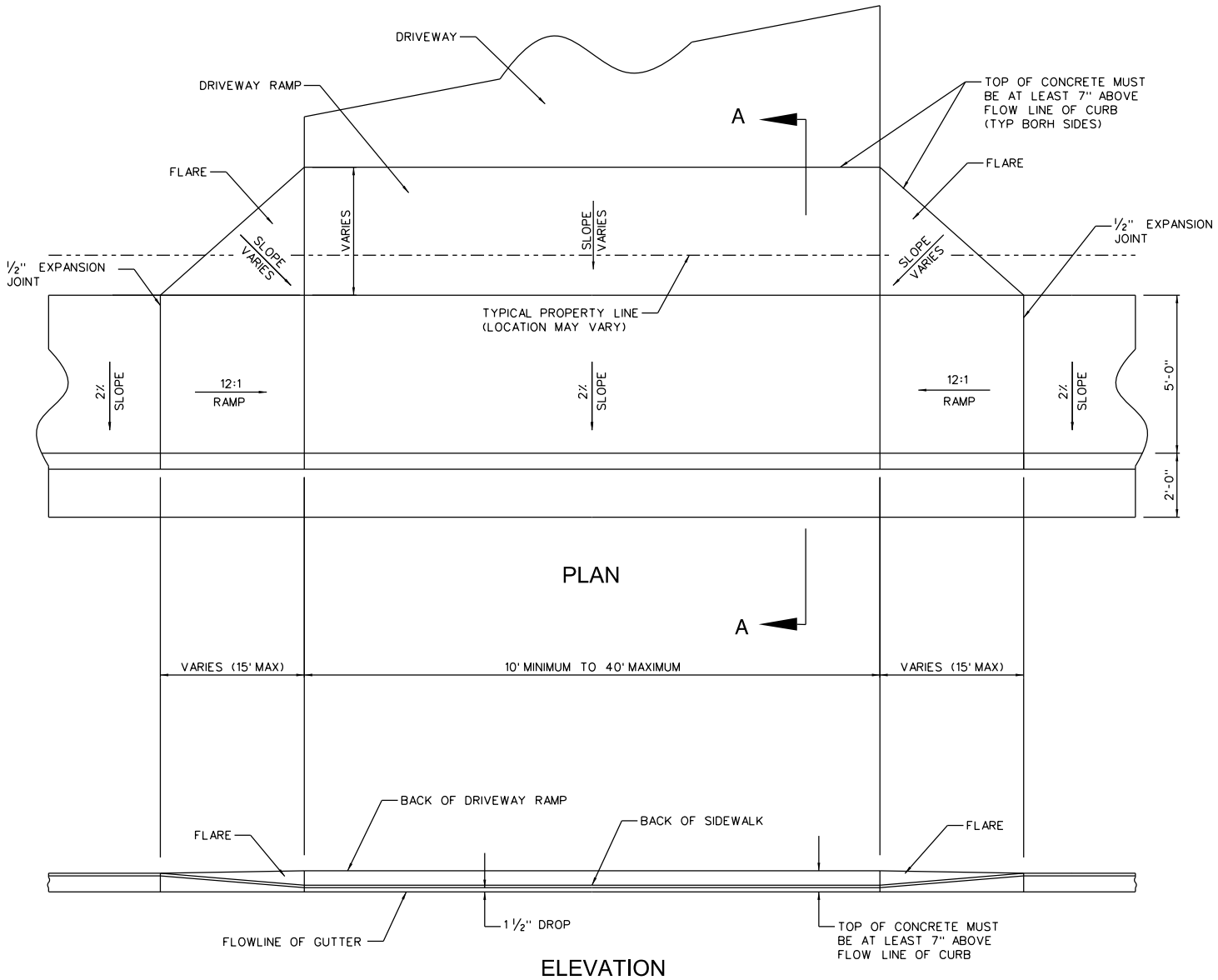
NO.	DESCRIPTION	BY	APR.	DATE

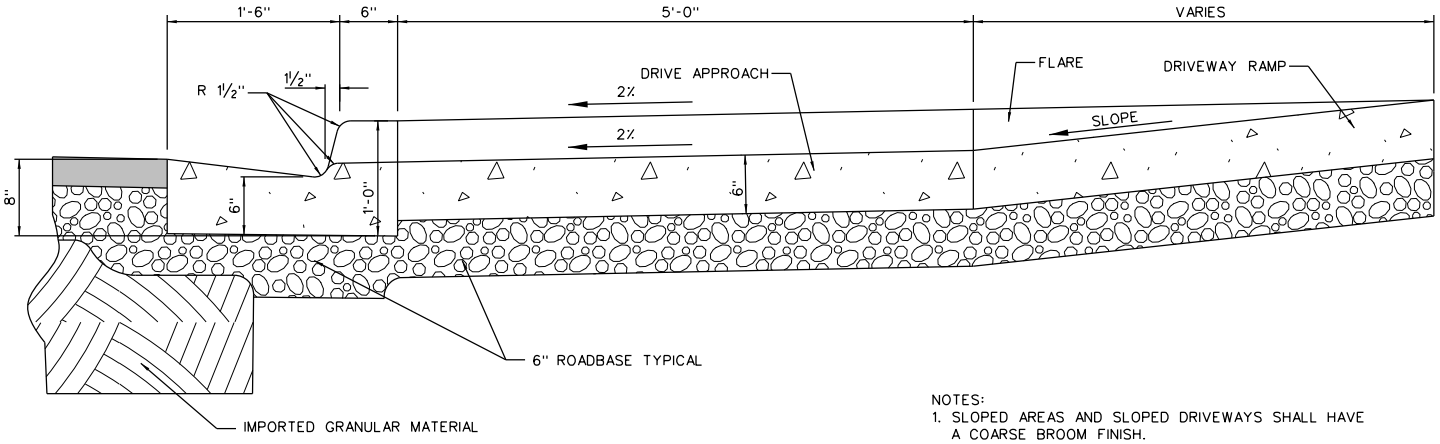
Pleasant Grove
Utah's City of Trees

MEDIAN CURB & PLOWABLE END SECTIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	4C
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017





SECTION A-A
N.T.S.

NOTES:
1. SLOPED AREAS AND SLOPED DRIVEWAYS SHALL HAVE A COARSE BROOM FINISH.
2. THE DRIVEWAY, AT A POINT BEHIND THE SIDEWALK, SHALL BE AT LEAST 7" HIGHER THAN THE FLOWLINE OF THE GUTTER. CONTRACTOR TO COORDINATE WITH PUBLIC WORKS ENGINEERING / INSPECTOR.
3. RAMPS AND FLARES ARE TO BE 6" THICK CONCRETE.

JUB 0 5'

REVISION

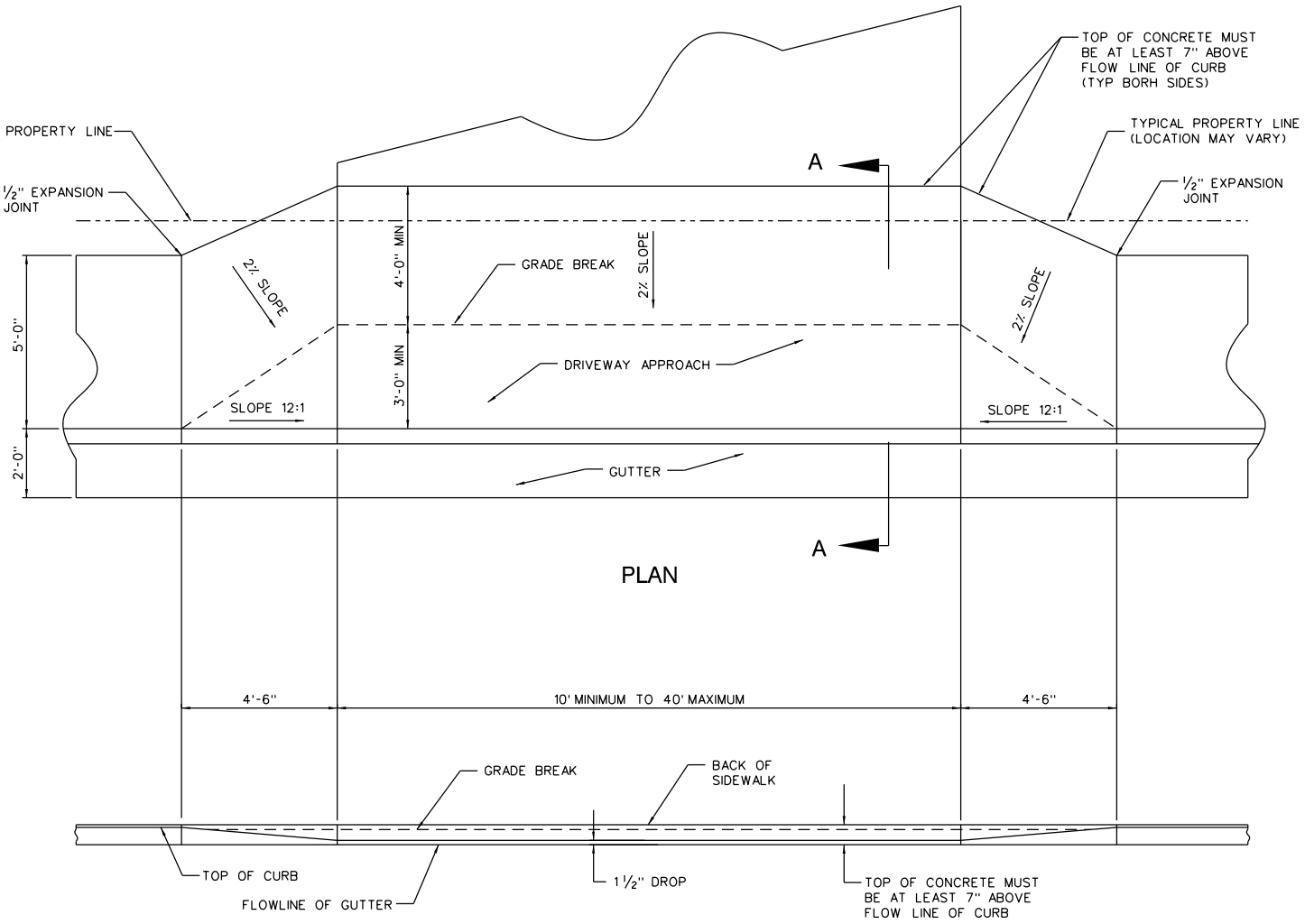
NO.	DESCRIPTION	BY	APR.	DATE

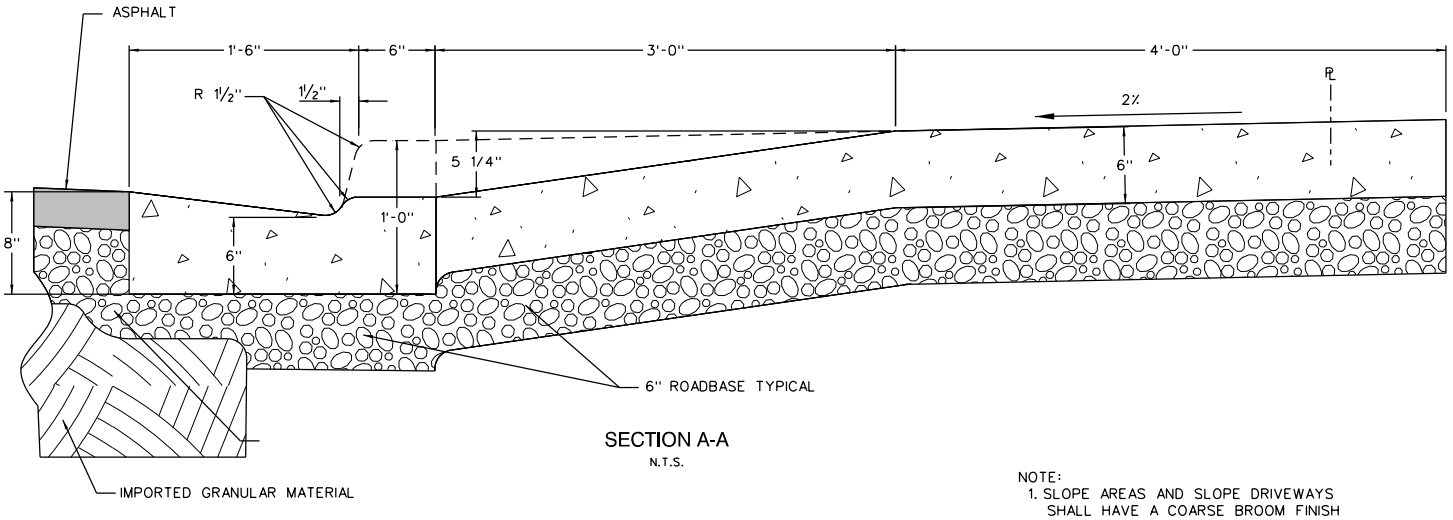
Pleasant Grove
Utah's City of Trees

TYPICAL DRIVEWAY APPROACH PREFERRED OPTION

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	5
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017





SECTION A-A
N.T.S.

NOTE:
1. SLOPE AREAS AND SLOPE DRIVEWAYS SHALL HAVE A COARSE BROOM FINISH
2. ALL CONCRETE IN THE DRIVEWAY SHALL BE A MINIMUM OF 6" THICK.

J-U-B

0 5'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

TYPICAL DRIVEWAY APPROACH WHERE APPROVED BY CITY

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 5A

CAD:	PGdetails_2017.dgn
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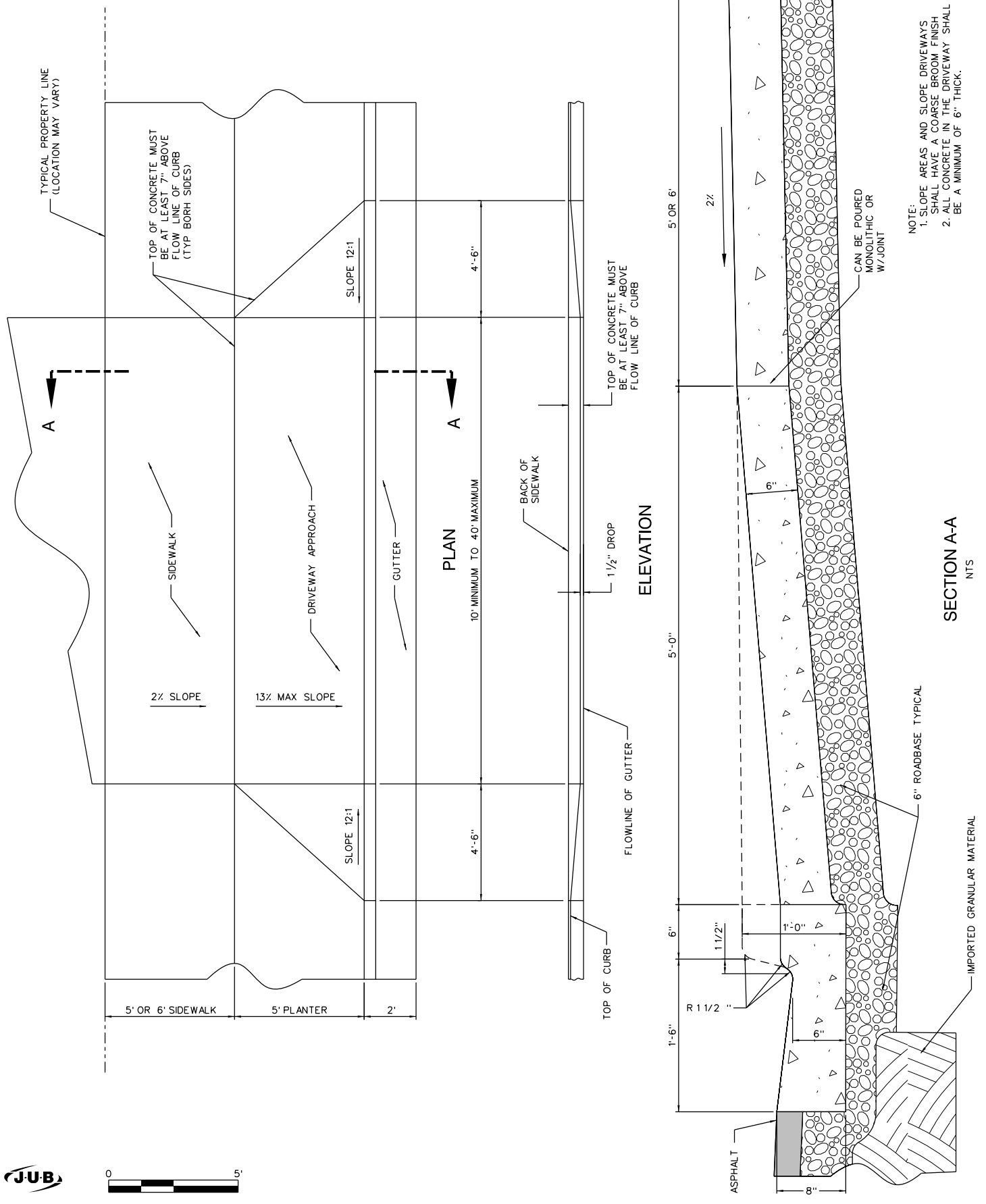
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



STATEMENT OF USE

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REVISION

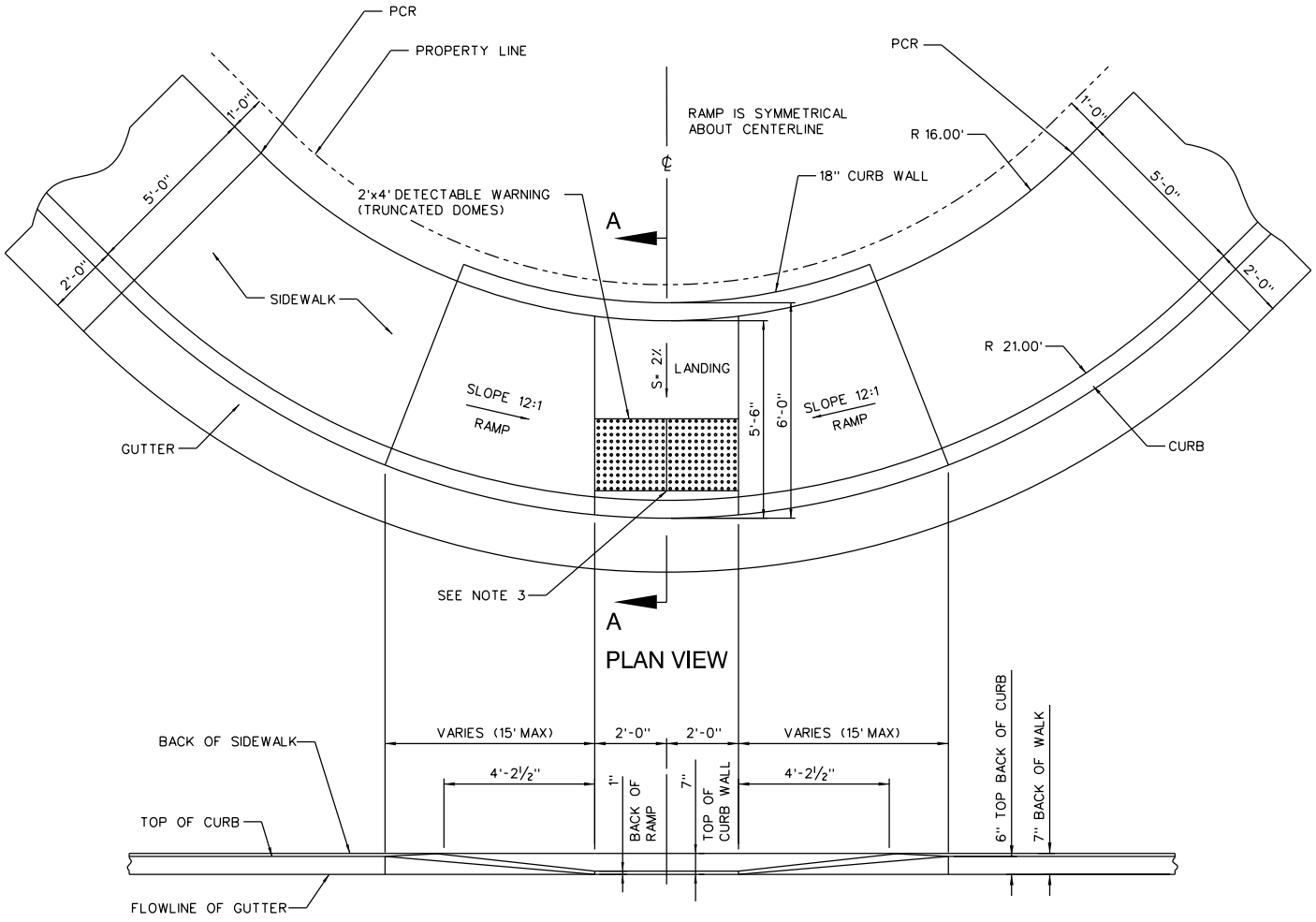
NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

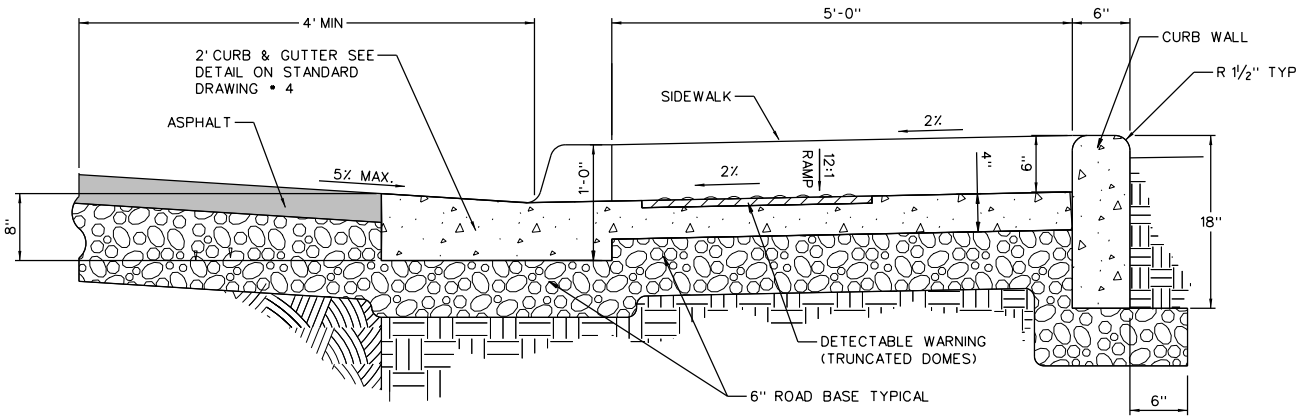
TYPICAL DRIVEWAY APPROACH

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	5B
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017

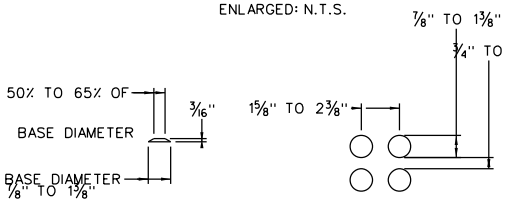


ELEVATION



SECTION A-A

ENLARGED: N.T.S.



TRUNCATED DOMES

ENLARGED SCALE 1"=1'

NOTES:

1. LANDING SHALL NOT EXCEED 2% IN ANY DIRECTION.
2. DETECTABLE WARNING SURFACE TO BE CAST IRON WITHIN ALL CITY RIGHT-OF-WAYS. OTHER ADA COMPLIANT INSERTS ARE ALLOWED IN PRIVATE DEVELOPMENTS ONLY. CONCRETE STAMPING IS NOT PERMITTED.
3. LOCATE DETECTABLE WARNING SURFACE SO THE EDGE NEAREST THE STREET IS AT OR WITHIN 2" OF THE BACK OF CURB.

JUB

0 5'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE
1	REDESIGN OF ADA RAMP, ADDED DETECTABLE WARNING	EEA	HJC	JAN 2005

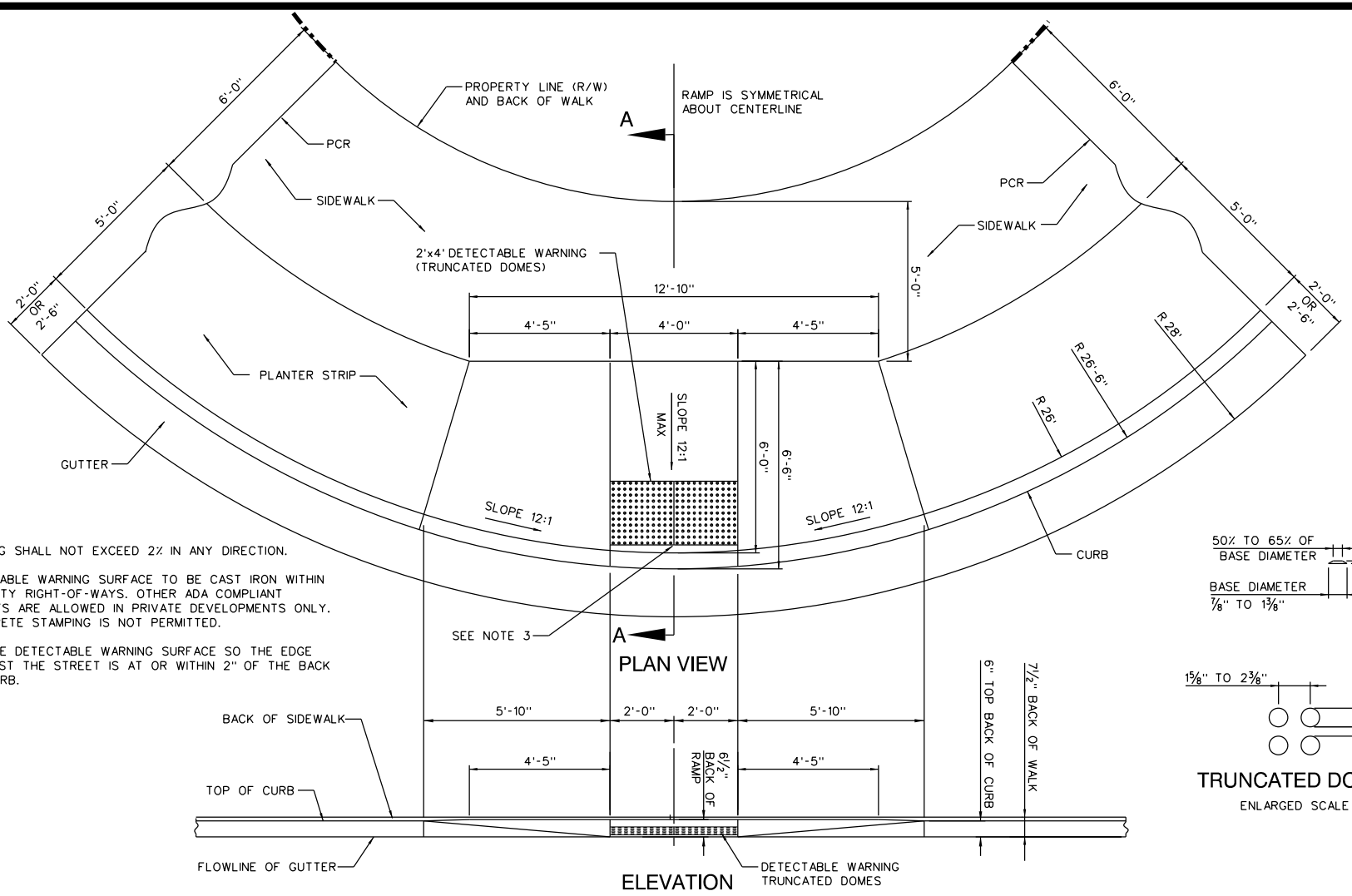
Pleasant Grove
Utah's City of Trees

CURB RETURN AT INTERSECTION A.D.A. REQUIREMENT

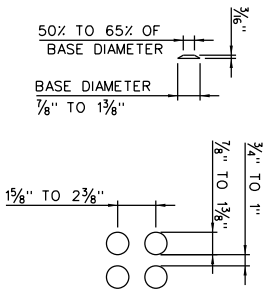
PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 6

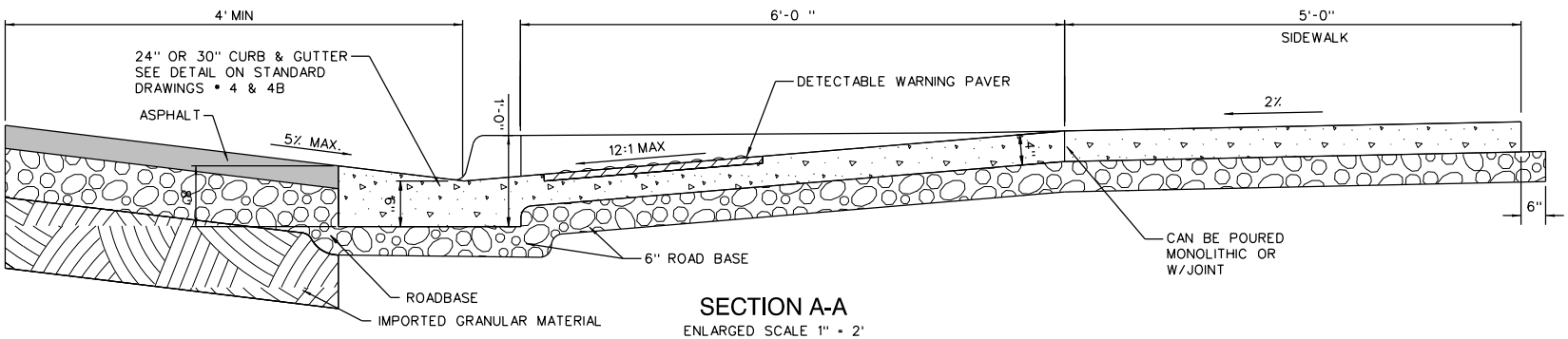
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



NOTES:
1. LANDING SHALL NOT EXCEED 2% IN ANY DIRECTION.
2. DECETABLE WARNING SURFACE TO BE CAST IRON WITHIN ALL CITY RIGHT-OF-WAYS. OTHER ADA COMPLIANT INSERTS ARE ALLOWED IN PRIVATE DEVELOPMENTS ONLY. CONCRETE STAMPING IS NOT PERMITTED.
3. LOCATE DETECTABLE WARNING SURFACE SO THE EDGE NEAREST THE STREET IS AT OR WITHIN 2" OF THE BACK OF CURB.



TRUNCATED DOMES
ENLARGED SCALE 1"=1'



SECTION A-A
ENLARGED SCALE 1" = 2'

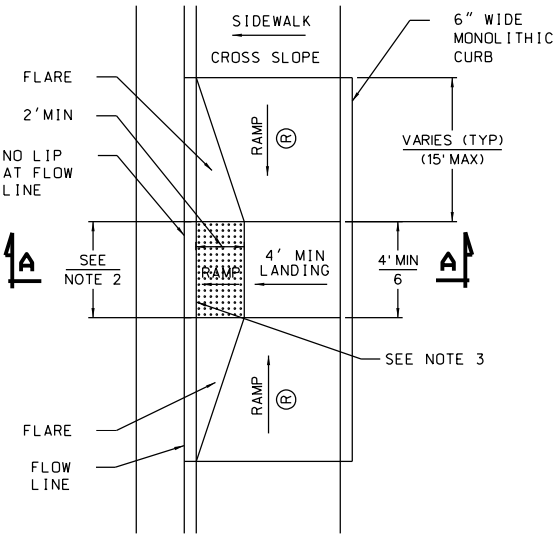
NO.	DESCRIPTION	BY	APPR.	DATE
	REVISION			

Pleasant Grove
Utah's City of Trees

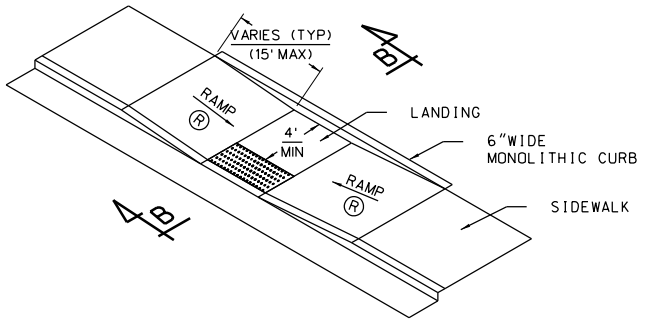
CURB RETURN AT INTERSECTION
A.D.A. REQUIREMENT

PLEASANT GROVE CITY
86 EAST 100 SOUTH

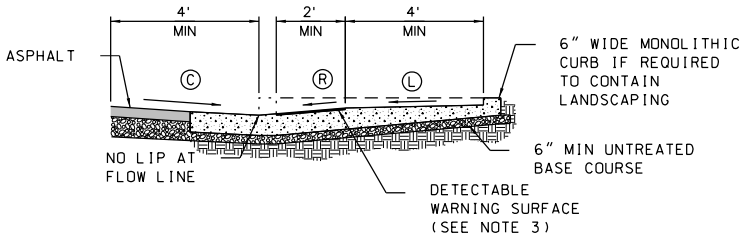
STANDARD DRAWING NUMBER:	6A
CAD:	Pdetails-2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGNED BY:	EEA
CHECKED BY:	KNG
ADOPTED DATE:	NOVEMBER 2017



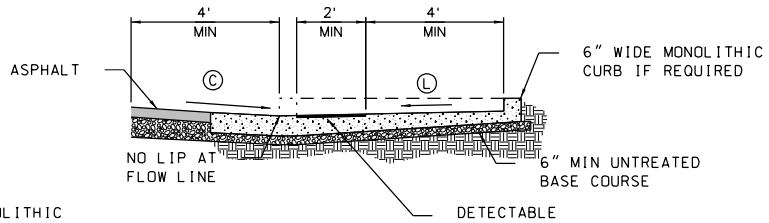
PEDESTRIAN ACCESS RAMP DETAIL



PARALLEL PEDESTRIAN RAMP



SECTION A-A



SECTION B-B

SLOPE TABLE			
	ITEM	MAX. RUNNING SLOPE *	MAX. CROSS SLOPE *
(L)	LANDING	2% (1V:48H)(b)	2% (1V:48H) (b)
(R)	RAMP	8.33% (1V:12H)(c)	2% (1V:48H) (d)
(C)	CLEAR SPACE	5% (1V:20H)(a)	
	SIDEWALK	--	2% (1V:48H)
	FLARE	12% (1V:12H)	--

* RUNNING SLOPE IS IN THE DIRECTION OF PEDESTRIAN TRAVEL. CROSS SLOPE IS PERPENDICULAR TO PEDESTRIAN TRAVEL.

(a) TRANSITION RUNNING SLOPE NEEDS TO BE CONSISTENT ACROSS ENTIRE CURB CUT. WARP GUTTER PAN TO MEET REQUIRED TRANSITION SLOPE AT CURB CUT.

EXCEPTIONS:

(b) SLOPE REQUIREMENTS DO NOT APPLY AT MID-BLOCK CROSSINGS.

(c) PARALLEL RAMPS ARE NOT REQUIRED TO EXCEED 15-FEET IN LENGTH.

(d) CROSS SLOPE REQUIREMENT DOES NOT APPLY AT PERPENDICULAR RAMP MID-BLOCK CROSSING.

GENERAL NOTES:

1. SITE CONDITIONS WILL VARY. CONFIGURATION OF RAMP, LANDING, AND TRANSITION MAY BE CHANGED, BUT THEY MUST MEET DIMENSIONS AND SLOPES SHOWN HERE. THE USE OF FLARES, CURBWALLS, ETC. ARE AT THE DISCRETION OF THE ENGINEER.
2. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF CURB CUT. SEE DETAIL ON STANDARD DRAWING 6 FOR TRUNCATED DOME DIMENSIONS.
3. LOCATE DETECTABLE WARNING SURFACE SO THE EDGE NEAREST THE STREET IS AT OR WITHIN 2" OF THE BACK OF CURB.
4. PARALLEL PEDESTRIAN RAMP SHOWN ON THIS DRAWING ARE ACCEPTABLE FOR USE AT MID-BLOCK OR CORNER INSTALLATIONS.
5. DETECTABLE WARNING SURFACE TO BE CAST IRON WITHIN ALL CITY RIGHT-OF-WAYS. OTHER ADA COMPLIANT INSERTS ARE ALLOWED IN PRIVATE DEVELOPEMENTS ONLY. CONCRETE STAMPING IS NOT PERMITTED.
6. WHEN DETECTABLE WARNING SURFACE IS CUT, GRIND OFF REMAINING PORTION OF ANY CUT DOMES. SEAL ALL CUT PANEL EDGES TO PREVENT WATER DAMAGE.
7. LOCATE CURB CUT WITHIN CROSSWALK.
8. RAMP GRADE BREAK MUST BE PERPENDICULAR TO THE RUNNING SLOPE.

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

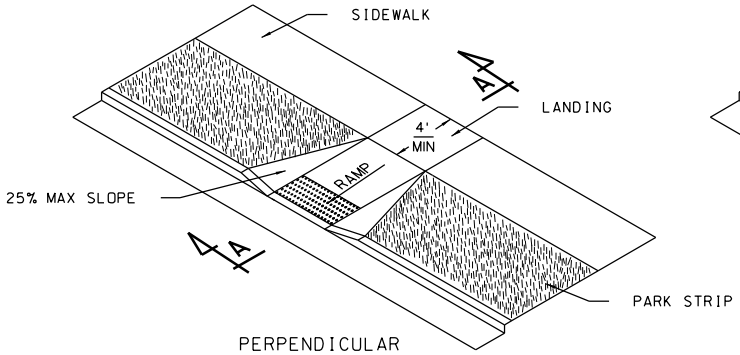
Pleasant Grove
Utah's City of Trees

PEDESTRIAN RAMP DETAIL A.D.A. REQUIREMENT

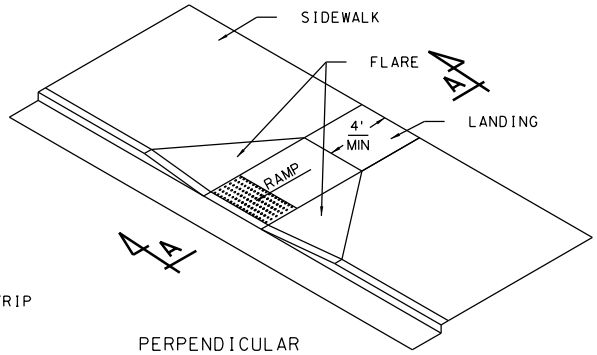
PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 6B

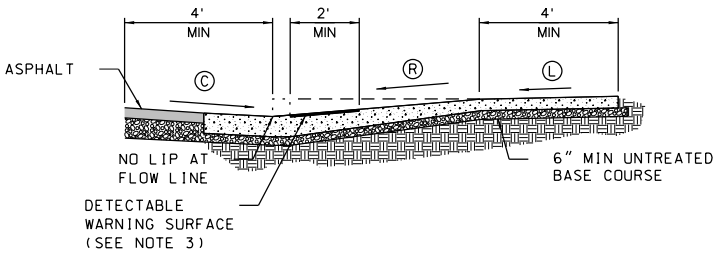
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



PERPENDICULAR
PEDESTRIAN RAMP



PERPENDICULAR
PEDESTRIAN RAMP



SECTION A-A

SLOPE TABLE			
	ITEM	MAX. RUNNING SLOPE *	MAX. CROSS SLOPE *
Ⓛ	LANDING	2% (1V:48H)(b)	2% (1V:48H) (b)
Ⓡ	RAMP	8.33% (1V:12H)	2% (1V:48H) (c)
Ⓒ	CLEAR SPACE	5% (1V:20H)(a)	
	SIDEWALK	--	2% (1V:48H)
	FLARE	12% (1V:12H)	--

* RUNNING SLOPE IS IN THE DIRECTION OF PEDESTRIAN TRAVEL. CROSS SLOPE IS PERPENDICULAR TO PEDESTRIAN TRAVEL.

(a) TRANSITION RUNNING SLOPE NEEDS TO BE CONSISTENT ACROSS ENTIRE CURB CUT. WARP GUTTER PAN TO MEET REQUIRED TRANSITION SLOPE AT CURB CUT.

EXCEPTIONS:

(b) SLOPE REQUIREMENTS DO NOT APPLY AT MID-BLOCK CROSSINGS.

(c) CROSS SLOPE REQUIREMENT DOES NOT APPLY AT PERPENDICULAR RAMP MID-BLOCK CROSSING.

GENERAL NOTES:

1. SITE CONDITIONS WILL VARY. CONFIGURATION OF RAMP, LANDING, AND TRANSITION MAY BE CHANGED, BUT THEY MUST MEET DIMENSIONS AND SLOPES SHOWN HERE. THE USE OF FLARES, CURBWALLS, ETC. ARE AT THE DISCRETION OF THE ENGINEER.
2. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF CURB CUT. SEE DETAIL ON STANDARD DRAWING 6 FOR TRUNCATED DOME DIMENSIONS.
3. LOCATE DETECTABLE WARNING SURFACE SO THE EDGE NEAREST THE STREET IS AT OR WITHIN 2" OF THE BACK OF CURB.
4. PERPENDICULAR PEDESTRIAN RAMPS SHOWN ON THIS DRAWING ARE ACCEPTABLE FOR USE AT MID-BLOCK OR CORNER INSTALLATIONS.
5. DETECTABLE WARNING SURFACE TO BE CAST IRON WITHIN ALL CITY RIGHT-OF-WAYS. OTHER ADA COMPLIANT INSERTS ARE ALLOWED IN PRIVATE DEVELOPEMENTS ONLY. CONCRETE STAMPING IS NOT PERMITTED.
6. WHEN DETECTABLE WARNING SURFACE IS CUT, GRIND OFF REMAINING PORTION OF ANY CUT DOMES. SEAL ALL CUT PANEL EDGES TO PREVENT WATER DAMAGE.
7. LOCATE CURB CUT WITHIN CROSSWALK.
8. RAMP GRADE BREAK MUST BE PERPENDICULAR TO THE RUNNING SLOPE.

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

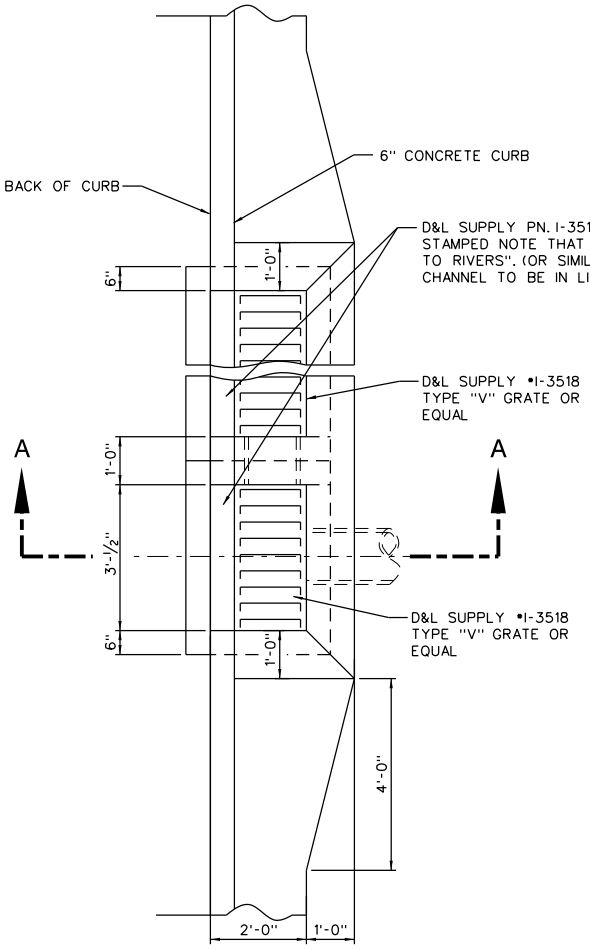
Pleasant Grove
Utah's City of Trees

PEDESTRIAN RAMP DETAIL
A.D.A. REQUIREMENT

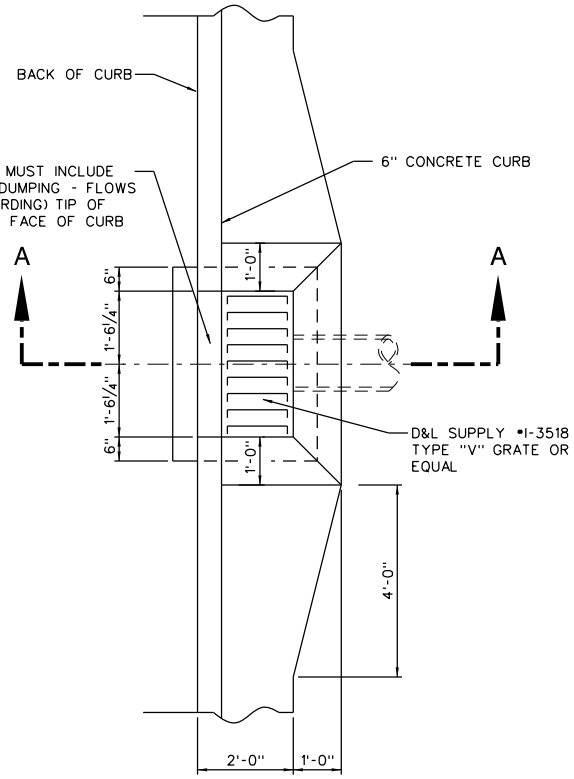
PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 6C

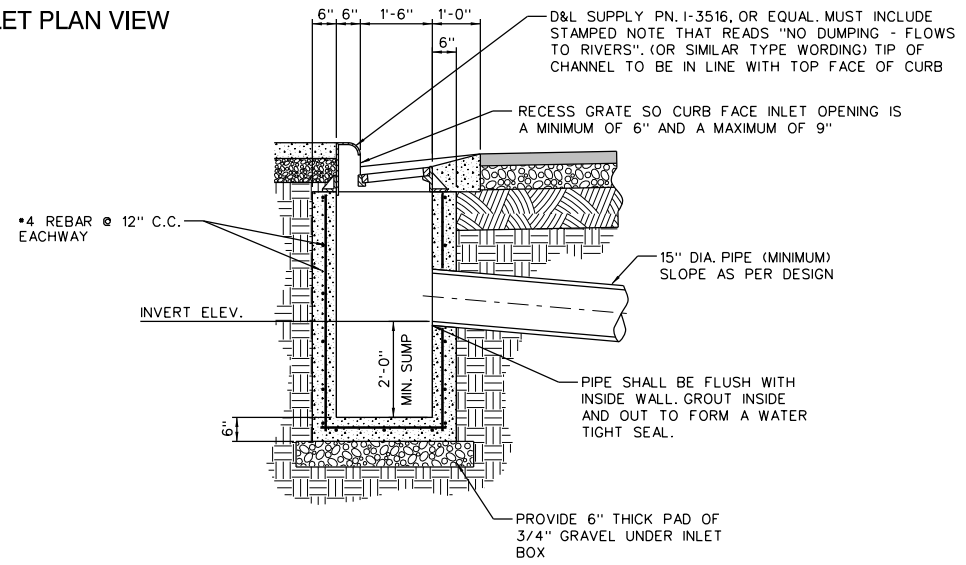
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



MULTIPLE INLET PLAN VIEW



SINGLE INLET PLAN VIEW



SECTION A-A

J-U-B

0 4'

REVISION

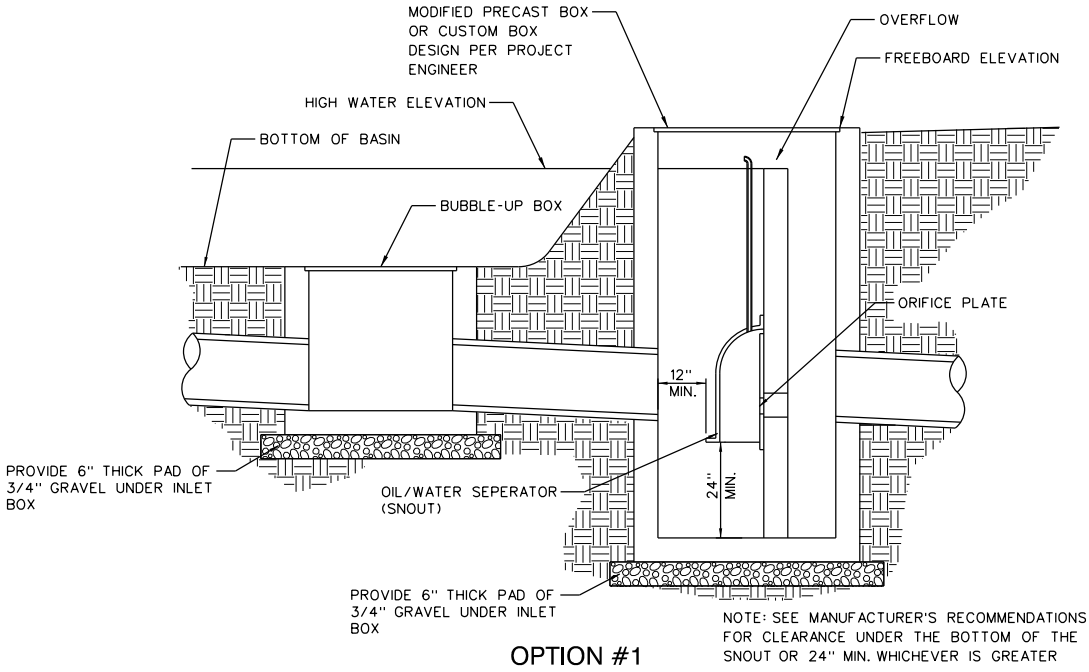
NO.	DESCRIPTION	BY	APR.	DATE
1	CORRECT NOTE SPELLING	DCT		

Pleasant Grove
Utah's City of Trees

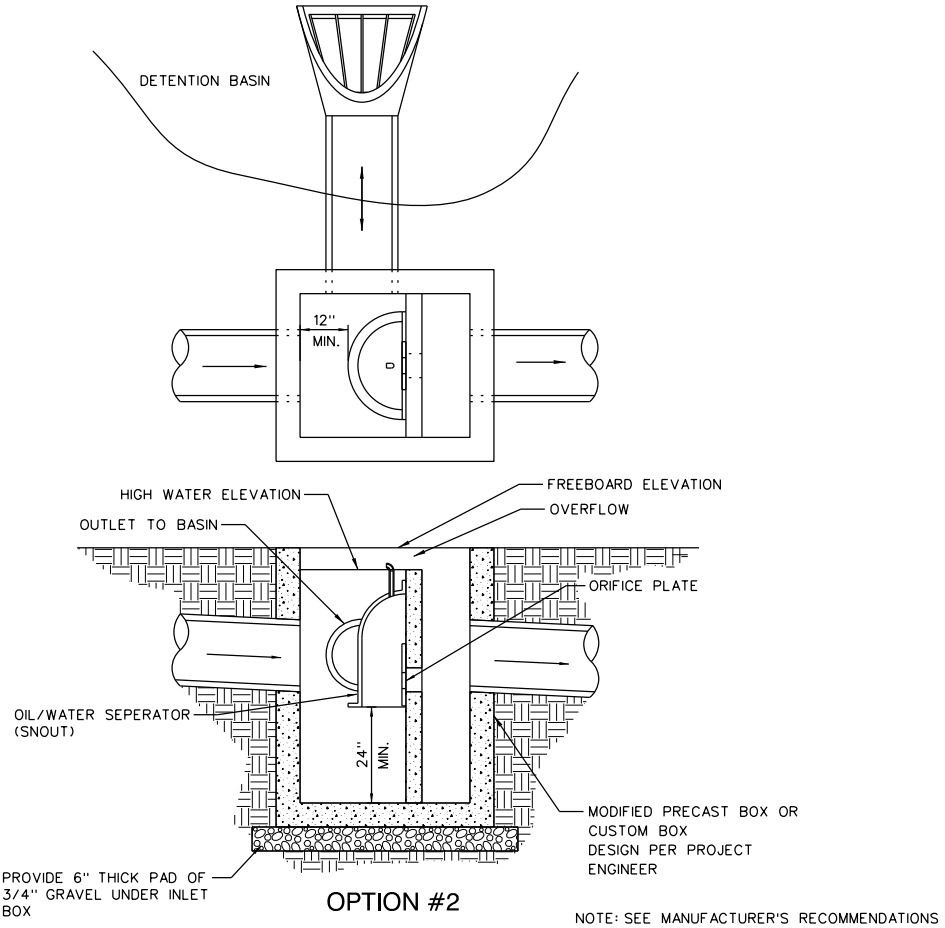
CURB FACE INLET DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	7
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



OPTION #1



OPTION #2

J-U-B

0 4'

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REVISION

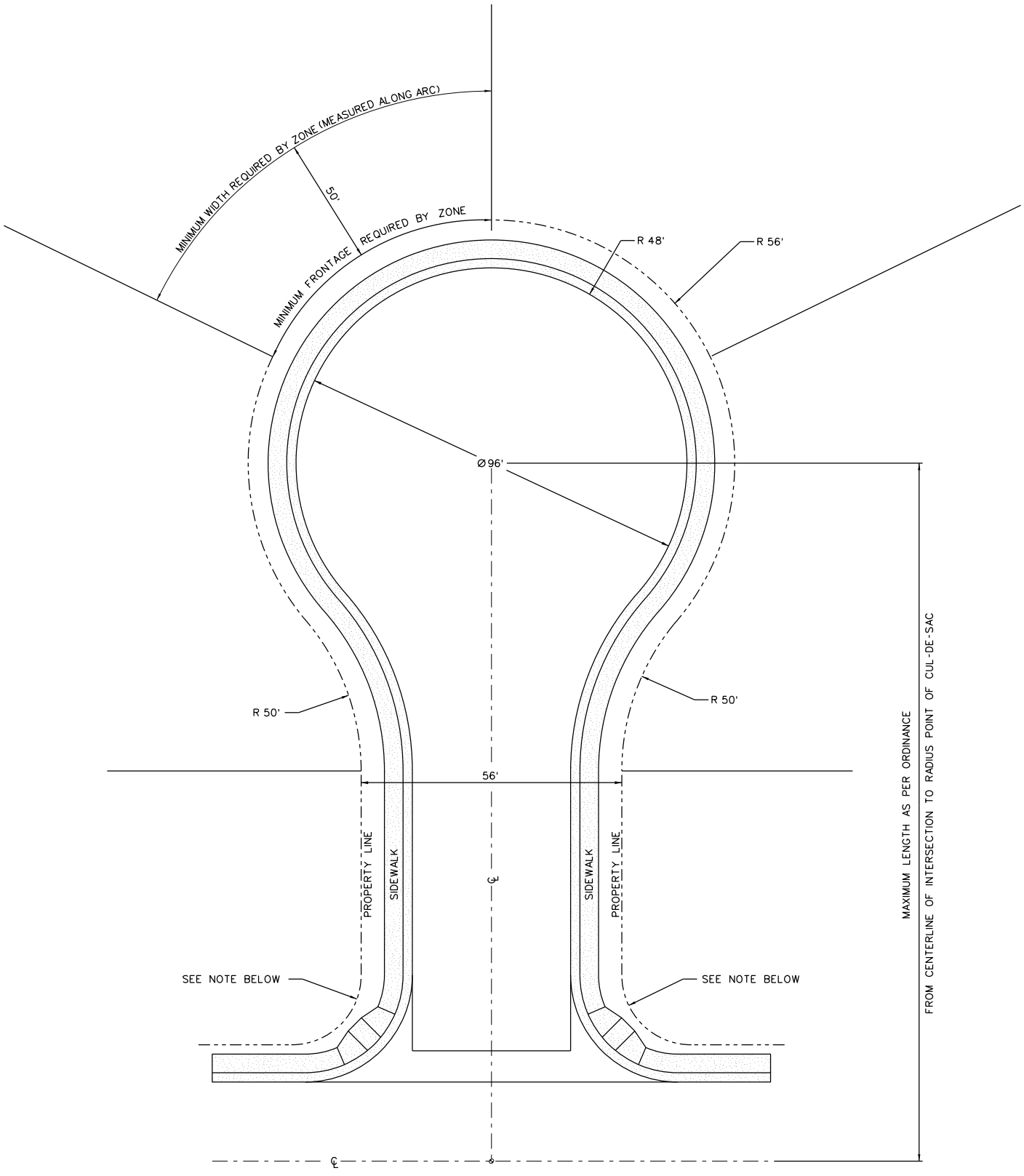
NO.	DESCRIPTION	BY	APR.	DATE

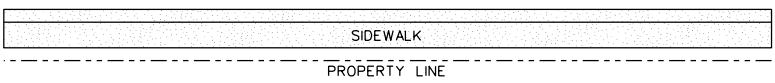
Pleasant Grove
Utah's City of Trees

DETENTION BASIN ORIFICE AND OVERFLOW DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	7A
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017





NOTE:
THE PROPERTY LINE RADIUS SHALL BE AS FOLLOWS:
- LOCAL STREET -15'
- COLLECTOR ST. - 29'
- ARTERIAL ST. - 39'

J·U·B

0 30'

REVISION

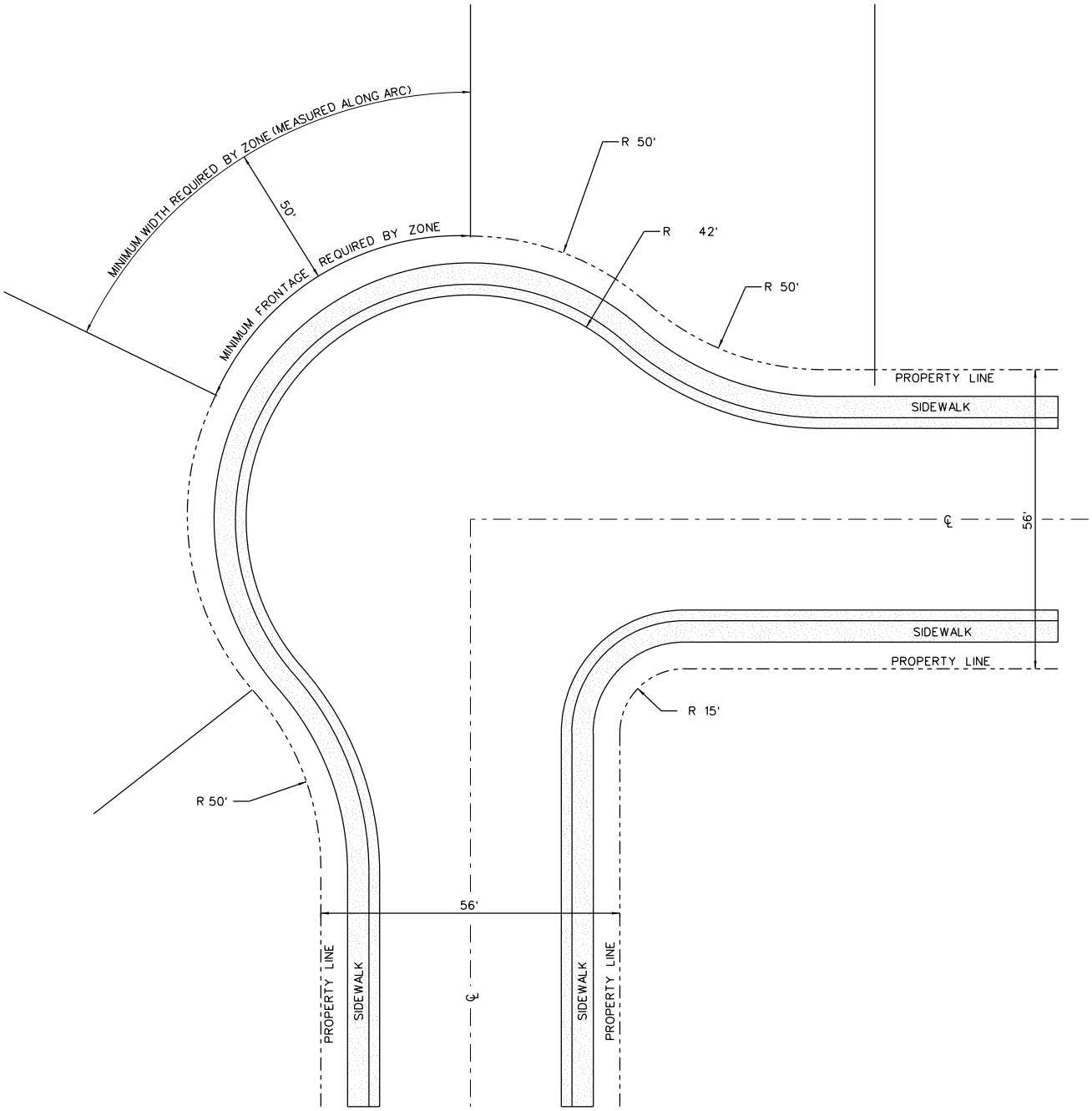
NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

STANDARD CUL-DE-SAC

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	8
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



J-U-B

0 30'

STATEMENT OF USE

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REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

STANDARD KNUCKLE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	9
CAD:	PGdetails_2017.dgn
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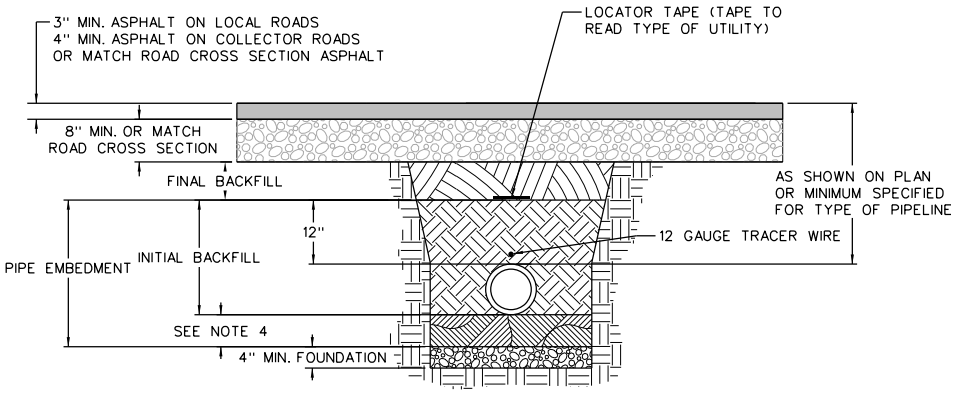
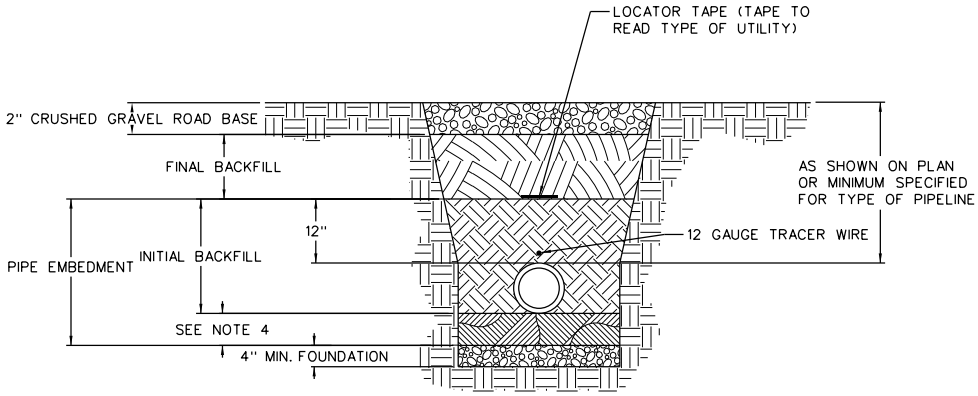
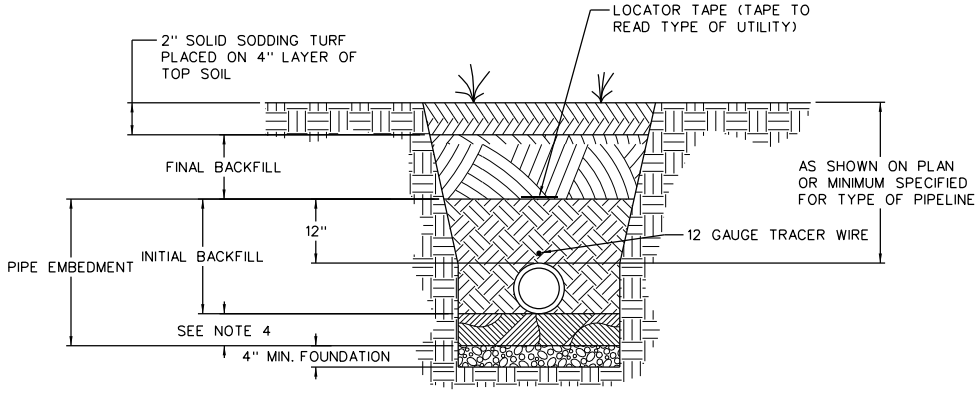
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



ASPHALT SURFACE (NEW ASPHALT CONSTRUCTION)



GRAVEL SURFACE



TURF SURFACE

NOTES:
1. SLOPE TRENCH TO MEET OSHA REQUIREMENTS (LATEST EDITION) OR USE TRENCH BOX.
2. FOUNDATION AND BEDDING MATERIAL AS REQUIRED.
3. INSTALL PIPELINES ON STABLE FOUNDATION WITH UNIFORM BEARING FOR FULL LENGTH OF BARREL, EXCAVATE IN BEDDING FOR ALL PIPE JOINTS.
4. CULINARY WATER PIPE REQUIRES 6 INCHES OF BEDDING MATERIAL, 4 INCHES FOR ALL OTHERS.

J·U·B

0 3'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

TYPICAL TRENCH SECTIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	10
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
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DESIGN BY:	EEA
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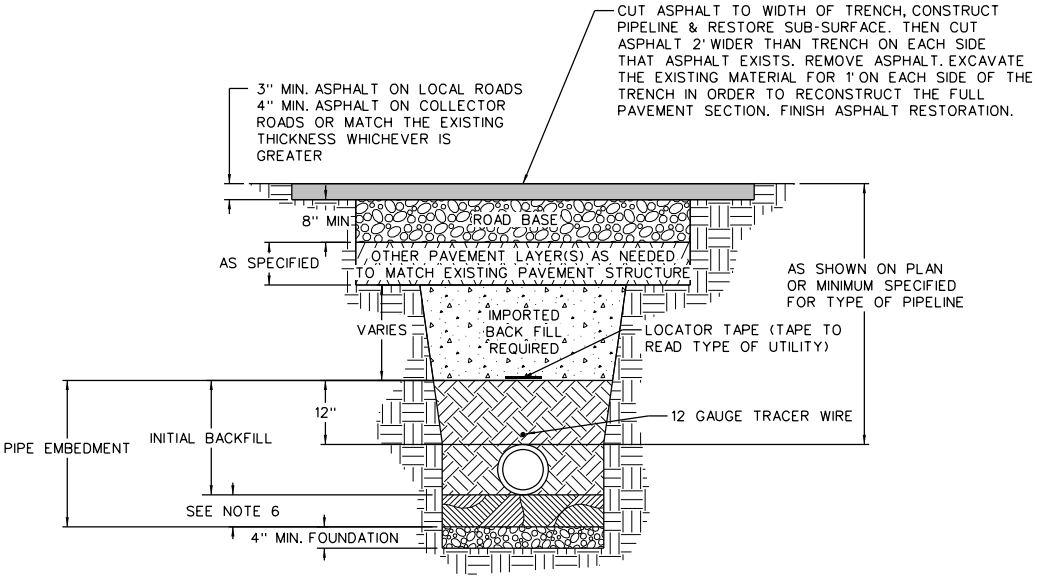
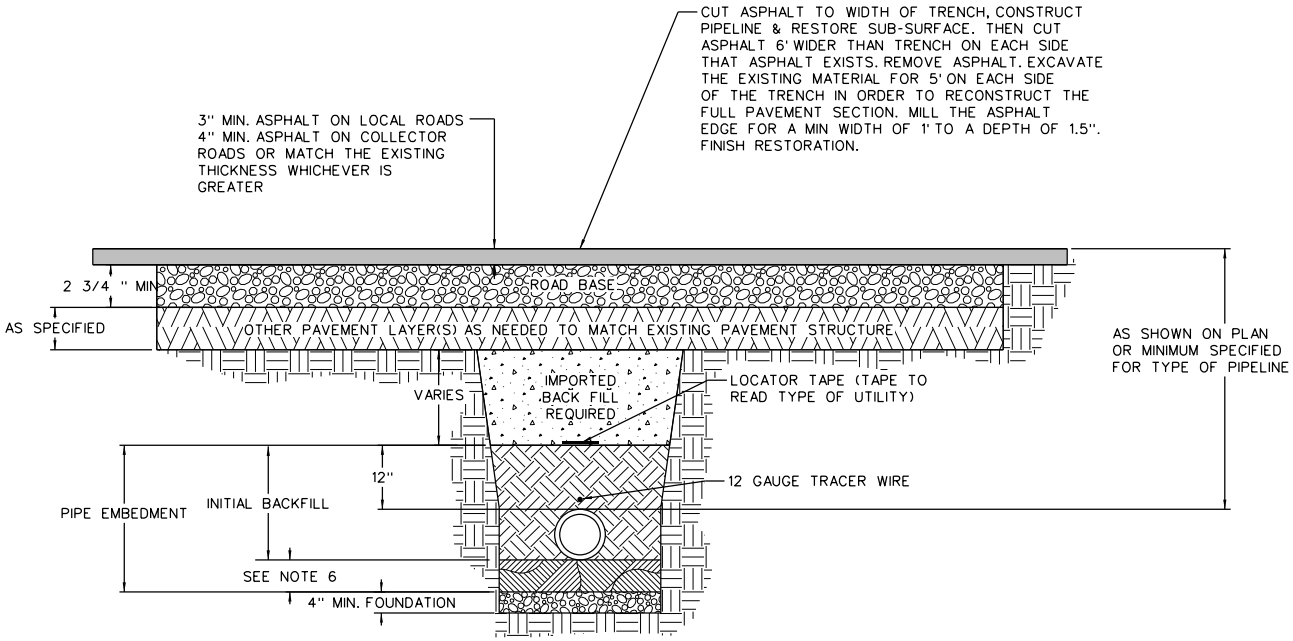


ASPHALT SURFACE (ASPHALT PATCHING IN EXISTING ROADWAY)



ASPHALT SURFACE REPAIR FOR TRENCHING IN A NEWLY CONSTRUCTED OR REHABILITATED ROAD (LESS THAN 5 YEARS OLD)

NOTES:
1. SLOPE TRENCH TO MEET OSHA REQUIREMENTS (LATEST EDITION) OR USE TRENCH BOX.
2. FOUNDATION AND BEDDING MATERIAL AS REQUIRED.
3. INSTALL PIPELINES ON STABLE FOUNDATION WITH UNIFORM BEARING FOR FULL LENGTH OF BARREL, EXCAVATE IN BEDDING FOR ALL PIPE JOINTS.
4. WHERE A NEW TRENCH PATCH IS PROPOSED THAT IS PARALLEL TO AN EXISTING OR ADDITIONAL PROPOSED TRENCH PATCH, IF LESS THAN 3' OF THE ORIGINAL ASPHALT PAVEMENT WILL REMAIN BETWEEN THE PATCHES, THE ENTIRE SECTION OF ASPHALT TO THE FAR SIDE OF THE EXISTING OR ADDITIONAL PROPOSED TRENCH PATCH WILL BE REQUIRED TO BE REMOVED AND REPLACED.
5. TACK COAT TO BE APPLIED ON ALL SURFACES PRIOR TO PLACING ASPHALT.
6. CULINARY WATER PIPE REQUIRES 6 INCHES OF BEDDING MATERIAL, 4 INCHES FOR ALL OTHERS.

J-U-B

0 3'

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Pleasant Grove
Utah's City of Trees

TYPICAL TRENCH SECTIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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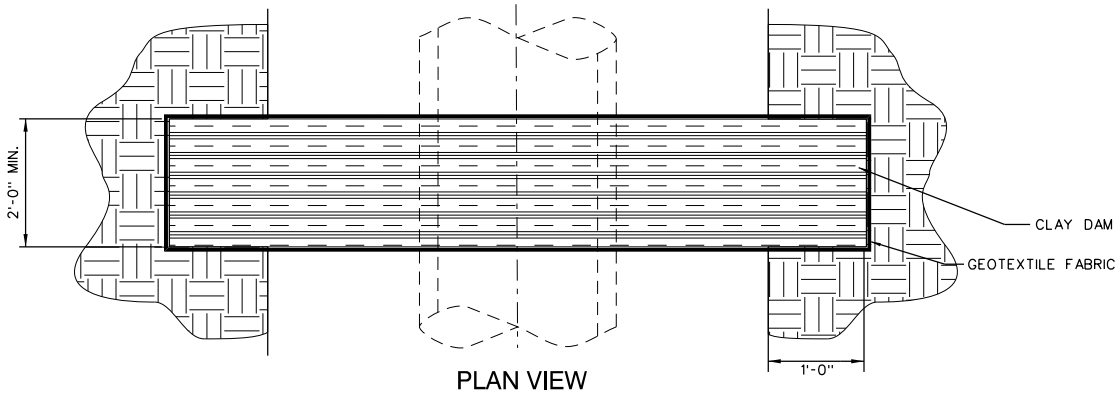
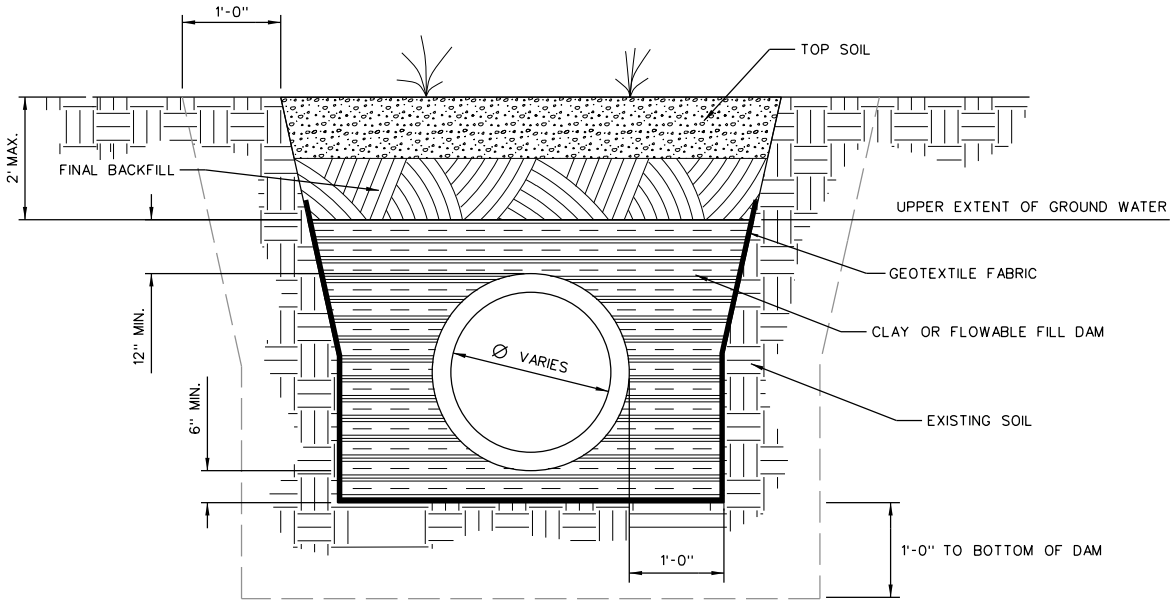
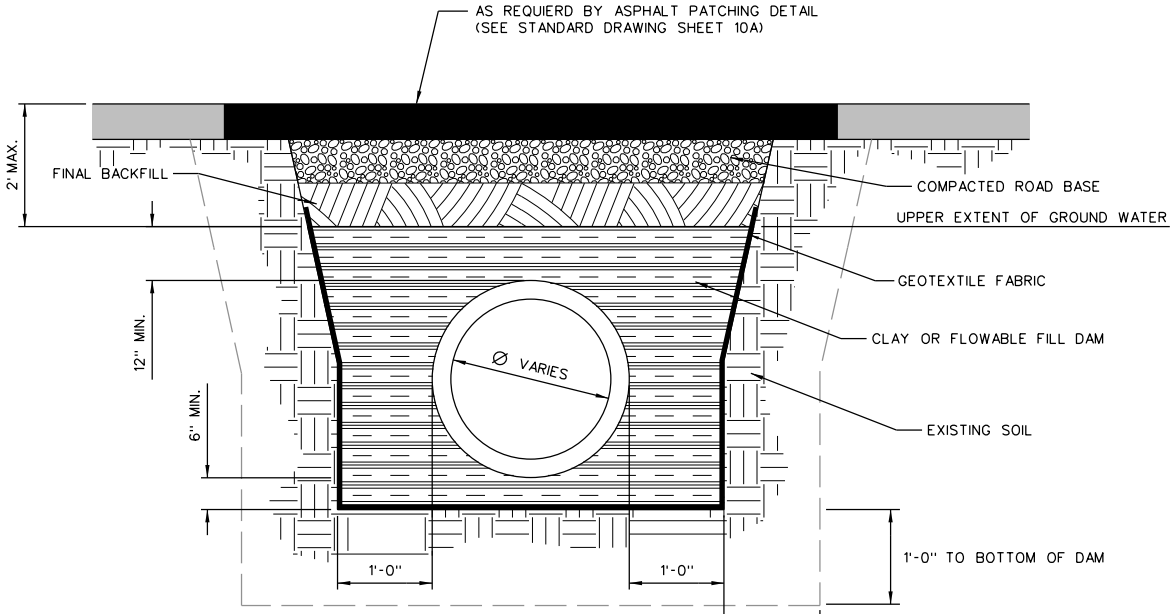


PLAN VIEW



TURF SURFACE



ASPHALT SURFACE

NOTES:
1. SLOPE TRENCH TO MEET OSHA REQUIREMENTS (LATEST EDITION) OR USE TRENCH BOX.

J·U·B

0 3'

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Pleasant Grove
Utah's City of Trees

CLAY DAM DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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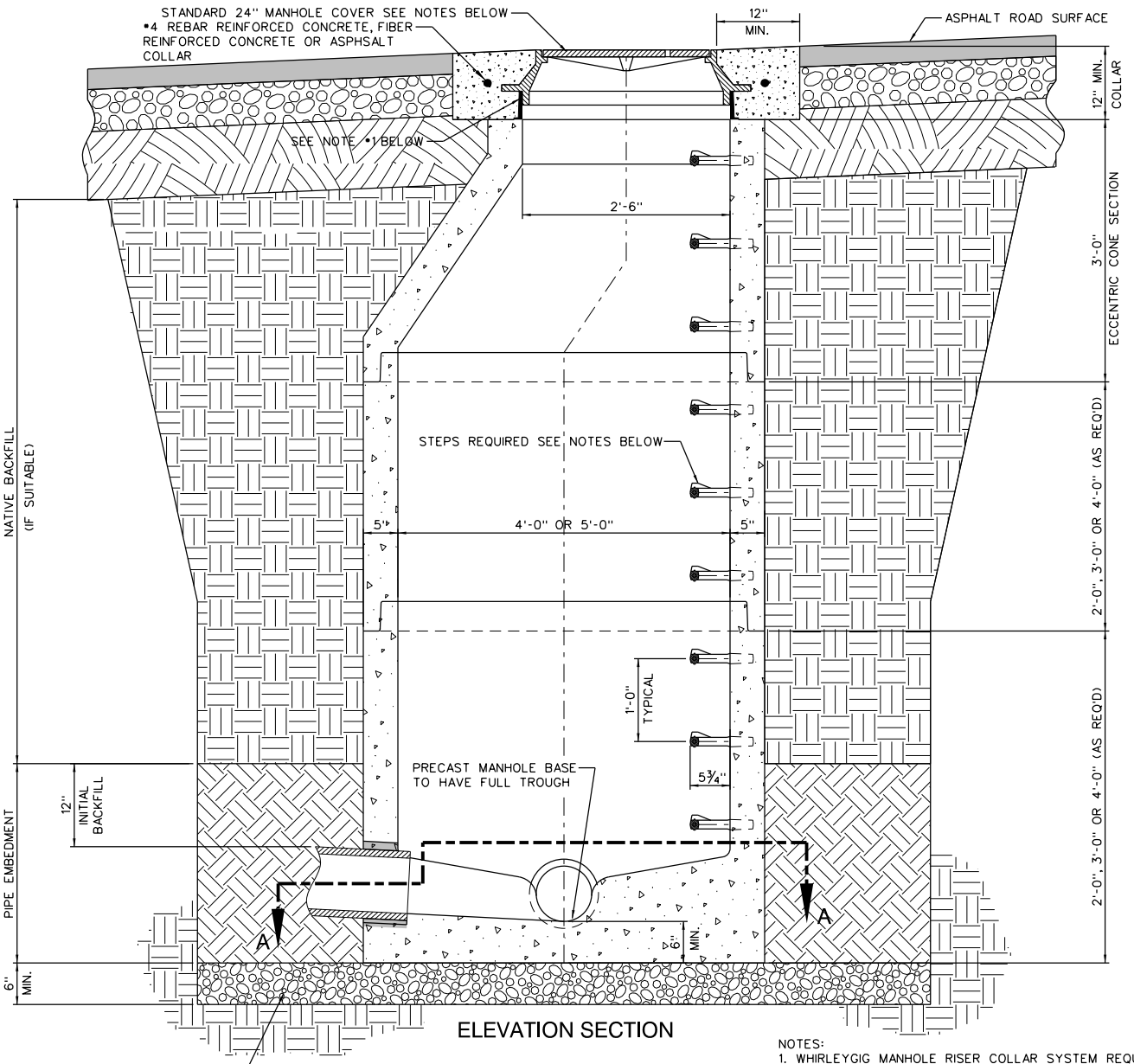
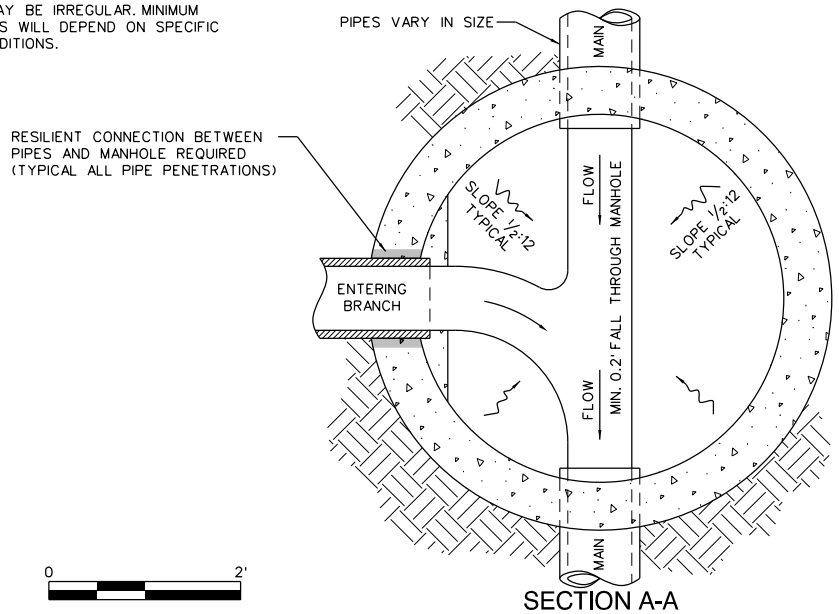


ELEVATION SECTION

3/4" GRAVEL FOUNDATION OUTSIDE SHAPE MAY BE IRREGULAR. MINIMUM THICKNESS WILL DEPEND ON SPECIFIC SITE CONDITIONS.



SECTION A-A

NOTES:
1. WHIRLEYGIG MANHOLE RISER COLLAR SYSTEM REQUIRED FOR ANY INSTALLATION UNDER A PAVEMENT OR CONCRETE SECTION. SEE SPECIFICATION DIVISION 5 SECTION 5-05.
2. INDUSTRY STANDARD FRAMES AND COVERS. SEE SPECIFICATION DIVISION 5 FOR COVER LABEL. D&L SUPPLY P/N A-1180 (WITH VENT HOLES) OR ADJUSTABLE MANHOLE FRAME WITH VENTED COVER. CITY ENGINEER/PUBLIC WORKS MAY APPROVE OR REQUIRE A SOLID LID IN SOME INSTANCES.
3. STEPS SHALL BE MADE OF COPOLYMER POLYPROPYLENE CONFORMING TO ASTM D-4101. REINFORCING STEEL TO BE DEFORMED 1/2 " DIAMETER GRADE 60 ROD.
4. FLAT LIDS MAY BE USED IN LIEU OF ECCENTRIC CONES WHERE NECESSARY. FLAT LIDS SHALL BE OF ECCENTRIC DESIGN AND MEET H20 LIVE LOADING. NO FLAT RING AND COVERS WILL BE ALLOWED UNLESS APPROVED BY PUBLIC WORKS.
5. SEE DIVISION 5, SECTION 5.05, SUBSECTION A FOR SETTING OF MANHOLE FRAMES AND COVERS
6. ADD GRADE RINGS AS REQUIRED TO MATCH FINISHED STREET GRADE.
7. AFTER INSTALLATION AND UNTIL STREET IS PAVED A PLYWOOD FLOOR SHALL BE PLACED INSIDE THE MANHOLE (HINGED FOR REMOVAL)

J·U·B

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE
1	ADDED 6-INCH GRADE RING	EEA	OCT	14APR03
2	ADDED REBAR & NOTE TO CONCRETE COLLAR	EEA	MJB	07APR06

Pleasant Grove
Utah's City of Trees

TYPICAL MANHOLE DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 11

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
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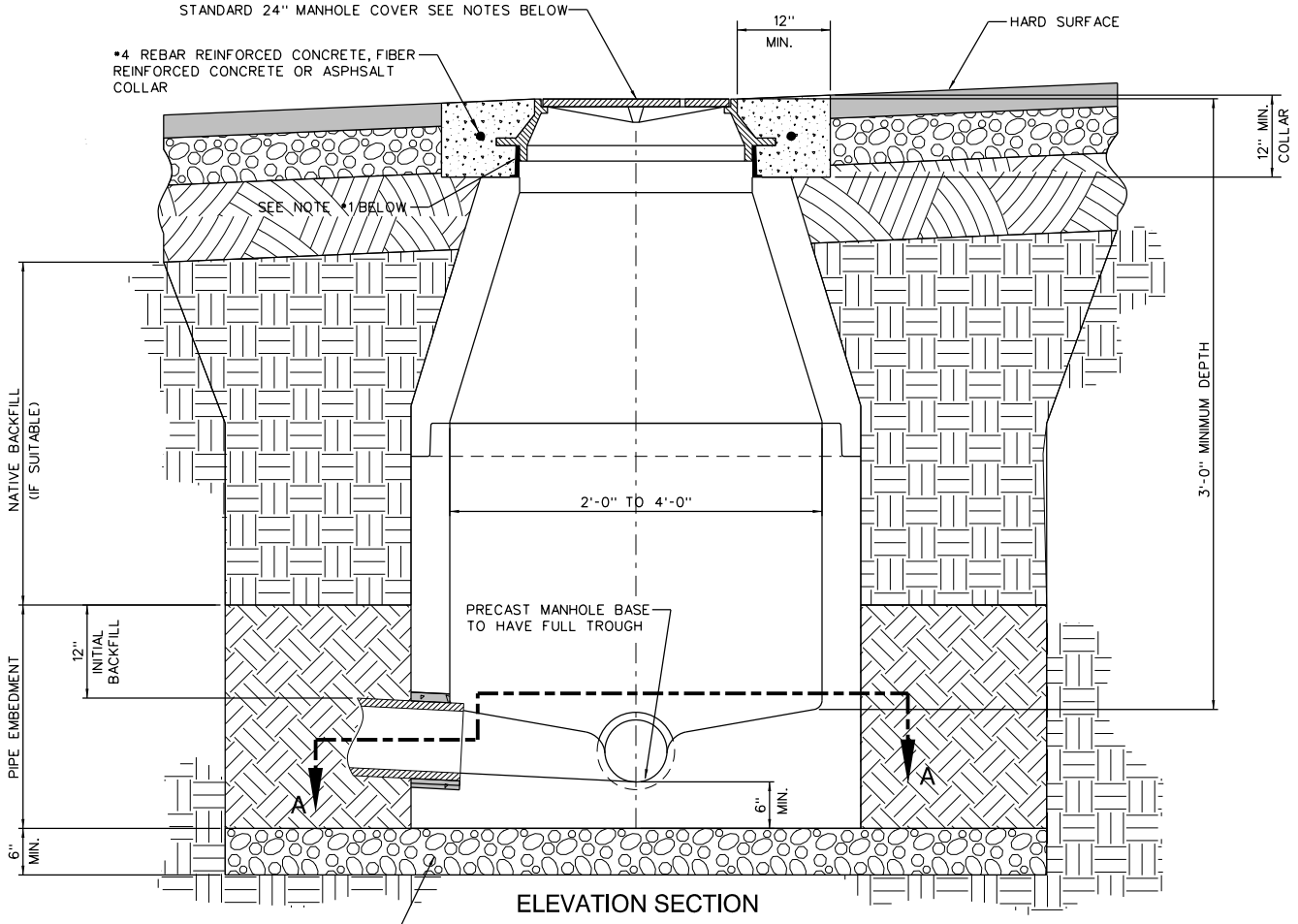
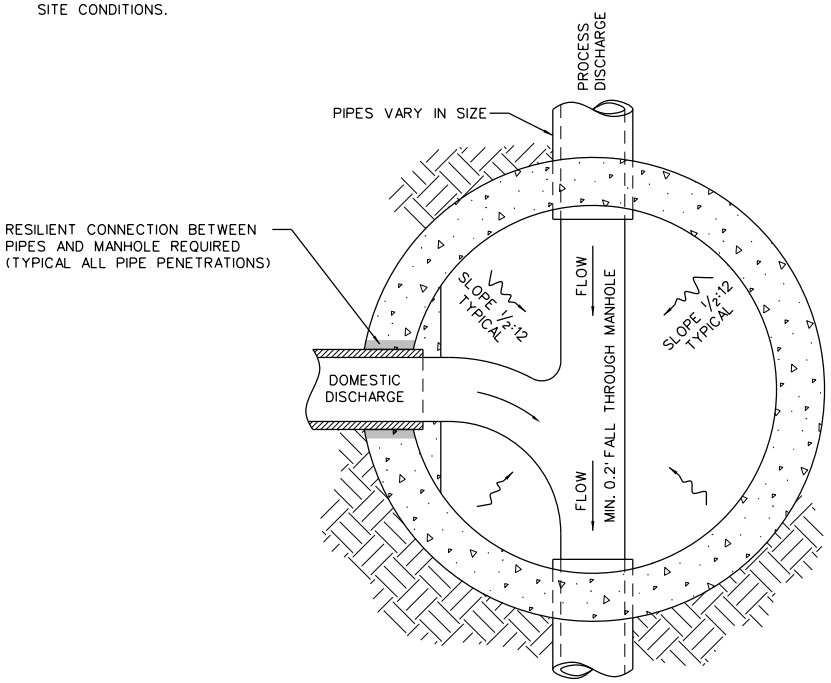


ELEVATION SECTION

3/4" GRAVEL FOUNDATION OUTSIDE SHAPE MAY BE IRREGULAR. MINIMUM THICKNESS WILL DEPEND ON SPECIFIC SITE CONDITIONS.

NOTES:

1. WHIRLEYGIG MANHOLE RISER SYSTEM REQUIRED FOR ANY INSTALLATION UNDER A PAVEMENT OR CONCRETE SECTION. SEE SPECIFICATION DIVISION 5 SECTION 5-05.
2. INDUSTRY STANDARD FRAMES AND COVERS. SEE SPECIFICATION DIVISION 5 FOR COVER LABEL. D&L SUPPLY P/N A-1180 (WITH VENT HOLES) OR ADJUSTABLE MANHOLE FRAME WITH VENTED COVER. CITY ENGINEER/PUBLIC WORKS MAY APPROVE OR REQUIRE A SOLID LID IN SOME INSTANCES.
3. SAMPLE MANHOLE MAY BE CORRUGATED METAL PIPE WITH A POURED BASE WHEN LOCATED IN A NON-TRAFFIC AREA. IF LOCATED IN A TRAFFIC AREA IT MUST BE CONCRETE WITH A POURED BASE.
4. FLAT LIDS MAY BE USED IN LIEU OF ECCENTRIC CONES WHERE NECESSARY. FLAT LIDS SHALL BE OF ECCENTRIC DESIGN AND MEET H20 LIVE LOADING. NO FLAT RING AND COVERS WILL BE ALLOWED UNLESS APPROVED BY PUBLIC WORKS.
5. LATERALS TO BE IN SEPERATE TROUGHS IN MANHOLE.
6. SEE DIVISION 5, SECTION 5.05, SUB-SECTION A FOR SETTING OF MANHOLE FRAMES AND COVERS



SECTION A-A

J·U·B

0 2'

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Pleasant Grove
Utah's City of Trees

TYPICAL SAMPLING MANHOLE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 12

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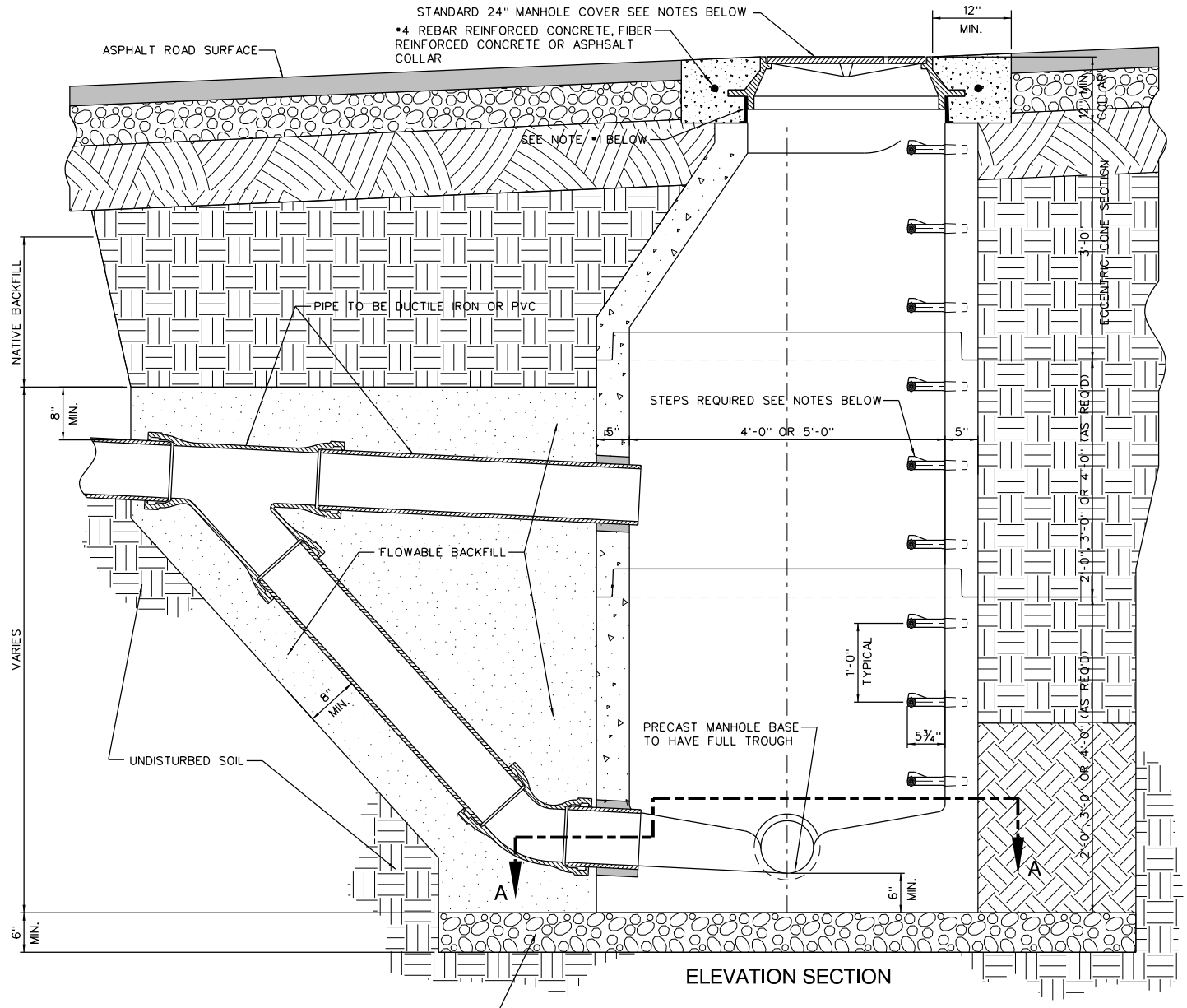
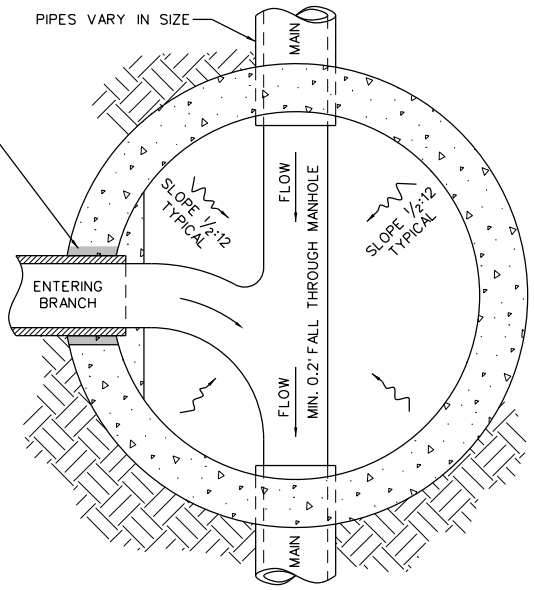


ELEVATION SECTION

3/4" GRAVEL FOUNDATION OUTSIDE SHAPE MAY BE IRREGULAR. MINIMUM THICKNESS WILL DEPEND ON SPECIFIC SITE CONDITIONS.



SECTION A-A

NOTES:
1. WHIRLEYGIG MANHOLE RISER SYSTEM REQUIRED FOR ANY INSTALLATION UNDER A PAVEMENT OR CONCRETE SECTION. SEE SPECIFICATION DIVISION 5 SECTION 5-05.
2. INDUSTRY STANDARD FRAMES AND COVERS. SEE SPECIFICATION DIVISION 5 FOR COVER LABEL. D&L SUPPLY P/N A-1180 (WITH VENT HOLES) OR ADJUSTABLE MANHOLE FRAME WITH VENTED COVER. CITY ENGINEER/PUBLIC WORKS MAY APPROVE OR REQUIRE A SOLID LID IN SOME INSTANCES.
3. STEPS SHALL BE MADE OF COPOLYMER POLYPROPYLENE CONFORMING TO ASTM D-4101. REINFORCING STEEL TO BE DEFORMED ½" DIAMETER GRADE 60 ROD.
4. FLAT LIDS MAY BE USED IN LIEU OF ECCENTRIC CONES WHERE NECESSARY. FLAT LIDS SHALL BE OF ECCENTRIC DESIGN AND MEET H20 LIVE LOADING. NO FLAT RING AND COVERS WILL BE ALLOWED UNLESS APPROVED BY PUBLIC WORKS.
5. SEE DIVISION 5, SECTION 5.05, SUBSECTION A FOR SETTING OF MANHOLE FRAMES AND COVERS
6. USE FERNCO COUPLING TO TRANSITION TO CONCRETE OR PVC PIPE AS APPROPRIATE.

JUB

0 2'

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Pleasant Grove
Utah's City of Trees

TYPICAL DROP MANHOLE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	13
CAD:	PGdetails_2017.dgn
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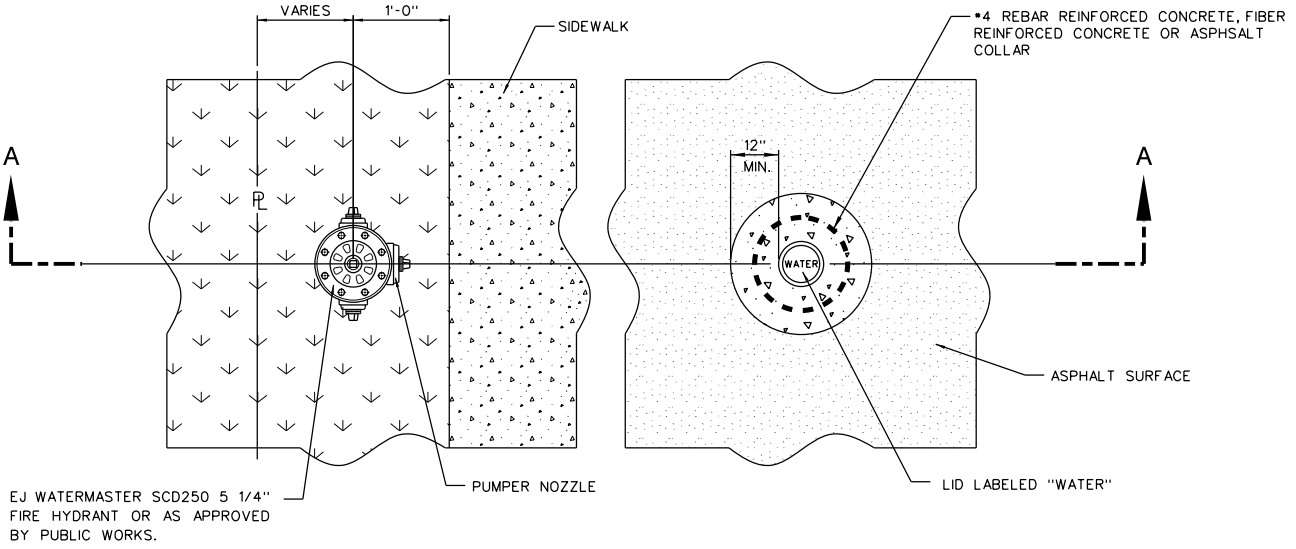
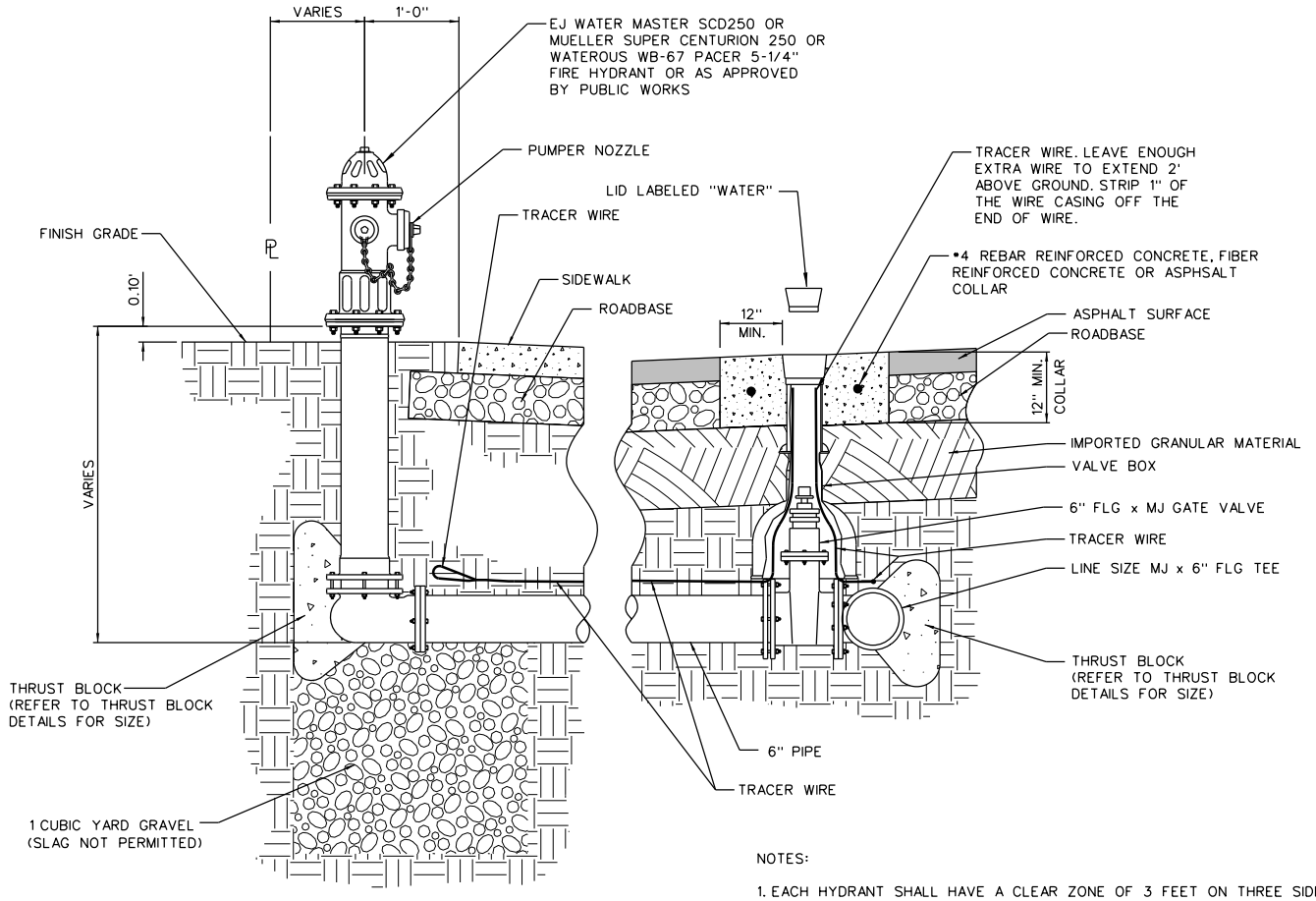


PLAN VIEW



SECTION A-A

NOTES:

1. EACH HYDRANT SHALL HAVE A CLEAR ZONE OF 3 FEET ON THREE SIDES AND OPEN ON THE SIDE OF THE PUMPER NOZZLE.
2. HYDRANT INSTALLED WHERE THERE IS NO CURB & GUTTER SHALL HAVE BOLLARDS PLACED ON EITHER SIDE IN FRONT OF THE HYDRANT.
3. INSPECTION REQUIRED FOR ALL VALVE BOX COLLARS.

JUB

0 2'

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NO.	DESCRIPTION	BY	APR.	DATE
1	ADDED REBAR & NOTE TO CONCRETE COLLAR	EEA	MJB	07APR06

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Utah's City of Trees

FIRE HYDRANT & WATER VALVE DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 14

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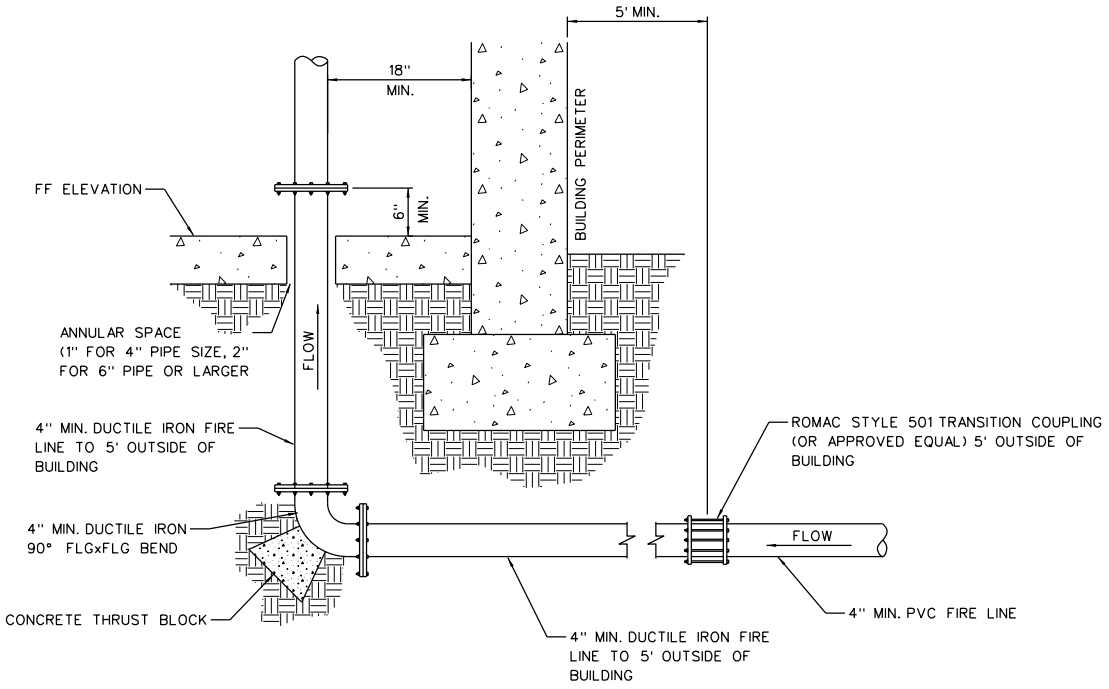
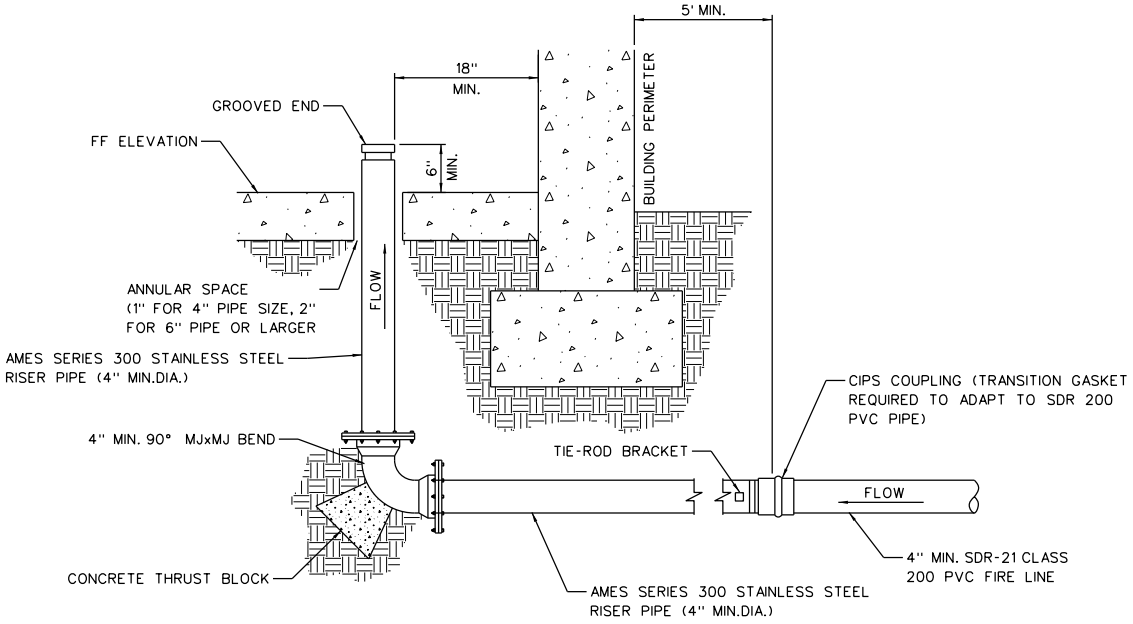


FIRE RISER DETAIL (CLASS 50 DUCTILE IRON)



UNDERGROUND FIRE RISER DETAIL (STAINLESS STEEL)

J-U-B

0 2'

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TYPICAL FIRE RISER DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	14A
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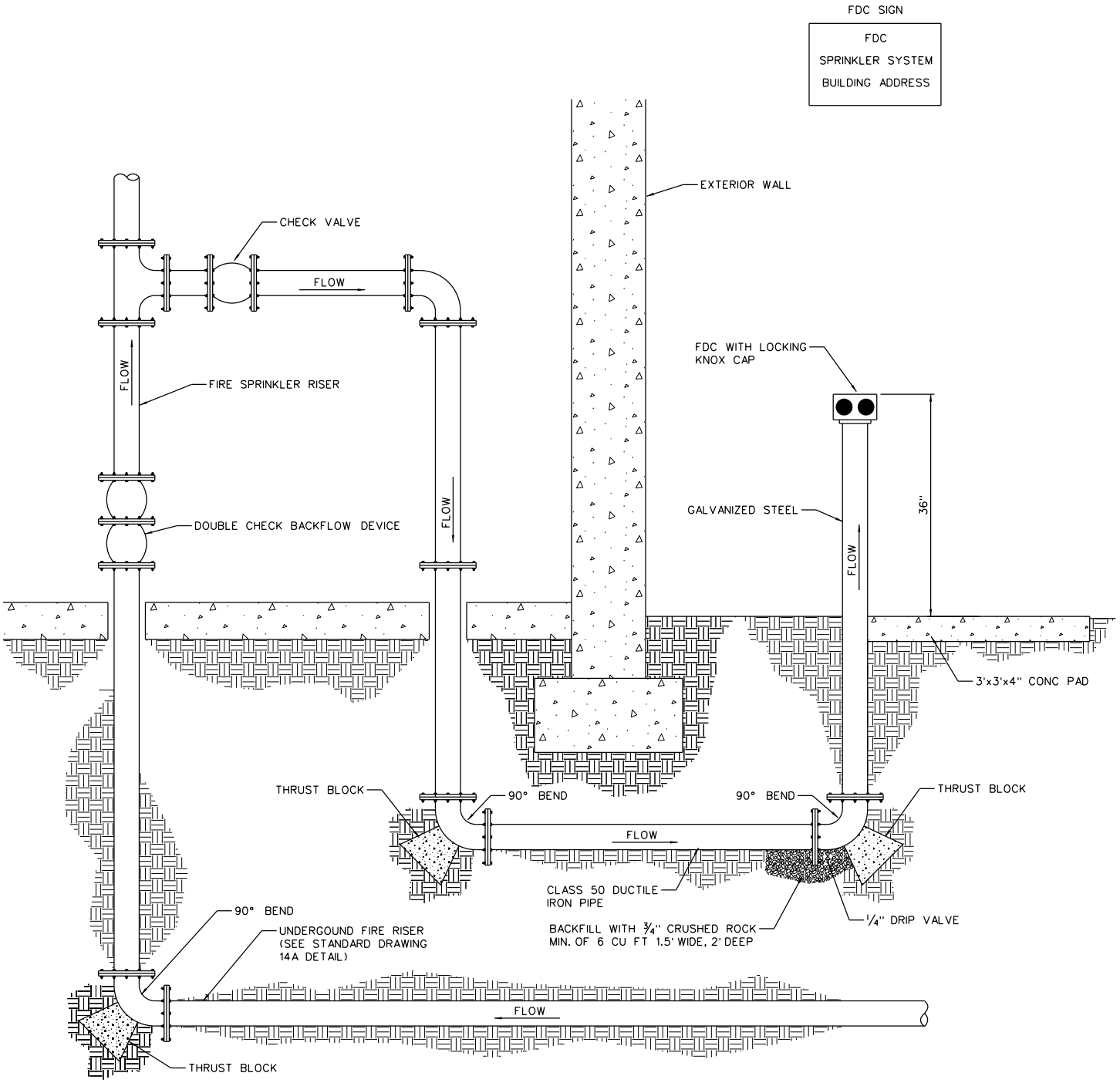

REMOTE FIRE DEPARTMENT CONNECTION

NOTES:

1. BY APPROVAL OF THE FIRE MARSHAL.
2. PROVIDE BUILDING ID ON FDC. THE SIGN SHALL BE 12"x12" WHITE LETTERS ON RED REFLECTIVE BACKGORUND.
3. 3'x3'x4" CONCRETE PAD AT BASE OF FDC.
4. FDC SHALL BE WITHIN 100' OF A FIRE HYDRANT.

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0 2'

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REMOTE FIRE DEPARTMENT CONNECTION DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

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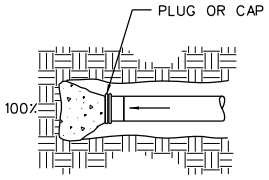
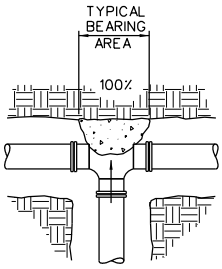
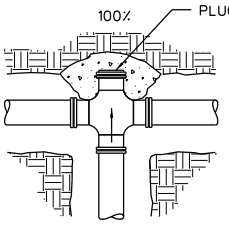


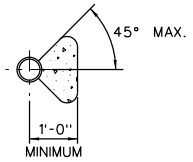
DEAD END PLAN VIEW



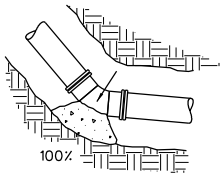
TEE PLAN VIEW



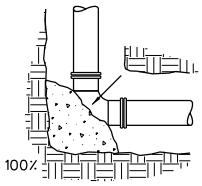
CROSS W/PLUG PLAN VIEW



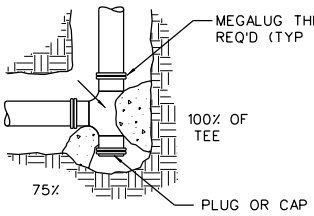
TYPICAL SECTION
THRU THRUST BLOCK



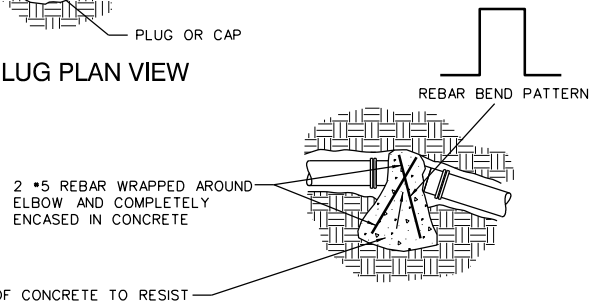
ELBOW PLAN VIEW



ELBOW PLAN VIEW



TEE W/PLUG PLAN VIEW



GRAVITY THRUST BLOCK
ELEVATION VIEW

NOTES:
1. THE FIGURE (100%) AT THE THRUST BLOCK INDICATES PER CENT OF TOTAL THRUST TO BE APPLIED FOR BEARING AREA.
2. THE ARROW (⟵) INDICATES THRUST DIRECTION.
3. CONCRETE FOR THRUST BLOCKS TO BE 3000 P.S.I. .
4. ALL MJ AND FLANGED FITTINGS TO BE WRAPPED WITH 12 MIL POLYETHYLENE PRIOR TO PLACING CONCRETE THRUST BLOCK
5. MEGALUG THRUST RETAINING GLANDS REQ'D ON ALL FITTING JOINTS. MEGALUG THRUST RESTRAINING GLANDS SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATION.

TABLE 1

Use when line pressure and soil bearing strength are known.

Line Pressure: _____ psi
Test Pressure (Sf = 1.5): _____ psi
Soil Bearing Strength: _____ psf
(Soil Bearing Strength determined from a geotechnical investigation.)

Side Thrust (lbs.) per 1 psi line pressure

Pipe Size (")	Pipe Area* (sq.in.)	Dead End or Tee (lbs.)	90° Bend (lbs.)	45° Bend (lbs.)	22.5° Bend (lbs.)	11.25° Bend (lbs.)
4	14.39	22	31	17	9	5
6	32.17	49	69	37	19	10
8	56.88	86	121	66	34	17
10	86.92	131	185	100	51	26
12	124.29	187	264	143	73	37
14	168.33	253	358	194	99	50
16	219.56	330	466	253	129	65
18	277.59	417	589	319	163	82
20	342.41	514	727	394	201	101
24	490.09	736	1,040	563	287	145
30	757.69	1,137	1,608	870	444	223

TABLE 2

Use when line pressure and soil bearing strength are not known.

Line Pressure: 200 psi
Test Pressure: 200 psi
Soil Bearing Strength: 1,500 psf

Area of Bearing Required (sq.ft.)

Pipe Size (")	Pipe Area* (sq.in.)	Dead End or Tee (sq.ft.)	90° Bend (sq.ft.)	45° Bend (sq.ft.)	22.5° Bend (sq.ft.)	11.25° Bend (sq.ft.)
4	14.39	1.9	2.7	1.5	0.7	0.4
6	32.17	4.3	6.1	3.3	1.7	0.8
8	56.88	7.6	10.7	5.8	3.0	1.5
10	86.92	11.6	16.4	8.9	4.5	2.3
12	124.29	16.6	23.4	12.7	6.5	3.2
14	168.33	22.4	31.7	17.2	8.8	4.4
16	219.56	29.3	41.4	22.4	11.4	5.7
18	277.59	37.0	52.3	28.3	14.4	7.3
20	342.41	45.7	64.6	34.9	17.8	9.0
24	490.09	65.3	92.4	50.0	25.5	12.8
30	757.69	101.0	142.9	77.3	39.4	19.8

Example for Table 1:
8-inch 90° bend
Line Pressure = 100 psi
From Table: Thrust per 1 psi = 121 lbs.
Calculate Total Thrust: 100 psi x 121lbs/psi = 12,100 lbs
Soil Bearing Strength = 2,000 psf
Area of bearing required for thrust block is 6.1 sq. ft. (12,100 lbs / 2,000 psf = 6.1 sq.ft.)

* Pipe area is based on largest actual inside diameter of ductile iron pipe.

J-U-B

0 4'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

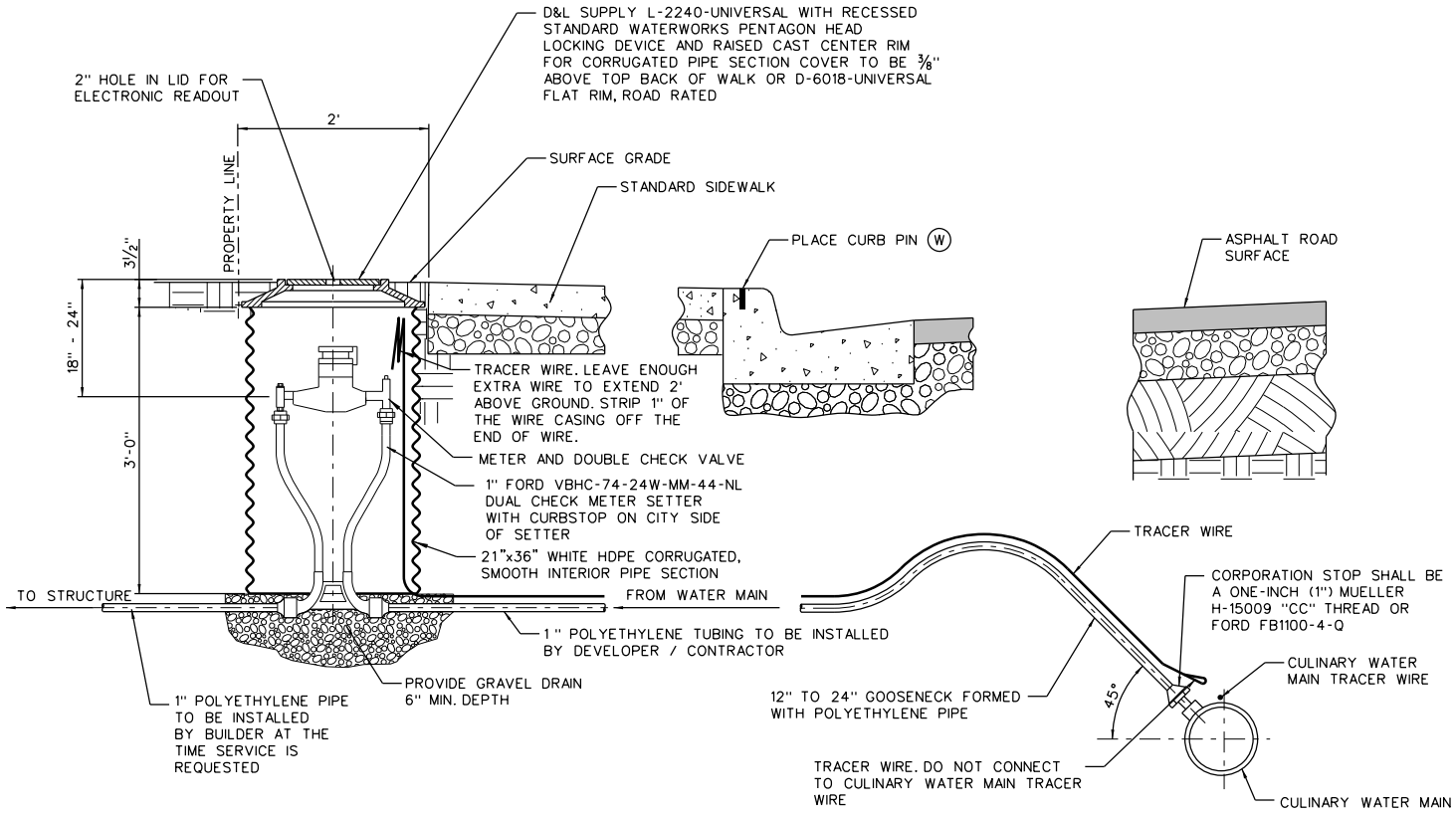
Pleasant Grove
Utah's City of Trees

THRUST BLOCK DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

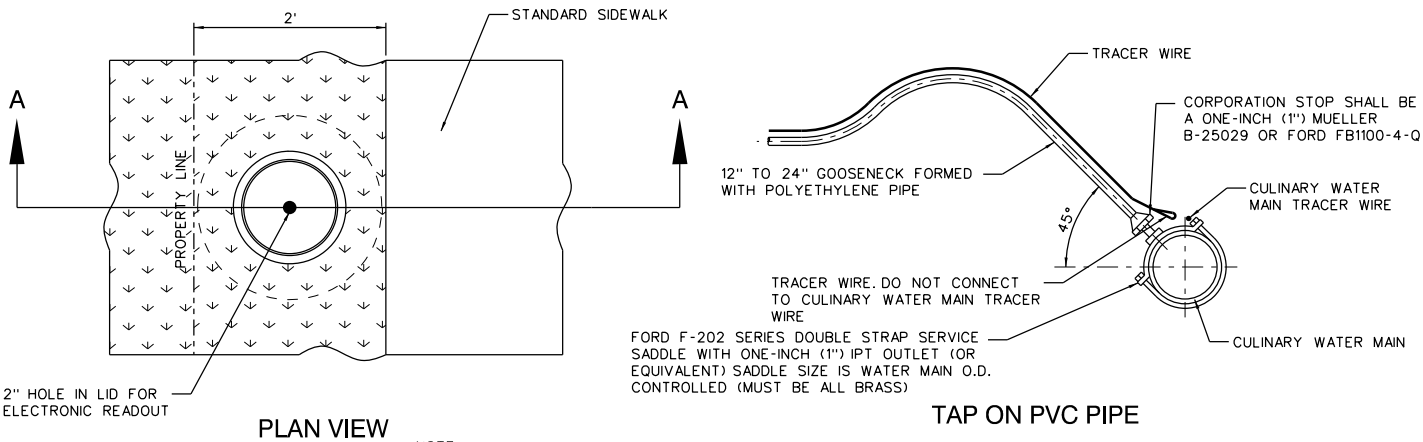
STANDARD DRAWING NUMBER: 15

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



SECTION A-A

DIRECT TAP ON D.I. PIPE



PLAN VIEW

TAP ON PVC PIPE

NOTE:
1. DOUBLE CHECK VALVE, SETTER, METER BOX AND COVER WILL BE INSTALLED BY DEVELOPER. CITY WILL INSTALL METER. DEPARTMENT CREWS.
2. WATER SERVICE TO BE STUBBED 90° TO PROPERTY LINE AND 5' UPHILL FROM THE CENTER OF THE LOT
3. ALL CONNECTIONS SHALL BE MADE USING PACK JOINTS (COMPRESSION) TYPE FITTINGS.
4. PLACE CURB PIN WITH "W" IN TOP OF CURB BEFORE CONCRETE FINAL SET TO MARK LOCATION WHERE WATER SERVICE PIPE CROSSES CURB.
5. ALL NEW CONSTRUCTION MUST HAVE 1" METER SETTER INSTALLED.
6. FOR RECONSTRUCTION INSTALLATIONS NEW 1" METER SETTER, METER CAN AND LID WILL BE FURNISHED BY THE CONTRACTOR.

PLEASANT GROVE CITY CORPORATION WATER SERVICE INFORMATION

SERVICE SIZE	METER BOX SIZE	TYPE OF MATERIAL FOR METER BOX	WATER METER	CONNECTION TYPE	BYPASS
1"	21" DIA.	21"x36" WHITE HDPE (BY DEVELOPER)	BY CITY	COMPRESSION	NO

JUB

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

TYPICAL CULINARY WATER CONNECTION 1" SERVICE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 16

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
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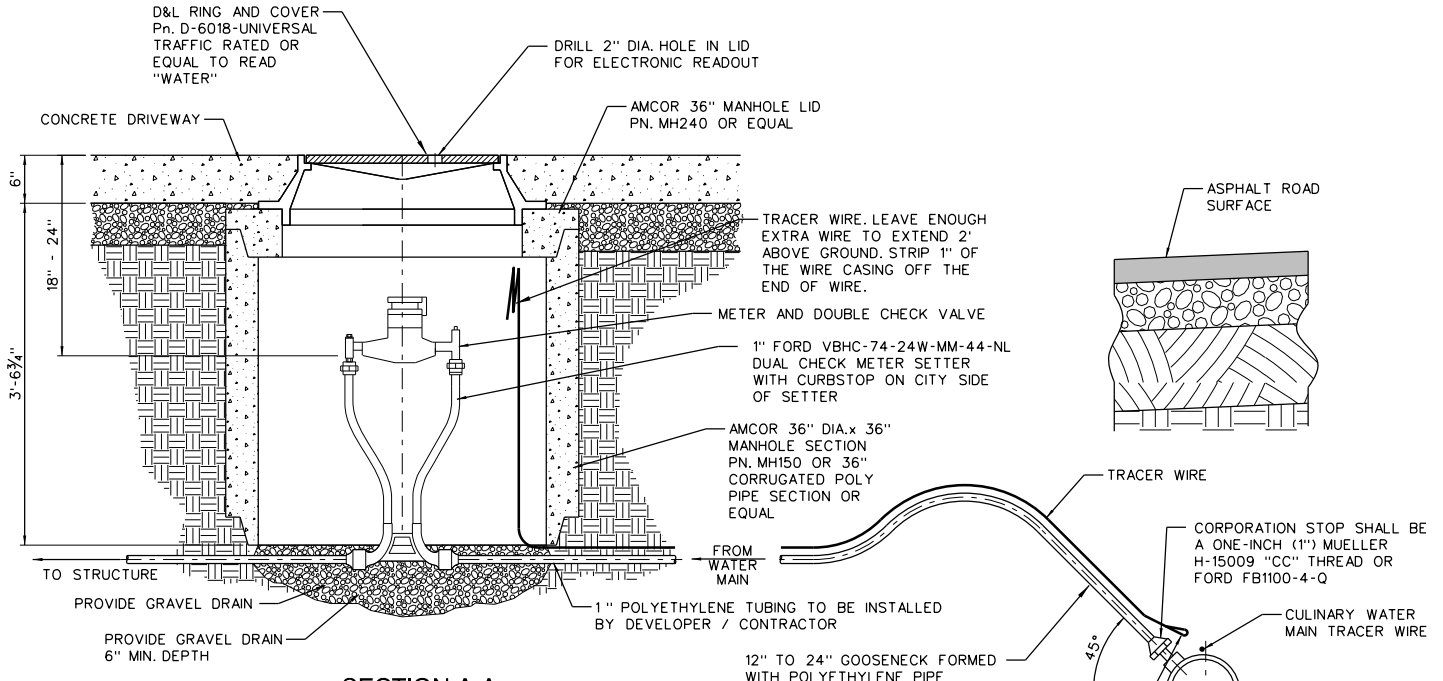
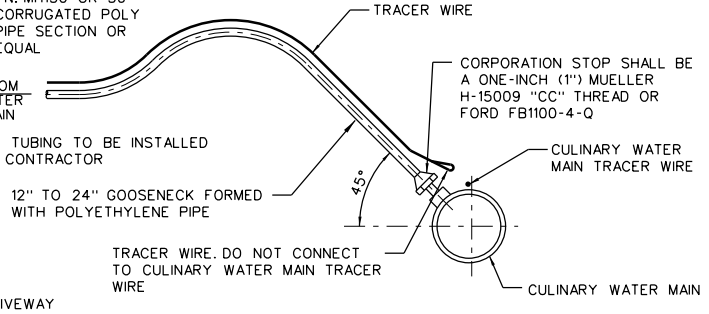
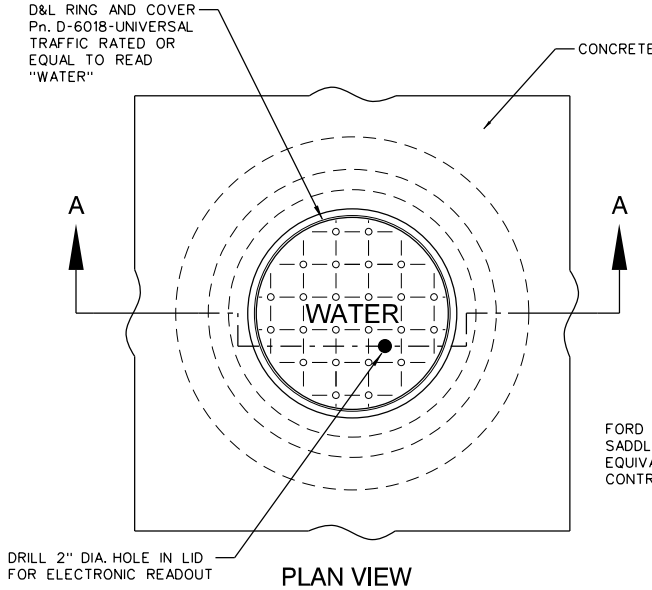


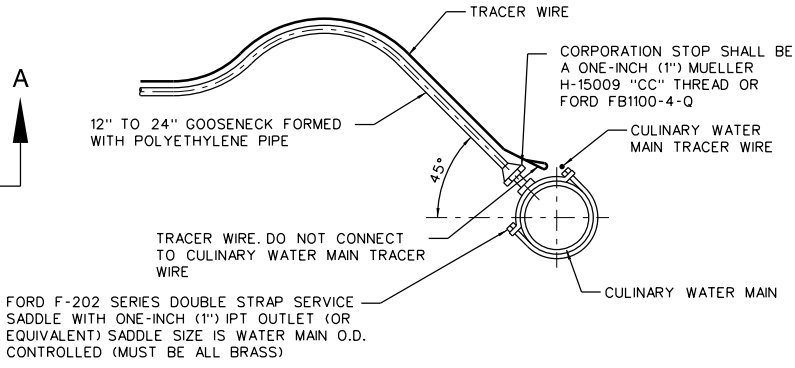
SECTION A-A



DIRECT TAP ON D.I. PIPE



PLAN VIEW



TAP ON PVC PIPE

NOTE:

1. DEVELOPER SHALL PROVIDE 36" MANHOLE SECTION, LID, RING & COVER WHEN PLACING THE WATER SERVICE METER IN A DRIVEWAY.
2. DOUBLE CHECK VALVE, SETTER, METER BOX AND COVER WILL BE INSTALLED BY THE DEVELOPER. CITY WILL INSTALL METER. ON CITY SIDE OF SETTER, SHALL BE FURNISHED AND INSTALLED BY CITY DEPARTMENT CREWS.
3. WATER SERVICE TO BE STUBBED 90° TO PROPERTY LINE AND 5' UPHILL FROM THE CENTER OF THE LOT
4. ALL CONNECTIONS SHALL BE MADE USING PACK JOINTS (COMPRESSION) TYPE FITTINGS.
5. PLACE CURB PIN WITH "W" IN TOP OF CURB BEFORE CONCRETE FINAL SET TO MARK LOCATION WHERE WATER SERVICE PIPE CROSSES CURB.
6. ALL NEW CONSTRUCTION MUST HAVE 1" METER SETTER INSTALLED.
7. FOR RECONSTRUCTION INSTALLATIONS NEW 1" METER SETTER, METER CAN AND LID WILL BE FURNISHED BY TGE CONTRACTOR.

PLEASANT GROVE CITY CORPORATION WATER SERVICE INFORMATION

SERVICE SIZE	METER BOX SIZE	TYPE OF MATERIAL FOR METER BOX	WATER METER	CONNECTION TYPE	BYPASS
1"	36" DIA.	36" DIA.X36" RCP (BY DEVELOPER)	BY CITY	COMPRESSION	NO

J-U-B

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

CULINARY WATER CONNECTION 1" SERVICE LOCATED IN DRIVEWAY

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 16A

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
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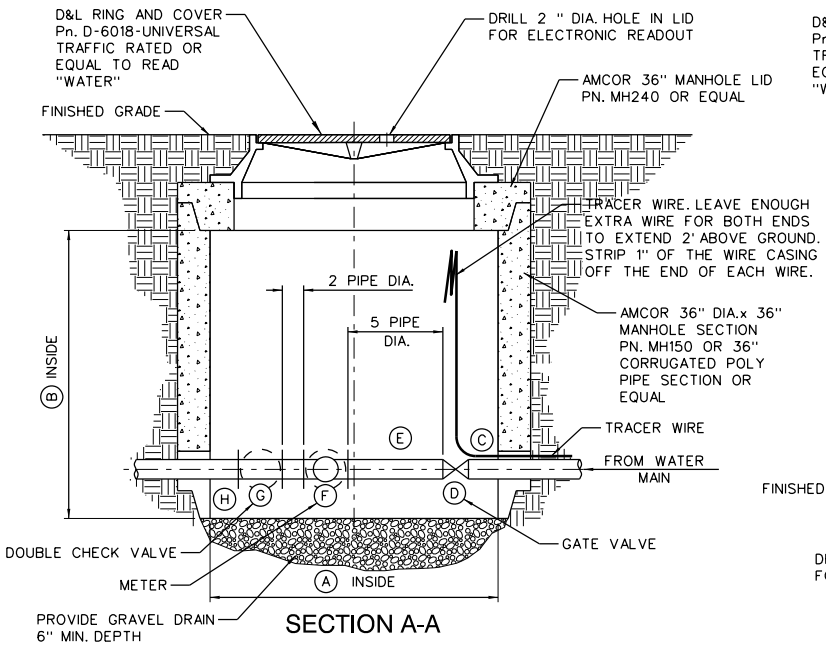
ADOPTED DATE:	NOVEMBER 2017



SIZE TABLE
DIMENSIONS

METER SIZE	A	B	C	D	E	F	G	H
1 ½"	36" DIA	36"	4"	7"	8"	1'-1"	1'-5¼"	4¾"
2"	36" DIA	36"	3½"	7"	10"	1'-5"	1'-7"	3½"

NOTE:
DEVELOPER TO PROVIDE 36" MANHOLE SECTION, LID, RING & COVER, WHEN PLACING THE WATER SERVICE METER IN A CONCRETE DRIVEWAY (SEE STANDARD DRAWING 16A)

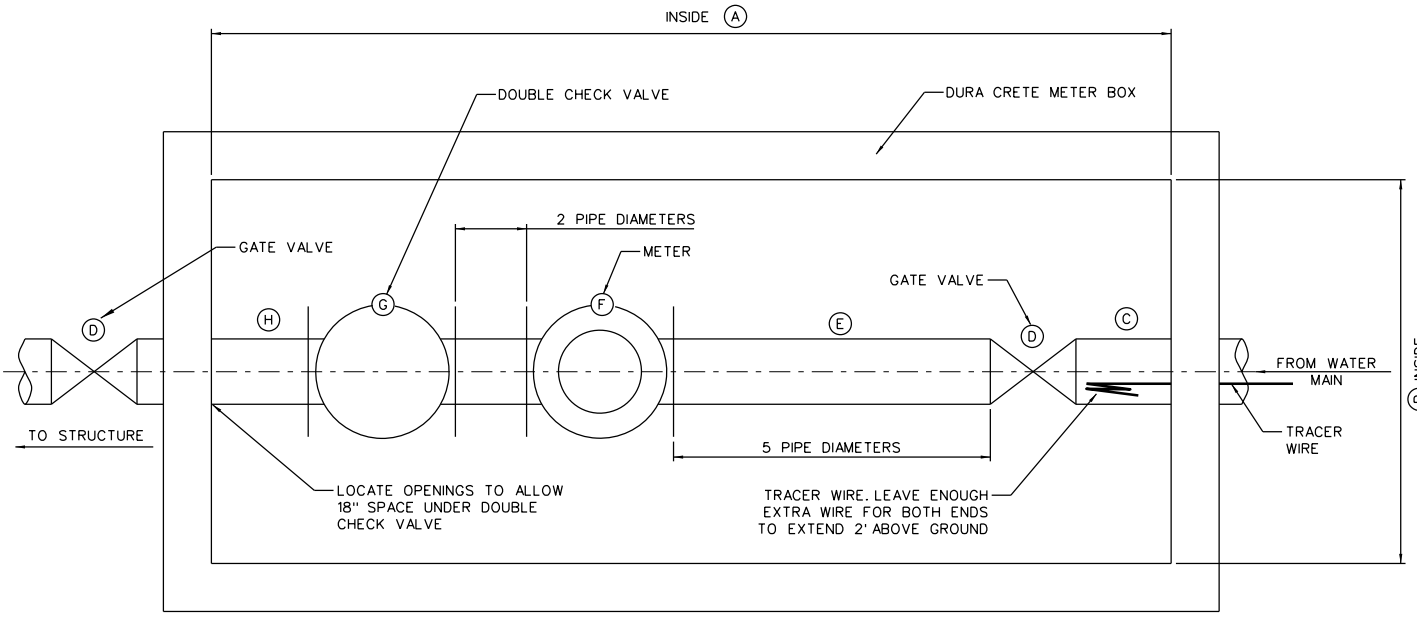
METER BOX FOR WATER METERS SIZE 1-1/2" & 2"

STANDARD DURA CRETE METER BOXES
4'x4', 5'x5', 5'x7', 5'x9', 6'x12', 7'x11.

SIZE TABLE
DIMENSIONS

METER SIZE	A	B	C	D	E	F	G	H
3"	7'-6"	4'	4"	8"	1'-3"	1'-7"	3'-4"	4"
4"	10'	4'	8"	9"	1'-8"	1'-11"	4'-4"	8"

NOTES:
1. CENTER M.H. OPENING RING & COVER OVER METER & CHECK VALVE.
2. METER BOX SHALL BE MINIMUM 4' DEEP WITH GRAVEL BOTTOM.
3. IF BACKFLOW IS LOCATED OUTSIDE OF METER BOX, METER BOX MAY BE REVISED AS REQUIRED.
4. LID OVER METER TO HAVE 1¾" HOLE FOR ELECTRONIC READING.
5. MUST HAVE CEMENT BOTTOM AND SEALED TO KEEP GROUND WATER OUT.



PLAN VIEW

METER BOX WITH BACKFLOW FOR WATER METERS SIZE 3" & 4"

J·U·B 0 2'

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Pleasant Grove
Utah's City of Trees

TYPICAL CULINARY WATER CONNECTION 1½" TO 4" SERVICE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 16B

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
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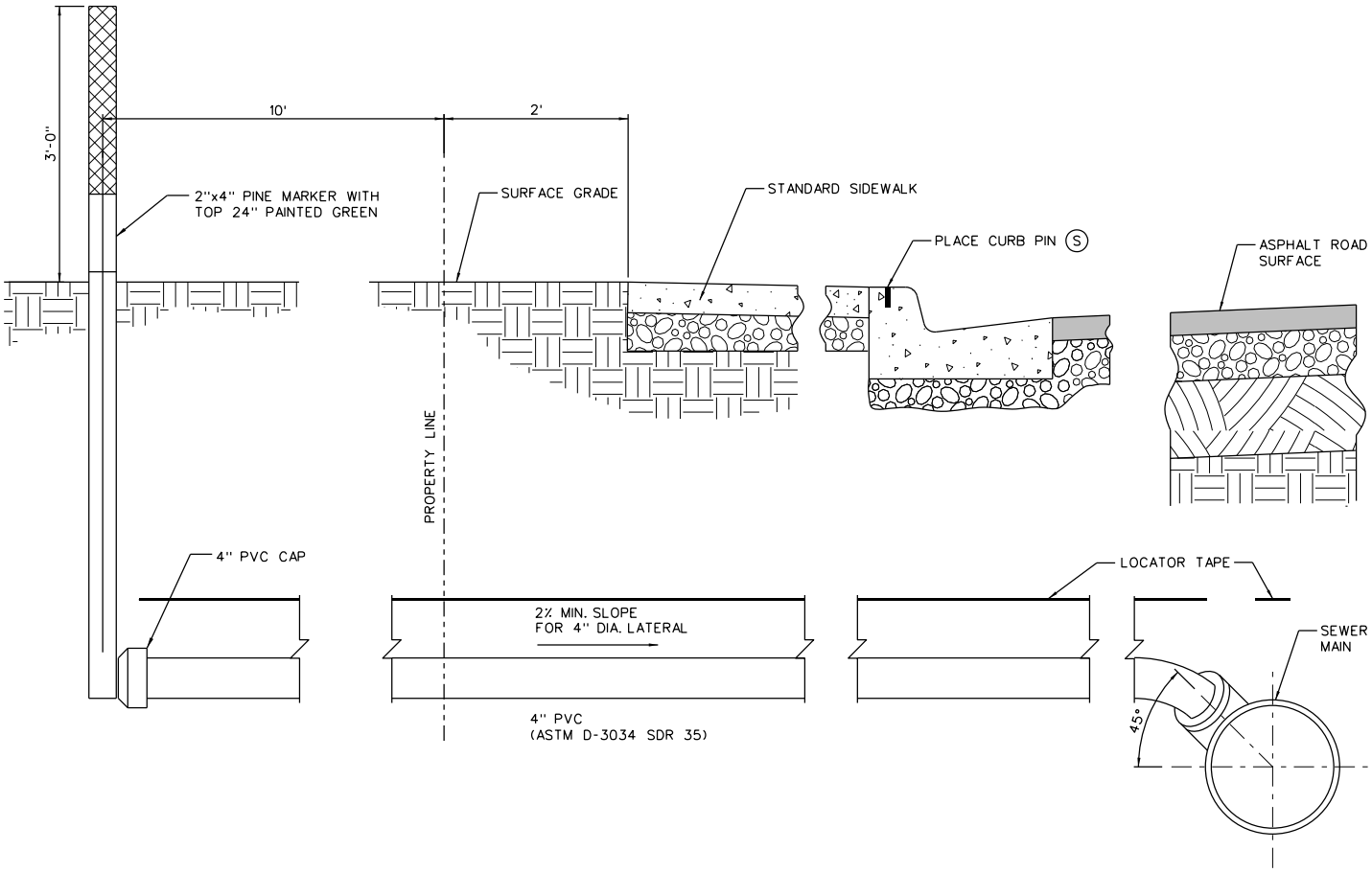
ADOPTED DATE:	NOVEMBER 2017



STUB FOR NEW CONSTRUCTION

NOTES FOR CONNECTING TO NEW SEWER MAIN:

1. CONNECTION TO MAIN SHALL BE BY WYE'S OR TEE'S INSTALLED AS PART OF THE SEWER MAIN CONSTRUCTION.
2. LOCATION OF STUB TO BE 5' DOWNHILL FROM THE CENTER OF THE LOT.
3. SHOW CENTERLINE STATION OF THE LATERAL FROM THE NEAREST DOWNSTREAM MANHOLE. USE SAME STATIONING USED FOR SEWER MAIN.
4. PLACE CURB PIN WITH "S" IN TOP OF CURB BEFORE CONCRETE FINAL SET TO MARK LOCATION WHERE SEWER SERVICE LATERAL PIPE CROSSES CURB.

J-U-B

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

TYPICAL SEWER LATERAL NEW CONSTRUCTION

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	17
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
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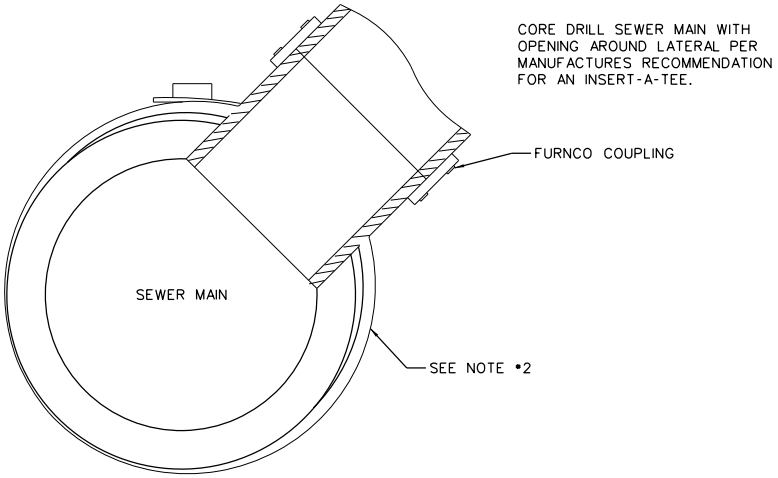
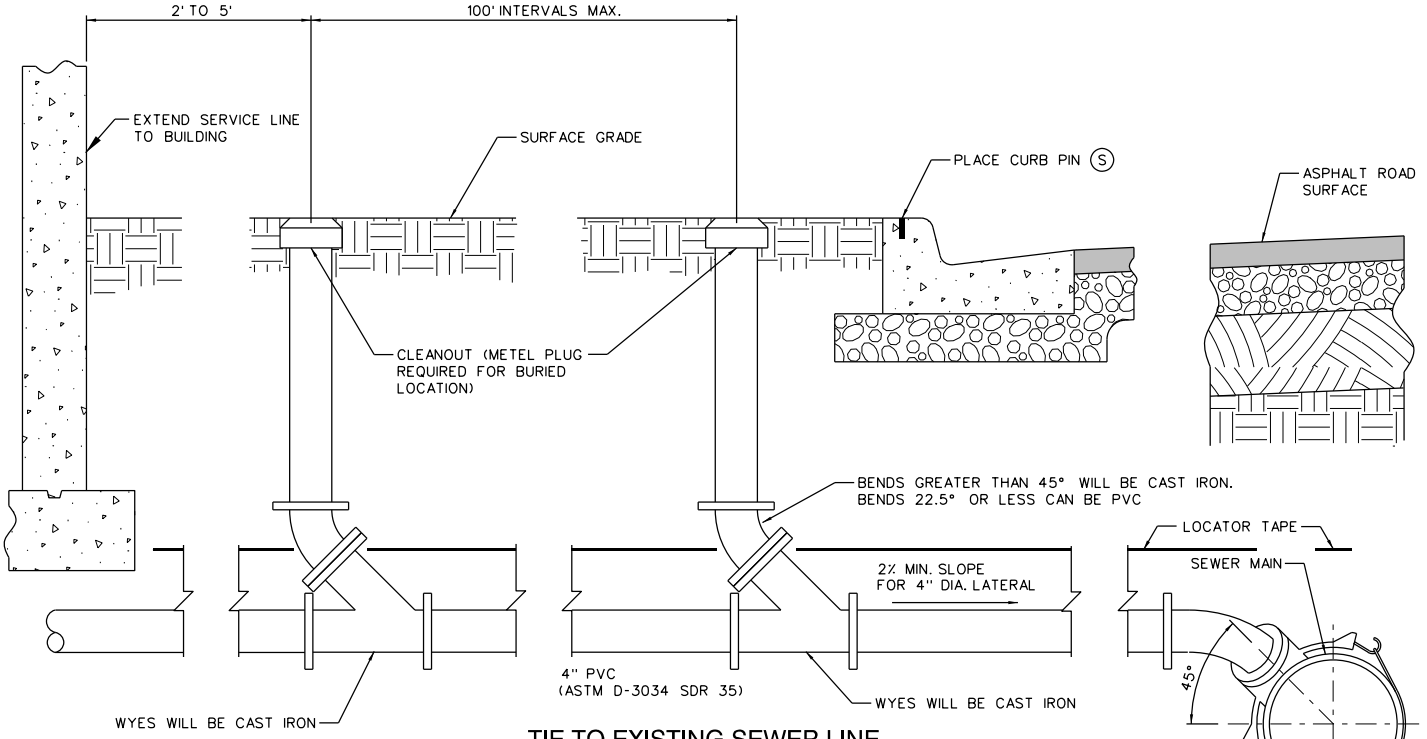
ADOPTED DATE:	NOVEMBER 2017



INSTALLATION TO EXISTING SEWER LINE

N.T.S.



TIE TO EXISTING SEWER LINE

NOTES FOR CONNECTING TO EXISTING SEWER MAIN:

1. CORE SEWER MAIN WITH OPENING AROUND LATERAL PER MANUFACTURES RECOMMENDATION
2. INSTALL INSERT-A-TEE SEWER SADDLE OR PVC SEWER SADDLE WITH 2- 1" STAINLESS STEEL STRAPS.
3. GROUT AROUND CONNECTION TO SEWER MAIN.
4. ENCASE SEWER MAIN AND LATERAL CONNECTION IN CONCRETE.
5. CONNECTION TO BE MADE IN PRESENCE OF / INSPECT BY AN AUTHORIZED REPRESENTATIVE OF THE CITY PRIOR TO BACKFILL
6. FURNCO COUPLERS SHALL BE USED WHEN CONNECTING CAST IRON OR ABS PIPE TO PVC PIPE.
7. ALL SEWER LATERALS SHALL BE BEDDED WITH ¾" MINUS GRAVEL. (i.e. PEA GRAVEL)
8. BACKFILL MATERIAL AROUND PIPE SHALL BE COMPACTED TO 95% OF DENSITY AS MEASURED BY AASHTO T-99.
9. A TIE SKETCH SHOWING THE LOCATION OF ALL SEWER LATERALS MUST BE SUBMITTED TO THE CITY.
10. THE CITY SHALL BE NOTIFIED 24 HOURS PRIOR TO WHEN A SEWER LATERAL INSPECTION IS NEEDED.
11. ALL APPROPRIATE EXCAVATION PERMITS MUST BE OBTAINED FROM THE CITY AND OTHER AGENCY PRIOR TO ANY EXCAVATION.
12. ALL APPROPRIATE IMPACT FEES MUST BE PAID PRIOR TO CONNECTING TO THE SEWER.
13. PLACE CURB PIN WITH "S" IN TOP OF CURB BRFORE CONCRETE FINAL SET TO MARK LOCATION WHERE SEWER SERVICE LATERAL PIPE CROSSES CURB.
14. ALL WYES WILL BE CAST IRON. BENDS GRATER THAN 45° MUST BE CAST IRON. BENDS 22.5° OR LESS CAN BE PVC.

J·U·B

0 2'

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NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

TYPICAL SEWER LATERAL EXISTING SEWER LINE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	17A
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
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DESIGN BY:	EEA
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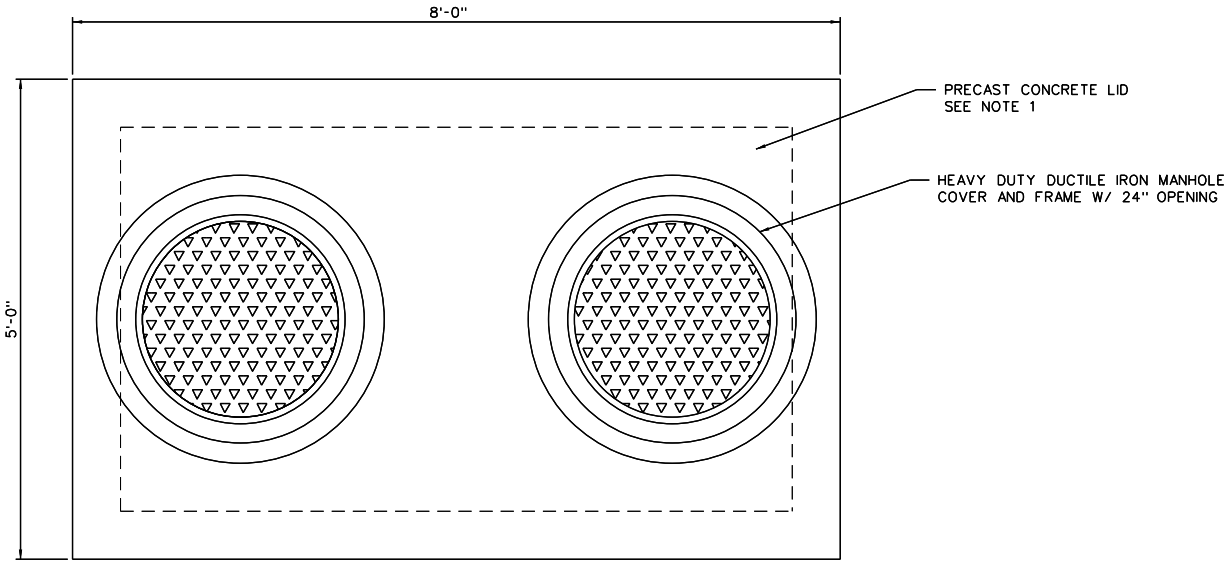
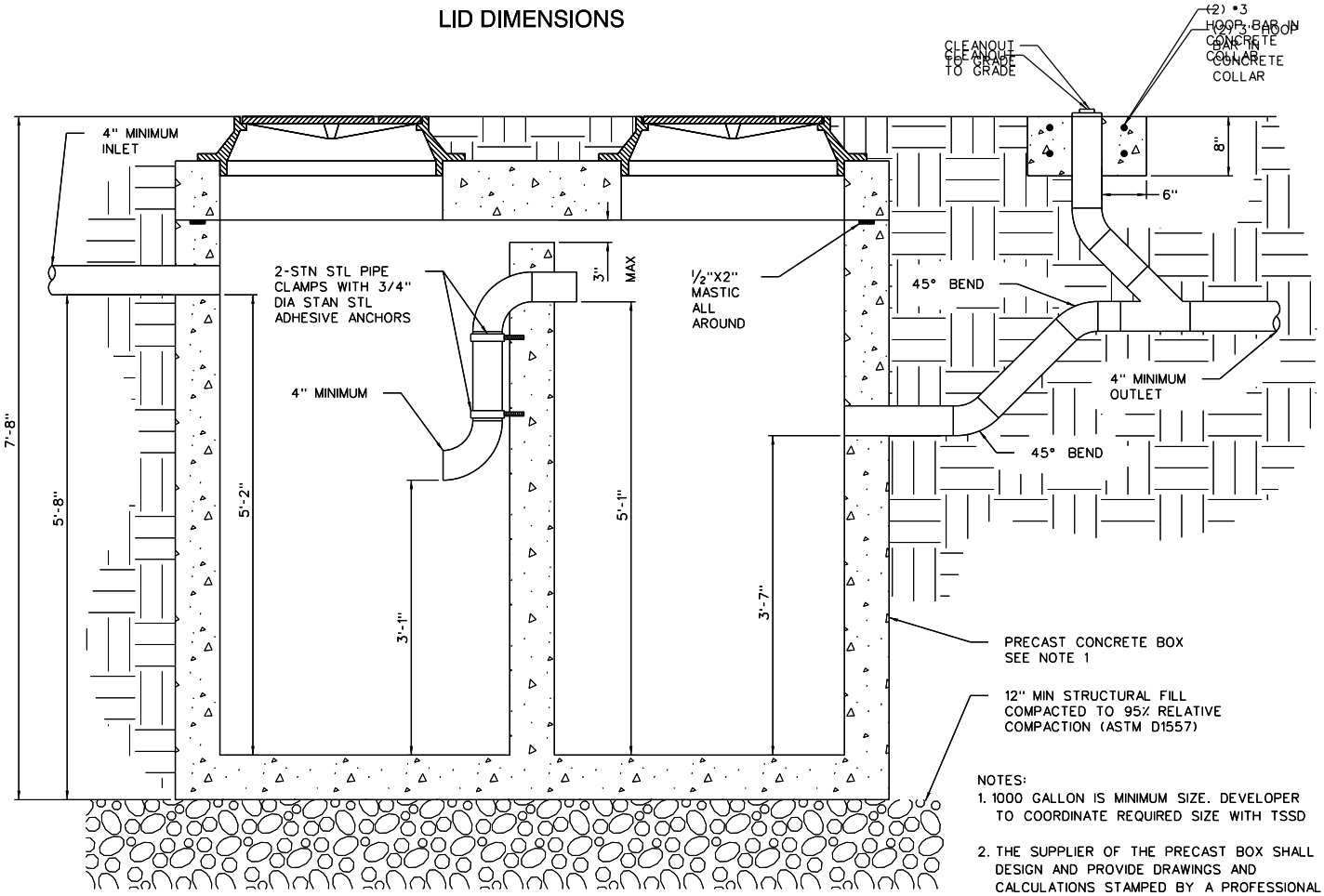


LID DIMENSIONS



PLUMBING & BOX DIMENSIONS

NOTES:

1. 1000 GALLON IS MINIMUM SIZE. DEVELOPER TO COORDINATE REQUIRED SIZE WITH TSSD
2. THE SUPPLIER OF THE PRECAST BOX SHALL DESIGN AND PROVIDE DRAWINGS AND CALCULATIONS STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF UTAH TO THE CITY ENGINEER FOR APPROVAL.
3. SUPPLIER SHALL COORDINATE WITH OWNER THE SIZE AND LOCATION OF ALL PIPE PENETRATIONS PRIOR TO FABRICATION
4. NO SANITARY SEWER THROUGH TRAP
5. OTHER MANUFACTURER'S DIMENSIONS MAY VARY

J-U-B

0 2'

REVISION

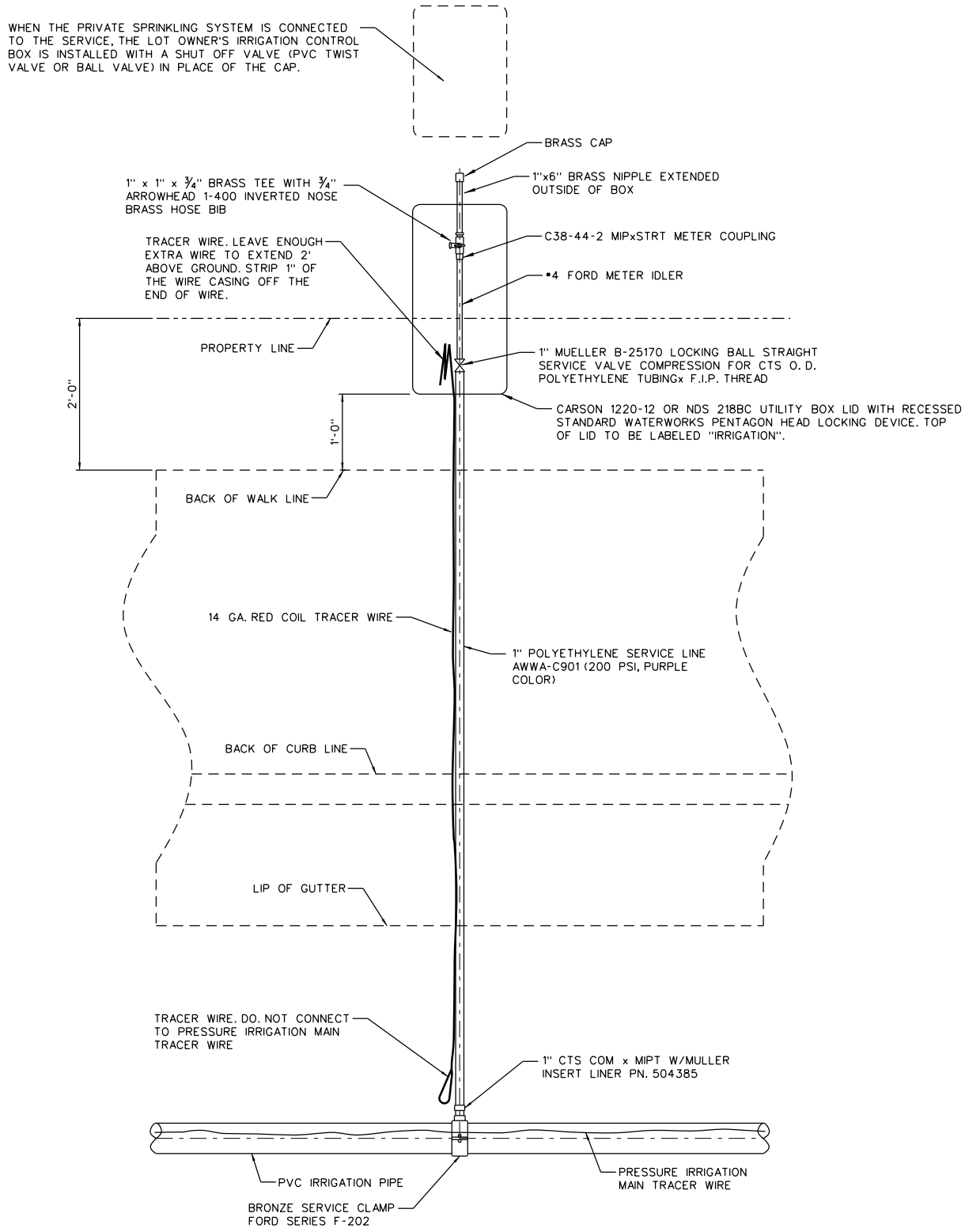
NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

TYPICAL GREASE TRAP
1000 GALLON CAPACITY

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	18
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



IRRIGATION CONNECTION NOTES:

1. 1" SINGLE SERVICE CONNECTION TO MAIN: USE MUELLER SERIES H-13490 BRONZE SERVICE CLAMP AND A BRASS COMPRESSION X MIPT ADAPTER. A RIGID LINER SHALL BE USED INSIDE OF TUBING AT THE COMPRESSION FITTINGS ON 1" SINGLE SERVICE LINE.

GENERAL NOTES:

1. ALL FITTINGS SHALL BE COMPATIBLE WITH SERVICE SIZE.
2. SERVICE LINE INSTALLATION AT AN EXISTING CURB GUTTER & SIDEWALK WITH A PLANTER STRIP SHALL HAVE THE UTILITY BOX LOCATED IN THE PLANTER STRIP.
3. SERVICE LINE INSTALLATION AT EXISTING OR NEW MONOLITHIC CURB, GUTTER & SIDEWALK SHALL HAVE THE UTILITY BOX LOCATED BEHIND THE SIDEWALK.
4. SERVICE LINE INSTALLATION AT A LOCATION WITH NO CURB, GUTTER & SIDEWALK SHALL HAVE THE UTILITY BOX LOCATED BEHIND THE FUTURE SIDEWALK.

J·U·B

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

SINGLE 1" SERVICE CONNECTION FOR PRESSURE IRRIGATION

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	19
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
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DESIGN BY:	EEA
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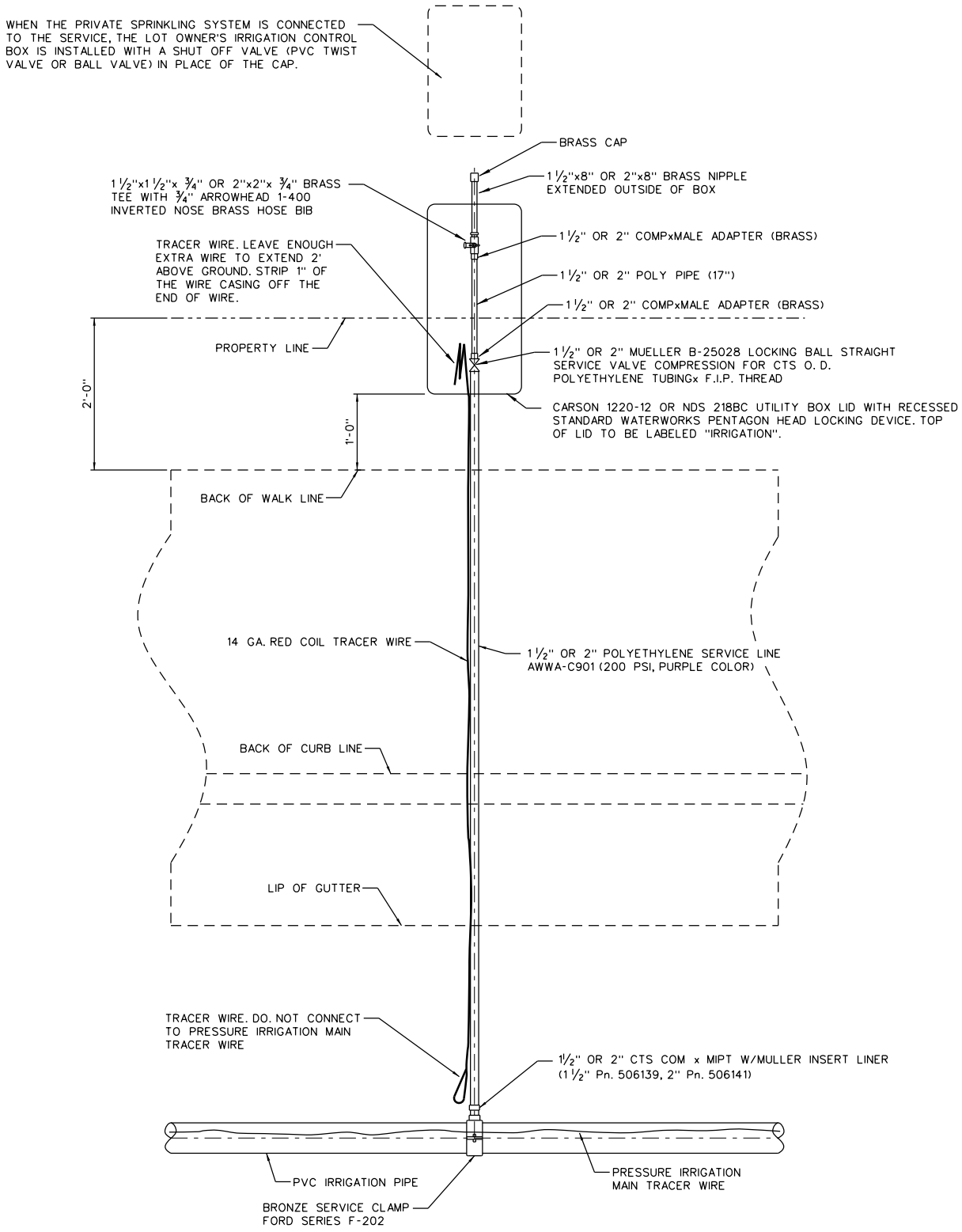
ADOPTED DATE:	NOVEMBER 2017



IRRIGATION CONNECTION NOTES:

1. 1 ½" OR 2" SINGLE SERVICE CONNECTION TO MAIN: USE MUELLER SERIES H-13490 BRONZE SERVICE CLAMP AND A BRASS COMPRESSION X MIPT ADAPTER. A RIGID LINER SHALL BE USED INSIDE OF TUBING AT THE COMPRESSION FITTINGS ON 1 ½" OR 2" SINGLE SERVICE LINE.

GENERAL NOTES:

1. ALL FITTINGS SHALL BE COMPATIBLE WITH SERVICE SIZE.
2. SERVICE LINE INSTALLATION AT AN EXISTING CURB GUTTER & SIDEWALK WITH A PLANTER STRIP SHALL HAVE THE UTILITY BOX LOCATED IN THE PLANTER STRIP.
3. SERVICE LINE INSTALLATION AT EXISTING OR NEW MONOLITHIC CURB, GUTTER & SIDEWALK SHALL HAVE THE UTILITY BOX LOCATED BEHIND THE SIDEWALK.
4. SERVICE LINE INSTALLATION AT A LOCATION WITH NO CURB, GUTTER & SIDEWALK SHALL HAVE THE UTILITY BOX LOCATED BEHIND THE FUTURE SIDEWALK.

J-U-B

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

SINGLE 1½" & 2" SERVICE CONNECTION FOR PRESSURE IRRIGATION

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	19A
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
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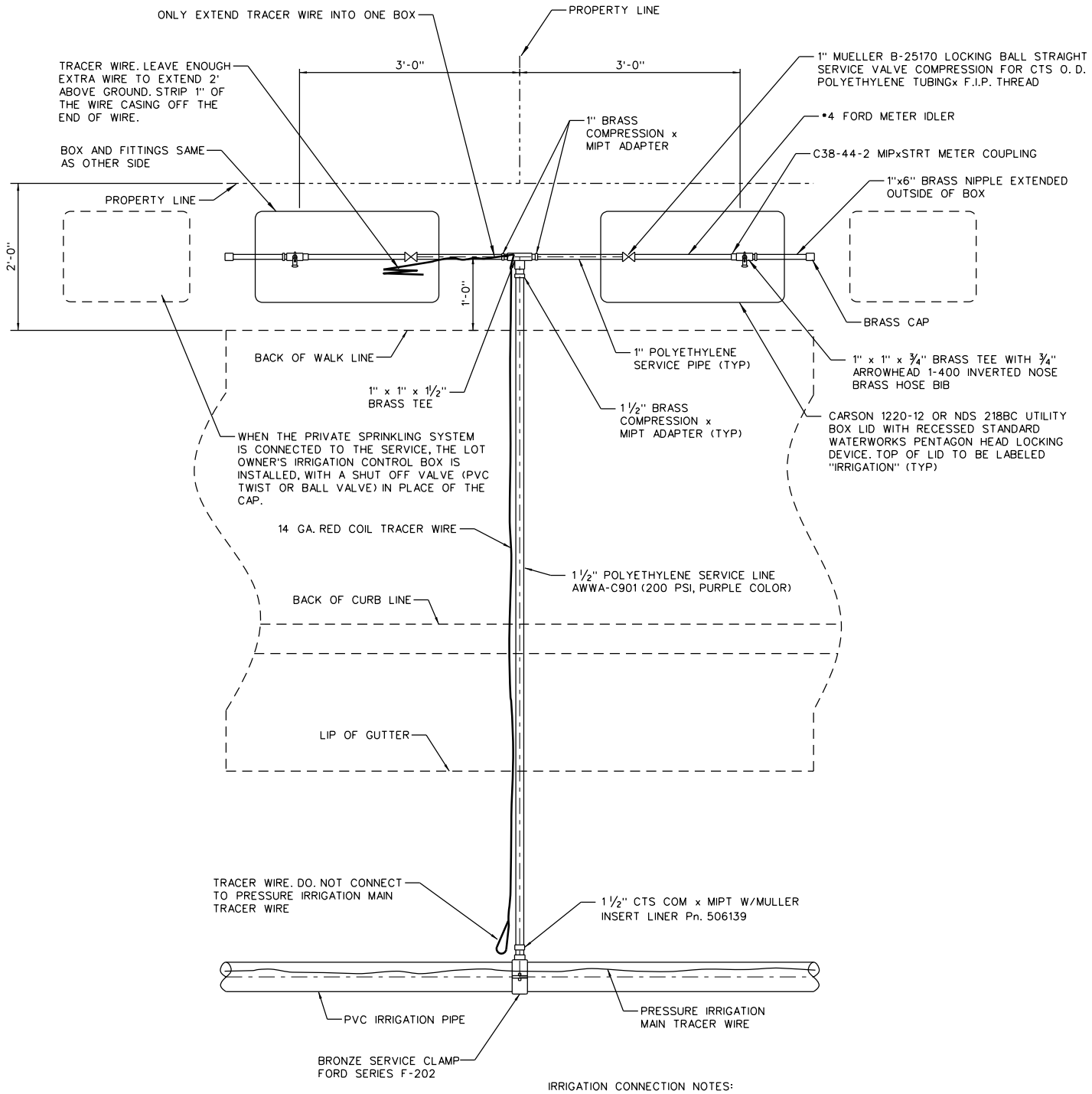

IRRIGATION CONNECTION NOTES:

1. 1-1/2" SERVICE CONNECTION TO MAIN:
   USE MUELLER SERIES H-13490 AND A BRASS COMPRESSION X MPT ADAPTER. A RIGIDED LINER WILL BE REQUIRED INSIDE OF TUBING AT COMPRESSION FITTINGS ON 1", 1-1/2" OR 2" SERVICE LINES

GENERAL NOTES:

ALL FITTINGS SHALL BE COMPATIBLE WITH SERVICE SIZE.
1. SERVICE LINE INSTALLATION AT AN EXISTING CURB GUTTER & SIDEWALK WITH A PLANTER STRIP SHALL HAVE THE UTILITY BOX LOCATED IN THE PLANTER STRIP.
2. SERVICE LINE INSTALLATION AT EXISTING OR NEW MONOLITHIC CURB, GUTTER & SIDEWALK SHALL HAVE THE UTILITY BOX LOCATED BEHIND THE SIDEWALK.
3. SERVICE LINE INSTALLATION AT A LOCATION WITH NO CURB, GUTTER & SIDEWALK SHALL HAVE THE UTILITY BOX LOCATED BEHIND THE FUTURE SIDEWALK.

J·U·B

0 2'

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

DOUBLE SERVICE CONNECTION FOR PRESSURE IRRIGATION

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 20

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
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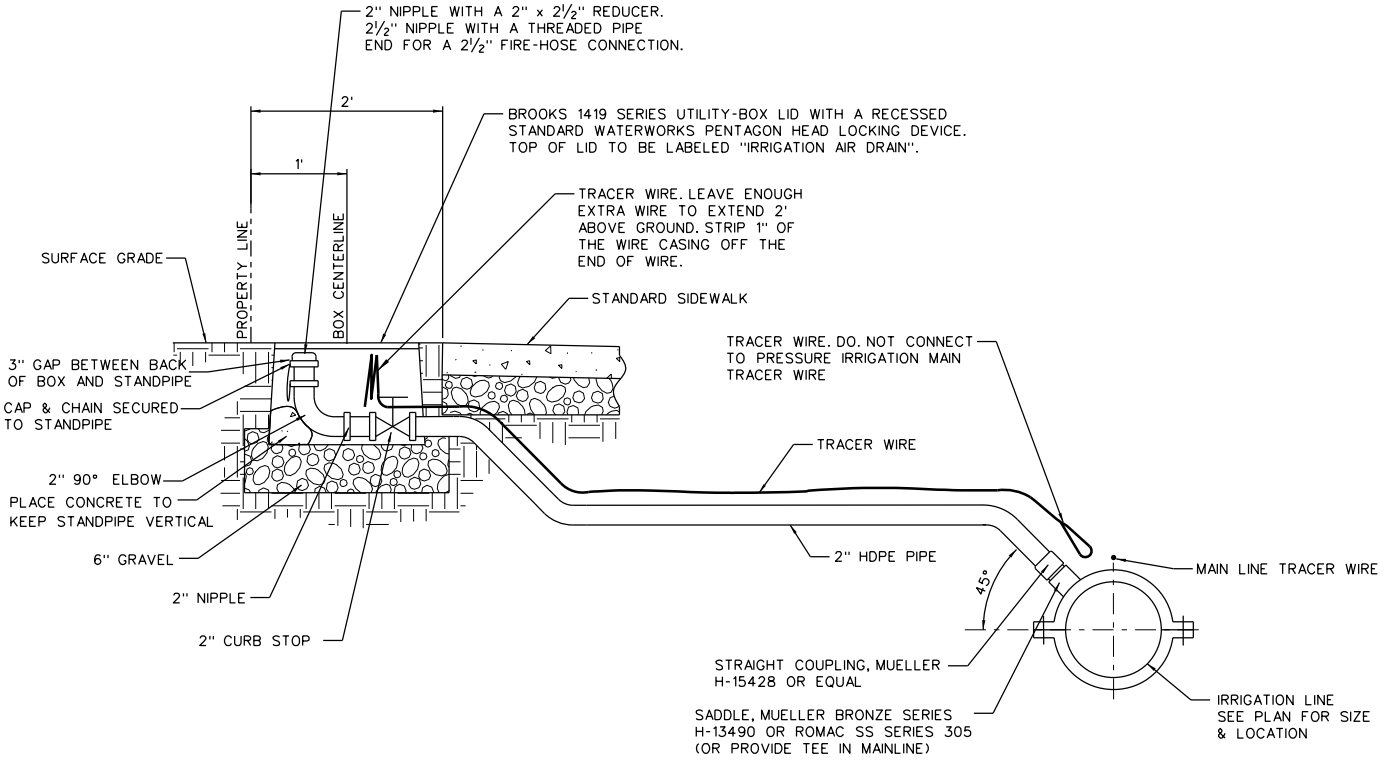
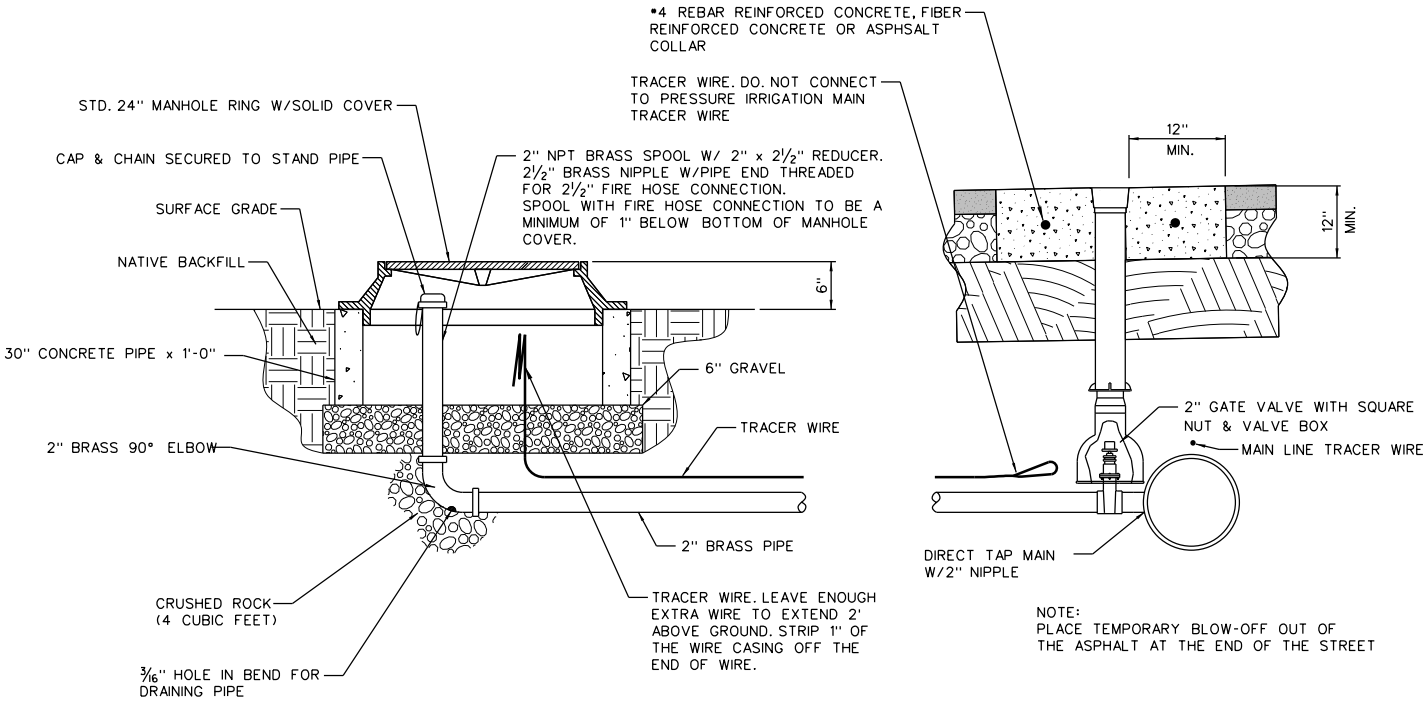


PRESSURE IRRIGATION SYSTEM AIR INLET & REMOVAL FACILITY



TEMPORARY PRESSURE IRRIGATION OR CULINARY WATER BLOW-OFF FOR TEMPORARY DEAD END STREETS

J-U-B

0 2'

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Pleasant Grove
Utah's City of Trees

AIR INLET & REMOVAL FACILITY FOR PRESSURE IRRIGATION
TEMPORARY PRESSURE IRRIGATION OR CULINARY WATER BLOW-OFF FOR TEMPORARY DEAD END STREETS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	21
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
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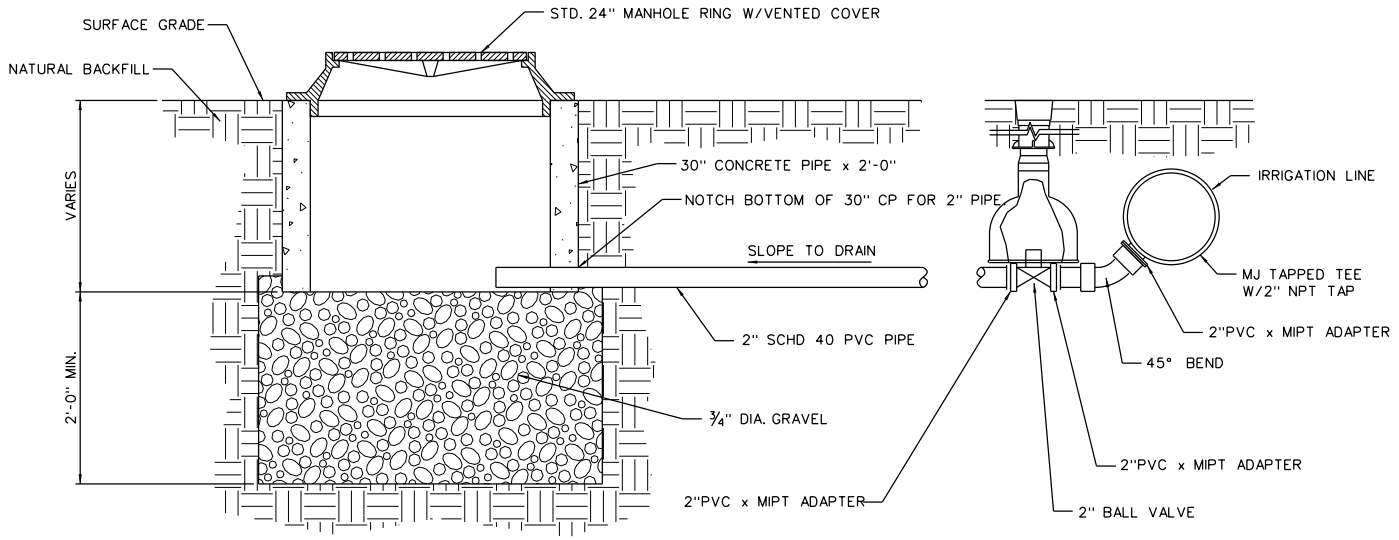
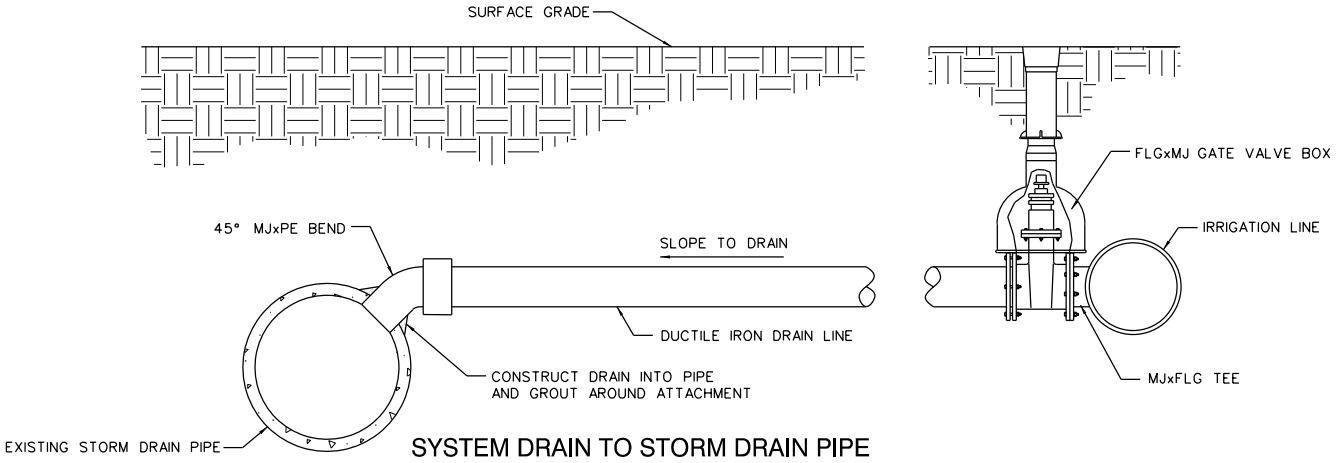
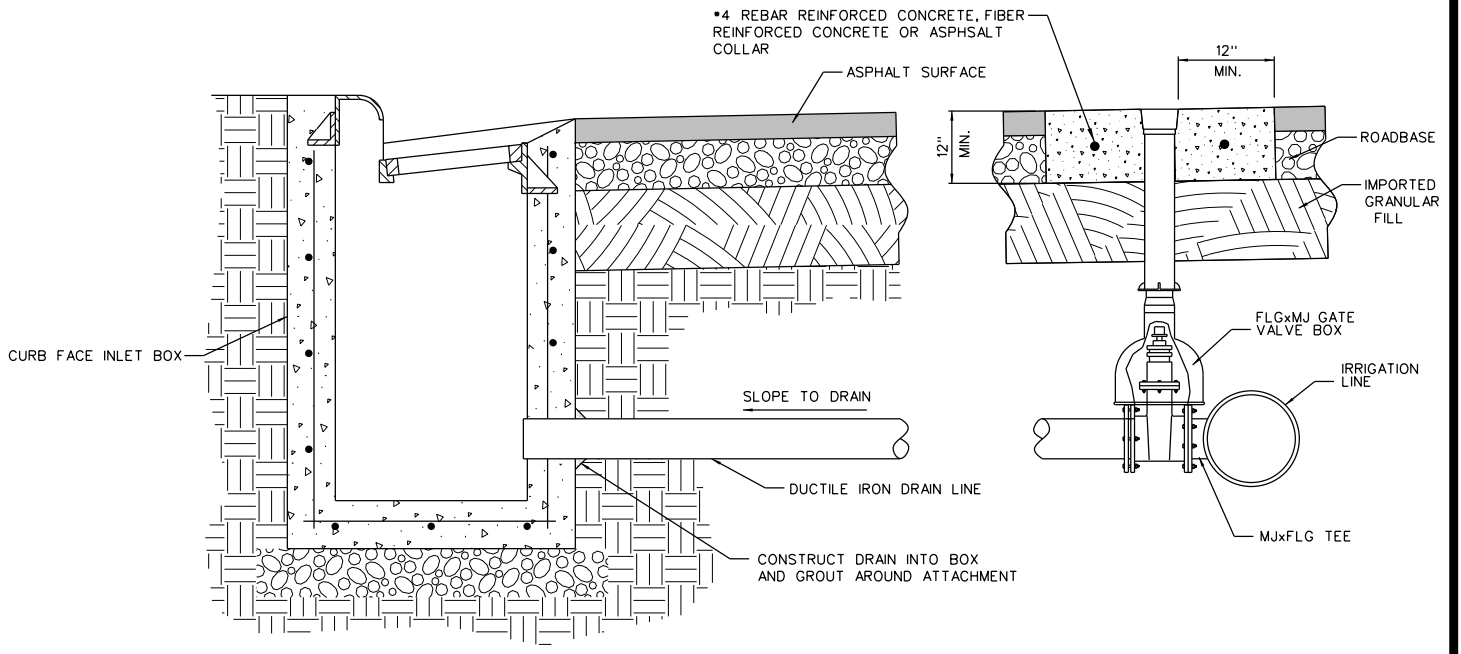


LOCAL DRAIN TO SUMP



SYSTEM DRAIN TO STORM DRAIN PIPE



SYSTEM DRAIN TO CURB INLET BOX

J-U-B

0 2'

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Pleasant Grove
Utah's City of Trees

PRESSURE IRRIGATION DRAINS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 22

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
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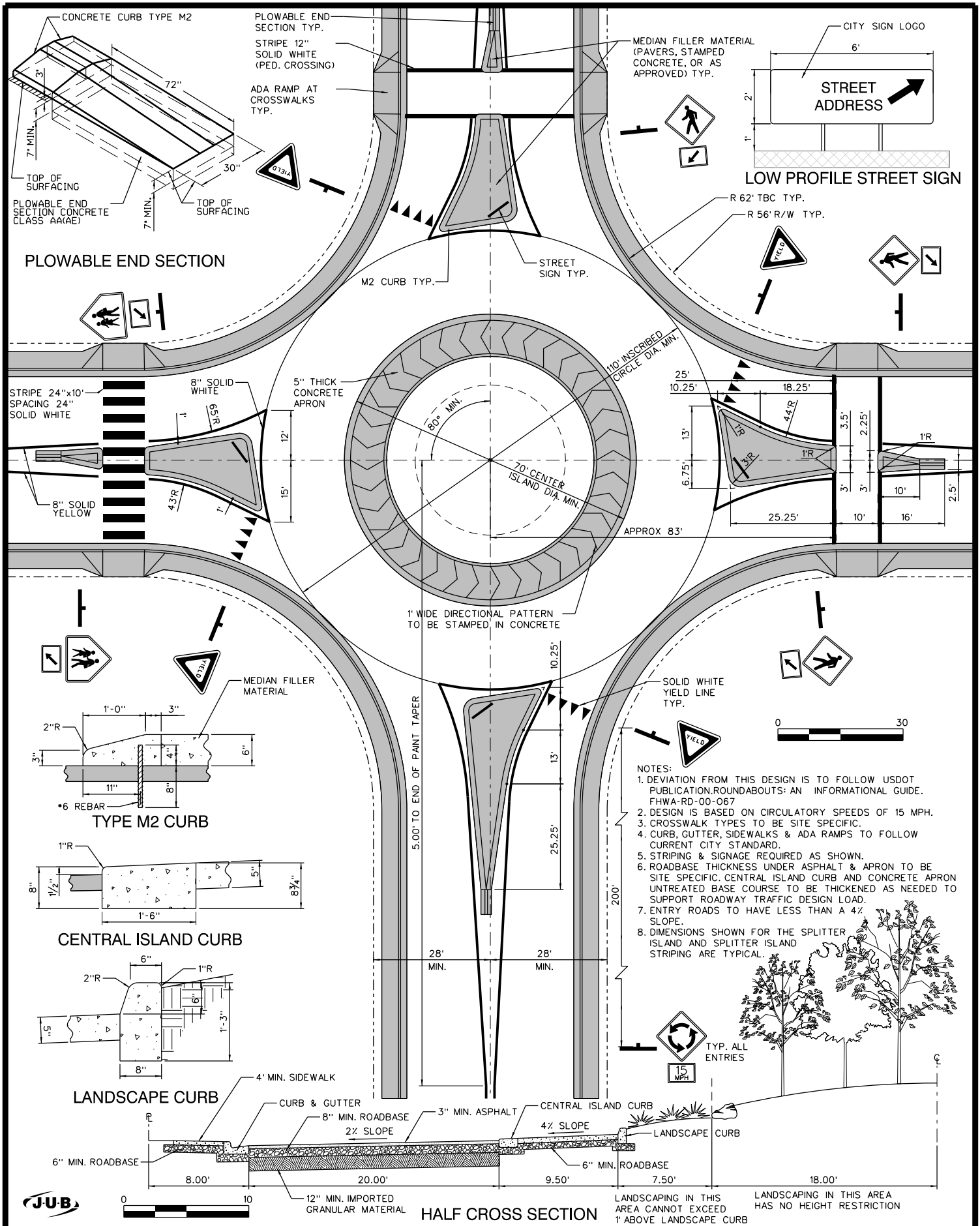

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NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

110' ROUNDABOUT FOR LOCAL STREET INTERSECTION

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	23
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
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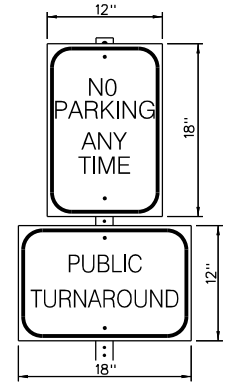
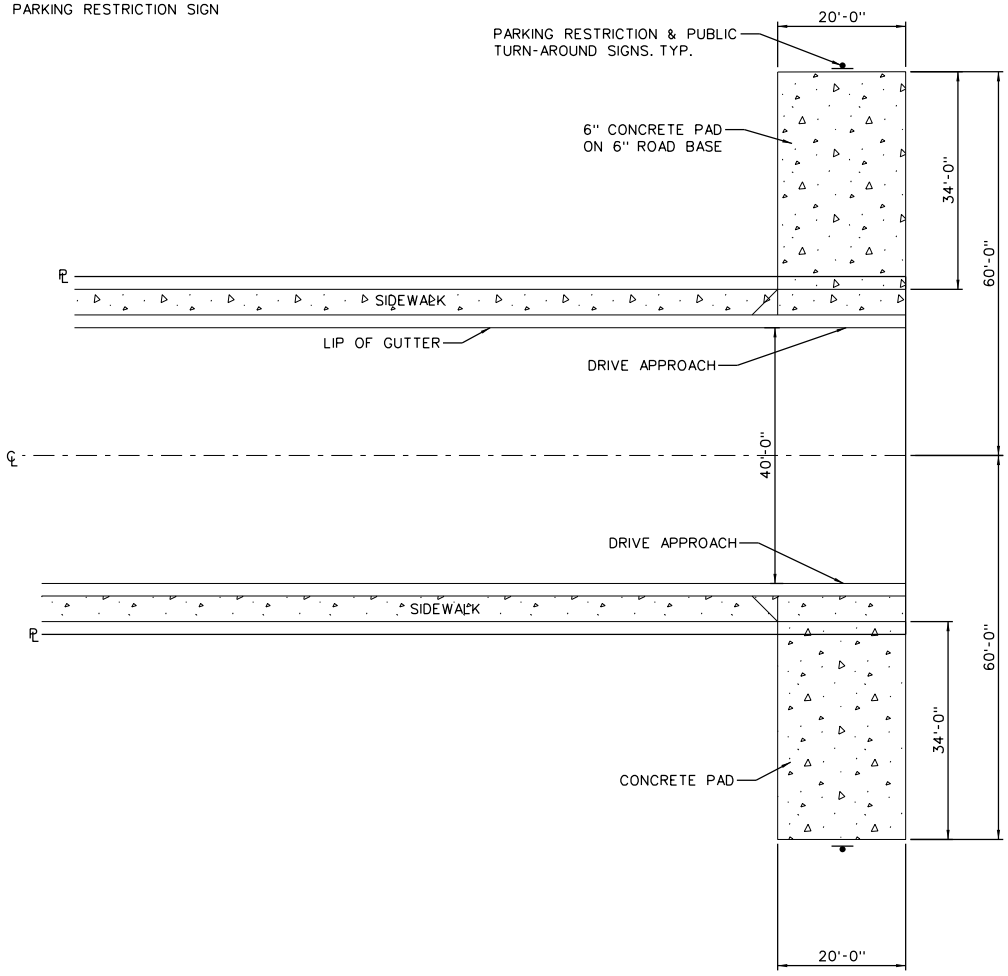
ADOPTED DATE:	NOVEMBER 2017



PARKING RESTRICTION SIGN



120' HAMMERHEAD TEMPORARY TURN AROUND

J-U-B

0 30'

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Pleasant Grove
Utah's City of Trees

STUB STREET TEMPORARY TURN-AROUND

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 24

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PLOT SCALE:	1.000
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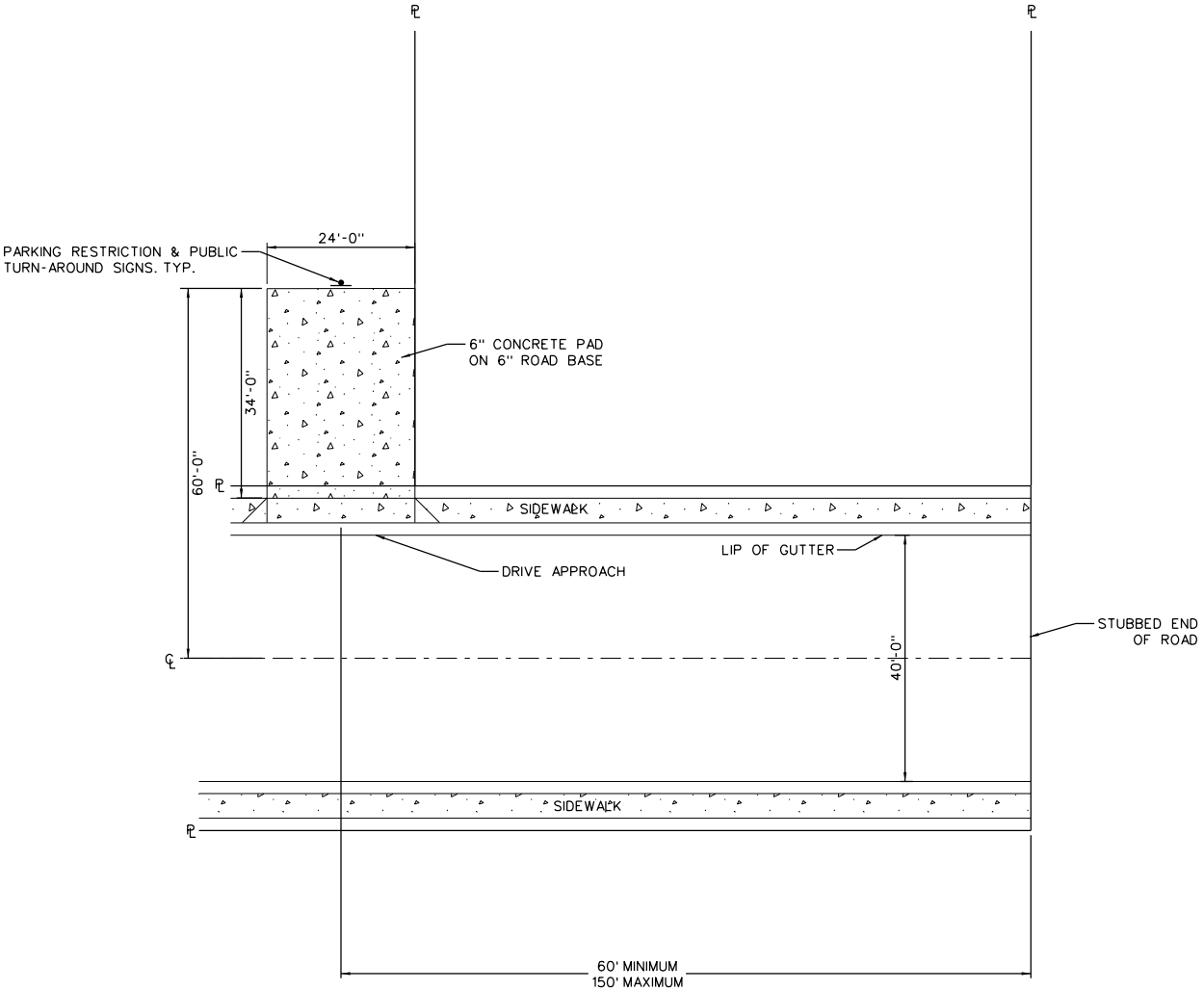
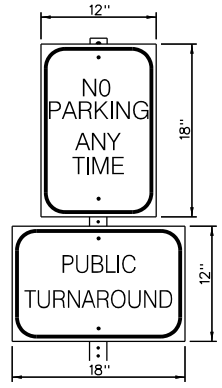
ADOPTED DATE:	NOVEMBER 2017





PARKING RESTRICTION SIGN

J-U-B

0 30'

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Utah's City of Trees

STUB STREET TEMPORARY TURN-AROUND

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	25
CAD:	PGdetails_2017.dgn
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DESIGN BY:	EEA
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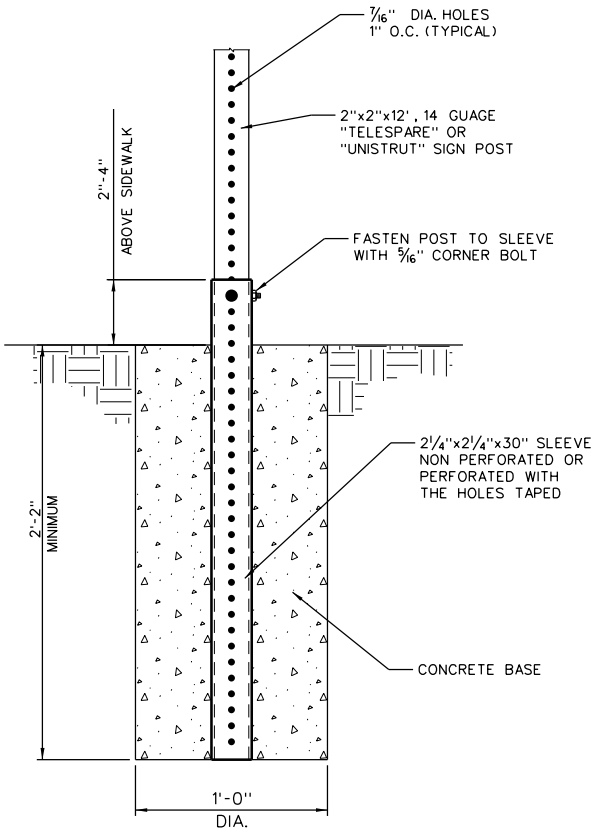
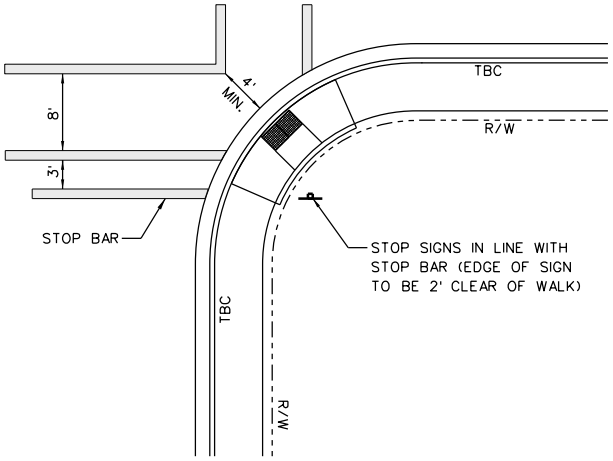


GROUND INSTALLATION DETAIL

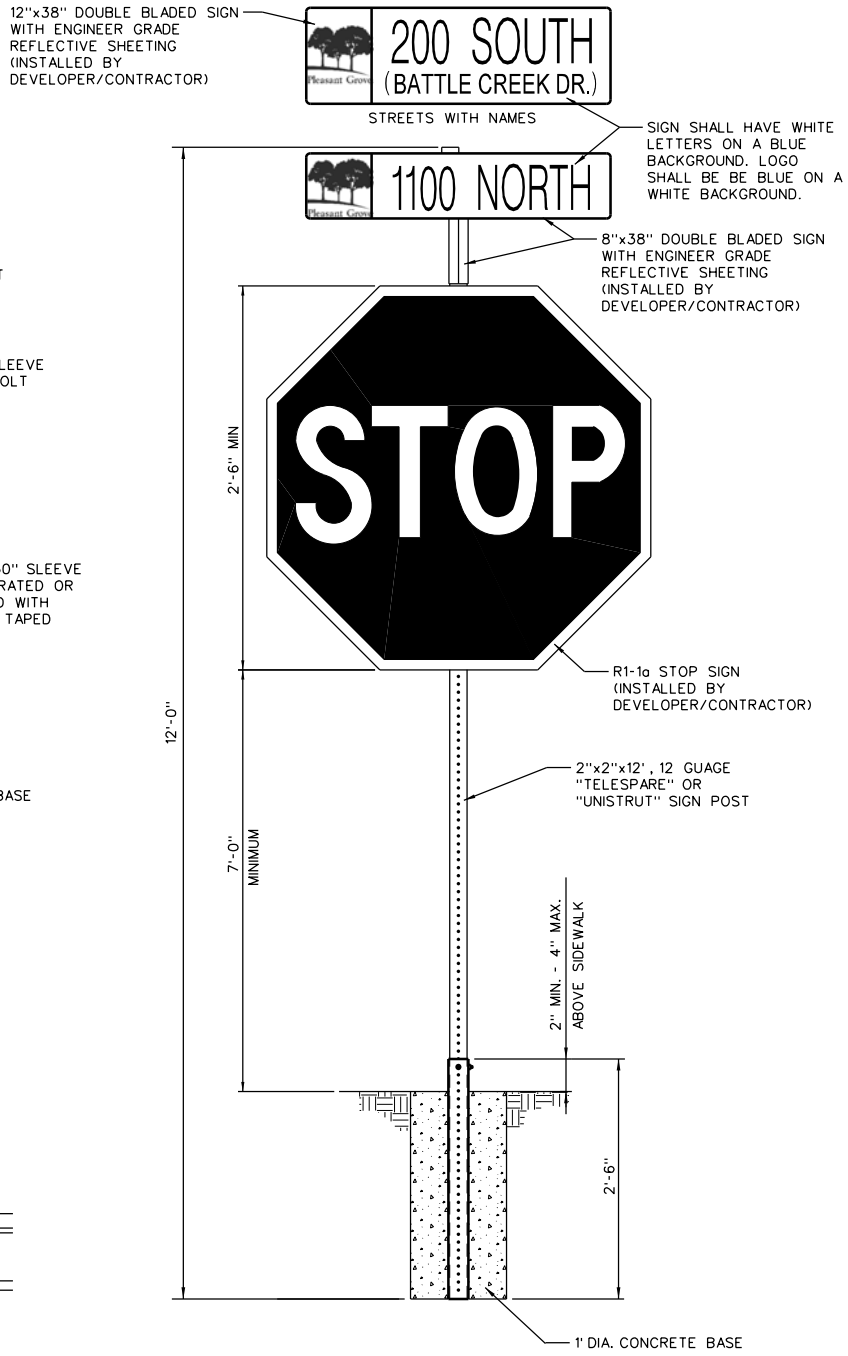
(W/ONE PIECE BREAKAWAY ANCHOR)

SCALE: 1"=1'



TYPICAL STREET/STOP SIGN LOCATION PLAN VIEW

SCALE: 1"=20'



TYPICAL STREET/STOP SIGN INSTALLATION

SCALE: 1"=2'

NOTES:
1. STREET SIGN SHALL BE 8"x36" DOUBLE BLADED WITH PG LOGO. IF THE STREET HAS A NAME, THE NAME SHALL BE PLACED BELOW IN SMALL LETTERS AND THE NUMBER ABOVE IN LARGER LETTERS. (INSTALLED BY DEVELOPER/CONTRACTOR)
2. SIGN POST AND SLEEVE SHALL BE "TELESPARE" OR "UNISTRUT" MANUFACTURED PRODUCTS. (INSTALLED BY DEVELOPER/CONTRACTOR)
3. SIGNS AND POSTS ARE TO BE OBTAINED FROM THE FOLLOWING SUPPLIERS:
   SAFETY SUPPLY/UTAH BARRICADE, SALT LAKE CITY
   INTERMOUNTAIN TRAFFIC SUPPLY, SALT LAKE CITY
   INTERWEST SAFETY SUPPLY, PROVO
4. ALL STOP SIGNS SHALL BE TYPE 9 "DIAMOND GRADE".
5. CONTRACTOR/DEVELOPER SHALL COORDINATE STAKING LOCATION WITH PUBLIC WORKS REPRESENTATIVE.

J·U·B 0 2'

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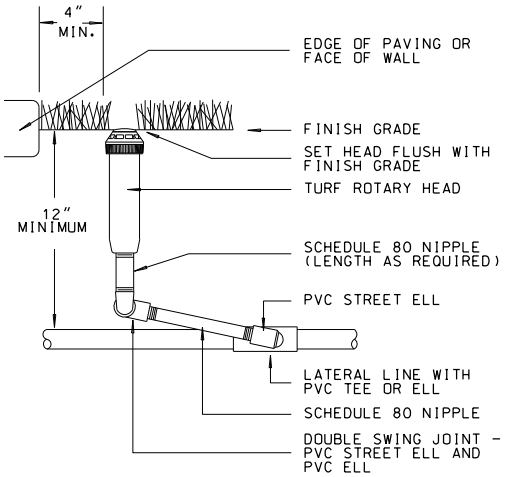
Utah's City of Trees

TYPICAL STREET/STOP SIGN INSTALLATION DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 26

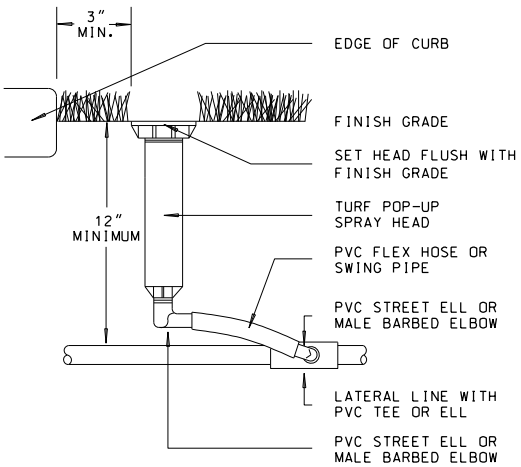
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



NOTE:
A SWING PIPE ASSEMBLY MAY BE USED WITH FLOWS LESS THAN 15 LITERS PER MINUTE.

TURF ROTARY HEAD DETAIL

SCALE: NTS



TURF/SHRUB POP-UP SPRAY

SCALE: NTS

J-U-B NO SCALE

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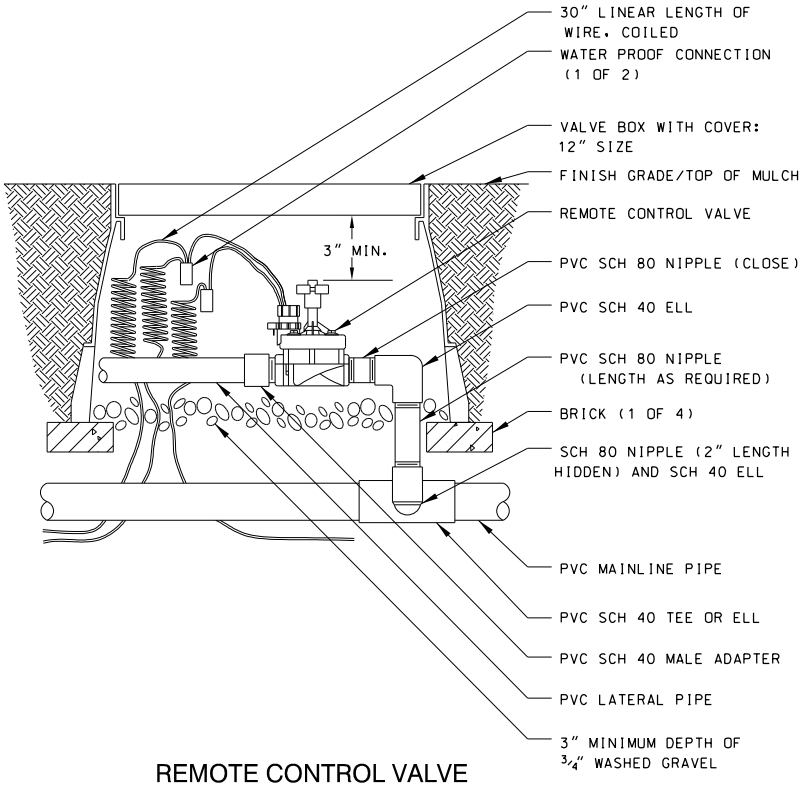
POP-UP/ROTARY HEAD DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

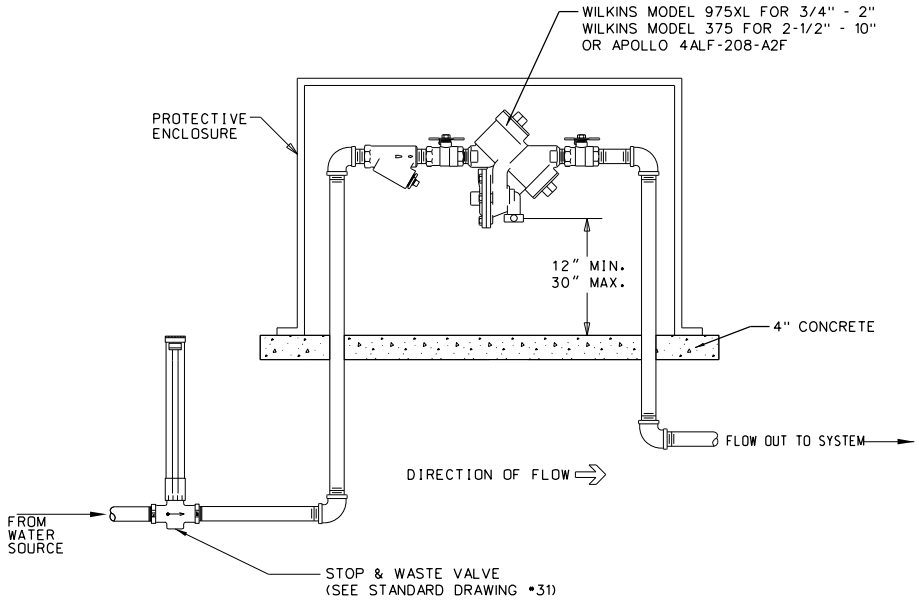
STANDARD DRAWING NUMBER: 27

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	HORROCKS
DESIGN BY:	
CHECKED BY:	
ADOPTED DATE:	NOVEMBER 2017



REMOTE CONTROL VALVE

SCALE: NTS



RPZ DOUBLE-CHECK VALVE DETAIL

SCALE: NTS

NOTE:
1. MUST BE INSPECTED BY CITY AT INSTALLATION AND YEARLY THEREAFTER.

J-U-B NO SCALE

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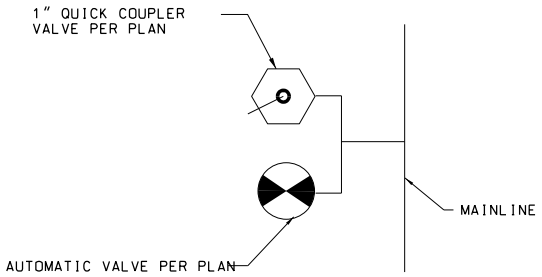
REMOTE CONTROL/DOUBLE CHECK VALVE DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

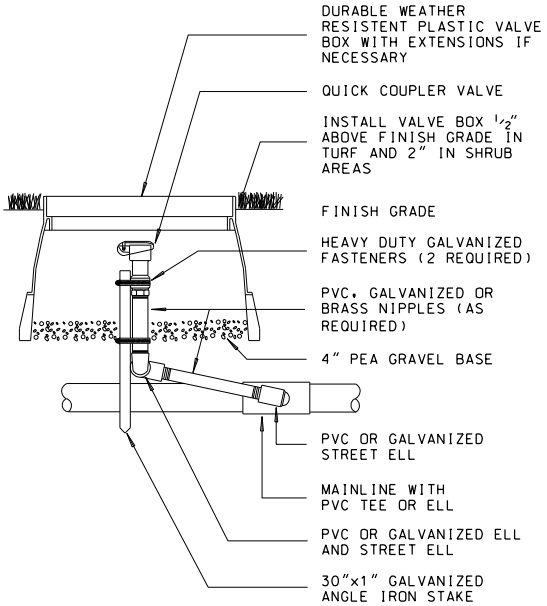
STANDARD DRAWING NUMBER: 28

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	HORROCKS
DESIGN BY:	
CHECKED BY:	
ADOPTED DATE:	NOVEMBER 2017



QUICK COUPLER/VALVE LAYOUT DETAIL

SCALE: NTS



QUICK COUPLER VALVE DETAIL

SCALE: NTS

J-U-B

NO SCALE

STATEMENT OF USE

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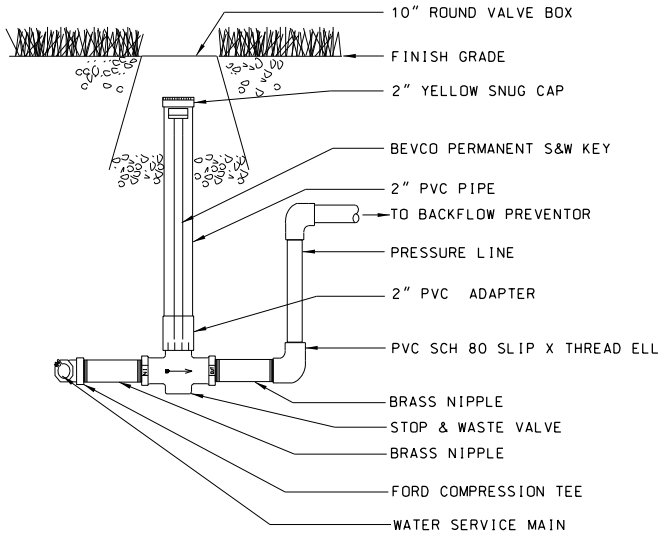
Pleasant Grove
Utah's City of Trees

QUICK COUPLER VALVE DETAIL & LAYOUT

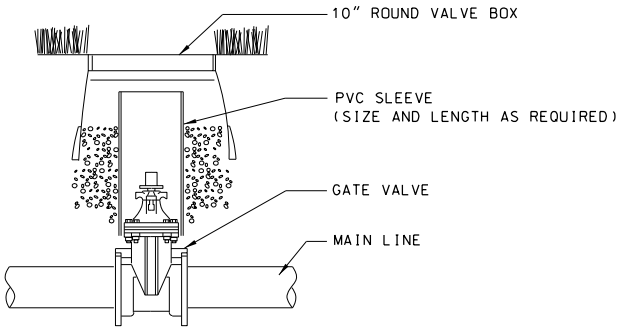
PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	29
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	HORROCKS
DESIGN BY:	
CHECKED BY:	
ADOPTED DATE:	NOVEMBER 2017



STOP & WASTE CONNECTION DETAIL

SCALE: NTS



MAINLINE ISOLATION VALVE DETAIL

SCALE: NTS

J·U·B NO SCALE

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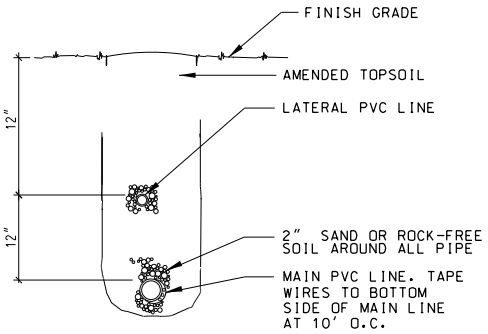
STOP & WASTE / ISOLATION VALVES

PLEASANT GROVE CITY
86 EAST 100 SOUTH

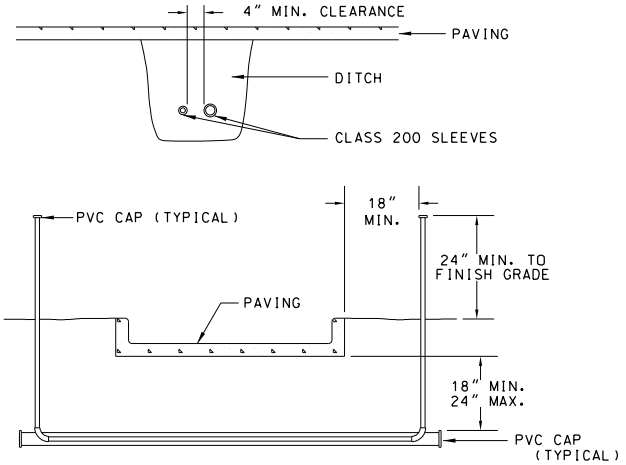
STANDARD DRAWING NUMBER: 30

CAD: PGdetails_2017.dgn
PLOT SCALE: 1.000
DRAWN BY: HORROCKS
DESIGN BY:
CHECKED BY:
ADOPTED DATE: NOVEMBER 2017



PIPE / TRENCH SECTION

SCALE: NTS



NOTE:
WHERE THERE IS MORE THAN ONE SLEEVE. EXTEND THE SMALLER SLEEVE TO 24" MINIMUM ABOVE FINISH GRADE.

SLEEVING DETAIL

SCALE: NTS

J-U-B NO SCALE

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TRENCH / SLEEVING DETAILS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 31
CAD: PGdetails_2017.dgn
PLOT SCALE: 1.000
DRAWN BY: HORROCKS
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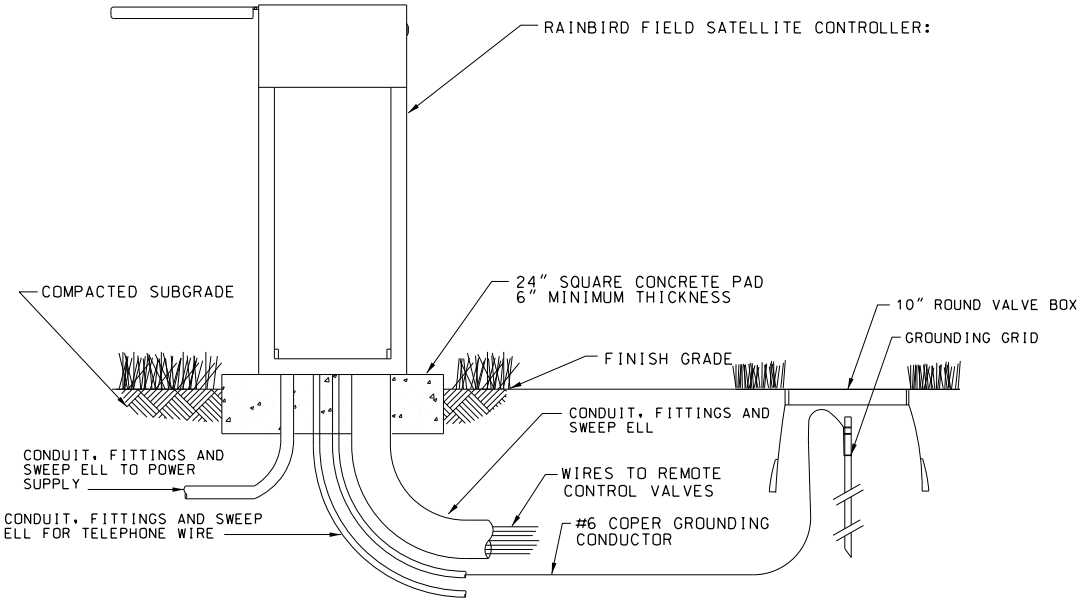
CHECKED BY:
ADOPTED DATE: NOVEMBER 2017

NOTE: MOUNT CONTROLLER PER MANUFACTURES WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH ALL LOCAL CODES. EXACT LOCATION TO BE APPROVED BY OWNER. GROUND WIRE OF 120V POWER SUPPLY TO BE CONNECTED TO GROUND SCREW OF ELECTRIC BOX. ALL WIRE EXTENDING THROUGH CONCRETE BASE SHALL BE HOUSED IN RIGID ELECTRICAL CONDUIT (SIZE AS REQUIRED). CONDUIT SHALL EXTEND A MINIMUM OF 6" BEYOND EDGE OF CONCRETE BASE PAD.



STAINLESS STEEL PEDESTAL CONTROLLER DETAIL

SCALE: NTS

J-U-B NO SCALE

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STAINLESS STEEL PEDESTAL CONTROLLER DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 32

CAD: PGdetails_2017.dgn
PLOT SCALE: 1.000
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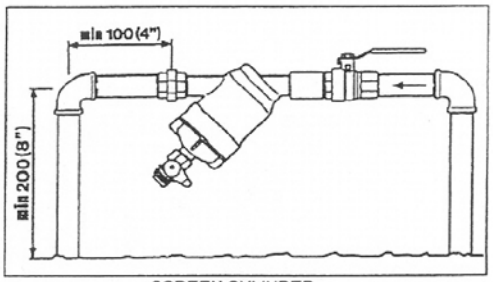
INSTALLATION AND MAINTENANCE INSTRUCTIONS
1"-Super Filters (01-1201)

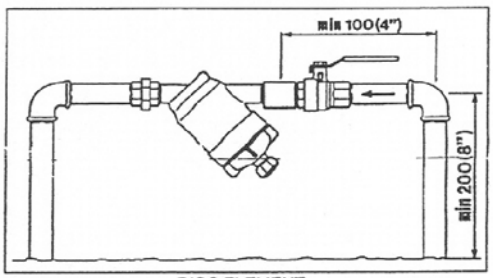
Thank you for selecting an Amiad filter. This filter has been designed to provide years of trouble free service. Please familiarize yourself with these instructions to ensure correct and reliable operation.

INSTALLATION

1. It is recommended to use plastic connectors when installing the filter onto metal pipes.
2. Use only teflon or silicon sealing material on the inlet/outlet connections. Do not use any sealing material on the plastic ball valve connection to the filter port drain. (SCREEN FILTER ONLY) This is a compression type fitting and does not require any sealing material.
3. Install a shut-off valve prior to the filter to permit cleaning.
4. It is recommended that the filter be installed with the housing downward. The filter must be installed according to the direction of water flow as shown.



SCREEN CYLINDER
(INSIDE TO OUTSIDE FLOW)



DISC ELEMENT
(OUTSIDE TO INSIDE FLOW)

NOTE:
This filter is available with a Screen Cylinder or Disc Element. Be sure the direction of flow is inside/out for the Screen Cylinder and outside/in for the Disc Element. Improper flow direction or backwash through a screen may damage the filter element. See drawing.

CLEANING

The filter requires cleaning when pressure drop between the inlet and outlet reaches 0.5-0.6 bar (7-8 psi).

WARNING: NEVER OPEN THE FILTER WHILE UNDER PRESSURE!

1. Close the water supply to the filter and release pressure from the filter by opening the drain valve.
2. Unscrew the filter housing to remove the filter element.
3. Screen Cylinder: Rinse the screen with water. Use a soft brush for hard-to-remove particles. Do not use a metal brush or damage may result.

   Disc Element: Twist the disc element core at each end and unscrew in a counter- clockwise rotation to expand and loosen the discs. Rinse along the disc edges to cause a spinning action. Hand tighten the disc element core after cleaning.
4. Insert the filter element into the housing. Verify the housing and element seals are in place. Screw on the filter housing, tightening completely, then back-off 1/8 turn for proper sealing.

IRRIGATION FILTER DETAIL

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IRRIGATION FILTER DETAIL

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	33
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PLOT SCALE:	1.000
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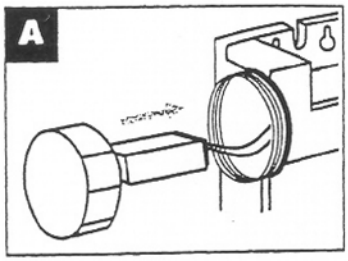

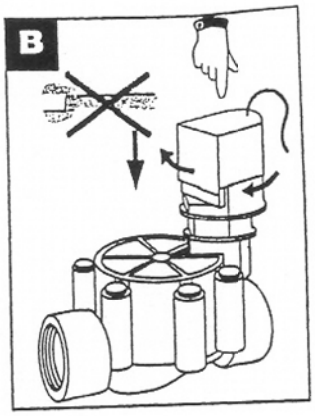

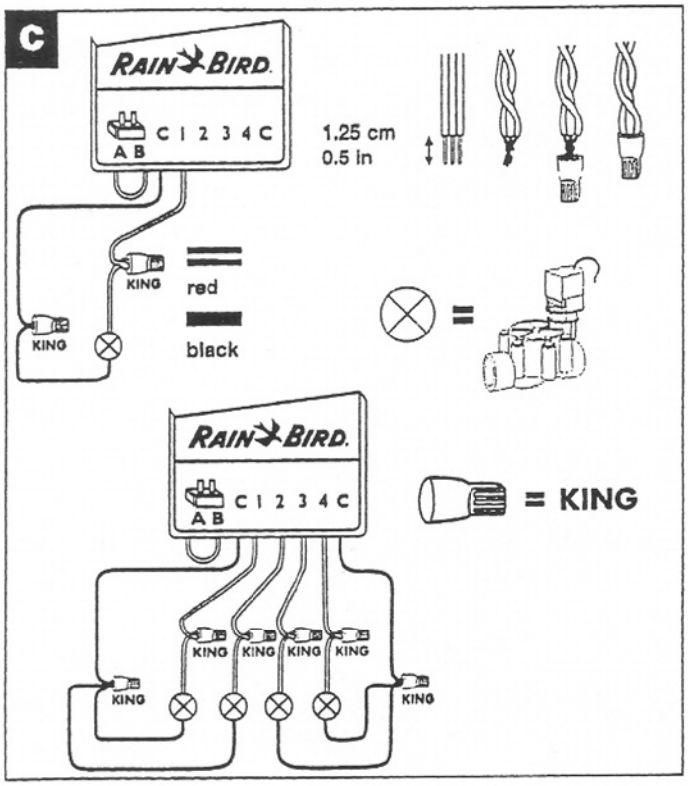

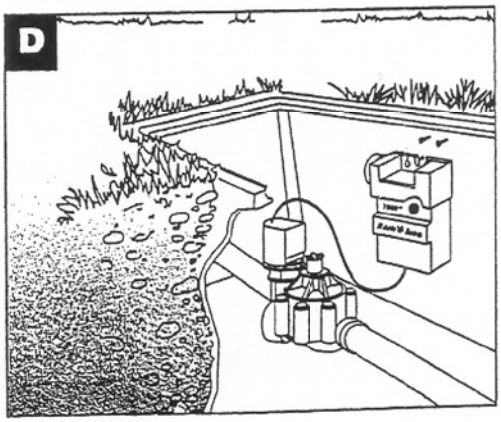

TBOS CONTROL MODULE

J-U-B

NO SCALE

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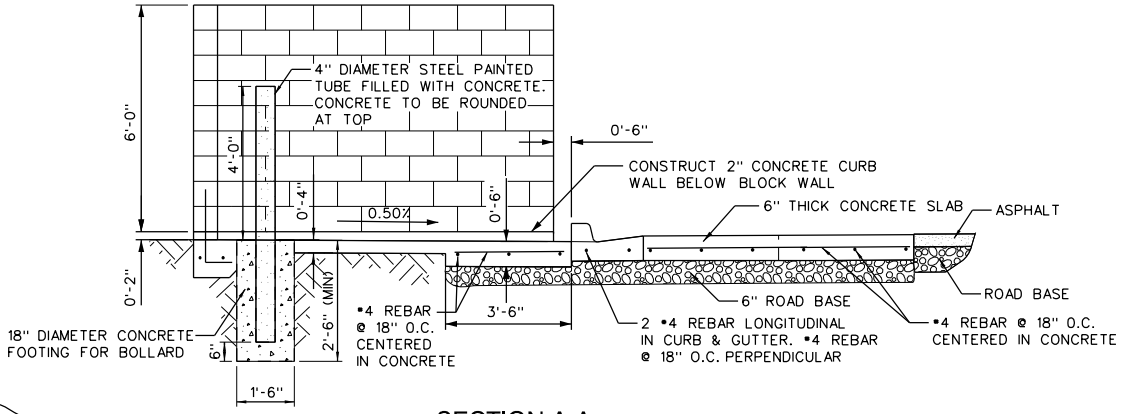
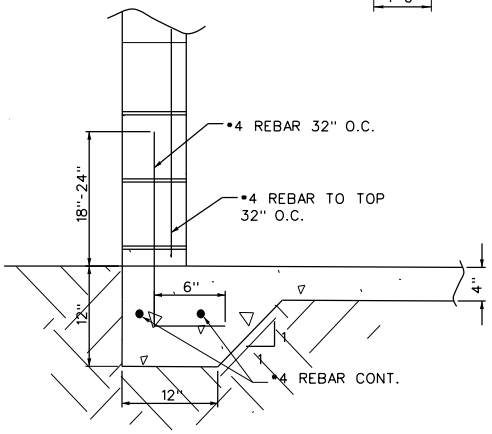
TBOS CONTROL MODULE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	34
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



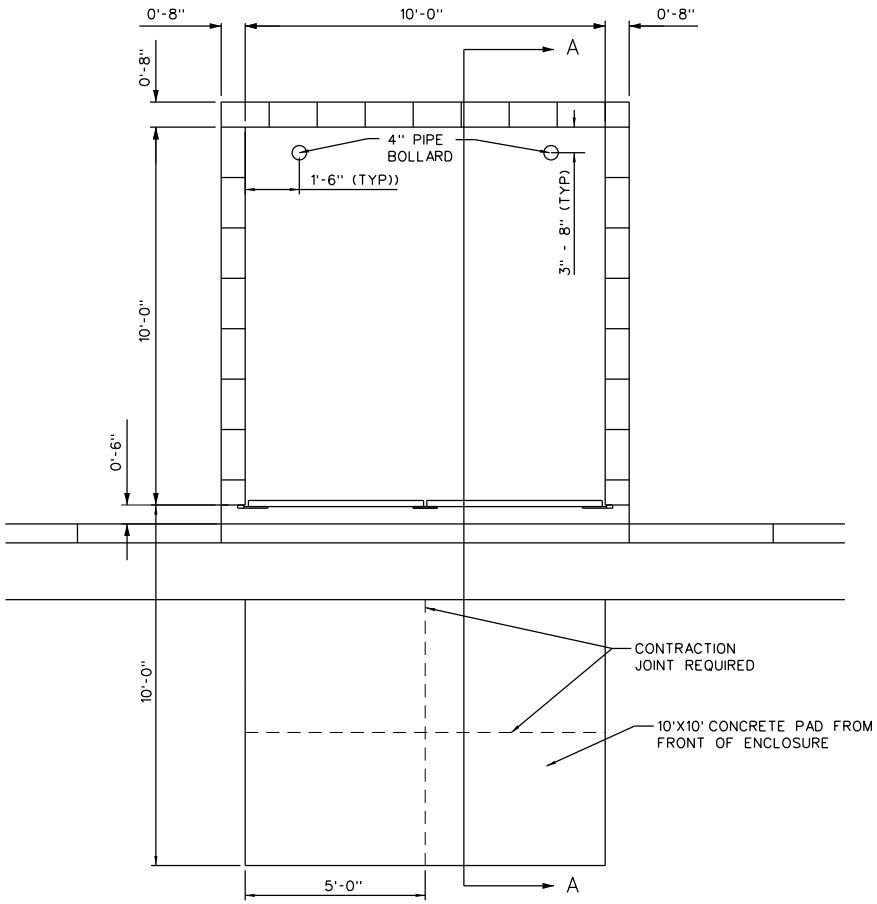
SECTION A-A



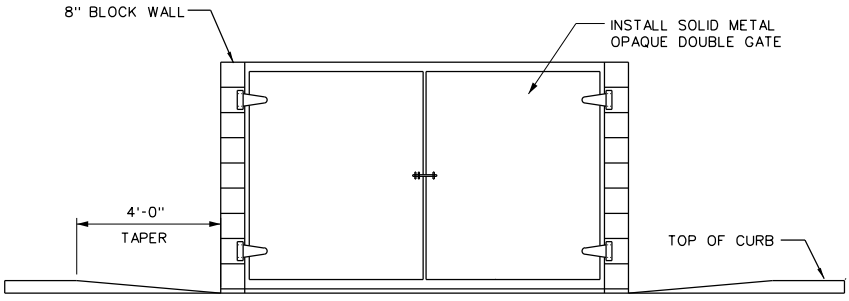
STANDARD FOOTING DETAIL
(3 SIDES UNDER BLOCK)

TRASH ENCLOSURES SHALL BE PROVIDED FOR ALL DEVELOPEMENTS IN NON-RESIDENTIAL AND MULTI-FAMILY ZONING DISTRICTS IN ACCORDANCE WITH THE FOLLOWING:

1. TRASH ENCLOSURES SHALL BE SIX FEET (6') HIGH (PLUS OR MINUS 8 INCHES), CONSTRUCTED OF MASONARY, CEMENT OR CONCRETE BLOCK AND SHALL HAVE A SOLID METAL OPAQUE GATE FOR SCREENING. THE FLOOR OF THE TRASH ENCLOSURE SHALL BE A CONCRETE PAD.
2. A SIX FOOT (6') HIGH CYCLONE FENCE WITH A SIX FOOT (6') HIGH SOLID LANDSCAPE HEDGE AND/OR BERM MAY BE SUBSTITUTED IN LIEU OF A WALL WHERE APPROPRIATE.
3. CLEAR VISIBILITY FOR ALL INTERIOR DRIVE AISLES SHALL BE MAINTAINED.
4. TRASH ENCLOSURES SHALL BE LOCATED SO AS TO MINIMIZE DISTURBANCE TO SINGLE FAMILY RESIDENTIAL DEVELOPEMENT. TRASH ENCLOSURES SHALL BE FIFTY FEET (50') AWAY FROM ANY SINGLE FAMILY RESIDENTIAL ZONING DISTRICT, UNLESS THE ADJACENT PROPERTY IS UNDEVELOPED AND THE PLANNING COMMISSION DETERMINES THAT THE SETBACK WILL NOT FUFILL ITS INTENDED PURPOSE AT THE PRESENT TIME.
5. THE PROVISION OF WEEP HOLES AT THE BOTTOM OF A TRASH ENCLOSURE IS RECOMMENDED FOR DRAINAGE PURPOSES.
6. EXTERIOR FINISH OF THE TRASH ENCLOSURE MUST MATCH THE FINISH OF THE BUILDINGS WITHIN THE DEVELOPMENT.



TRASH ENCLOSURE PLAN VIEW



TRASH ENCLOSURE FRONT VIEW

NO SCALE

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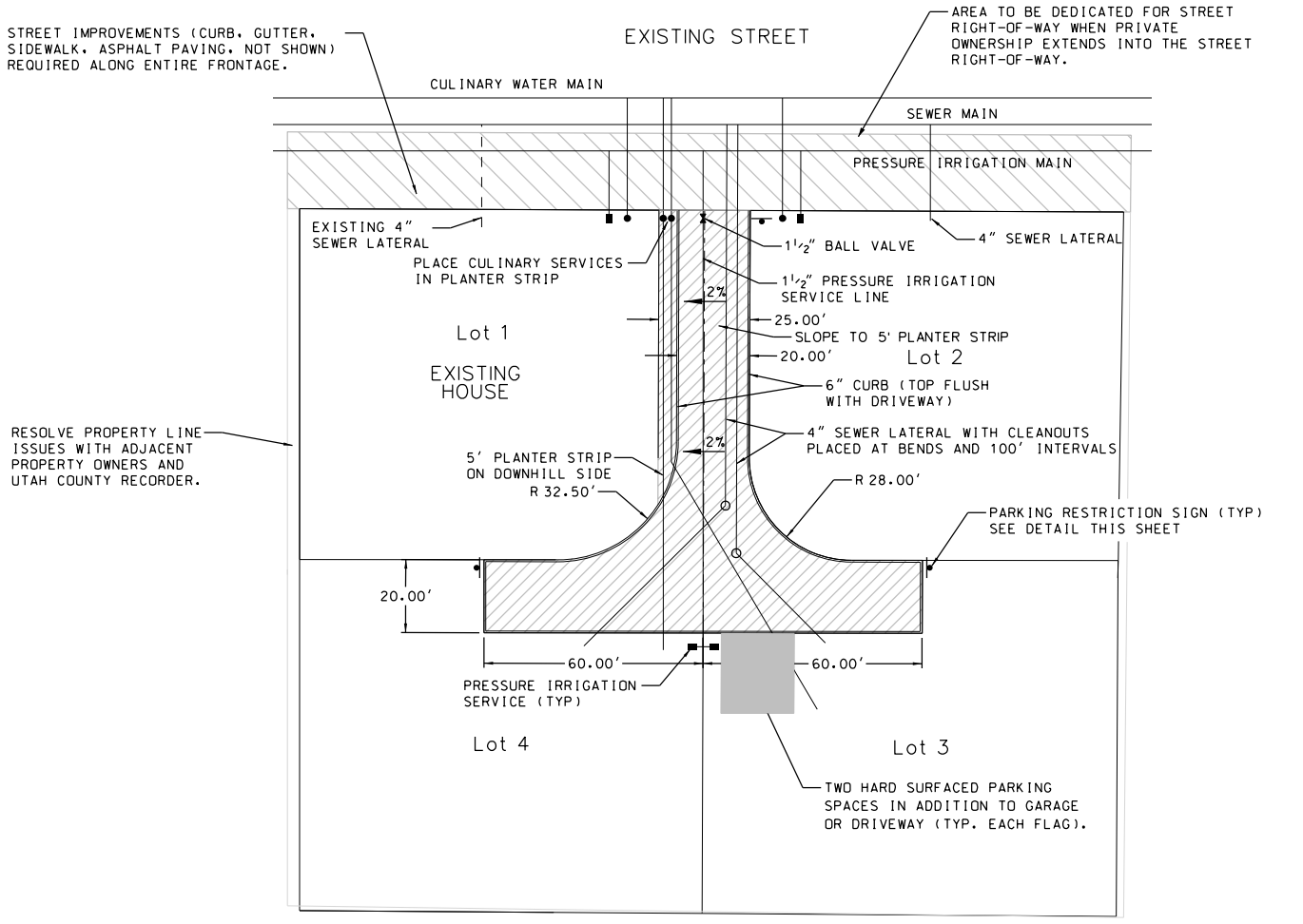
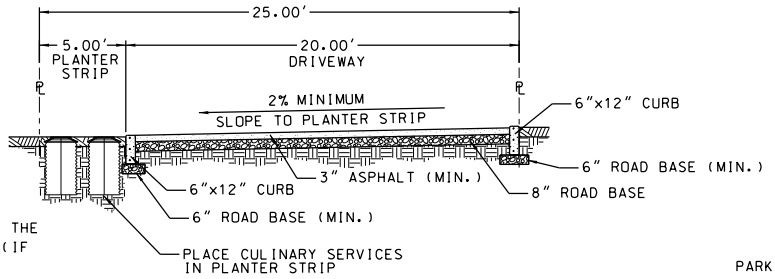
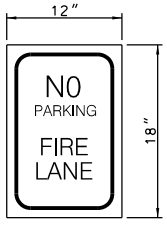
TRASH ENCLOSURE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	35
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017







PARKING RESTRICTION SIGN

NOTES:

1. THE COMMON STEM SHOWN HEREON IS THE COMMON ACCESS FOR LOTS 1 AND 2 (IF APPLICABLE), 3 AND 4.
2. THE COMMON STEM IS DEDICATED AS A PUBLIC UTILITY, SEWER, CULINARY WATER, PRESSURE IRRIGATION, AND RIGHT-OF-WAY EASEMENT.
3. ONLY A TOTAL OF 3 LOTS ARE PERMITTED TO ACCESS OFF OF THE STEM.
4. THE FOLLOWING CONDITIONS APPLY TO THE COMMON STEM:
   a. The pavement and landscaped areas of the Common Stem shall be maintained and repaired by the owners of lots 2 (if applicable), 3 & 4. This shall include, but not be limited to, snow removal, weed control, landscape maintenance, asphalt maintenance, and repaving when and as needed.
   b. The owners of Lots 2 (if applicable), 3 & 4 shall not block each others' access along this Common Stem for any reason whatsoever.
   c. Parking is not permitted in the Common Stem. Each lot being accessed by the Common Stem shall provide at least four (4) hard surfaced parking spaces on the "flag".
5. INCLUDE ITEMS 2 & 4 ON THE PLAT.

LEGEND

- COMMON STEM
- STREET DEDICATION
- PRESSURE IRRIGATION SERVICE
- PRESSURE IRRIGATION VALVE
- CULINARY WATER SERVICE
- PARKING RESTRICTION SIGN
- SANITARY SEWER CLEANOUT

J-U-B NO SCALE

REVISION

NO.	DESCRIPTION	BY	APR.	DATE

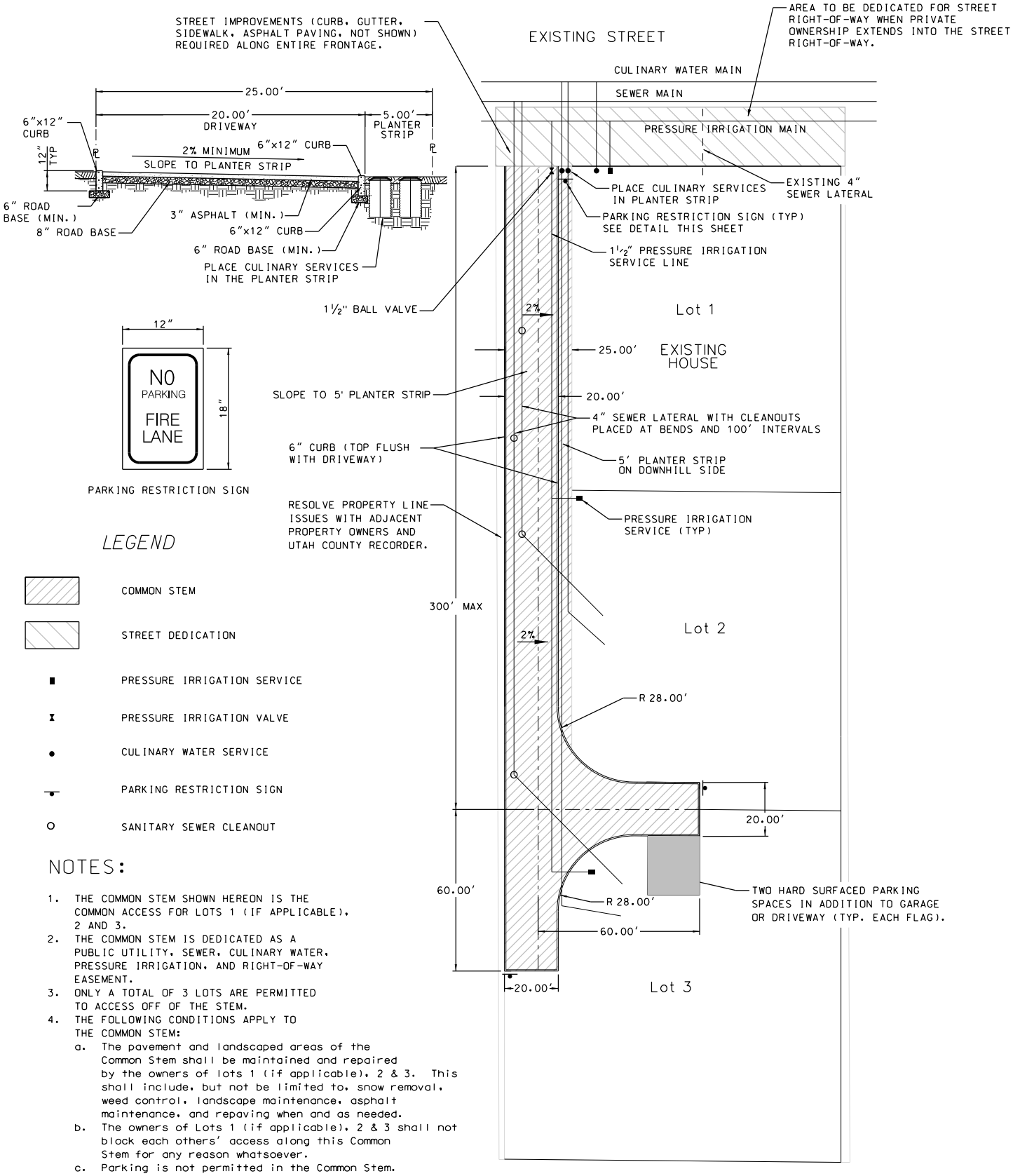
Pleasant Grove
Utah's City of Trees

FLAG LOT PLAT REQUIREMENTS USING A COMMON STEM ACCESS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 36

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



LEGEND

- COMMON STEM
- STREET DEDICATION
- PRESSURE IRRIGATION SERVICE
- PRESSURE IRRIGATION VALVE
- CULINARY WATER SERVICE
- PARKING RESTRICTION SIGN
- SANITARY SEWER CLEANOUT

NOTES:

1. THE COMMON STEM SHOWN HEREON IS THE COMMON ACCESS FOR LOTS 1 (IF APPLICABLE), 2 AND 3.
2. THE COMMON STEM IS DEDICATED AS A PUBLIC UTILITY, SEWER, CULINARY WATER, PRESSURE IRRIGATION, AND RIGHT-OF-WAY EASEMENT.
3. ONLY A TOTAL OF 3 LOTS ARE PERMITTED TO ACCESS OFF OF THE STEM.
4. THE FOLLOWING CONDITIONS APPLY TO THE COMMON STEM:
   a. The pavement and landscaped areas of the Common Stem shall be maintained and repaired by the owners of lots 1 (if applicable), 2 & 3. This shall include, but not be limited to, snow removal, weed control, landscape maintenance, asphalt maintenance, and repaving when and as needed.
   b. The owners of Lots 1 (if applicable), 2 & 3 shall not block each others' access along this Common Stem for any reason whatsoever.
   c. Parking is not permitted in the Common Stem. Each lot being accessed by the Common Stem shall provide at least four (4) hard surfaced parking spaces on the "flag".
5. INCLUDE ITEMS 2 & 4 ON THE PLAT.

NO SCALE

REVISION

NO.	DESCRIPTION	BY	APP.	DATE

Pleasant Grove
Utah's City of Trees

FLAG LOT PLAT REQUIREMENTS USING A COMMON STEM ACCESS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	37
CAD:	PGdetails_2017.dgn
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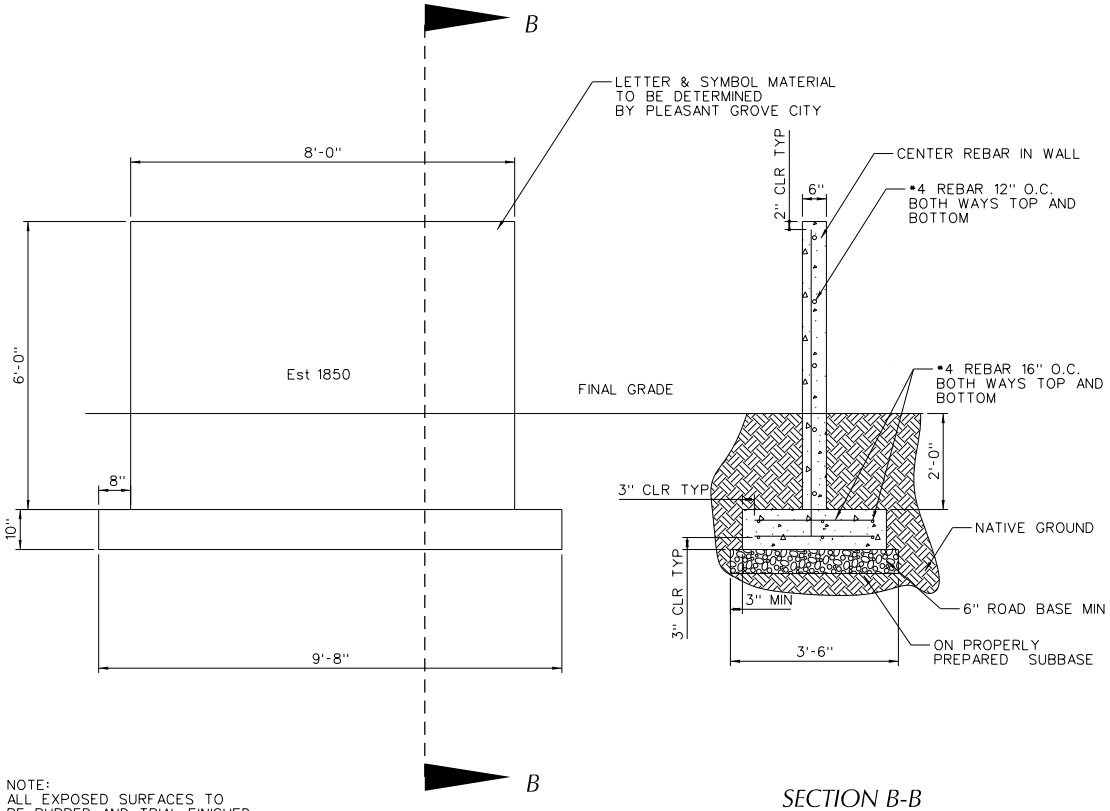
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



NOTE:
ALL EXPOSED SURFACES TO
BE RUBBED AND TRIAL FINISHED
(NO BROOM TEXTURE) AND SEALED
WITH HIGH GLOSS ACRYLIC SEALER

SECTION B-B

J-U-B

0 2' 4'

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Pleasant Grove
Utah's City of Trees

CITY SIGN MONUMENT

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	38
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
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ADOPTED DATE:	NOVEMBER 2017

DIVISION 2

PLANNING & ZONING

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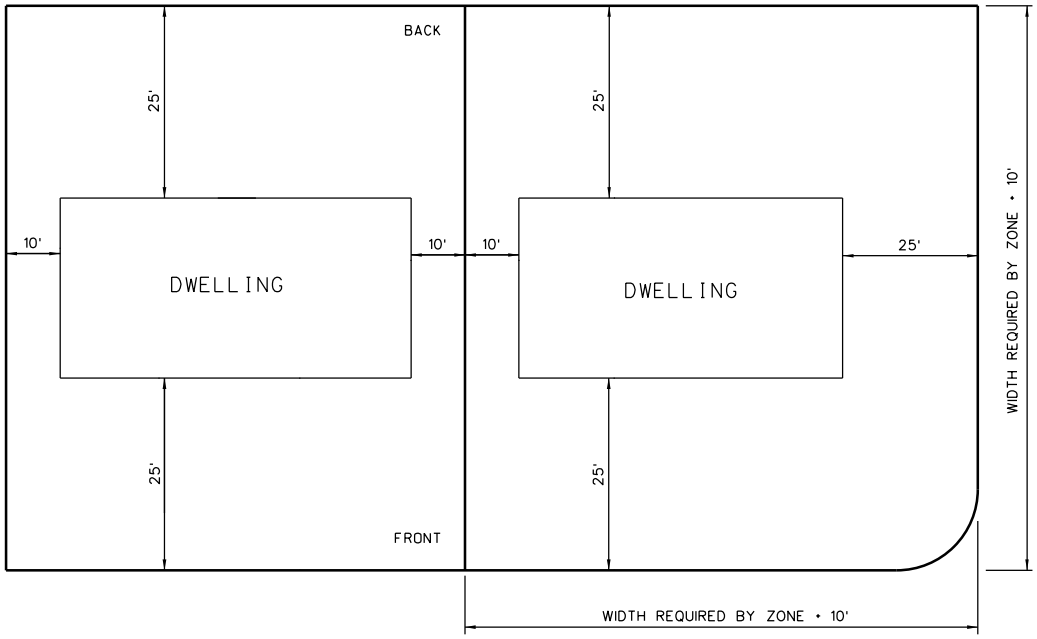
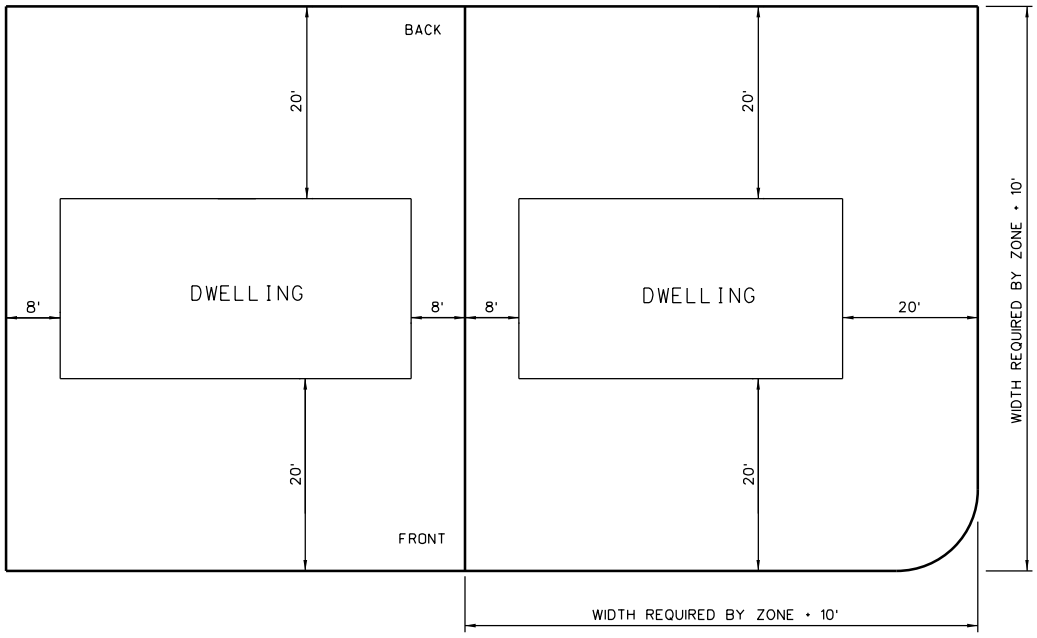
SETBACK REQUIREMENTS: R-1 PROPERTY DEVELOPEMENT STANDARDS

SINGLE-FAMILY DWELLING: INTREIOR AND CORNER LOT



SETBACK REQUIREMENTS: R1-7 PROPERTY DEVELOPEMENT STANDARDS



ALL SETBACKS SHOWN ARE MINIMUMS, UNLESS OTHERWISE NOTED.
PROPERTY LINE IS 2' BEHIND SIDEWALK.
DENSITY: AS REQUIRED BY ZONE.
LOT AREA: AS REQUIRED BY ZONE.
PERMISSIBLE LOT COVERAGE: AS REQUIRED BY ZONE.
ON-SITE PARKING: 2 SPACES (MINIMUM)
*ACCESSORY BUILDING SETBACKS AS REQUIRED BY ZONE.
ALL UTILITIES UNDERGROUND
NOTE: THESE DRAWINGS ARE FOR ILLUSTRATION PURPOSES ONLY.

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Pleasant Grove
Utah's City of Trees

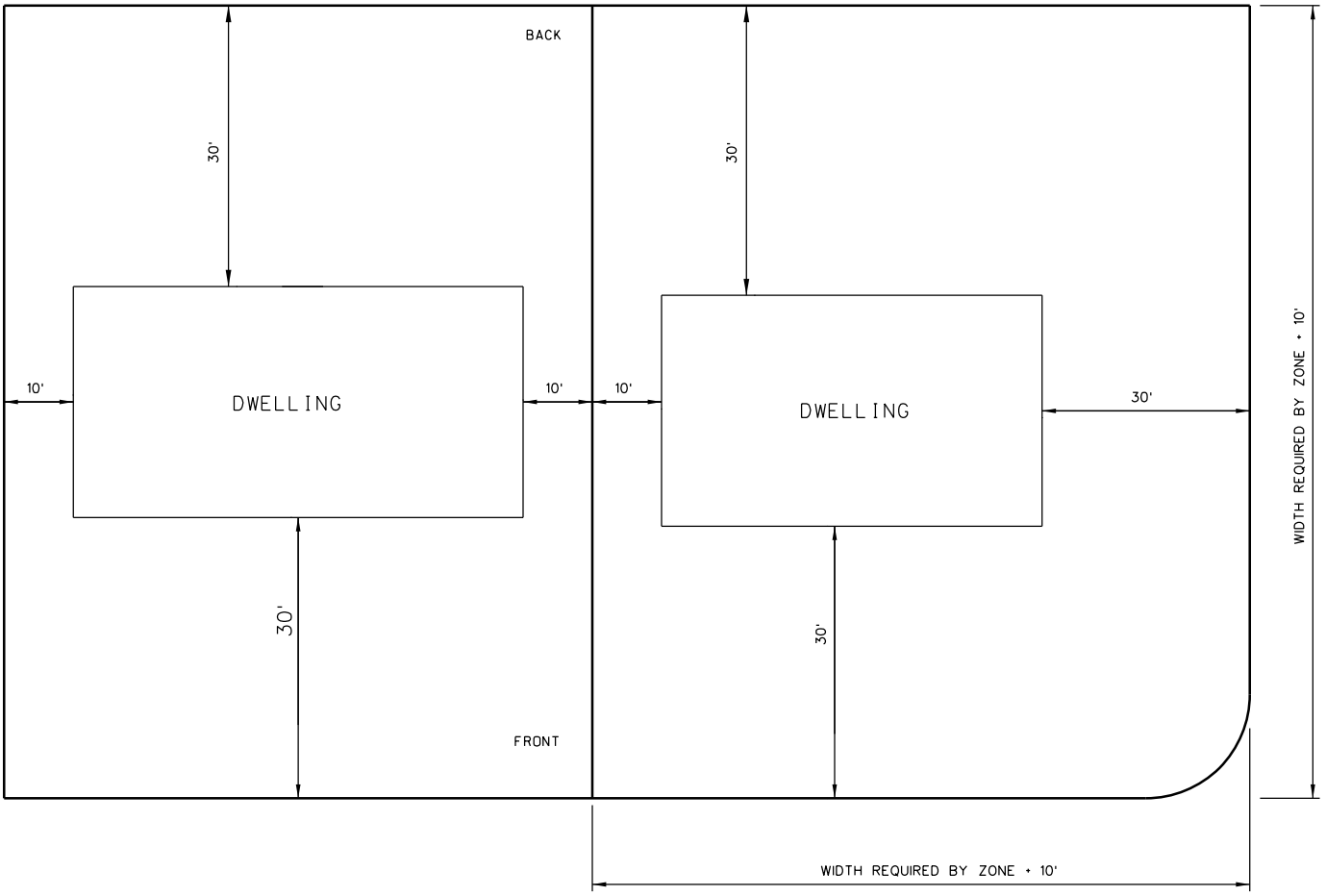
SETBACK REQUIREMENTS
R-1 & R1-7 ZONES

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER:	100
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017

SETBACK REQUIREMENTS: A–1 & R–R PROPERTY DEVELOPEMENT STANDARDS

SINGLE–FAMILY DWELLING: INTERIOR AND CORNER LOT



ALL SETBACKS SHOWN ARE MINIMUMS, UNLESS OTHERWISE NOTED.
PROPERTY LINE IS 2' BEHIND SIDEWALK.
DENSITY: AS REQUIRED BY ZONE.
LOT AREA: AS REQUIRED BY ZONE.
PERMISSIBLE LOT COVERAGE: AS REQUIRED BY ZONE.
ON-SITE PARKING: 2 SPACES (MINIMUM)
•ACCESSORY BUILDING SETBACKS AS REQUIRED BY ZONE.
ALL UTILITIES UNDERGROUND
NOTE: THESE DRAWINGS ARE FOR ILLUSTRATION PURPOSES ONLY.

J-U-B NO SCALE

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Pleasant Grove
Utah's City of Trees

SETBACK REQUIREMENTS
A-1 & R-R ZONES

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 101

CAD:	PGdetails_2017.dgn
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DRAWN BY:	EEA
DESIGN BY:	EEA
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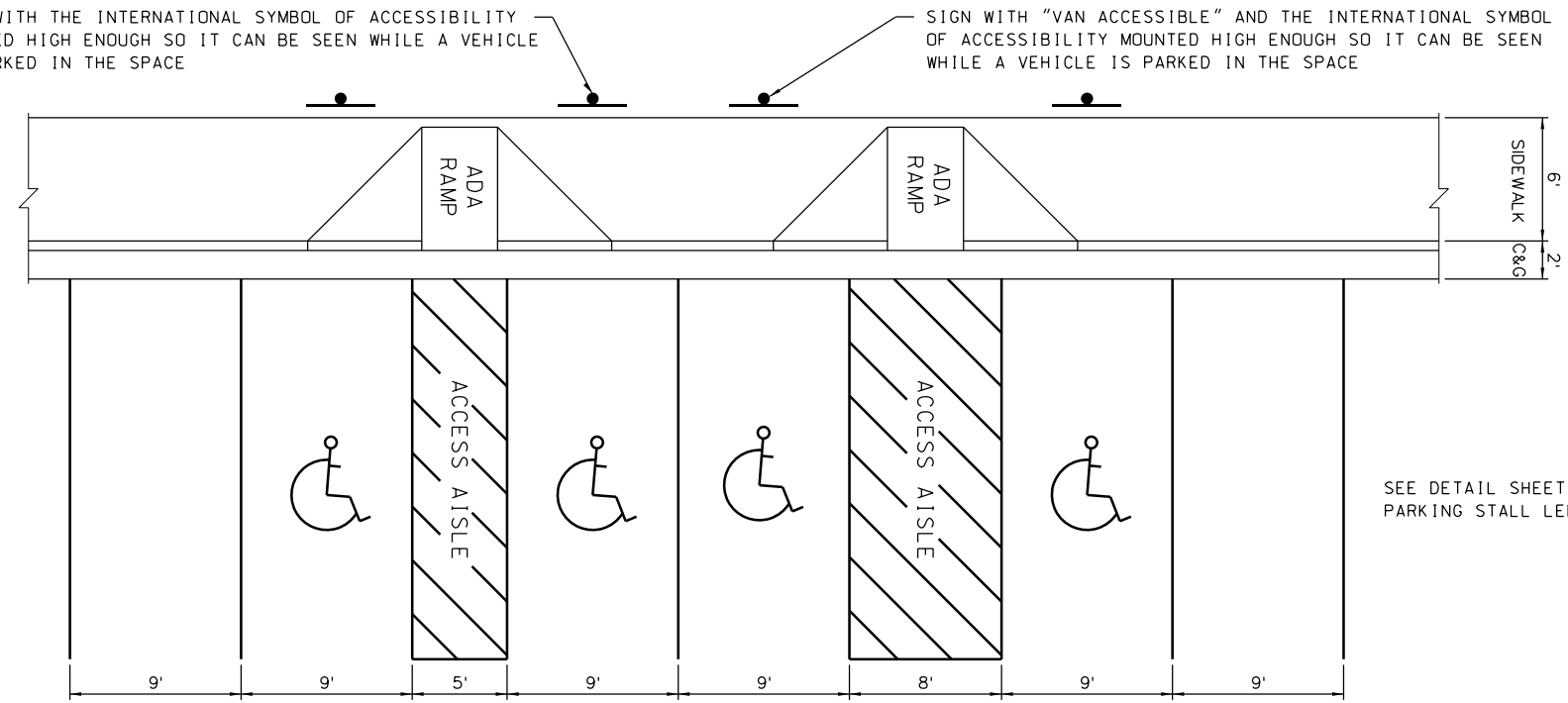
ADOPTED DATE:	NOVEMBER 2017



SEE DETAIL SHEET 103 FOR PARKING STALL LENGTHS

NOTES:

1. ACCESSIBLE PARKING AS CLOSE TO BUILDING AS POSSIBLE.
2. DESIGNATED RESERVED SIGN BY EACH SPACE.
3. EACH PARKING LOT SHALL HAVE A MINIMUM OF ONE (1) "VAN ACCESSIBLE" SPACE
4. ONE IN EVERY EIGHT (8) ACCESSIBLE SPACES SHALL HAVE AN ACCESS AISLE 8'-0" WIDE AND SHALL BE SIGNED " VAN ACCESSIBLE".
5. SIGNS SHALL HAVE THE "ACCESSIBLE SYMBOL" WITH "VAN ACCESSIBLE" INDICATED BELOW.
6. RAMP MAXIMUM SLOPE 12:1.
7. OTHER AS REQUIRED BY ADA STANDARDS.

MINIMUM NUMBER OF ACCESSIBLE PARKING SPACES

ADA STANDARD FOR ACCESSIBLE DESIGN 4.1.2(5)

TOTAL NUMBER OF PARKING SPACES PROVIDED (PER LOT)	TOTAL MINIMUM NUMBER OF ACCESSIBLE PARKING SPACES (60" & 96" AISLES)	VAN ACCESSIBLE PARKING SPACES WITH MIN. 96" WIDE ACCESS AISLE	ACCESSIBLE PARKING SPACES WITH MIN. 60" WIDE ACCESS AISLE
	COLUMN A		
1 TO 25	1	1	0
26 TO 50	2	1	1
51 TO 75	3	1	2
76 TO 100	4	1	3
101 TO 150	5	1	4
151 TO 200	6	1	5
201 TO 300	7	1	6
301 TO 400	8	1	7
401 TO 500	9	2	7
501 TO 999	2% OF TOTAL PARKING PROVIDED IN EACH LOT	1/8 OF COLUMN A *	7/8 OF COLUMN A **
1000 AND OVER	20 PLUS 1 FOR EACH 100 OVER 1000	1/8 OF COLUMN A *	7/8 OF COLUMN A **

* ONE OUT OF EVERY 8 ACCESSILBE SPACES ** 7 OUT OF EVERY 8 ACCESSIBLE PARKING SPACES

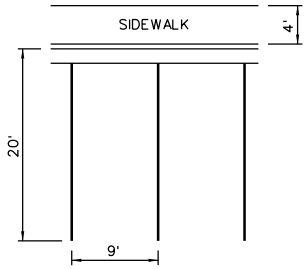
NO.	DESCRIPTION	BY	APP'D	DATE
	REVISION			

Pleasant Grove
Utah's City of Trees

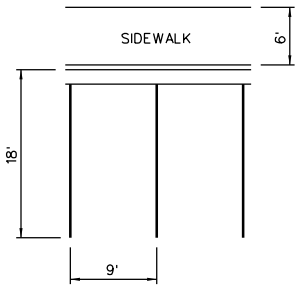
ADA PARKING & PASSENGER LOADING ZONE

PLEASANT GROVE CITY
86 EAST 100 SOUTH

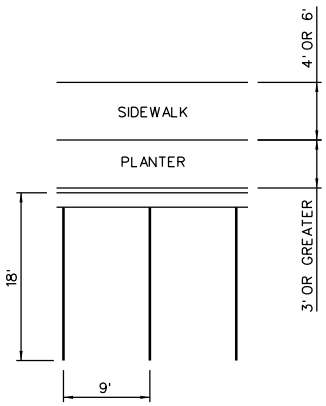
STANDARD DRAWING NUMBER:	102
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



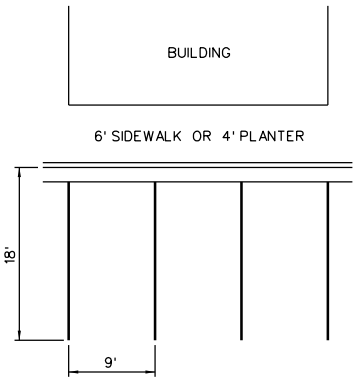
4" SIDEWALK



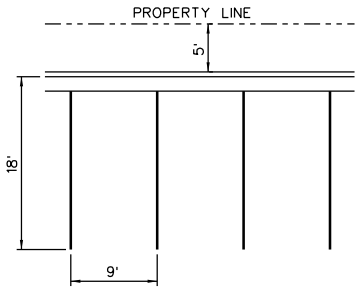
6" SIDEWALK



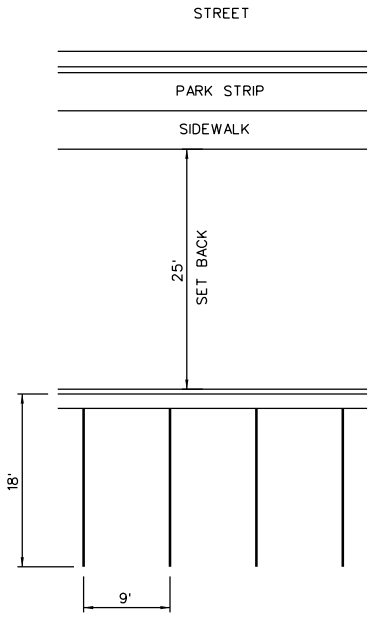
4' OR 6' SIDEWALK,WITH
3' OR GREATER PLANTER



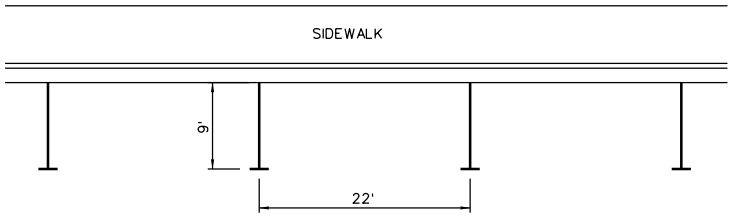
BUILDING OR PLANTER



SIDE OR REAR PROPERTY LINE



FRONT YARD SET BACK



PARALLEL PARKING STALL

J-U-B

0 10'

STATEMENT OF USE

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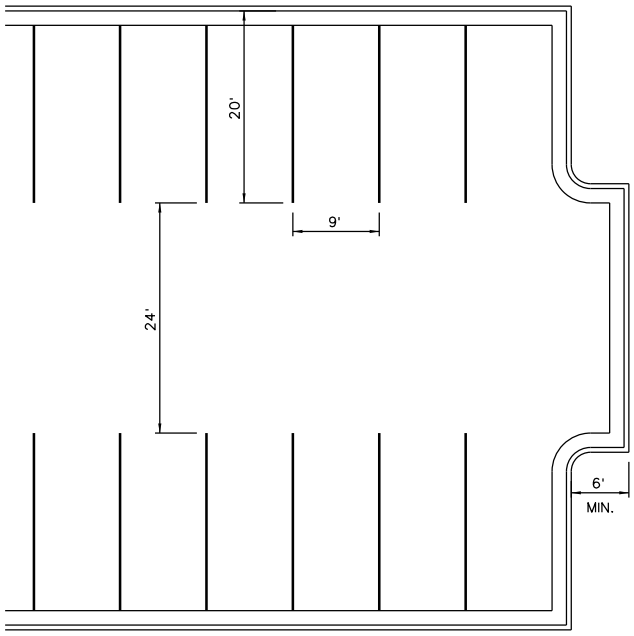
NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

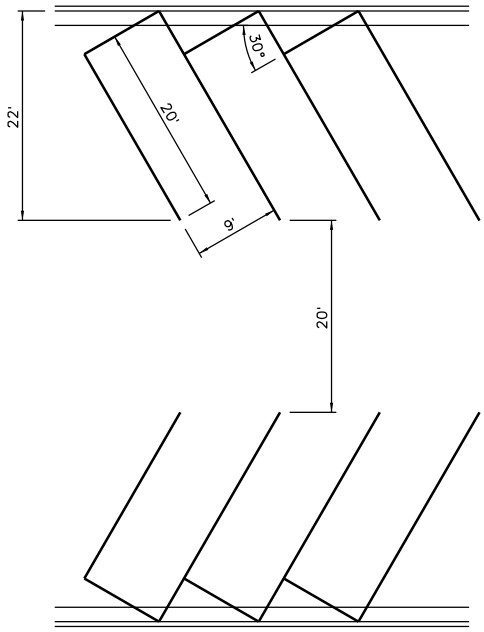
PARKING STALL LAYOUT & DIMENSIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

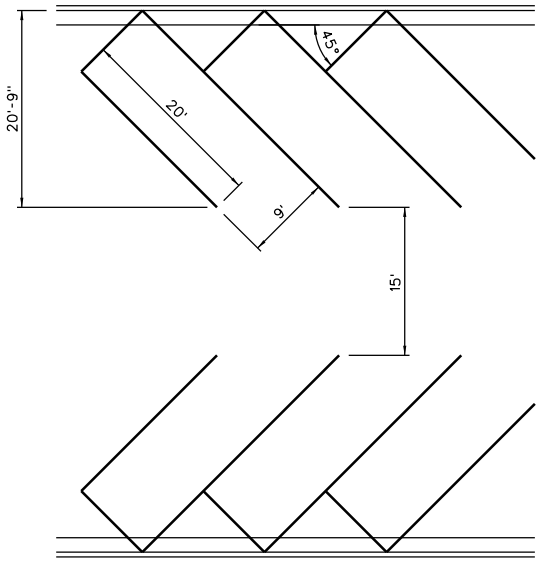
STANDARD DRAWING NUMBER:	103
CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017



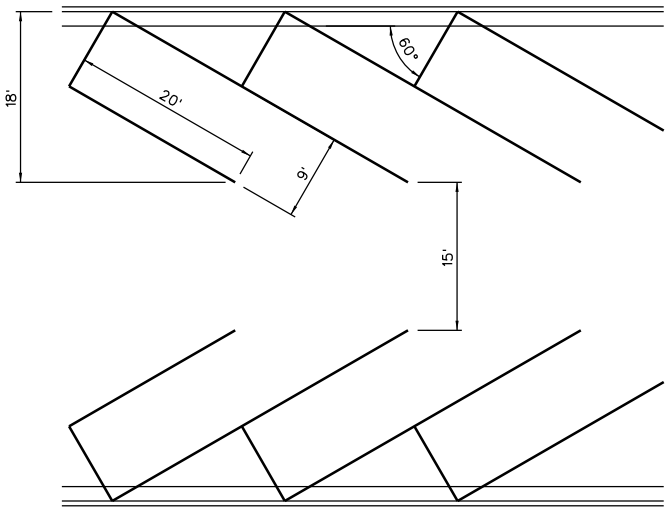
90° STALL & TURN AROUND



30° DIAGONAL STALL



45° DIAGONAL STALL



60° DIAGONAL STALL

J·U·B

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NO.	DESCRIPTION	BY	APR.	DATE

Pleasant Grove
Utah's City of Trees

PARKING STALL LAYOUT & DIMENSIONS

PLEASANT GROVE CITY
86 EAST 100 SOUTH

STANDARD DRAWING NUMBER: 104

CAD:	PGdetails_2017.dgn
PLOT SCALE:	1.000
DRAWN BY:	EEA
DESIGN BY:	EEA
CHECKED BY:	KNC
ADOPTED DATE:	NOVEMBER 2017

APPENDIX A

STORM WATER TECHNICAL MANUAL & BEST MANAGEMENT PRACTICES

PART 3
STORM WATER TECHNICAL MANUAL

A. INTRODUCTION

The Storm Water Technical Manual contains requirements for land development and construction activities, as well as design criteria and guidelines for those performing such activities. It includes best management practices applicable to development and construction activities. It also includes the plan submittal requirements. The City Engineer has authority to modify the requirements of the Storm Water Technical Manual as needed to accomplish reasonable and effective storm water pollution prevention objectives.

B. REQUIREMENTS FOR PROPOSED DEVELOPMENTS

1. Incorporate best management practices (BMPs) into development design to limit quantity of runoff and preserve quality of runoff

Storm water best management practices (BMPs) must be considered throughout the development process. PART 4, CONSTRUCTION AND POST CONSTRUCTION BEST MANAGEMENT PRACTICES of the Pleasant Grove Storm Water Management Program contains fact sheets for BMPs whose use Pleasant Grove City encourages. Section F.2, Storm Water Quality Criteria of this Storm Water Technical Manual identifies BMPs that are required on all Construction Site Storm Water Management Plans.

2. Prepare Construction Site Storm Water Management Plan

A Construction Site Storm Water Management Plan must be prepared and submitted with the development plans for approval. This requirement applies to all developments (other than construction of a single family house, with associated on-site improvements). See section G of this chapter, CONSTRUCTION SITE STORM WATER MANAGEMENT PLAN CONTENTS for the required contents of the plan.

3. Provide financial guarantee that improvements contained in the Construction Site Storm Water Management Plan will be installed and maintained

Financial guarantee must be posted with Pleasant Grove City prior to beginning construction. In the case of a subdivision of land, this will be included in the bond that is required for the cost of the subdivision improvements. In the case of site improvements, rather than a financial guarantee, non-monetary methods of

enforcement already in place in Pleasant Grove City (business licenses, utility services, building and occupancy permits) are available to encourage compliance with the improvements contained in the approved Construction Site Storm Water Management Plan.

At the time of development, the developer shall provide an estimate of the cost of the required improvements. The City will review the estimate and establish the dollar amount of the financial guarantee.

4. Prepare Post Construction Storm Water Management Plan

A Post Construction Storm Water Management Plan must be prepared and submitted with the development plans for approval. This requirement applies to all developments in which private improvements are constructed (except construction of single family houses, with associated on-site improvements). See section H of this chapter, POST CONSTRUCTION STORM WATER MANAGEMENT PLAN CONTENTS for the required contents of the plan.

5. Obtain UPDES Permit (all sites having land disturbance area equal to or greater than 1 acre)

Developments having a disturbed area of 1 acre or more require a UPDES Storm Water General Permit for Construction activities from the Division of Water Quality of the Department of Environmental Quality of the State of Utah.

Obtaining the permit requires preparation of a Storm Water Pollution Prevention Plan (we would expect that the Construction Site Storm Water Management Plan previously described would suffice) and a Notice of Intent. The permit form is available on the Internet in PDF format at http://www.deq.state.ut.us/eqwq/updes/swconst.pdf. The developer must submit a copy of the Notice of Intent to the City before the site plan or improvement plans will be considered finalized.

Note that when a development of over 1 acre in size is phased, the permit is required for each phase, even if each phase is less than 1 acre in size.

C. REQUIREMENTS FOR CONSTRUCTION ACTIVITIES (OTHER THAN THOSE ASSOCIATED WITH INDIVIDUAL RESIDENTIAL STRUCTURES)

1. Provide instruction to construction site operators regarding the Construction Site Storm Water Management Plan

Prior to beginning work, developers and contractors must provide appropriate instruction to on-site construction supervisors and operators, regarding the requirements of the Construction Site Storm Water Management Plan. A copy of the approved plan must be present at the construction site.

2. Following Construction Site Storm Water Management Plan

The improvements shown in the approved Construction Site Storm Water Management Plan must be constructed as indicated in the plan. The appropriate activities outlined in the Construction Site Storm Water Management Plan must be performed prior to any other construction activities on the site. Pleasant Grove City encourages modifications to the plan when needed to improve storm water management in light of site conditions. However, variations from the plan that reduce or eliminate elements of the plan must only be done with the approval of the Pleasant Grove City Public Works Representative or City Engineer.

3. Monitor effectiveness of the elements included in the Construction Site Storm Water Management Plan, and make improvements as necessary to achieve the plan objectives.

After initial implementation of the improvements outlined in the approved Construction Site Storm Water Management Plan, rainfall activity will provide opportunity to observe the effectiveness of the storm water management improvements. Those responsible for construction activities must monitor the in-place storm water management improvements to assess their effectiveness; they must then make adjustments to the improvements as needed to accomplish effective storm water management.

4. Provide verification that improvements were constructed as approved

Following implementation of the improvements contained in the Construction Site Storm Water Management Plan, the preparer of the plan shall provide Pleasant Grove City with a statement as to the condition of the improvements contained in the plan. The statement shall be made on a copy of the Construction Site Storm Water Management Plan document, and shall be signed.

If the improvements were constructed as approved, it shall include language verifying such. If the improvements were not constructed as approved, it shall state the differences, the reason for the differences, and provide an opinion as to the adequacy of the constructed improvements. This statement must be provided to Pleasant Grove City at the time record drawings are submitted (in the case of public improvements) or prior to issuance of an occupancy permit (in the case of private site improvements)

D. REQUIREMENTS FOR CONSTRUCTION ACTIVITIES ASSOCIATED WITH INDIVIDUAL RESIDENTIAL STRUCTURES

1. Construction Site Storm Water Management Plan

While the Public Works Representative or City Engineer may require that a Construction Site Storm Water Management Plan be created on individual residential lots in special circumstances, generally no lot-specific plan is required.

2. Sediment Control on Small Construction Sites

The BMP fact sheet for Sediment Control on Small Construction Sites (SCSCS) is to be included as a part of the building permit. This BMP applies to construction and landscaping activities associated with individual residential structures, and shall be followed.

3. Owner or operator shall make adjustments to practices as needed to prevent storm water pollution

Sediment that is left in the street or on adjacent lots is evidence of inadequate sediment control. Where storm water pollution prevention measures are inadequate, or are not being properly followed, the Public Works Representative, Community Development Representative or City Engineer may refuse to perform inspections or shut down work on the project.

E. REQUIREMENTS FOR EXISTING DEVELOPMENTS

1. Following approved Post Construction Storm Water Management Plan

The owners of existing developments are responsible to maintain improvements and observe practices that were part of an approved Post Construction Storm Water Management Plan. Failure to adhere to the plan may result in failure of the City to renew business licenses, fines or other action as prescribed by Pleasant Grove City Code.

2. Operator or owner makes adjustments to practices or improvements when necessary to achieve Post Construction Storm Water Management Plan objectives

Pleasant Grove City encourages adjustments to the plan that enhance effective storm water management. However, significant reduction of practices contained in the plan is to be accomplished through formal modification of the plan and resubmission to the Development Review Committee (or designee) for approval.

F. STORM WATER PERFROMANCE CRITERIA AND DESIGN GUIDELINES

The following storm drainage criteria and design guidelines apply to all storm drainage plans in Pleasant Grove and shall be used in storm drainage calculations. The City Engineer has authority to modify the criteria and guidelines as needed to meet changing or unusual needs or conditions.

1. Storm water quantity criteria & design guidelines

A. Design Storm
   i. Frequency
      a. Design piping system for a 25-year storm and detention for a 10-year storm
      b. Control the point of discharge and the flooding hazard of a 100-year storm
   ii. Depth and Intensity—per the following tables:

Design Rainfall Depths (Inches) for the Given Duration

Duration	10 Year	25 Year	50 Year	100 Year
5 min	0.276	0.328	0.377	0.436
10 min	0.428	0.509	0.585	0.677
15 min	0.542	0.644	0.741	0.858
30 min	0.751	0.893	1.027	1.190
60 min	0.950	1.130	1.300	1.510
2 hours	1.078	1.281	1.461	1.690
3 hours	1.169	1.387	1.574	1.800
6 hours	1.350	1.600	1.800	2.020
12 hours	1.750	2.060	2.260	2.520
24 hours	2.100	2.500	2.700	3.230

Design Rainfall Intensities (inches per hour) for the Given Duration

Duration	10 Year	25 Year	50 Year	100 Year
5 min	3.325	3.952	4.542	5.253
10 min	2.563	3.048	3.503	4.054
15 min	2.168	2.576	2.964	3.432
30 min	1.502	1.786	2.054	2.380
60 min	0.950	1.130	1.300	1.510
2 hours	0.539	0.641	0.731	0.845
3 hours	0.390	0.462	0.525	0.600
6 hours	0.225	0.267	0.300	0.337
12 hours	0.146	0.172	0.188	0.210
24 hours	0.088	0.104	0.113	0.135

B. Runoff Coefficients

The design engineer is to calculate a composite runoff coefficient based on surface type and associated runoff coefficient, weighted by the area of each surface type.

C. Inlet Spacing

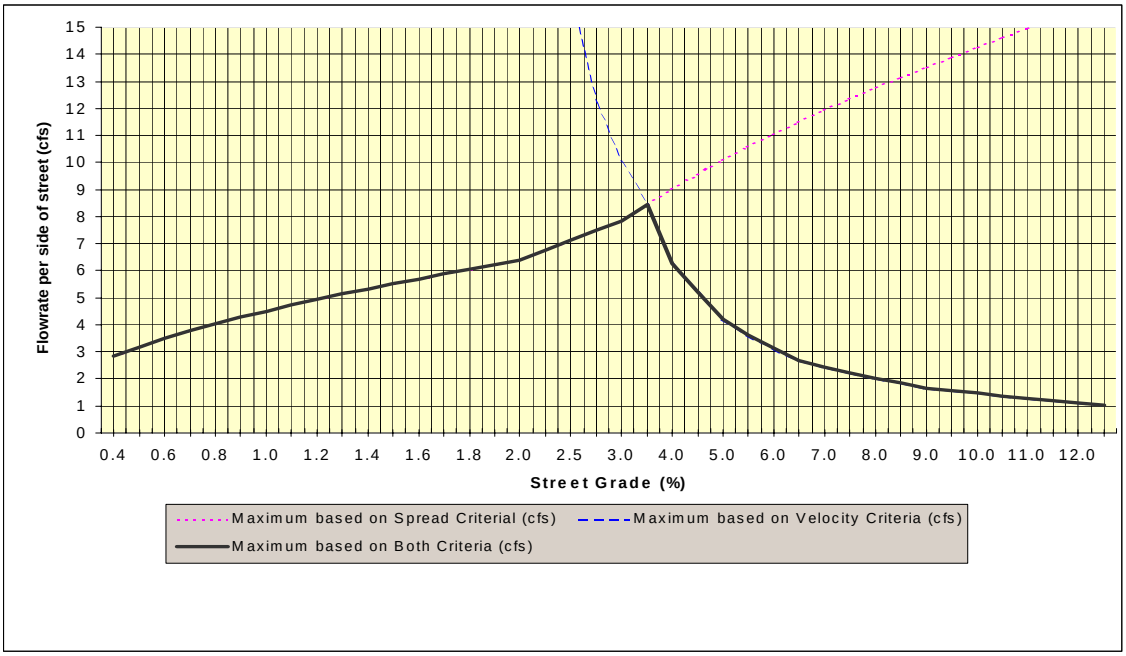
Two criteria must be met:

i. Spread of water in the street—storm water must be delivered from the street into an underground piped system when the spread of water in the street covers the outside 10 feet of asphalt. This will leave two 7-foot traffic lanes in local streets and three 10-foot traffic lanes in collector streets that are not submerged.

ii. Gutter velocity—water must be delivered from the street into an underground piped system when the velocity of water in the deepest part of the gutter reaches 10 feet per second (as a safety consideration).

Each of these requirements is a function of street slope and storm water flow rate. Storm water must be delivered from the street to storm drains when flows reach amounts shown in the following graph:

Maximum Flow Rates Allowed in Streets (25-year storm)



Note: The spread of water in the street is calculated using the Manning Equation in the form developed by Izzard, with a roughness coefficient of 0.013 and the standard street cross section. The velocity criteria calculates the velocity at the deepest part of the gutter with the Manning's Equation, with a roughness coefficient of 0.013, and using a depth at a point six inches from the face of the curb as the hydraulic radius.

D. Inlet Capacity

The designer is to assume 50% blockage of inlets when considering storm drain inlet capacity.

E. Detention

Storm water must be detained such that the peak flow rate released from the site does not exceed 0.15 cubic feet per second per acre (cfs/acre). The following limitations apply to detention basins:

i. No part of the bottom of a landscaped detention area may be flatter than 3%.
ii. Within 10 feet of the outlet, the slope of a landscaped basin bottom must not be flatter than 5% unless a concrete apron is constructed around the outlet.
iii. Excluding areas within 10 feet of the outlet, the maximum allowable depth of the basin is 3 feet.
iv. Storm drain pipes are to continue through detention areas to allow low flows to proceed through the storm drainage system without having to come to the surface. These low flows must still pass through the outlet restriction that limits runoff rates.
v. Basins are to be designed such that water does not run into them after they reach a maximum depth (unless a free flowing overflow is provided)—this can often be controlled by the elevation of an inlet box in the street adjacent to the basin.
vi. The design drawings for the basin shall include the total basin area, side slopes and width of the berm or height of retaining walls if used, basin depth, storage capacity curve, and design details of the outlet control structure including orifice plate installation.
vii. Side slopes shall not be steeper than 3-feet horizontal to 1-foot vertical (3:1).

2. Storm water quality criteria

A. Storm Water Treatment

Prior to discharging storm water, it must be treated to reduce illicit discharges of sediment, oils, floatables and other pollutants. The treatment method must be approved by the City.

B. Use of Best Management Practices

Pleasant Grove City encourages the use of the BMP fact sheets included in PART 4, CONSTRUCTION AND POST CONSTRUCTION BEST MANAGEMENT PRACTICES. **The following BMPs are required to be a part of all Construction Site Storm Water Management Plans:**

* BMP Inspection & Maintenance	BMPIM
* Concrete Waste Management	CWM
* Dust Controls	DC
* Hazardous Waste Management	HWM
* Material Storage	MS
* Portable Toilets	PT
* Spill Clean-Up	SCU
* Vehicle and Equipment Cleaning	VEC
* Vehicle and Equipment Fueling	VEF

There is no list of BMPs that is required on all Post Construction Storm Water Management Plans.

In addition to the required BMPs listed above, other BMPs from PART 4 that apply to a given development should be used. Pleasant Grove City also encourages the use of practices in addition to those contained in the Pleasant Grove Storm Water Management Program that may be suitable for a given development. Engineering judgment must be used in selecting BMPs for a given development.

C. Prohibited Practices

The following practices are specifically prohibited:

- Soil or construction materials may not be piled in streets
- Soil bridges over curb and gutter may not be constructed

G. CONSTRUCTION SITE STORM WATER MANAGEMENT PLAN CONTENTS

1. Purpose of the Construction Site Storm Water Management Plan

The purpose of the Construction Storm Water Management Plan is to control storm water runoff and reduce pollutants in storm water runoff during construction by accomplishing the following:

A. Controlling soil erosion
B. Controlling discharge of sediment into storm drainage facilities or onto adjacent properties
C. Prevent illicit discharges into on-site soils, into storm drainage facilities or onto adjacent properties
D. Prevent uncontrolled discharge of storm water to adjacent property
E. Controlling construction waste
F. Controlling dust

2. Contents of the Construction Site Storm Water Management Plan

The Construction Storm Water Management Plan is to be submitted with the site plans or improvement plans, and is to contain at least the following elements:

A. Existing and proposed contours as shown on the grading plan
B. Existing and proposed storm drainage improvements
C. Best management practices to accomplish the purpose of the plan--show the following for each BMP specified, as applicable:
    i. Location and extent of specified BMP
    ii. Timing of implementation, possibly in terms of planting season or number of days following commencement of grading
    iii. Duration of implementation
    iv. Any information in addition to or different from that shown on the BMP fact sheet as necessary to employ the BMP on the site
D. BMP Fact sheets or other descriptive material for all specified BMPs
E. Proposed re-vegetation—show the following:
    i. Location and type of re-vegetation proposed
    ii. Timing of re-vegetation, possibly in terms of planting season or number of days following commencement of grading
F. Sequencing of construction activities and BMPs
G. Name, address & telephone number of individual who has responsibility for implementation and maintenance of the plan.

H. POST CONSTRUCTION STORM WATER MANAGEMENT PLAN CONTENTS

1. Purpose of the Post Construction Storm Water Management Plan

The purpose of the Post Construction Storm Water Management Plan is to control storm water runoff and reduce pollutants in storm water runoff after construction is complete and the developed site is in operation. This is achieved by accomplishing the following:

A. Controlling soil erosion
B. Controlling discharge of sediment into storm drainage facilities or onto adjacent properties
C. Preventing illicit discharges into on-site soils, into storm drainage facilities or onto adjacent properties

2. Contents of the Post Construction Storm Water Management Plan

The Post Construction Storm Water Management Plan is to be submitted with the site plans or improvement plans. It shall be contained on a plan sheet of its own, rather than being a part of another plan sheet, and is to contain at least the following:

A. The site plan, including vicinity map, proposed contours, permanent storm drainage improvements, and landscaping.
B. Best management practices to accomplish the purpose of the plan. Examples of appropriate BMPs may include those addressing operation and maintenance of storm drainage quality control facilities, operation and maintenance of storm water discharge control facilities, maintenance of landscaping, good housekeeping practices, etc.
C. Show the following for each BMP specified:
    i. Location and extent of specified BMPs, as appropriate
    ii. Detailed schedule of execution for each specified BMP, in terms of starting time, duration, frequency, etc., as appropriate
    iii. Any information in addition to or different from that shown on the BMP fact sheets as necessary to employ the BMPs on the site
D. BMP fact sheets or other descriptive material for all specified BMPs. BMP fact sheets that are part of the Post Construction Storm Water Management Plan are to be on a separate sheet from those BMP fact sheets associated with the Construction Site Storm Water Management Plan.

E. The following statement shall prominently appear on all Post Construction Storm Water Management Plans:

The holders of the business license at this site (or owner of the lot if there is no business license) are responsible to perpetually follow this Post Construction Storm Water Management Plan. Failure to follow the plan may result in the City refusing to renew business licenses or take other action against the property owner.

The objectives of the Plan are to:

1. Control soil erosion
2. Control discharge of sediment into storm drainage facilities or onto adjacent properties
3. Prevent illicit discharges into on-site soils, into storm drainage facilities or onto adjacent properties

If the objectives of the Plan are not being met, the site operator or owner shall make adjustments to the Plan as needed to accomplish its purposes.

Pleasant Grove City encourages adjustments to the plan that enhance effective storm water management. However, significant reduction of practices contained in the plan is to be accomplished through formal modification of the plan and resubmission to the Development Review Committee for approval.

I. PROPOSED CONSTRUCTION AND POST CONSTRUCTION STORM WATER MANAGEMENT PLAN REVIEW PROCEDURES

The Construction Storm Water Management Plan and Post Construction Storm Water Management Plan will be submitted to Pleasant Grove City with the development plans. They will be reviewed along with the development plans, with storm water quantity and quality benefits in mind. The review procedure will be the same as for subdivision improvement plans and site plans.

J. CONCLUSION

Inasmuch as the construction and post construction related best management practices will generally be carried out by those in the private construction industry, they will be implemented as specified in specific construction site and post construction storm water management plans as development occurs. The BMPs found in PART 2, BMPs PERFORMED BY PLEASANT GROVE CITY, cover Pleasant Grove City's efforts to assure that the plans are followed.

Pleasant Grove City's Storm Water Technical Manual satisfies, in part, two of the six minimum control measures established by the Storm Water Phase II Rule: #4: Construction site storm water runoff control, and #5: Post-construction storm water management in new development and redevelopment.

PART 4
CONSTRUCTION
AND POST CONSTRUCTION
BEST MANAGEMENT PRACTICES

A. BMP INDEX

Pleasant Grove City encourages the use of the following best management practices on Construction Site and Post Construction Site Storm Water Management Plans. As established in Section F.2.A of PART 3, STORM WATER TECHNICAL MANUAL, **BMPs with an asterisk are required to be a part of all Construction Site Storm Water Management Plans**

Benching	BE
Biofilters	BF
* BMP Inspection & Maintenance	BMPIM
Brush or Rock Filter	BRF
Building Repair, Remodeling & Construction	BRRC
Catch Basin Cleaning	CBC
Contaminated or Erodible Surface Areas	CESA
Compaction	CP
Construction Road Stabilization	CR
Construction Sequencing	CS
Constructed Wetlands	CW
* Concrete Waste Management	CWM
* Dust Controls	DC
Diversion Dike	DD
Detention/Infiltration Device Maintenance	DIDM
Earth Berm Barrier	EB
Erosion Control Blankets	ECB
Extended Detention Basins	EDB
Filter Strips	FS
Geotextiles and Mats	GM
Grading Practices	GP
Grassed Swales	GS
Hydromulching	HM
* Hazardous Waste Management	HWM
In-Line Storage	ILS
Infiltration	IN
Inlet Protection – Concrete Block	IPC
Inlet Protection – Excavated	IPE

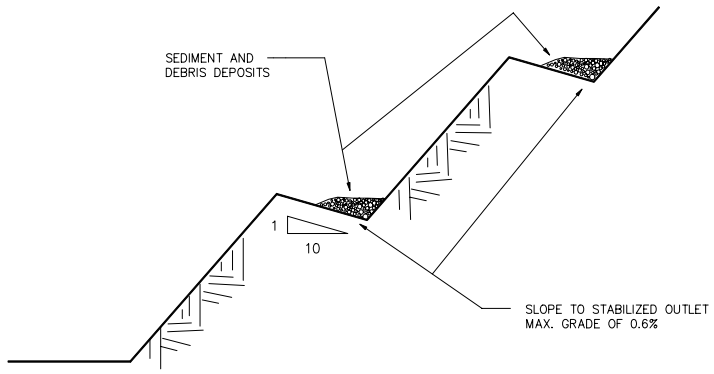
Inlet Protection – Gravel	IPG
Inlet Protection – Silt Fence or Straw Bale	IPS
Level Spreaders	LS
* Material Storage	MS
Mulching	MU
Outlet Protection	OP
Parking Lot Sweeping/Vacuuming	PLSV
* Portable Toilets	PT
Rock Check Dams	RCD
Riprap	RR
Sediment Basin	SB
Sand Bag Barrier	SBB
Street Cleaning	SC
Stabilized Construction Entrance and Wash Area	SCEWA
Sediment Control on Small Construction Sites	SCSCS
* Spill Clean-Up	SCU
Slope Drain	SD
Storm Drain Flushing	SDF
Silt Fence	SF
Seeding and Planting	SP
Surface Roughening	SR
Sediment Trap	ST
Straw Bale Barrier	STB
Temporary Drains and Swales	TDS
Temporary and Permanent Seeding	TPS
Temporary Stream Crossing	TSC
* Vehicle and Equipment Cleaning	VEC
* Vehicle and Equipment Fueling	VEF
Waste Disposal	WD
Wet Ponds	WP

B. BMP FACT SHEETS

The following sheets contain BMP Fact Sheets for use in Pleasant Grove.

BMP: Benching

BE



DESCRIPTION:

Slope construction with benches spaced at regular intervals perpendicular to the slope which intercept and collect sheet flow and direct it to a stable outfall point.

APPLICATION:

- Unstabilized cut and fill slopes
- Large stockpiles
- Existing unstable slopes

INSTALLATION/APPLICATION CRITERIA:

- Benches should be formed as slope is constructed and graded to the outlet point.
- Stabilized outlet with sediment controls should be in place prior to slope construction.

LIMITATIONS:

- Construction slope design must accommodate benching
- Not appropriate for sandy or rocky soil
- Only effective if suitable outlet provided

MAINTENANCE:

- Inspect after major storm events and at least biannually, repair any damaged areas
- Remove debris blocking water flow
- Inspect outlet, repair/replace sediment controls and remove sediment build up.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

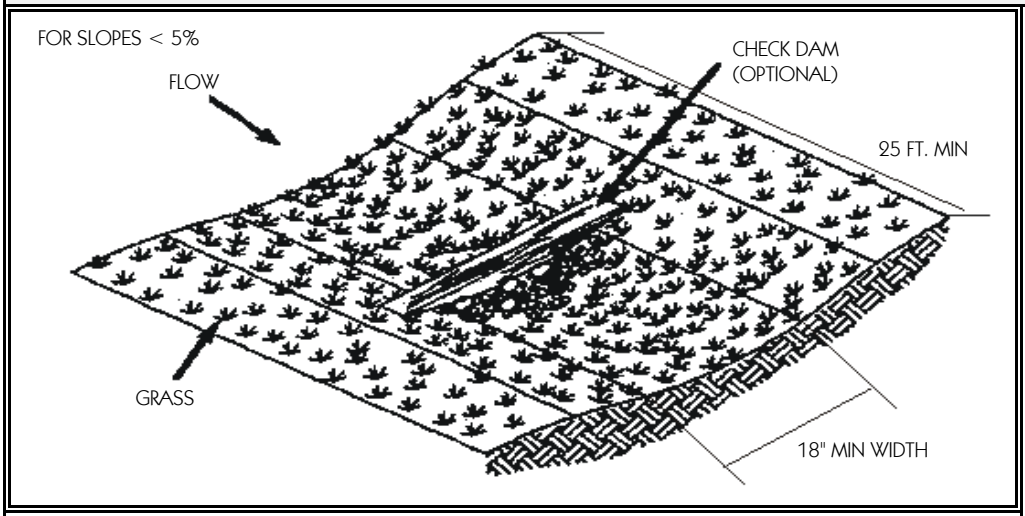
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Biofilters

BF



DESCRIPTION:

Biofilters are of two general types: vegetated channel and vegetated filter strip. The vegetated channel is sloped like a standard storm drain channel; the storm water is treated as it passes through the channel. With filter strips the flow is distributed broadly along the width of the vegetated area.

APPLICATION:

- Comparable performance to wet ponds and constructed wetlands.
- Limited to treating a few acres.

INSTALLATION/APPLICATION CRITERIA:

- The surface area must be defined.
- The minimum width for a swale is determined by Mannings Equation.
- Minimum length of a strip is 10 feet.
- The longitudinal slope must not exceed 5%.
- Use a flow spreader and energy dissipater at the entrance of a swale.
- Good soils are important to achieve good vegetation cover.

LIMITATIONS:

- Good performance depends upon good design
- May be limited to areas where summer irrigation is feasible.
- Can be difficult to maintain sheet flow in strips.
- Can be difficult to avoid channelization in swales.
- Cannot be placed on steep slope.
- Area required may make infeasible on industrial sites.
- Proper maintenance required to maintain health and density of vegetation.
- Limited to treating a few acres and availability of water during dry season.

MAINTENANCE:

- Make sure soils are suitable for healthy vegetation.
- Level cross-section and even longitudinal slope for swales.
- Any damage to the channel such as rutting must be repaired with suitable soil, properly tamped and seeded.

CONSIDERATIONS

☒ Soils
☒ Area Required
☒ Slope
☒ Water Availability
☒ Aesthetics
☐ Hydraulic Head
☐ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

■ Sediment
☒ Nutrients
☒ Heavy Metals
☒ Toxic Materials
☒ Oxygen Demanding Substances
☒ Oil & Grease
☒ Floatable Materials
☐ Bacteria & Viruses

■ High Impact
☒ Medium Impact
☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

☒ Capital Costs
☒ O&M Costs
☒ Maintenance
☐ Training

■ High ☒ Medium ☐ Low

BMP: BMP Inspection and Maintenance

BMPIM

APPLICATIONS

- ☐ Manufacturing
- ☒ Material Handling
- ☒ Vehicle Maintenance
- ☐ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Inspect and maintain all structural BMP's (both existing and new) on a routine basis to remove pollutants from entering storm drain inlets. This includes the establishment of a schedule for inspections and maintenance.

APPROACH:

Regular maintenance of all structural BMP's is necessary to ensure their proper functionality.

- Annual inspections.
- Prioritize maintenance to clean, maintain, and repair or replace structures in areas beginning with the highest pollutant loading.
- Clean structural BMP's in high pollutant areas just before the wet season to remove sediments and debris accumulated during the summer and fall.
- Keep accurate logs of what structures were maintained and when they were maintained.
- Record the amount of waste collected.

LIMITATIONS:

- Availability of trained staff

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substances
- ■ Oil & Grease
- ■ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

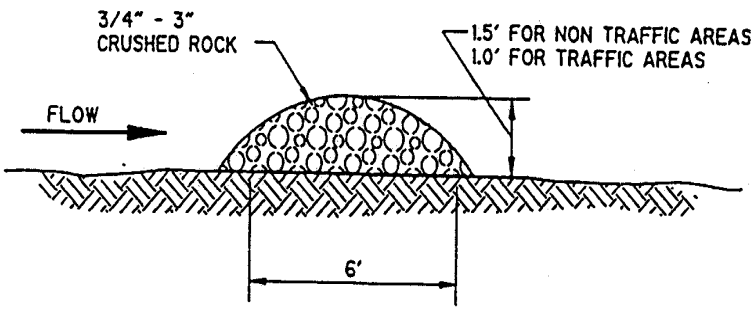
IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ■ O&M Costs
- ☒ Maintenance
- ☒ Staffing
- ☐ Training
- ☐ Administrative

■ High ☒ Medium ☐ Low

BMP: Brush or Rock Filter

BRF



DESCRIPTION:

A rock filter is made of rock 3/4 - 3" in diameter and placed along a level contour. A brush filter is composed of brush (usually obtained during the site clearing) wrapped in filter cloth and anchored to the toe of the slope. If properly anchored brush or rock filters may be used for sediment trapping and velocity reduction.

APPLICATION:

- As check dams across mildly sloped construction roads.
- Below the toe of slopes.
- Along the site perimeter.
- In areas where sheet or rill flow occurs.
- Around temporary spoil areas.
- At sediment traps or culvert/pipe outlets.

INSTALLATION/APPLICATION CRITERIA:

- For rock filter, use larger rock and place in a staked, woven wire sheathing if placed where concentrated flows occur.
- Install along a level contour.
- Leave area behind berm where runoff can pond and sediment can settle.
- Drainage areas should not exceed 5 acres.

LIMITATIONS:

- Rock berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Runoff will pond upstream of the filter, possibly causing flooding if sufficient space does not exist.

MAINTENANCE:

- Inspect monthly after each rainfall.
- If berm is damaged, reshape and replace lost/dislodged rock.
- Remove sediment when depth reaches 1/3 of berm height, or 1 ft.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

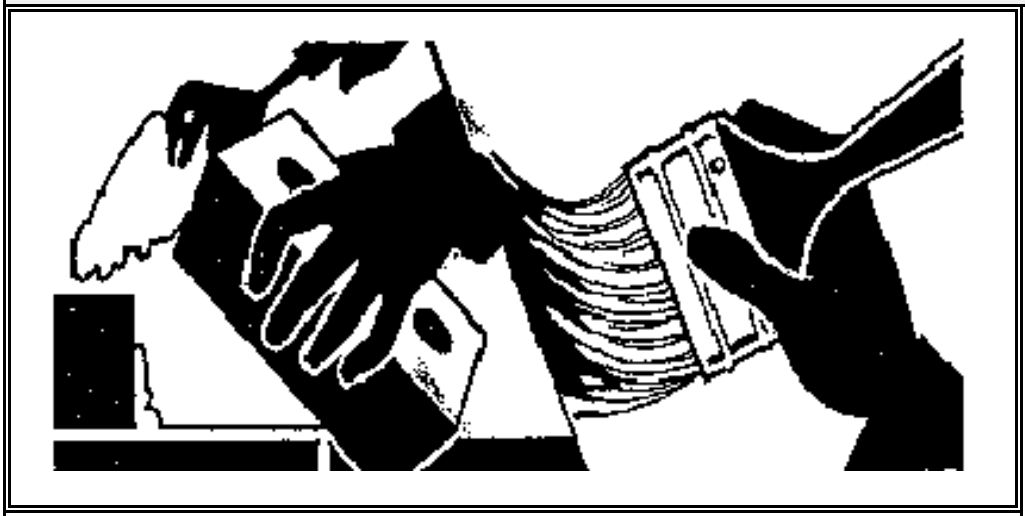
IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Building Repair, Remodeling, and Construction

BRRC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from building repair, remodeling and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

APPLICATION:

- Use soil erosion control techniques if bare ground is temporarily exposed.
- Use permanent soil erosion control techniques if the remodeling clears buildings from an area that is not to be replaced.

INSTALLATION/APPLICATION CRITERIA:

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Properly store materials that are normally used in repair and remodeling such as paints and solvents.
- Properly store and dispose of waste materials generated from the activity.
- Maintain good housekeeping practices while work is underway.

LIMITATIONS:

- This BMP is for minor construction only.
- Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.
- Safer alternative products may not be available, suitable, or effective in every case.
- Be certain that actions to help storm water quality are consistent with OSHA and air quality regulations.

MAINTENANCE:

None.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ■ Toxic Materials
- ■ Oil & Grease
- ■ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

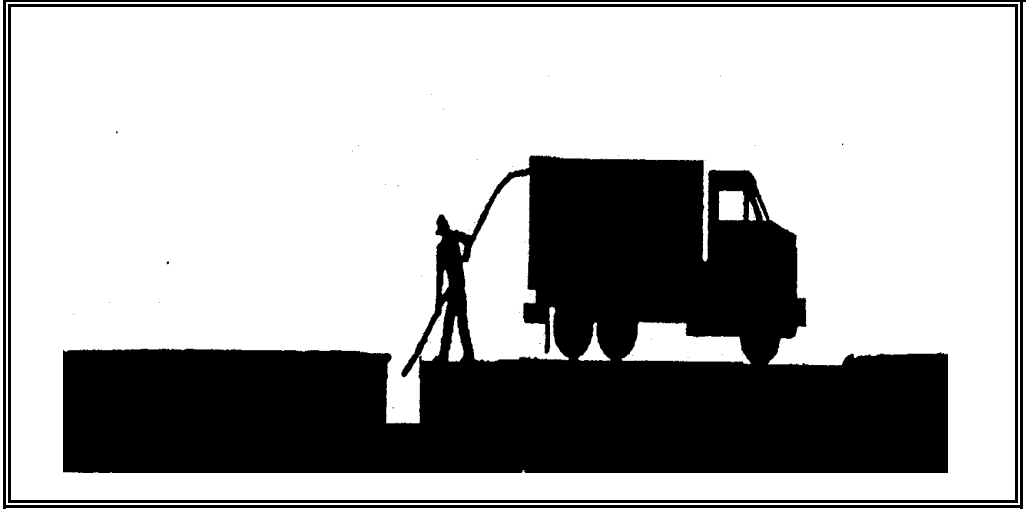
IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

BMP: Catch Basin Cleaning

CBC



DESCRIPTION:

Maintain catch basin and stormwater inlets on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, and restore the catch basins' sediment trapping capacity. A catch basin is distinguished from a stormwater inlet by having at its base a sediment sump designed to catch and retain sediments below the overflow point. This information sheet focuses on the cleaning of accumulated sediments from catch basins.

APPROACH:

Regular maintenance of catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants. In general, the key to effective catch basins are:

- At least annual inspections.
- Prioritize maintenance to clean catch basins and inlets in areas with the highest pollutant loading.
- Clean catch basins in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.

LIMITATIONS:

There are no major limitations to this best management practice.

MAINTENANCE:

Regular maintenance of public and private catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants. In general, the keys to effective catch basins are:

- Annual/monthly inspection of public and private facilities to ensure structural integrity, a clean sump, and a stenciling of catch basins and inlets.
- Keep logs of the number of catch basins cleaned.
- Record the amount of waste collected.

PROGRAM ELEMENTS

- ☐ New Development
- ☐ Residential
- ☐ Commercial Activities
- ☐ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ■ Heavy Metals
- ☐ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☒ Oil & Grease
- ■ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ■ O&M Costs
- ☐ Regulatory
- ☒ Training
- ■ Staffing
- ☒ Administrative

■ High ☒ Medium ☐ Low

BMP: Contaminated or Erodible Surface Areas

CESA

DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from contaminated or erodible surface areas by leaving as much vegetation on-site as possible, minimizing soil exposure time, stabilizing exposed soils, and preventing storm water runon and runoff.

APPLICATION:

This BMP addresses soils which are not so contaminated as to exceed criteria but the soil is eroding and carrying pollutants off in the storm water.

INSTALLATION/APPLICATION CRITERIA:

Contaminated or erodible surface areas can be controlled by:

- Preservation of natural vegetation
- Re-vegetation
- Removal of contaminated soils
- Geosynthetics.

LIMITATIONS:

Disadvantages of preserving natural vegetation or re-vegetating include:

- Requires substantial planning to preserve and maintain the existing vegetation.
- May not be cost-effective with high land costs.
- Lack of rainfall and/or poor soils may limit the success of re-vegetated areas.

MAINTENANCE:

Maintenance should be minimal, except possibly if irrigation of vegetation is necessary.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Toxic Materials
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

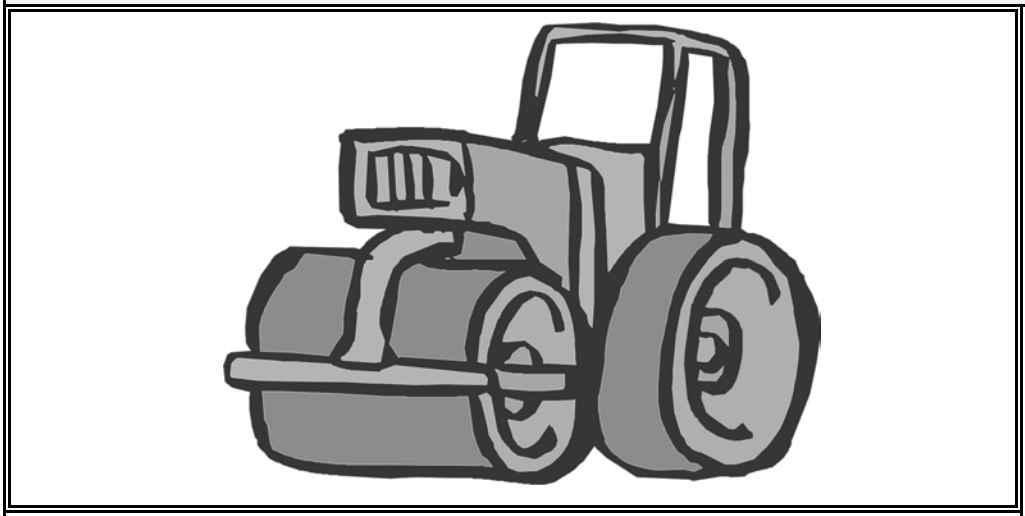
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Compaction

CP



DESCRIPTION:

Use of rolling, tamping, or vibration to stablize fill materials and control erosion by increasing the soil density. Increasing the density of soil improves soil strength, reduces long-term soil settlement, and provides resistance to erosion.

APPLICATIONS:

- Stabilize fill material placed around various structures.
- Improve soil in place as foundation support for roads, parking lots, and buildings.

INSTALLATION/APPLICATION CRITERIA:

- Make sure soil moisture content is at optimum levels.
- Use proper compaction equipment.
- Install sediment control and storm water management devices below compacted areas and runon interceptor devices above these areas. Drainage from compacted areas must be carefully planned to protect adjacent uncompacted soils.
- The surface of compacted areas should be scarified and seeded or mulched and seeded to increase the effectiveness of compaction.

LIMITATIONS:

- Compaction tends to increase runoff.
- Over-compaction will hamper revegetation efforts.

MAINTENANCE:

No maintenance required.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☒ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

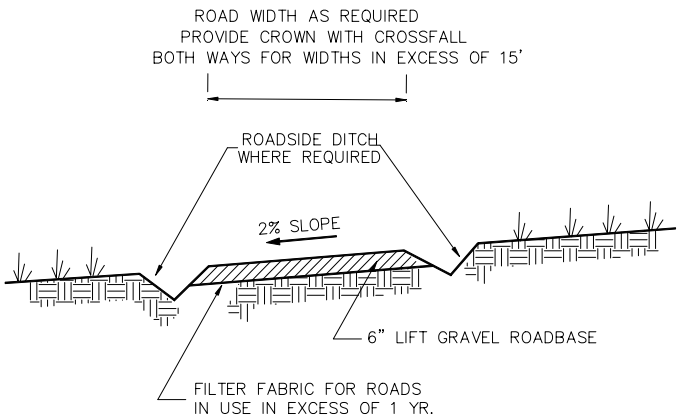
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

BMP: Construction Road Stabilization

CR



DESCRIPTION:

Temporary stabilization of on-site roadway by placement of gravel roadbase.

APPLICATION:

- On-site roadways used daily by construction traffic (may not apply to gravelly type soils)
- Parking or staging areas susceptible to erosion due to traffic use

INSTALLATION/APPLICATION CRITERIA:

- Grade temporary access road with 2% cross fall, for two-way width provide crown.
- Provide roadside ditch and outlet controls where required.
- Place 6 inches of 2-inch to 4-inch crushed rock on driving area

LIMITATIONS:

- May require removal of gravel roadbase at completion of activities if final cover is not impervious
- May require controls for surface storm water runoff

MAINTENANCE:

- Inspect after major rainfall events and at least monthly.
- Place additional gravel as needed and repair any damaged areas.
- Maintain any roadside drainage controls.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☒ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Construction Sequencing

CS

In sequenced construction, sites are completed in stages and completed portions are permanently stabilized before other areas are disturbed

DESCRIPTION:

Construction sequencing requires creating and following a work schedule that balances the timing of land disturbance activities and the installation of measures to control erosion and sedimentation, in order to reduce on-site erosion and off-site sedimentation. Staging areas can be used to limit contamination and erosion.

APPROACH:

Construction sequencing can be used to plan earthwork and erosion and sediment control (ESC) activities at sites where land disturbances might affect water quality in a receiving water body.

Construction sequencing schedules should, at a minimum, include the following:

- The ESC practices that are to be installed
- Principal development activities
- Which measures should be installed before other activities are started
- Compatibility with the general contract construction schedule

The following activities and features should be included (as they apply):

- Construction access—entrance to site, construction routes, areas designated for equipment parking
- Sediment traps and barriers—basin traps, sediment fences, outlet protection
- Runoff conveyance system—stabilize stream banks, storm drains, channels, inlet and outlet protection, slope drains
- Land clearing and grading—site preparation (cutting, filling, and grading, sediment traps, barriers, diversions, drains, surface roughening)
- Landscaping and final stabilization—top-soiling, trees and shrubs, permanent seeding, mulching, sodding, riprap

LIMITATIONS:

- Weather and other unpredictable variables may affect construction sequence schedules.

MAINTENANCE:

- The construction sequence should be followed throughout the project and the written plan should be modified before any changes in construction activities are executed.

APPLICATIONS

- ☐ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☐ Waste Containment
- ☐ Housekeeping Practices

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

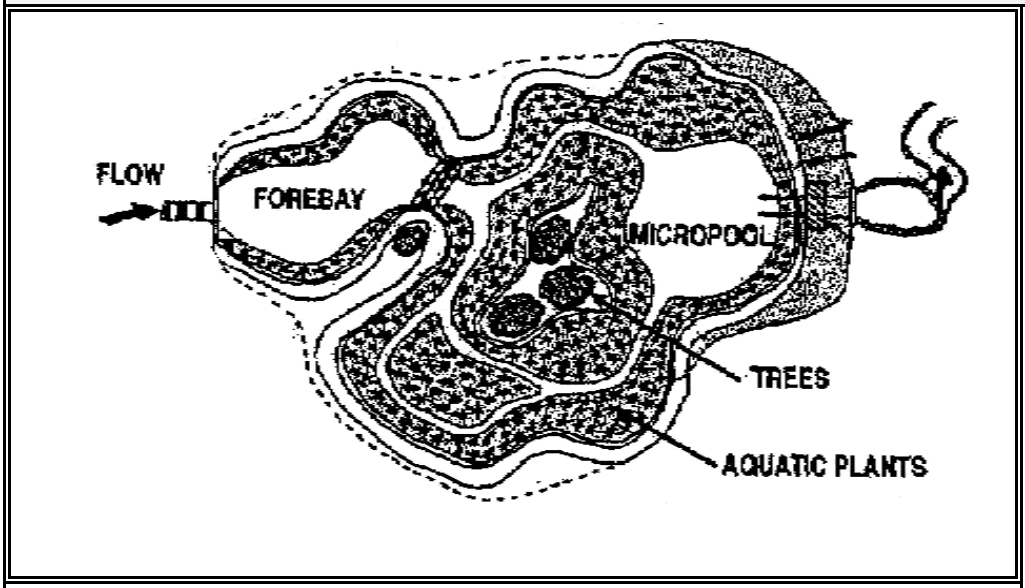
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Constructed Wetlands

CW



DESCRIPTION:

Constructed wetlands have a significant percentage of the facility covered by wetland vegetation.

APPLICATION:

- Need to achieve high level of particulate and some dissolved contaminant removal.
- Ideal for large, regional tributary areas.
- Multiple benefits of passive recreation and wildlife.

INSTALLATION/APPLICATION CRITERIA:

- Suitable soils for wetland vegetation are required.
- Surface area equal to at least 1% and preferably 2% of the tributary watershed.
- Include a forebay for extra storage and to trap incoming sediment.
- Involve qualified wetland ecologist to design and install wetland vegetation.
- Establishing wetland vegetation may be difficult.

LIMITATIONS:

- Concern for mosquitoes.
- Cannot be placed on steep unstable slopes.
- Need base flow to maintain water level.
- Not feasible in densely developed areas.
- Nutrient release may occur during winter.
- Overgrowth can lead to reduced hydraulic capacity.
- Regulatory agencies may limit water quality to constructed wetlands.

MAINTENANCE:

- Remove foreign debris and sediment build-up.
- Areas of bank erosion should be repaired.
- Remove nuisance species.
- Control mosquitoes.

CONSIDERATIONS

☒ Soils
☒ Area Required
☒ Slope
☒ Water Availability
☒ Aesthetics
☐ Hydraulic Head
☒ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

■ Sediment
■ Nutrients
■ Heavy Metals
■ Toxic Materials
■ Oxygen Demanding Substances
■ Oil & Grease
■ Floatable Materials
☒ Bacteria & Viruses

■ High Impact
☒ Medium Impact
☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

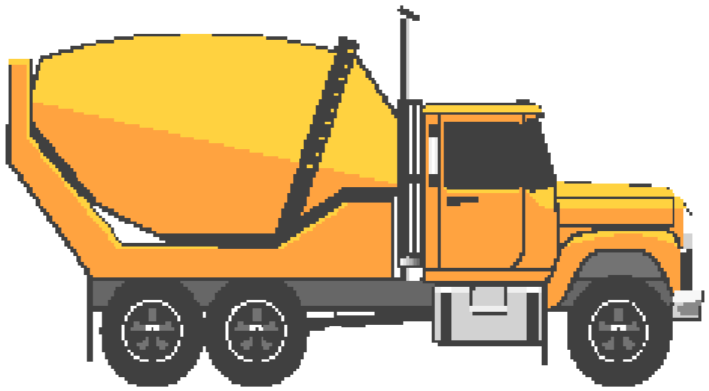
■ Capital Costs
☒ O&M Costs
☒ Maintenance
☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Concrete Waste Management

CWM



Description:

Prevent or reduce the discharge of pollutants to storm water from concrete waste by conducting washout off-site, performing on-site washout in a designated area, and training employees and subcontractors.

Applications:

This technique is applicable to all types of sites.

Installation/Application Criteria:

- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete or cement on-site.
- Perform washout of concrete trucks off-site or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped on-site, except in designated areas.
- When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water within a bermed or level area. (See Earth Berm Barrier information sheet.)
- Train employees and subcontractors in proper concrete waste management.

Limitations:

- Off-site washout of concrete wastes may not always be possible.

Maintenance:

- Inspect subcontractors to ensure that concrete wastes are being properly managed.
- If using a temporary pit, dispose hardened concrete on a regular basis.

Objectives

- ☐ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☒ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

Implementation Requirements

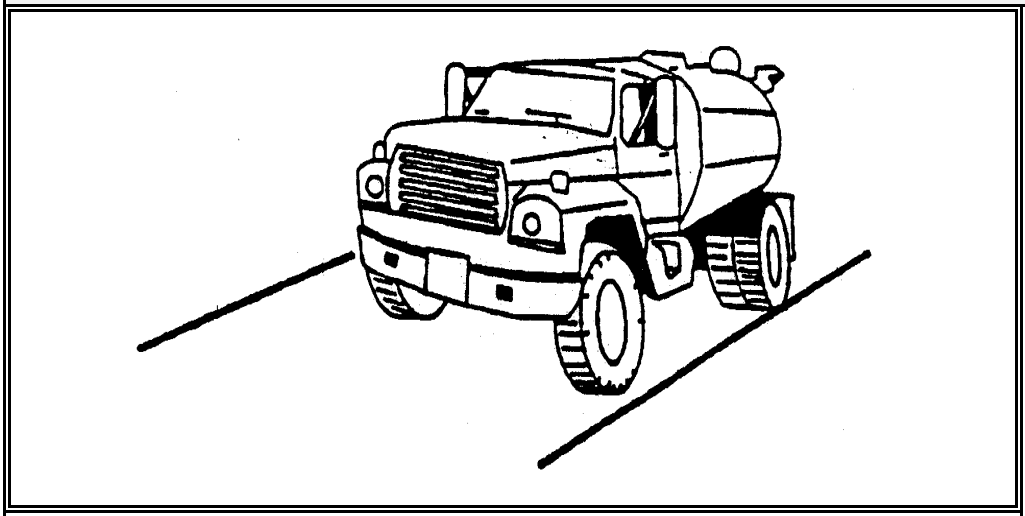
- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Dust Controls

DC



DESCRIPTION:

Dust control measures are used to stabilize soil from wind erosion, and reduce dust by construction activities.

APPLICATION:

Dust control is useful in any process area, loading and unloading area, material handling areas, and transfer areas where dust is generated. Street sweeping is limited to areas that are paved.

INSTALLATION/APPLICATION CRITERIA:

- Two kinds of street sweepers are common: brush and vacuum. Vacuum sweepers are more efficient and work best when the area is dry.
- Mechanical equipment should be operated according to the manufacturers' recommendations and should be inspected regularly.
- Water may be sprayed on the ground surface to moisten dry soils, making it less susceptible to wind erosion.

LIMITATIONS:

- Street sweeping is labor and equipment intensive and may not be effective for all pollutants.
- Water sprayed from water trucks must be done at a rate such that the water is absorbed in the soil; if excessive amounts of water are used, it may run off, carrying soil with it.

MAINTENANCE:

If excess water results from water spraying, dust-contaminated waters should not be allowed to run off site. Areas may need to be resprayed to keep dust from spreading.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☒ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

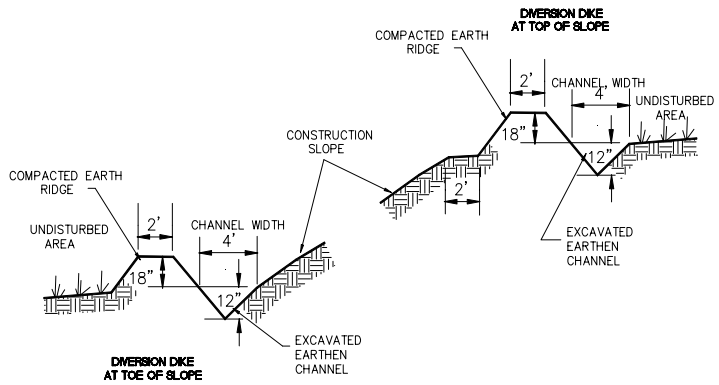
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

BMP: Diversion Dike

DD



DESCRIPTION:

A temporary sediment barrier and storm runoff conveyance consisting of an excavation channel and compacted earth ridge.

APPLICATION:

- Construct along top of construction slope to intercept upgradient runoff and convey around construction site.
- Construct along toe of construction to divert sediment laden runoff.
- Construct along midpoint of construction slope to intercept runoff and channel to controlled discharge point.
- Construct around base of soil stockpiles to capture sediment.
- Construct around perimeter of disturbed areas to capture sediment.

INSTALLATION/APPLICATION CRITERIA:

- Clear and grub area for dike construction.
- Excavate channel and place soil on downgradient side.
- Shape and machine compact excavated soil to form ridge.
- Place erosion protection (riprap, mulch) at outlet.
- Stabilize channel and ridge as required with mulch, gravel, or vegetative cover.

LIMITATIONS:

- Recommended maximum drainage area of 5 acres
- Recommended maximum sideslopes of 2h:1v (50%)
- Recommended maximum slope on channel of 1%

MAINTENANCE:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff breaching dike or eroding channel or sideslopes.
- Check discharge point for erosion or bypassing of flows.
- Repair and stabilize as necessary.
- Inspect daily during vehicular activity on slope, check for and repair any traffic damage.

OBJECTIVES

- ☐ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Detention/Infiltration Device Maintenance

DIDM

DESCRIPTION:

Proper maintenance and siltation removal is required on both a routine and corrective basis to promote effective storm water pollutant removal efficiencies for wet/dry detention pond and infiltrative devices.

APPROACH:

- Remove silt after sufficient accumulation.
- Periodically clean accumulated sediment and silt out of pre-treatment inlets.
- Infiltration device silt removal should occur when the infiltration rate drops below ½ inch per hour.
- Removal of accumulated paper, trash, and debris should occur every six months or as needed to prevent clogging of control devices.
- Vegetation growth should not be allowed to exceed 18 inches in height.
- Mow the slopes periodically and check for clogging, erosion and tree growth on the embankment.
- Corrective maintenance may require more frequent attention (as required).
- Create a public education campaign to explain the function of wet/dry detention pond/infiltration devices and their operation requirements for proper effectiveness.
- Encourage the public to report wet/dry detention pond/infiltration devices needing maintenance.

LIMITATIONS:

- Wet detention pond dredging can produce slurried waste that often exceeds the requirements of many landfills.
- Frequent sediment removal is labor and cost intensive.

PROGRAM ELEMENTS

☐ New Development
☒ Residential
☒ Commercial Activities
☒ Industrial Activities
☒ Municipal Facilities
☐ Illegal Discharges

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

■ Sediment
☒ Nutrients
■ Heavy Metals
☐ Toxic Materials
☒ Oxygen Demanding Substances
☐ Oil & Grease
☐ Floatable Materials
■ Bacteria & Viruses

■ High Impact
☒ Medium Impact
☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

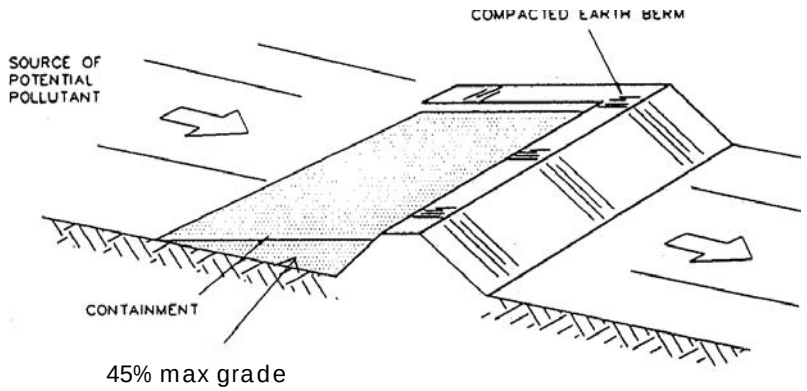
☒ Capital Costs
■ O&M Costs
☐ Regulatory
☐ Training
☒ Staffing
☐ Administrative

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Earth Berm Barrier

EB



45% max grade

DESCRIPTION:

A temporary containment control constructed of compacted soil.

APPLICATION:

- Construct around waste and materials storage area.
- Construct around staging and maintenance areas.
- Construct around vehicle parking and servicing areas.

INSTALLATION/APPLICATION CRITERIA:

- Construct an earthen berm down hill of the area to be controlled. The berm should surround fueling facilities and maintenance areas on three sides to provide containment.
- Berm needs to be a minimum of 1 foot tall by 1 foot wide and be compacted by earth moving equipment.

LIMITATIONS:

- Not effective on steep slopes.
- Limits access to controlled area.
- Personnel need to quickly respond to spills with remedial actions.

MAINTENANCE:

- Observe daily for any non-storm water discharge.
- Look for runoff bypassing ends of berms or undercutting berms.
- Repair or replace damaged areas of the berm and remove accumulated sediment.
- Recompact soil around berm as necessary to prevent piping.

OBJECTIVES

- ☐ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ■ Toxic Materials
- ☐ Oil & Grease
- ■ Floatable Materials
- ☐ Other Construction Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

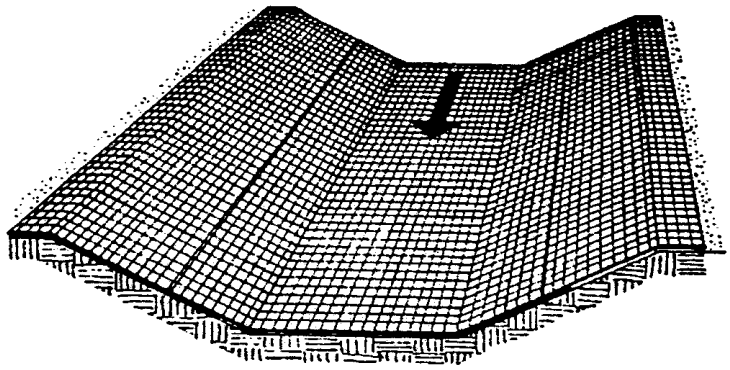
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Erosion Control Blankets

ECB



DESCRIPTION:

Erosion control blankets are used in place of mulch on areas of high velocity runoff and/or steep grade, to aid in controlling erosion on critical areas by protecting young vegetation. See related Geotextiles and Mats BMP Fact Sheet (GM).

APPLICATIONS:

- Where vegetation is likely to grow too slowly to provide adequate cover.
- In areas subject to high winds where mulch would not be effective.
- On steep slopes in which planting and mulching alone may not be as effective.

INSTALLATION/APPLICATION CRITERIA:

- Install erosion control blankets parallel to the direction of the slope.
- In ditches, apply in direction of the flow.
- Place erosion control blankets loosely on soil - do not stretch.
- Ends of blankets should be buried no less than six inches deep.
- Staple the edges of the blanket at least every three feet.

LIMITATIONS:

- Not recommended in areas which are still under construction.

MAINTENANCE:

- Check for erosion and undermining periodically, particularly after rainstorms.
- Repair dislocations or failures immediately.
- If washouts occur, reinstall after repairing slope damage.
- Monitor until permanently stabilized.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

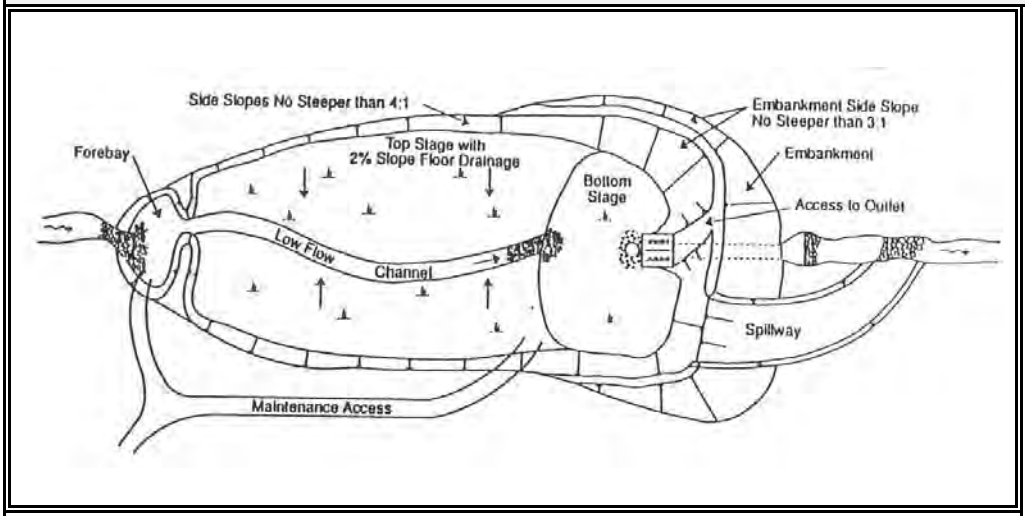
IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Extended Detention Basins

EDB



DESCRIPTIONS:

Extended detention basins are dry between storms. During a storm the basin fills. A bottom outlet releases the storm water slowly to provide time for sediments to settle.

APPLICATION:

- Objective is to remove only particulate pollutants.
- Use where lack of water prevents the use of wet ponds, wetlands or biofilters.
- Use where wet ponds or wetlands would cause unacceptable mosquito conditions.

INSTALLATION/APPLICATION CRITERIA:

- Basin volume is sized to capture a particular fraction of the runoff.
- Drawdown time of 24 to 40 hours is required.
- A shallow basin with large surface area performs better than a deep basin with the same volume.
- Place energy dissipater at the entrance to minimize bottom erosion and resuspension.
- Vegetate side slopes and bottom to the maximum extent practical.
- If side erosion is particularly severe, consider paving or soil stabilization.
- If floatables are a problem, protect outlet with a trash rack or other device.
- Provide bypass or pass through capabilities for 100-year storm.

LIMITATIONS:

- May be less reliable than other treatment control BMPs. Inability to vegetate banks and bottom may result in erosion and resuspension.
- Limitation of the orifice diameter may preclude use in small watersheds.
- Requires differential elevation between inlet and outlet.

MAINTENANCE:

- Check outlet regularly for clogging.
- Check banks and bottom of basin for erosion and correct as necessary.
- Remove sediment when accumulation reaches 6-inches, or if resuspension is observed.

CONSIDERATIONS

- ☐ Soils
- ☒ Area Required
- ☐ Slope
- ☐ Water Availability
- ☐ Aesthetics
- ☒ Hydraulic Head
- ☐ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☒ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☒ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

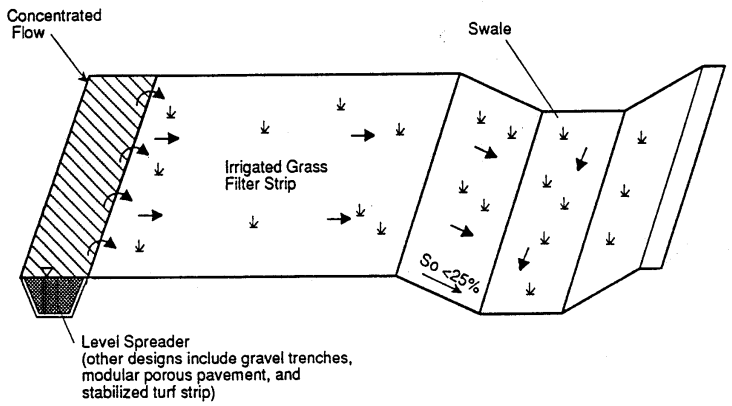
- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Filter Strips

FS



General Description:

Filter strips are 20-foot-wide strips of natural or planted vegetation around a construction site. They are designed to cause deposition of sediments within the vegetation layer.

Applications:

- Suited for areas where the soils are well drained or moderately well drained.
- Areas where the bedrock and the water table are well below the surface.

Installation/Application Criteria:

- Make sure the vegetative cover is dense enough to protect underlying soil while causing sediment to settle.
- Filter strip must be approximately 20 feet wide to function well.
- The length should be approximately 50 to 75 feet. Where slopes become steeper the length of the strip must be increased.

Limitations:

- Only applicable in areas where vegetation is previously established or where sod is added.
- Vegetated filter strips will not function well on steep slopes, in hilly areas, or in highly paved areas.
- Sites with slopes of 15 percent or more may not be suitable for filtering storm water flows.

Maintenance:

- Check for channels and repair.
- Provide rock aprons to aid in slowing flow if necessary.
- Maintain vegetation at optimal height and thickness.

Objectives

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

Targeted Pollutants

- ■ Sediment
- ☒ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

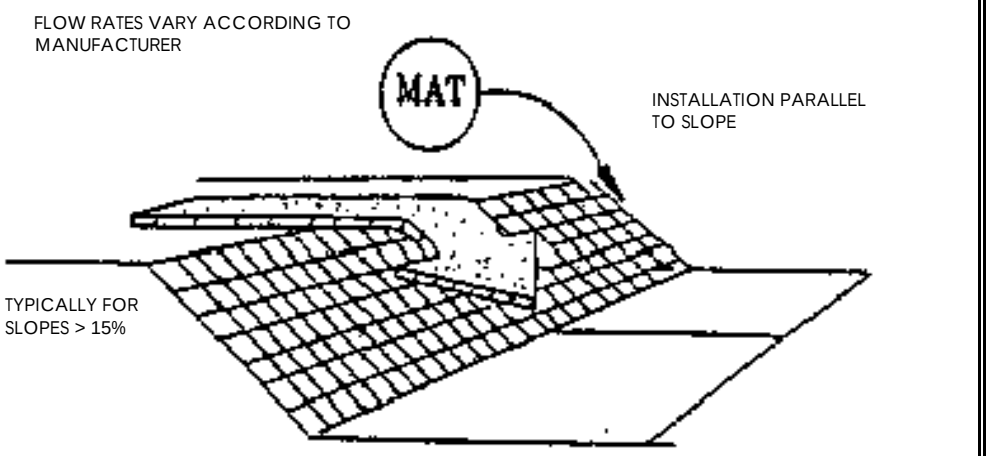
Implementation Requirements

- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Geotextiles and Mats

GM



DESCRIPTION:

Mattings made of natural or synthetic material which are used to temporarily or permanently stabilize soil. See the related Erosion Control Blankets BMP Fact Sheet (ECB).

APPLICATION:

- Typically suited for post-construction site stabilization, but may be used for temporary stabilization of highly erosive soils.
- Channels and streams.
- Steep slopes.

INSTALLATION/APPLICATION CRITERIA:

- Mattings may be applied to disturbed soils and where existing vegetation has been removed.
- The following organic matting materials provide temporary protection until permanent vegetation is established, or when seasonal circumstances dictate the need for temporary stabilization until weather or construction delays are resolved: Jute mattings and straw mattings.
- The following synthetic mattings may be used for either temporary or post-construction stabilization, both with and without vegetation: excelsior matting, glass fiber matting, mulch matting.
- Staples are needed to anchor the matting.

LIMITATIONS:

- Mattings are more costly than other BMP practices, limiting their use to areas where other BMPs are ineffective (e.g., channels, steep slopes).
- May delay seed germination, due to reduction in soil temperature.
- Installation requires experienced contractor to ensure soil stabilization and erosion protection.

MAINTENANCE:

- Inspect monthly and after significant rainfall.
- Re-anchor loosened matting and replace missing matting and staples as required.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Grading Practices

GP

Soils exposed from land grading activities are very vulnerable to erosion

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☒ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

DESCRIPTION:

Control soil erosion by minimizing the exposure of bare soil to erosive forces. This is done by

1) limiting the amount of land disturbed at one time in preparation for construction
2) limiting the amount of time between the disturbance of soil and protection or stabilization of disturbed soils, and
3) using grading practices to protect exposed soils susceptible to storm water runoff.

Related practices include construction sequencing, preservation of existing vegetation, erosion control practices and sediment control practices.

APPROACH:

- Limit the area of disturbance to those areas requiring grading. This preserves existing vegetation and reduces the vulnerability of soil to erosion.
- Based on erosion potential and sediment control measures on the site, establish what areas are to be graded at one time.
- An undisturbed buffer zone containing vegetation at the lowest elevation of a construction site can reduce the transport of sediment off site.
- Initiate soil protection measures during the course of work to minimize the length of time soil is exposed to erosive forces.
- Conduct work in stages so that construction or soil stabilization occurs promptly after disturbance of soil.
- Establish a schedule governing the stabilization of disturbed slopes, both in terms of passage of time since commencement and completion of disturbance and in terms of planting season.
- Leaving the surface of the disturbed soil graded in a roughened condition (not smooth) can reduce the quantity and velocity of storm water runoff.
- Prevent storm water runoff from running onto steep slopes from above.
- Avoid long, steep cut or fill slopes that allow runoff water of sufficient quantity or velocity to cut into and erode the slope.

LIMITATIONS:

- The specific approach to grading on a particular site depends on the conditions of the site and surrounding land; engineering judgment is required to design the approach best suited for each site.

MAINTENANCE:

- Practices may need to vary from the approved plan if erosion problems appear when storm water runoff occurs.

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ■ Training

■ High ☒ Medium ☐ Low

BMP: Grassed Swales

GS

Grassed swales can be used along roadsides and parking lots to collect and treat storm water runoff

DESCRIPTION:

A series of vegetated, open channel management practices designed specifically to treat and attenuate storm water runoff. Storm water is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils.

APPROACH:

- Grassed swales can be applied in most situations with some restrictions. Swales are very well suited for treating highway or residential road runoff because they are linear practices.
- Grassed swales should be used on sites with relatively flat slopes of less than 4 percent slope; 1 to 2 percent slope is recommended.
- A small fore-bay should be used at the front of the swale to trap incoming sediments. A pea gravel diaphragm, a small trench filled with river run gravel, should be used as pretreatment for runoff entering the sides of the swale.
- Swales should also have the capacity to pass larger storms (typically a 10-year storm) safely.

LIMITATIONS:

- Grassed swales cannot treat a very large drainage area.
- Wet swales may become a nuisance due to mosquito breeding.

MAINTENANCE:

Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover.

APPLICATIONS

- ☐ Manufacturing
- ☐ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☐ Waste Containment
- ☐ Housekeeping Practices

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Hydromulching

HM

DESCRIPTION:

A combination of wood fiber mulch, processed grass, or hay or straw mulch and a tacking agent. It is made into a slurry, then applied to bare slopes or other bare areas to provide temporary stabilization.

APPLICATIONS:

- Small roadside slopes.
- Large, relatively flat areas.

INSTALLATION/APPLICATION CRITERIA:

- Legume seeds should be pellet inoculated with the appropriate bacteria.
- The seed should not remain in the hydromulcher tank for more than 30 minutes.
- Wood fiber may be dyed to aid in uniform application.
- Slurry should be uniformly applied until an adequate coverage is achieved.
- The applicator should not be directed at one location for a long period of time; erosion will occur.

LIMITATIONS:

- Will lose effectiveness after 1 year.
- Can use only on physically stable slopes (at natural angle of repose, or less).

MAINTENANCE:

- Periodically inspect for damage caused by wind, water, or human disturbance.
- Promptly repair damaged areas.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ■ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Hazardous Waste Management

HWM

DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from hazardous waste through proper material use, waste disposal, and training of employees. Another important aspect of this BMP is to insure the use of sub-consultants who are properly licensed and trained.

APPLICATION:

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

- Paints and solvents; petroleum products such as oils; fuels and greases; herbicides and pesticides; acids for cleaning masonry; and concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with federal, state and local regulations, including:

- Sandblasting grit mixed with lead, cadmium or chromium based paints, asbestos, and PCBs.

INSTALLATION/APPLICATION CRITERIA:

The following steps will help reduce storm water pollution from hazardous wastes:

- Use all of the product before disposing of the container.
- Do not remove the original product label, it contains important safety and disposal information.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

LIMITATIONS:

Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste collector.

MAINTENANCE:

- Inspect hazardous waste receptacles and areas regularly.
- Arrange for regular hazardous waste collection.

PROGRAM ELEMENTS

- ☒ New Development
- ☒ Residential
- ☒ Commercial Activities
- ☒ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substances
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

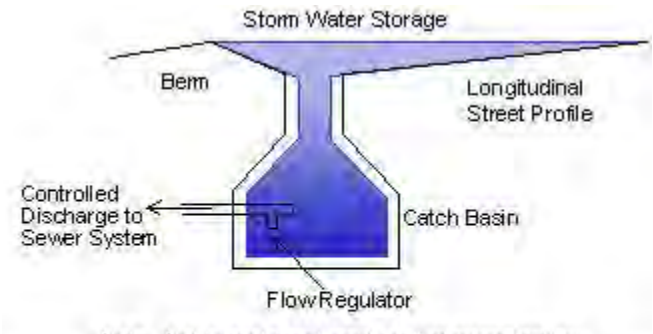
IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☒ O&M Costs
- ☒ Regulatory
- ☒ Training
- ☒ Staffing
- ☒ Administrative

■ High ☒ Medium ☐ Low

BMP: In-Line Storage

ILS



Catch basins can be equipped with flow restrictors to temporarily detain storm water in the conveyance system

APPLICATIONS

- ☒ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☒ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

In-line storage refers to a number of practices designed to use the storage within the storm drain system to detain flows. While these practices can reduce storm peak flows, they are unable to improve water quality or protect downstream channels. Devices can slow the rate of flow by backing up flow, as in the case of a dam or weir, or through the use of vortex valves, devices that reduce flow rates by creating a helical flow path in the structure.

APPROACH:

- In-line storage practices serve the same purpose as traditional detention basins
- These practices can act as a surrogate for aboveground storage when little space is available for aboveground storage facilities.

LIMITATIONS:

- In-line storage practices only control flow, and thus are not able to improve the water quality of storm water runoff.
- If improperly designed, these practices may cause upstream flooding.
- Flow regulators cannot be applied to all storm drain systems. In older cities, the storm drainpipes may not be oversized, and detaining storm water within them would cause upstream flooding.

MAINTENANCE:

- Flow regulators require very little maintenance, because they are designed to be "self - cleaning," much like the storm drain system.
- For some designs, such as check dams, regulations will require only moderate construction in order to modify the structure's design.

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

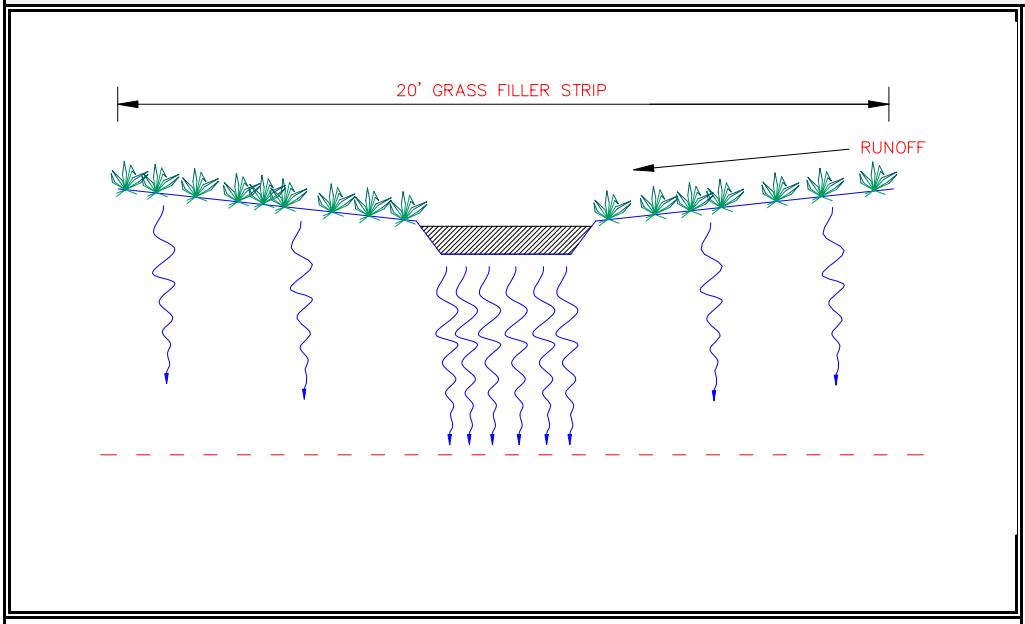
- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Infiltration

IN



DESCRIPTION:

A family of systems in which the majority of the runoff from small storms is infiltrated into the ground rather than discharged to a surface water body. Infiltration systems include: ponds, vaults, trenches, dry wells, porous pavement, and concrete grids.

APPLICATION:

Suitable site soils and geologic conditions; low potential for long-term erosion in the watershed.

INSTALLATION/APPLICATION CRITERIA:

- Volume sized to capture a particular fraction of annual runoff.
- Pretreatment is necessary in fine soils.
- Emergency overflow or bypass for larger storms is needed.
- Observation wells are required in trenches.
- Infiltration surface must be protected during construction.
- Pond sides need vegetation to prevent erosion.
- During construction frequent inspection for clogging is necessary.
- Line sides of trench with permeable filter fabric
- Trench should be filled with clean washed stone or gravel. (1.5-3.0 in.)
- A six inch sand filter layer; cloth lines the bottom of trench.

LIMITATIONS:

- Loss of infiltrative capacity and high maintenance cost in fine soils.
- Low removal of dissolved pollutants in very coarse soils.
- Not suitable on fill sites or steep slopes.
- The risk of ground water contamination in very coarse soils, may require ground water monitoring.

MAINTENANCE:

- Remove sediment at a frequency appropriate to avoid excessive concentrations of pollutants and loss of infiltrative capacity.
- Frequent cleaning of porous pavements is required.
- Maintenance is difficult and costly for underground trenches.

CONSIDERATIONS

- ☒ Soils
- ☒ Area Required
- ☒ Slope
- ☐ Water Availability
- ☐ Aesthetics
- ☐ Hydraulic Head
- ☒ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substances
- ■ Oil & Grease
- ☒ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

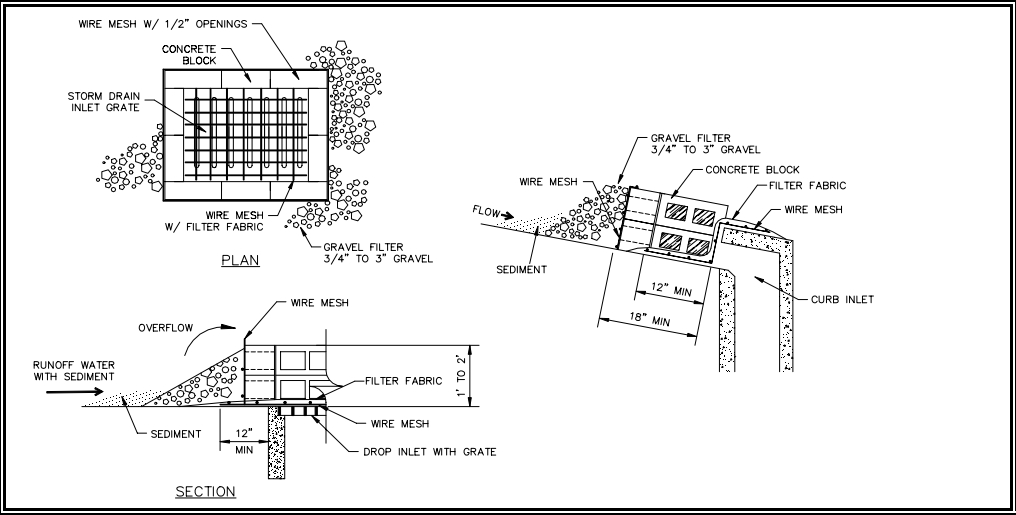
- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Inlet Protection - Concrete Block

IPC



DESCRIPTION:

Concrete block and gravel filter placed over inlet to storm drain system.

APPLICATION:

Construct at inlets in paved or unpaved areas where upgradient area is to be disturbed by construction activities.

INSTALLATION/APPLICATION CRITERIA:

- Place wire mesh (with ½ inch openings) over the inlet grate extending one foot past the grate in all directions.
- Place concrete blocks around the inlet with openings facing outward. Stack blocks to minimum height of 12-inches and maximum height of 24-inches.
- Place wire mesh around outside of blocks.
- Place gravel (3/4" to 3") around blocks.

LIMITATIONS:

- Recommended for maximum drainage area of one acre.
- Excess flows may bypass the inlet requiring down gradient controls.
- Ponding will occur at inlet.

MAINTENANCE:

- Inspect inlet protection after every large storm event and at a minimum of once monthly.
- Remove sediment accumulated when it reaches 4-inches in depth.
- Replace filter fabric and clean or replace gravel if clogging is apparent.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ■ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

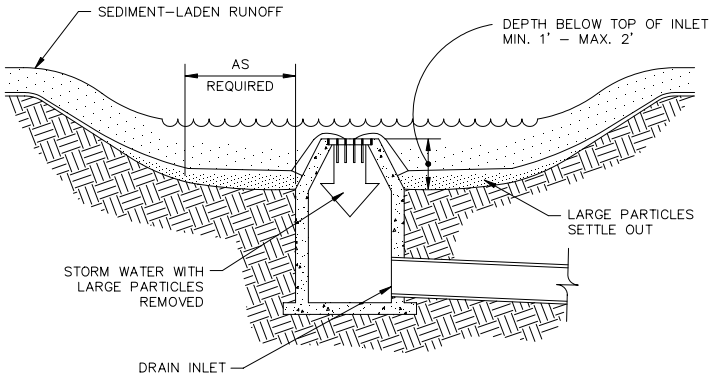
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Inlet Protection - Excavated

IPE



DESCRIPTION:

An area excavated around a storm drain inlet to impound water below the inlet.

APPLICATION:

Construct at storm drainage inlets located downgradient of areas to be disturbed by construction (for inlets in paved areas see other information sheets for inlet protection).

INSTALLATION/APPLICATION CRITERIA:

- Provide upgradient sediment controls, such as silt fence during construction of inlet.
- When construction of inlet is complete, excavate adjacent area 1 to 2 feet lower than the grate elevation. Size of excavated area should be based on soil type and contributing acreage.

LIMITATIONS:

- Recommended maximum contributing drainage area of one acre.
- Limited to inlets located in open unpaved areas.
- Requires flat area adjacent to inlet.

MAINTENANCE:

- Inspect inlet protection following storm event and at a minimum of once monthly.
- Remove accumulated sediment when it reaches one half of the excavated sump below the grate.
- Repair side slopes as required.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ■ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

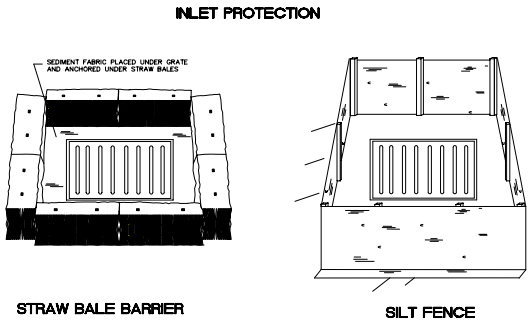
IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Inlet Protection - Silt Fence or Straw Bale

IPS



SEE INDIVIDUAL BMP INFORMATION SHEETS FOR INSTRUCTIONS FOR CONSTRUCTION OF STRAW BALE BARRIER AND SILT FENCE..

DESCRIPTION:

Sediment barrier erected around storm drain inlet.

APPLICATION:

Construct at storm drainage inlets located downgradient of areas to be disturbed by construction (for inlets in paved areas see other information sheets for inlet protection).

INSTALLATION/APPLICATION CRITERIA:

- Provide upgradient sediment controls, such as silt fence during construction of inlet.
- When construction of inlet is complete, erect straw bale barrier or silt fence surrounding perimeter of inlet. Follow instructions and guidelines on individual BMP information sheets for straw bale barrier and silt fence construction.

LIMITATIONS:

- Recommended maximum contributing drainage area of one acre.
- Limited to inlets located in open unpaved areas.
- Requires shallow slopes adjacent to inlet.

MAINTENANCE:

- Inspect inlet protection following storm event and at a minimum of once monthly.
- Remove accumulated sediment when it reaches 4-inches in depth.
- Repair or realign barrier/fence as needed.
- Look for bypassing or undercutting and recompact soil around barrier/fence as required.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ■ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

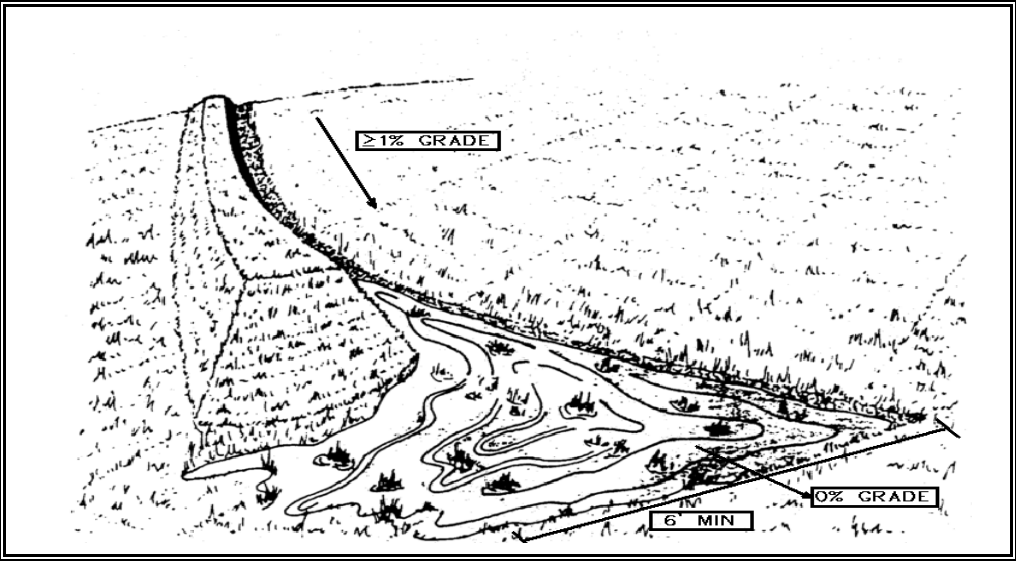
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Level Spreaders

LS



DESCRIPTION:

Level spreaders are devices used at storm water outlets to spread out collected storm water flows into sheet flow (runoff that flows over ground surface in a thin, even layer). Typically, a level spreader consists of a depression in the soil surface that spreads the flow onto a flat area across a gentle slope. Level spreaders then release the storm water flow onto level areas stabilized by vegetation to reduce speed and increase infiltration.

APPLICATION:

Level spreaders are most often used as an outlet for temporary or permanent storm water conveyances or dikes. Runoff that contains high sediment loads should be treated in a sediment trapping device prior to release into a level spreader.

INSTALLATION/APPLICATION CRITERIA:

- The length of the spreader depends upon the amount of water that flows through the conveyance.
- Larger volumes of water need more space to even out.
- Level spreaders are generally used with filter strips (see Filter Strips BMP).
- The depressions are seeded with vegetation (see Permanent & Temporary Seeding BMP).
- Level spreaders should be constructed on natural soils and not on fill material.
- The entrance to the spreader should be level so that the flow can spread out evenly.
- Level Spreader should have a grade of 0%; minimum width should be 6'.

LIMITATIONS:

- Can easily develop "short circuiting" (concentration of flows into small streams instead of sheet flow over the spreader) because of erosion or other disturbance.
- Cannot handle large quantities of sediment-laden storm water.

MAINTENANCE:

- The spreader should be inspected after every storm event to check for damage.
- If ponding or erosion channels develop, the spreader should be regraded.
- Dense vegetation should be maintained and damaged areas reseeded as needed.

CONSIDERATIONS

- ☒ Soils
- ☒ Area Required
- ☒ Slope
- ☐ Water Availability
- ☒ Aesthetics
- ☐ Hydraulic Head
- ☒ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

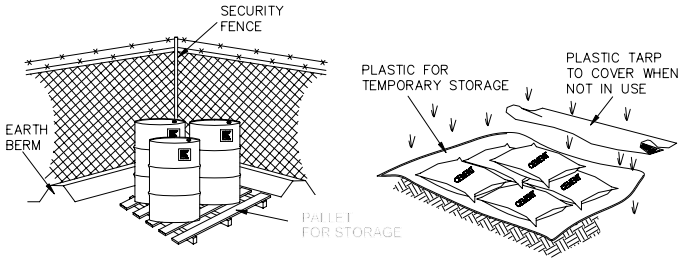
- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Materials Storage

MS



►CONTROLLED STORAGE LOCATION
►BERMED PERIMETER IMPOUNDMENT
►STORAGE OFF GROUND
►COVER WHEN NOT IN USE

DESCRIPTION:

Controlled storage of on-site materials.

APPLICATION:

- Storage of hazardous, toxic, and all chemical substances.
- Any construction site with outside storage of materials.

INSTALLATION/APPLICATION CRITERIA:

- Designate a secured area with limited access as the storage location. Ensure no waterways or drainage paths are nearby.
- Construct compacted earthen berm (See Earth Berm Barrier Information Sheet), or similar perimeter containment around storage location for impoundment in the case of spills.
- Ensure all on-site personnel utilize designated storage area. Do not store excessive amounts of material that will not be utilized on site.
- For active use of materials away from the storage area ensure materials are not set directly on the ground and are covered when not in use. Protect storm drainage during use.

LIMITATIONS:

- Does not prevent contamination due to mishandling of products.
- Spill Prevention and Response Plan still required.
- Only effective if materials are actively stored in controlled location.

MAINTENANCE:

- Inspect daily and repair any damage to perimeter impoundment or security fencing.
- Verify that materials are being correctly stored (i.e. standing upright, in labeled containers, tightly capped) and that no materials are being stored away from the designated location.

OBJECTIVES

- ☒ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake City BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ■ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☒ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ■ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Mulching

MU

DESCRIPTION:

Placement of material such as straw, grass, woodchips, woodfibers or fabricated matting over open area.

APPLICATION:

- Any exposed area to remain untouched longer than 14 days and that will be exposed less than 60 days (seed areas to be exposed in excess of 60 days).
- Areas that have been seeded.
- Stockpiled soil material.

Material	Application	Depth	Comments
Gravel: Washed 1/4" to 1-1/2"	9 cy/1000 sf	3 inches	Good for traffic areas Good for short slopes
Straw: Air-dried, free of seeds and coarse material	2-3 bales/1000 sf	2 inches min.	Subject to wind blowing Tack down or keep moist
Wood Fiber Cellulose: Free from growth inhibitors; dyed green	35 lb/1000 sf	1 inch	For critical areas, double application rate; Limit to slopes < 3% and < 150 feet

INSTALLATION/APPLICATION CRITERIA:

- Roughen area to receive mulch to create depressions that mulch material can settle into.
- Apply mulch to required thickness and anchor as necessary.
- Ensure material used is weed free and does not contain any constituents that will inhibit plant growth.

LIMITATIONS:

- Anchoring may be required to prevent migration of mulch material.
- Downgradient control may be required to prevent mulch material being transported to storm water system.

MAINTENANCE:

- Inspect mulched areas after every rainfall event and at a minimum of monthly.
- Replace mulch on any bare areas and reanchor as necessary.
- Clean and replace downgradient controls as necessary.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

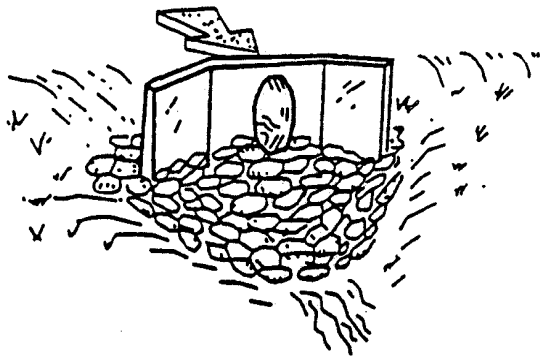
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Outlet Protection

OP



Objectives

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Description:

A rock outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble which is placed at the outlet of a pipe to prevent scour of the soil caused by high pipe flow velocities, and to absorb flow energy to produce non-erosive velocities.

Applications:

- Wherever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach.
- Rock outlet protection is best suited for temporary use during construction becasue it is usually less expensive and easier to install than concrete aprons or energy dissipators.
- A sediment trap below the pipe outlet is recommended if runoff is sediment laden.
- Permanent rock riprap protection should be designed and sized by the engineer as part of the culvert, conduit or channel design.
- Grouted riprap should be avoided in areas of freeze and thaw because the grout will break up.

Installation/Application Criteria:

Rock outlet protection is effective when the rock is sized and placed properly. When this is accomplished, rock outlets do much to limit erosion at pipe outlets. Rock size should be increased for high velocity flows. Best results are obtained when sound, durable, angular rock is used.

Limitations:

- Large storms often wash away the rock outlet protection and leave the area susceptible to erosion.
- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.

Maintenance:

- Inspect after each significant rain for erosion and/or disruption of the rock, and repair immediately.
- Grouted or wire-tied rock riprap can minimize maintenance requirements.

Adapted from Salt Lake County BMP Fact Sheet

Targeted Pollutants

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Parking Lot Sweeping/Vacuuming

PLSV

DESCRIPTION:

Reduce the discharges of pollutants to stormwater from parking lot surfaces by conducting parking lot cleaning on a regular basis.

APPROACH:

- Restrict parking prior to and during sweeping.
- Establish frequency of sweeping based on anticipated need and observations of debris or sediment accumulation
- Increase sweeping frequency just before the rainy season.
- Lots that generate greater amounts of debris or sediment must be swept more frequently. These include lots associated with or adjacent to recreational, commercial, or industrial areas, or other areas of high vehicle or pedestrian traffic.
- Manually remove debris from corners or other areas of the parking lot that equipment cannot reach
- Keep accurate operation logs to track programs.
- Equipment selection can be key for this particular BMP. There are two types used, the mechanical broom sweepers (more effective at picking up large debris and cleaning wet streets), and the vacuum sweepers (more effective at removing fine particles and associated heavy metals). It may be useful to have the ability to use both kinds.

LIMITATIONS:

- Conventional sweepers are not able to remove oil and grease.
- Mechanical sweepers are not effective at removing finer sediments.
- Effectiveness may also be limited by parking lot conditions, presence of parked vehicles, presence of construction projects, climatic conditions and condition of curbs.

MAINTENANCE:

- Acquisition and maintenance of equipment is generally handled by the company hired to perform the sweeping/vacuuming.

PROGRAM ELEMENTS

- ☐ New Development
- ☐ Residential
- ☒ Commercial Activities
- ☒ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ☒ Toxic Materials
- ■ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

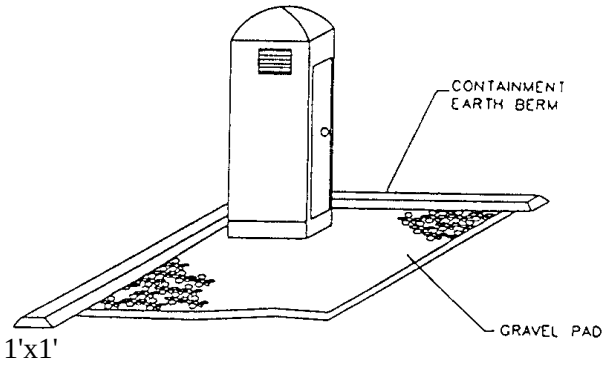
IMPLEMENTATION REQUIREMENTS

- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Regulatory
- ☐ Training
- ☐ Staffing
- ☒ Administrative

■ High ☒ Medium ☐ Low

BMP: Portable Toilets

PT



1'x1'

DESCRIPTION:

Temporary on-site sanitary facilities for construction personnel.

APPLICATION:

All sites with no permanent sanitary facilities or where permanent facility is too far from activities.

INSTALLATION/APPLICATION CRITERIA:

- Locate portable toilets in convenient locations throughout the site.
- Prepare level, gravel surface and provide clear access to the toilets for servicing and for on-site personnel.
- Construct earth berm perimeter (See Earth Berm Barrier Information Sheet), control for spill/protection leak.
- Stake toilets to prevent them from tipping.

LIMITATIONS:

No limitations.

MAINTENANCE:

- Portable toilets should be maintained in good working order by licensed service with daily observation for leak detection.
- Regular waste collection should be arranged with licensed service.
- All waste should be deposited in sanitary sewer system for treatment with appropriate agency approval.

OBJECTIVES

☒ Housekeeping Practices
☒ Contain Waste
☐ Minimize Disturbed Areas
☐ Stabilize Disturbed Areas
☐ Protect Slopes/Channels
☐ Control Site Perimeter
☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

☐ Sediment
☐ Nutrients
☐ Toxic Materials
☐ Oil & Grease
☐ Floatable Materials
■ Other Waste

■ High Impact
☒ Medium Impact
☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

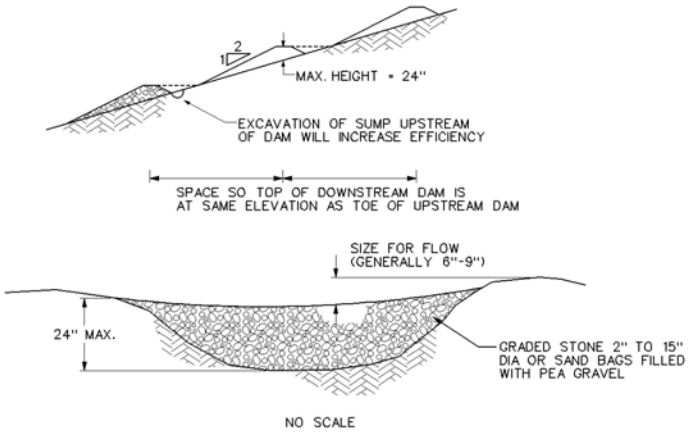
☒ Capital Costs
☒ O&M Costs
☒ Maintenance
☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Rock Check Dams

RCD



DESCRIPTION:

A small, temporary dam constructed across a drainage ditch to reduce velocity of concentrated storm water flows, thereby reducing the erosion of the ditch.

APPLICATION:

- Temporary drainage paths
- Permanent drainage ways not yet stabilized
- Existing drainage paths receiving increased flows due to construction

INSTALLATION/APPLICATION CRITERIA:

- Prepare location of dam by removing any debris and rough grading any irregularities in channel bottom
- Place rocks by hand or with appropriate machinery, do not dump
- Construct dam with center lower to pass design flow
- Construct 50% side slopes on dam

LIMITATIONS:

- Maximum recommended drainage area is 10 acres
- Maximum recommended height is 24"
- Do not use in running stream

MAINTENANCE:

- Inspect dams daily during prolonged rainfall, after each major rain event and at a minimum of once monthly.
- Remove any large debris and repair any damage to dam, channel or sideslopes
- Remove accumulated sediment when it reaches one half the height of the dam

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

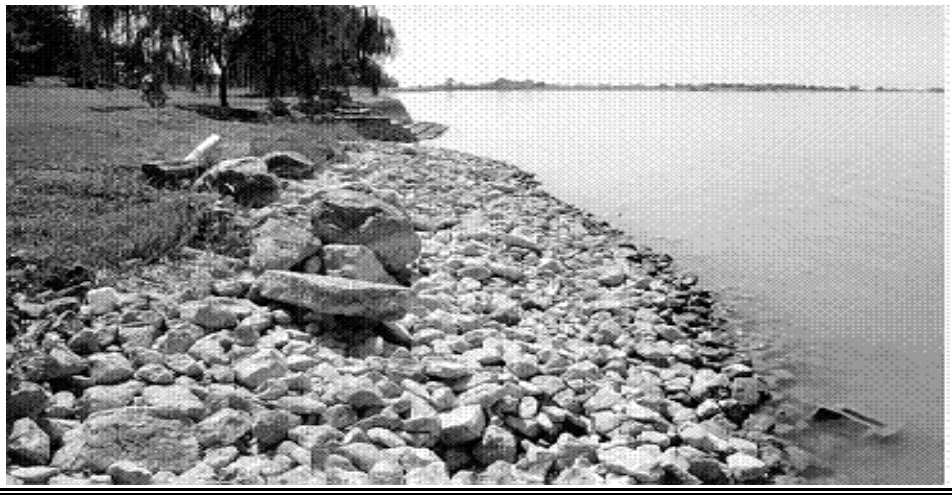
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Riprap

RR



DESCRIPTION:

Riprap is a permanent, erosion-resistant protective layer made of loose stones. It is intended to protect soil from erosion in areas of concentrated runoff. Riprap may also be used to stabilize slopes that are unstable because of seepage problems.

APPLICATION:

- Riprap is normally used at locations where erosive forces from water flow exceed the ability of the soil or vegetative cover to resist those forces.
- Riprap can be used for pipe outlet protection, channel lining, scour protection, etc.
- Riprap is commonly used for wave protection on lakes.

INSTALLATION/APPLICATION CRITERIA:

- For slopes steeper than 2:1, consider using materials other than riprap for erosion protection.
- If riprap is being planned for the bottom of a permanently flowing channel, the bottom can be modified to enhance fish habitat. This can be done by constructing riffles and pools which simulate natural conditions.
- When working within flowing streams, measures should be taken to prevent excessive turbidity and erosion during construction. Bypassing base flows or temporarily blocking base flows are two possible methods. Work should be done during a period of low flow.

In designing riprap consider the following:

- Use durable rock, such as granite, and a variety of rock sizes.
- The thickness of riprap layers should be at least 1.25 times the max. stone diameter.
- Filter material is usually required between riprap and the underlying soil surface.

LIMITATIONS:

- Riprap may be unstable on very steep slopes.
- The placement of a riprap in streams requires a state stream alteration permit.

MAINTENANCE:

- Riprap should be inspected annually and after major storms.
- If riprap has been damaged, repairs should be made promptly to prevent a progressive failure.
- If repairs are needed repeatedly at one location, the site should be evaluated to see if original design conditions have changed.

CONSIDERATIONS

- ☒ Soils
- ☒ Area Required
- ☒ Slope
- ☐ Water Availability
- ☒ Aesthetics
- ☐ Hydraulic Head
- ☒ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☒ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

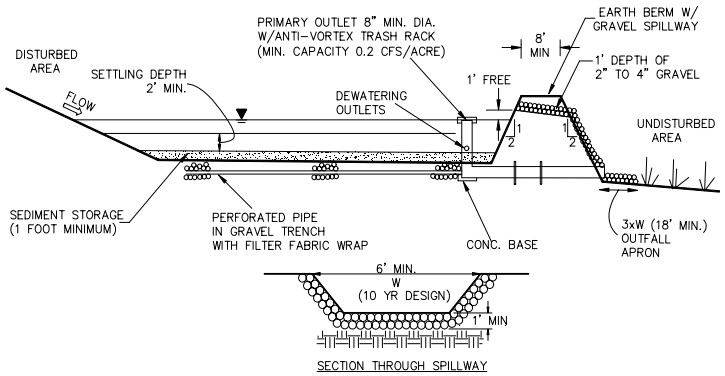
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Sediment Basin

SB



DESCRIPTION:

A pond created by excavation or construction of an embankment, and designed to retain or detain runoff sufficiently to allow excessive sediment to settle.

APPLICATION:

- At the outlet of all disturbed watersheds 10 acres or larger.
- At the outlet of smaller disturbed watersheds, as necessary.
- Where post construction detention basins will be located.

INSTALLATION/APPLICATION CRITERIA:

- Design basin for site specific location, maintain effective flow length 2 times width.
- Excavate basin or construct compacted berm containment, ensure no downgradient hazard if failure should occur. (Provide minimum of 67 cy. per acre of drainage area).
- Construct dewatering and outfall structure and emergency spillway with apron.

LIMITATIONS:

- Should be sized based on anticipated runoff, sediment loading and drainage area size.
- May require silt fence at outlet for entrapment of very fine silts and clays.
- May require safety fencing to prevent public access.
- Height restrictions for embankment regulated by Utah Division of Dam Safety.

MAINTENANCE:

- Inspect after each rainfall event and at a minimum of monthly.
- Repair any damage to berm, spillway or sidewalls.
- Remove accumulated sediment as it reaches 2/3 height of available storage.
- Check outlet for sedimentation/erosion of downgradient area and remediate as necessary. Install silt fence if sedimentation apparent.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

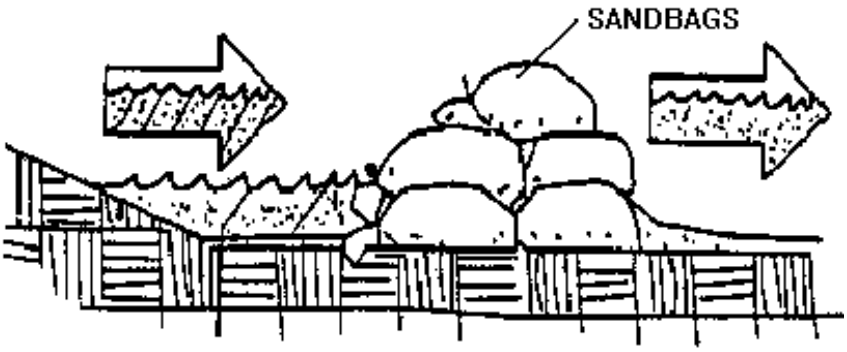
- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Sand Bag Barrier

SBB



DESCRIPTION:

Stacking sand bags along a level contour creates a barrier which detains sediment-laden water, ponding water upstream of the barrier and promoting sedimentation.

APPLICATION:

- Along the perimeter of the site.
- May be used in drainage areas up to 5 acres.
- Along streams and channels
- Across swales with small catchments.
- Around temporary spoil areas.
- Below the toe of a cleared slope.

INSTALLATION/APPLICATION CRITERIA:

- Install along a level contour.
- Base of sand bag barrier should be at least 48 inches wide.
- Height of sand bag barrier should be at least 18 inches high.
- 4 inch PVC pipe may be installed between the top layer of sand bags to drain large flood flows.
- Provide area behind barrier for runoff to pond and sediment to settle.
- Place below the toe of a slope.

LIMITATIONS:

- Sand bags are more expensive than other barriers, but also more durable.
- Burlap should not be used.

MAINTENANCE:

- Inspect after each rain.
- Reshape or replace damaged sand bags immediately.
- Replace sediment when it reaches six inches in depth.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Street Cleaning

SC

DESCRIPTION:
Reduce the discharges of pollutants to stormwater from street surfaces by conducting street cleaning on a regular basis.

APPROACH:
- Prioritize cleaning to use the most sophisticated sweepers, at the highest frequency, and in areas with the highest pollutant loading.
- Restrict street parking prior to and during sweeping.
- Increase sweeping frequency just before the rainy season.
- Proper maintenance and operation of sweepers greatly increase their efficiency.
- Keep accurate operation logs to track programs.
- Reduce the number of parked vehicles using regulations.
- Sweepers effective at removing smaller particles (less than 10 microns) may generate dust that would lead to concerns over worker and public safety.
- Equipment selection can be key for this particular BMP. There are two types used, the mechanical broom sweepers (more effective at picking up large debris and cleaning wet streets), and the vacuum sweepers (more effective at removing fine particles and associated heavy metals). Many communities find it useful to have a compliment of both types in their fleet.

LIMITATIONS:
- Conventional sweepers are not able to remove oil and grease.
- Mechanical sweepers are not effective at removing finer sediments.
- Effectiveness may also be limited by street conditions, traffic congestion, presence of construction projects, climatic conditions and condition of curbs.

MAINTENANCE:
- Replace worn parts as necessary.
- Install main and gutter brooms of the appropriate weight.

PROGRAM ELEMENTS

☐ New Development
☐ Residential
☐ Commercial Activities
☐ Industrial Activities
☒ Municipal Facilities
☒ Illegal Discharges

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

■ Sediment
■ Nutrients
■ Heavy Metals
☒ Toxic Materials
■ Oxygen Demanding Substances
☐ Oil & Grease
☒ Floatable Materials
☐ Bacteria & Viruses

■ High Impact
☒ Medium Impact
☐ Low or Unknown Impact

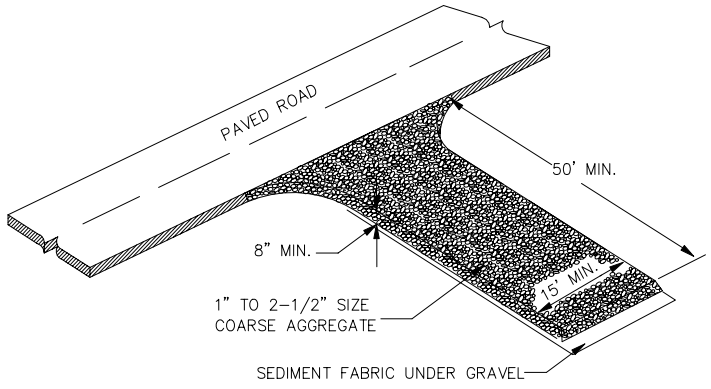
IMPLEMENTATION REQUIREMENTS

■ Capital Costs
■ O&M Costs
☒ Regulatory
☒ Training
■ Staffing
☒ Administrative

■ High ☒ Medium ☐ Low

BMP: Stabilized Construction Entrance and Wash Area

SCEWA



DESCRIPTION:

A stabilized pad of crushed stone located where construction traffic enters or leaves the site from or to paved surface. The area can be used to spray off vehicles before they leave the site.

APPLICATIONS:

At any point of ingress or egress at a construction site where adjacent traveled way is paved. Generally applies to sites over 2 acres unless special conditions exist.

INSTALLATION/APPLICATION CRITERIA:

- Clear and grub area and grade to provide maximum slope of 2%.
- Compact subgrade and place filter fabric if desired (recommended for entrances to remain for more than 3 months).
- Place coarse aggregate, 1 to 2-1/2 inches in size, to a minimum depth of 8 inches.
- Provide water to the area that can be used to spray off vehicles as needed to prevent the tracking of mud off of the construction site. This may not be needed during dry periods of work, but is needed when construction is proceeding under wet conditions.
- Provide berming as needed to prevent sediment laden wash water from entering storm water facilities or other water bodies, or leaving the site.

LIMITATIONS:

- Requires periodic top dressing with additional stones.
- Should be used in conjunction with street sweeping on adjacent public right-of-way.
- Must be situated such that waste water does not run off site.

MAINTENANCE:

- Inspect daily for loss of gravel or sediment buildup.
- Inspect adjacent roadway for sediment deposit and clean by shoveling and sweeping.
- Repair entrance and replace gravel as required to maintain control in good working condition.
- Expand stabilized area as required to accommodate traffic and prevent erosion at driveways.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

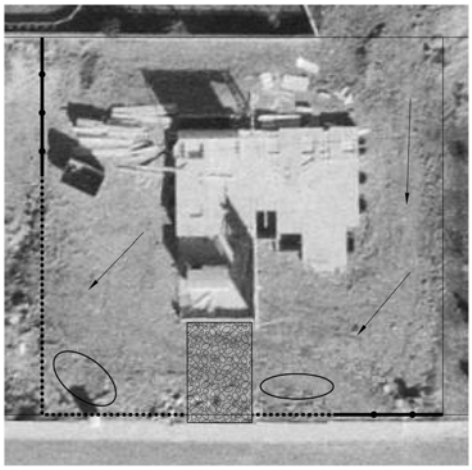
- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Sediment Control on Small Construction Sites

SCSCS



APPLICATIONS

- ☐ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☐ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Control the perimeter, vehicular access, and the delivery of materials to small construction sites so that sediment, landscaping materials and other construction debris is not in the street. This BMP is intended to be applied to residential construction sites and small nonresidential sites.

APPROACH:

- Prior to any building construction on a site, identify the point of access to the property. This should generally be the location of the future driveway. Fence the remainder of the street frontage of the property, as well as side lot lines (as far as necessary to prevent access) with temporary fencing (silt fence may be used where silt fence is needed). This fencing is to remain in place until all construction or landscape material deliveries are complete. **No access is to be made at any point other than the designated point of access.**
- Control the perimeter of the site so that sediment-laden storm water does not leave the site during construction. This may involve sediment control measures such as silt fences, drainage swales or berms, straw or hay bale barriers, or rock check dams.
- Either utilize the curb cut or leave the curb, gutter and sidewalk in place (and replace it if needed when work is complete). **Do not place anything in the gutter, including dirt ramps.**
- Excavate for and place a bed of gravel or drain rock the full width of the future driveway (16' minimum), a distance of 27 feet back from the back of sidewalk. Place the rock to the depth necessary to prevent material delivery vehicles from contacting the on-site soils.
- At the proper time, the gravel or rock bed can be modified to serve as the base for concrete driveway placement. At that point, the concrete driveway will prevent delivery and other vehicles from coming into contact with on-site soils.

LIMITATIONS:

- It may be necessary to pump concrete to locations away from the bed of gravel or rock.
- Parking of workers' vehicles may require that the bed of gravel or rock be enlarged to make space for vehicle parking that keeps the vehicles from contacting the on-site soils.
- Builders, subcontractors, material suppliers, vendors and other visitors to the site must be educated to adhere to the practices outlined.
- Landscaping and construction materials must be placed on the lot, not the street or walk.

MAINTENANCE:

- Repair fencing as needed to maintain control of access.
- Repair sediment control measures as needed during construction.
- Replenish and dress up the gravel/rock area as needed during the course of construction.
- Any tracking of soil onto the adjacent street indicates inadequate performance of this BMP. Remove soil tracked onto the street at the end of any day that it occurs and take corrective measures to prevent soil tracking onto the street from recurring.

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Heavy Metals
- ☐ Toxic Materials
- ☐ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

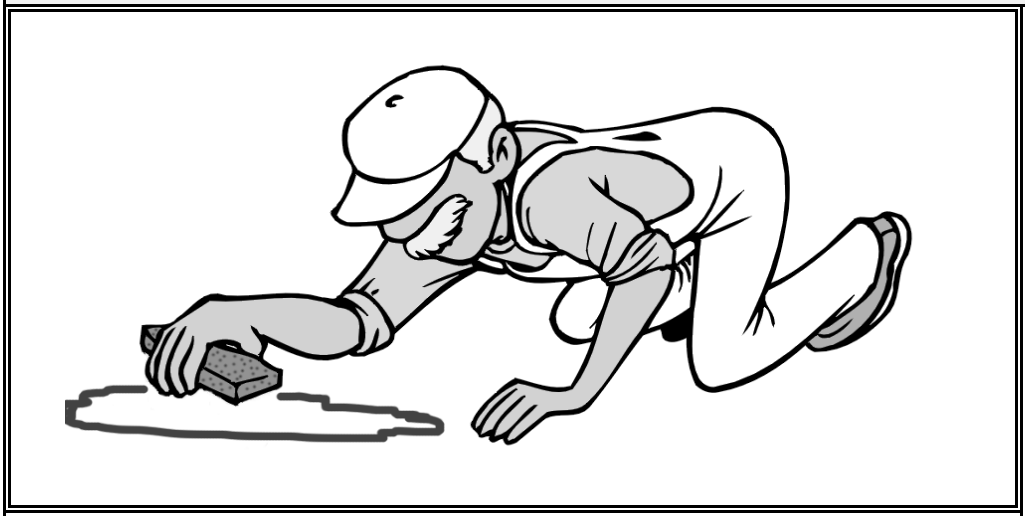
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ■ Maintenance
- ■ Training

■ High ☒ Medium ☐ Low

BMP: Spill Clean-Up

SCU



DESCRIPTION:
Practices to clean-up leakage/spillage of on-site materials that may be harmful to receiving waters.

APPLICATION:
All sites

GENERAL:
- Store controlled materials within a storage area.
- Educate personnel on prevention and clean-up techniques.
- Designate an Emergency Coordinator responsible for employing preventative practices and for providing spill response.
- Maintain a supply of clean-up equipment on-site and post a list of local response agencies with phone numbers.

METHODS:
- Clean-up spills/leaks immediately and remediate cause.
- Use as little water as possible. NEVER HOSE DOWN OR BURY SPILL CONTAMINATED MATERIAL.
- Use rags or absorbent material for clean-up. Excavate contaminated soils. Dispose of clean-up material and soil as hazardous waste.
- Document all spills with date, location, substance, volume, actions taken and other pertinent data.
- Contact local Fire Department and State Division of Environmental Response and Remediation (Phone #801-536-4100) for any spill of reportable quantity.

OBJECTIVES

☒ Housekeeping Practices
☒ Contain Waste
☐ Minimize Disturbed Areas
☐ Stabilize Disturbed Areas
☐ Protect Slopes/Channels
☐ Control Site Perimeter
☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

☐ Sediment
☐ Nutrients
■ Toxic Materials
☒ Oil & Grease
☐ Floatable Materials
☐ Other Waste

■ High Impact
☒ Medium Impact
☐ Low or Unknown Impact

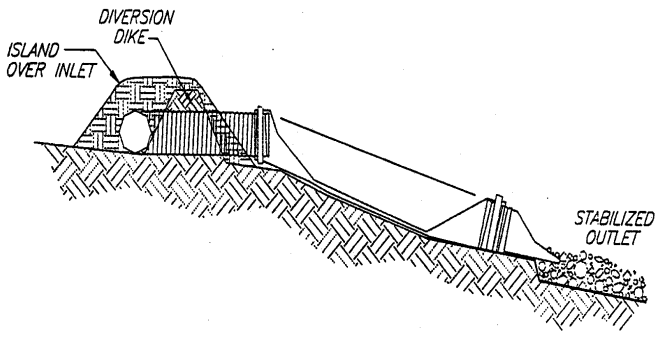
IMPLEMENTATION REQUIREMENTS

☒ Capital Costs
☐ O&M Costs
☐ Maintenance
■ Training

■ High ☒ Medium ☐ Low

BMP: Slope Drain

SD



DESCRIPTION:

A temporary pipe or lined channel that drains the top of a slope to a stable discharge point at the bottom of a slope without causing erosion.

APPLICATIONS:

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top slope diversion dikes or swales.
- Emergency spillway for a sediment basin.
- Drainage for top of cut/fill slopes where water can accumulate.

INSTALLATION/APPLICATION CRITERIA:

- Secure inlet and surround with dikes to prevent gully erosion, and anchor pipe to slope.
- Size to convey at least the peak of a 10-year, storm event.
- Stabilize outlet. (See Outlet Protection BMP).

LIMITATIONS:

- Maximum drainage area per slope drain is 5 acres.
- Clogged slope drains will force water around the pipe and cause slope erosion.
- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.
- Failure can result in flooding and severe erosion.

MAINTENANCE:

- Structure must be inspected weekly and after storms.
- Inlet must be free of undercutting and no water should circumvent the entry.
- Outlet should not produce erosion; velocity dissipaters must be maintained.
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

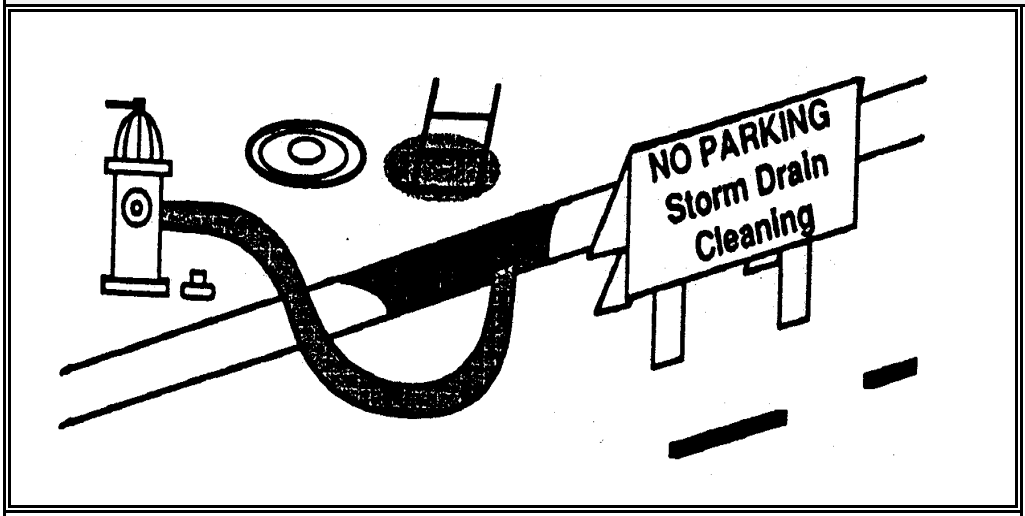
- ■ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Storm Drain Flushing

SDF



DESCRIPTION:

A storm drain is "flushed" with water to suspend and remove deposited materials. Flushing is particularly beneficial for storm drain pipes with grades too flat to be self-cleansing. Flushing helps ensure pipes convey design flow and remove pollutants from the storm drain system.

APPROACH:

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Whenever possible, flushed effluent should be collected, decanted, evaporated, and disposed of in a landfill.

LIMITATIONS:

- Most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity).
- Water source must be available.
- May have difficulty finding downstream area to collect sediments.
- Requires liquid/sediment disposal.

PROGRAM ELEMENTS

- ☐ New Development
- ☐ Residential
- ☐ Commercial Activities
- ☐ Industrial Activities
- ☒ Municipal Facilities
- ☐ Illegal Discharges

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☐ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☐ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

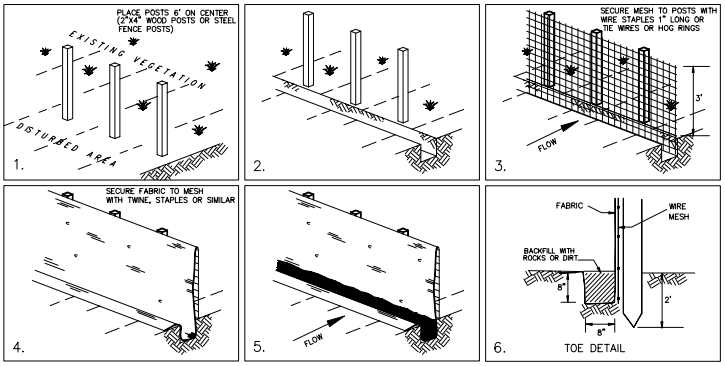
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ■ O&M Costs
- ☐ Regulatory
- ☒ Training
- ■ Staffing
- ☐ Administrative

■ High ☒ Medium ☐ Low

BMP: Silt Fence

SF



OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

DESCRIPTION:

A temporary sediment barrier consisting of entrenched filter fabric stretched across and secured to supporting posts.

APPLICATION:

- Perimeter control: place barrier at downgradient limits of disturbance
- Sediment barrier: place barrier at toe of slope or soil stockpile
- Protection of existing waterways: place barrier near top of stream bank
- Inlet protection: place fence surrounding catchbasins

INSTALLATION/APPLICATION CRITERIA:

- Place posts 6 feet apart on center along contour (or use preassembled unit) and drive 2 feet minimum into ground. Excavate an anchor trench immediately upgradient of posts.
- Secure wire mesh (14 gage min. With 6 inch openings) to upslope side of posts. Attach with heavy duty 1 inch long wire staples, tie wires or hog rings.
- Cut fabric to required width, unroll along length of barrier and drape over barrier. Secure fabric to mesh with twine, staples, or similar, with trailing edge extending into anchor trench.
- Backfill trench over filter fabric to anchor.

LIMITATIONS:

- Recommended maximum drainage area of 0.5 acre per 100 feet of fence
- Recommended maximum upgradient slope length of 150 feet
- Recommended maximum uphill grade of 2:1 (50%)
- Recommended maximum flow rate of 0.5 cfs
- Ponding should not be allowed behind fence

MAINTENANCE:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff bypassing ends of barriers or undercutting barriers.
- Repair or replace damaged areas of the barrier and remove accumulated sediment.
- Reanchor fence as necessary to prevent shortcutting.
- Remove accumulated sediment when it reaches ½ the height of the fence.

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

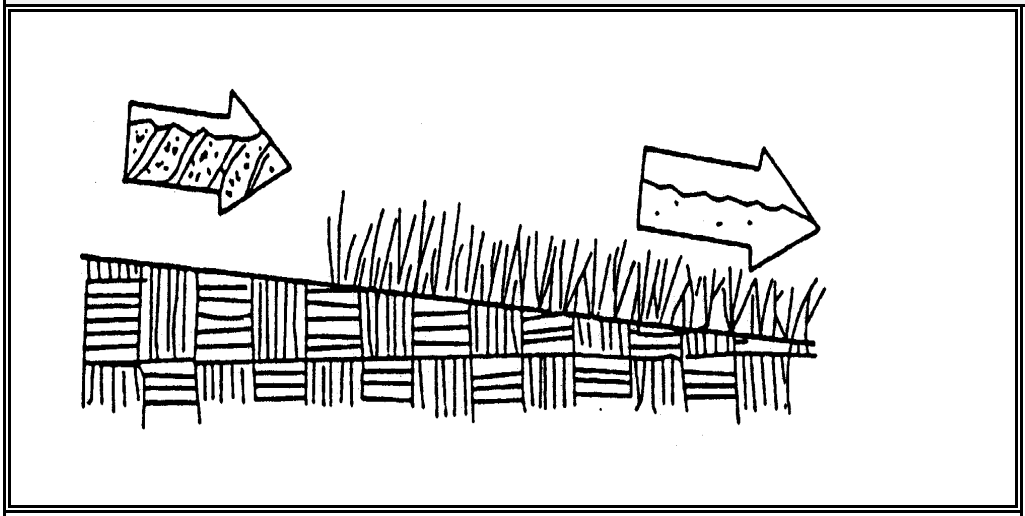
- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Seeding and Planting

SP



DESCRIPTION:

Seeding of grass and plantings of trees, shrubs, vines and ground covers provide long-term stabilization of soil. Grasses can be planted for temporary stabilization.

APPLICATION:

- Appropriate for site stabilization both during construction and post-construction.
- Any graded/cleared areas where construction activities have ceased.
- Open space cut and fill areas.
- Steep slopes, spoil piles, vegetated swales, landscape corridors, stream banks.

INSTALLATION/APPLICATION CRITERIA:

Type of vegetation, site and seedbed preparation, planting time, fertilization and water requirements should be considered for each application.

Grasses:

- Ground preparation: fertilize and mechanically stabilize the soil.
- Tolerant of short-term temperature extremes and waterlogged soil composition.
- Appropriate soil conditions: shallow soil base, good drainage, slope 2:1 or flatter.
- Mowing, irrigating, and fertilizing are vital for promoting vigorous grass growth.

Trees and Shrubs:

- Selection criteria: vigor, species, size, shape & wildlife food source.
- Soil conditions: select species appropriate for soil, drainage & acidity.
- Other factors: wind/exposure, temperature extremes, and irrigation needs.

Vines and Ground Covers:

- Ground preparation: lime and fertilizer preparation.
- Use proper seeding rates.
- Appropriate soil conditions: drainage, acidity and slopes.
- Generally avoid species requiring irrigation.

LIMITATIONS:

- Permanent and temporary vegetation may not be appropriate in dry periods without irrigation.
- Fertilizer requirements may have potential to create stormwater pollution.

MAINTENANCE:

- Shrubs and trees must be adequately watered and fertilized and if needed pruned.
- Grasses may need to be watered and mowed.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

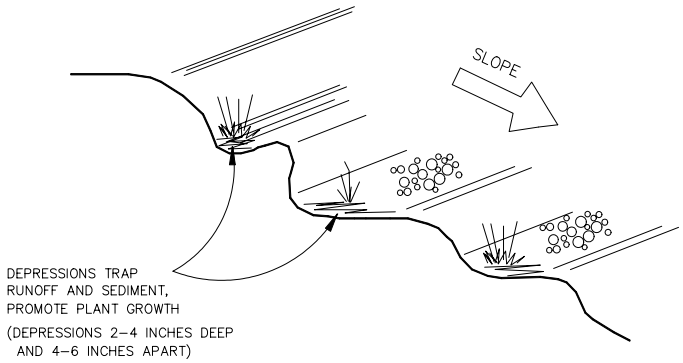
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Surface Roughening

SR



DESCRIPTION:

Rough preparation of working areas leaving depressions and uneven surface. Depressions should be done parrallel to contours.

APPLICATION:

Surface roughening is appropriate for all construction that will not be receiving impervious cover within 14 days and that will be exposed less than 60 days (seed areas to be open in excess of 60 days).

INSTALLATION/APPLICATION CRITERIA:

- Surface should be left in rough condition during initial earthwork activity.
- Surfaces that have become smoothed or compacted due to equipment traffic should be roughened by use of disks, spring harrows, teeth on front end loader, or similar, operating along the contours of the slope. Tracking (by crawler tractor driving up and down slope) may also be used to provide depressions parallel to contours.
- Avoid compaction of soils during roughening as this inhibits plant growth and promotes storm water runoff. Limit tracked machinery to sandy soil.
- Seed or mulch areas to be exposed in excess of 60 days.
- Employ dust controls (See Dust Control BMP Fact Sheet).

LIMITATIONS:

- Will not withstand heavy rainfall.
- Slopes steeper than 2:1 (50%) should be benched (See Benching BMP Fact Sheet).

MAINTENANCE:

- Inspect following any storm event and at a minimum of weekly.
- If erosion in the form of rills (small waterways formed by runoff) is evident, perform machine roughening of area.
- For vegetated slopes reseed areas that are bare or have been reworked.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

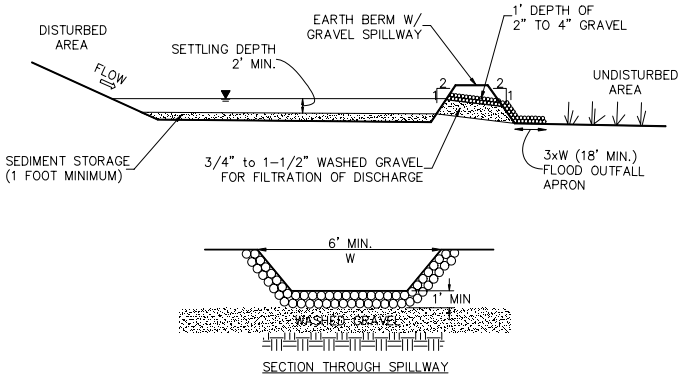
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Sediment Trap

ST



DESCRIPTION:

A sediment trap is a small excavated or bermed area where runoff from small drainage areas is detained and sediment can settle.

APPLICATION:

- Temporary control for runoff from disturbed areas of less than 3 acres.
- Temporary control for discharge from diversion dike, surface benching, or other temporary drainage measures.

INSTALLATION/APPLICATION CRITERIA:

- Design basin for site specific location.
- Excavate basin or construct compacted berm containment.
- Construct outfall spillway with apron.
- Provide downstream silt fence if necessary.

LIMITATIONS:

- Should be sized based on anticipated runoff, sediment loading and drainage area size.
- May require silt fence at outlet for entrapment of very fine silts and clays.

MAINTENANCE:

- Inspect after each rainfall event and at a minimum of monthly.
- Repair any damage to berm, spillway or sidewalls.
- Remove accumulated sediment as it reaches 2/3 height of available storage.
- Check outlet for sedimentation/erosion of downgradient area and remediate as necessary. Install silt fence if sedimentation apparent.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

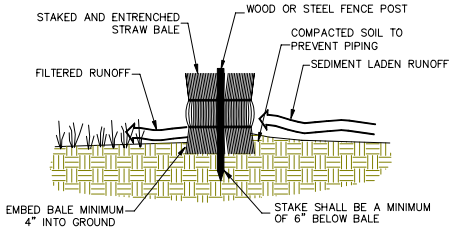
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☐ Training

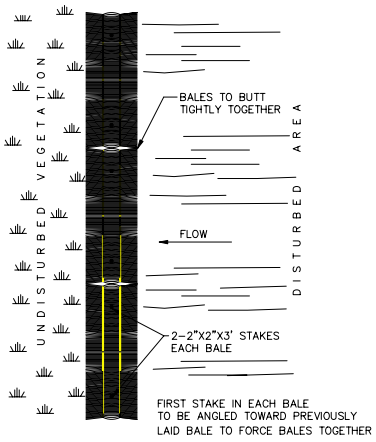
■ High ☒ Medium ☐ Low

BMP: Straw Bale Barrier

STB



SECTION



PLAN

DESCRIPTION:

Temporary sediment barrier consisting of a row of entrenched and anchored straw bales.

APPLICATION:

- Perimeter Control: place barrier at downgradient limits of disturbance.
- Sediment barrier: place barrier at toe of slope or soil stockpile.
- Protection of existing waterways: place barrier near top of stream bank.
- Inlet Protection.

INSTALLATION/APPLICATION CRITERIA:

- Excavate a 4-inch minimum deep trench along contour line, i.e. parallel to slope, removing all grass and other material that may allow underflow.
- Place bales in trench with ends tightly abutting, fill any gaps by wedging loose straw into openings.
- Anchor each bale with 2 stakes driven flush with the top of the bale.
- Backfill around bale and compact to prevent piping, backfill on uphill side to be built up 4-inches above ground at the barrier.

LIMITATIONS:

- Recommended maximum area of 0.5 acre per 100 feet of barrier
- Recommended maximum upgradient slope length of 150 feet
- Recommended maximum uphill grade of 2:1 (50%)

MAINTENANCE:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff bypassing ends of barriers or undercutting barriers.
- Repair or replace damaged areas of the barrier and remove accumulated sediment.
- Realign bales as necessary to provide continuous barrier and fill gaps.
- Recompact soil around barrier as necessary to prevent piping.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

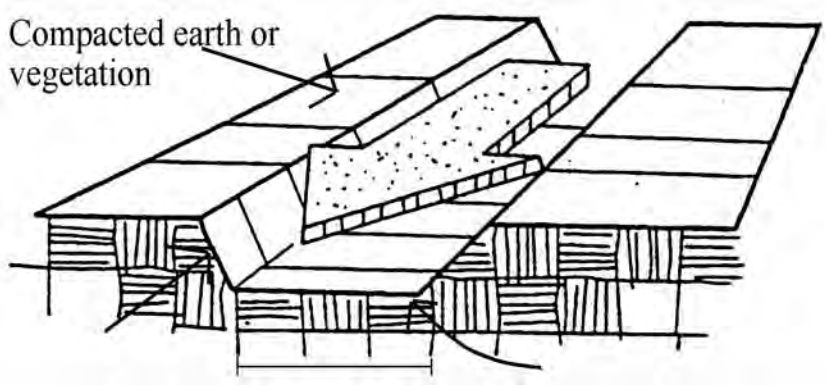
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Temporary Drains And Swales

TDS



DESCRIPTION:
Temporary drains and swales are used to divert off-site runoff around the construction site, divert runoff from stabilized areas around disturbed areas, and direct runoff into sediment.

APPLICATIONS:
- Temporary drains and swales are appropriate for diverting any upslope runoff around unstabilized or disturbed areas of the construction site.
- Prevent slope failures. Prevent damage to adjacent property. Prevents erosion and transport of sediments into water ways. Increases the potential for infiltration. Diverts sediment-laden runoff into sediment basins or traps.

INSTALLATION/APPLICATION:
- Temporary drainage swales will effectively convey runoff and avoid erosion if built properly:
- Size temporary drainage swales using local drainage design criteria. A permanent drainage channel must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drain/swale should conform to predevelopment drainage patterns and capacities.
- Construct the drain/swale with an uninterrupted, positive grade to a stabilized outlet. Provide erosion protection or energy dissipation measures if the flow out of the drain or swale can reach an erosive velocity.

LIMITATIONS:
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.

MAINTENANCE:
- Inspect weekly and after each rain.
- Repair any erosion immediately.
- Remove sediment which builds up in the swale and restricts its flow capacity.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Temporary and Permanent Seeding

TPS

DEFINITION:

Temporary seeding - establishment of short term cover by application of rapidly germinating seed mix (alternatively hydroseeding may be utilized).
Permanent seeding - establishment of final term cover by application of perennial seed mix (alternatively sod may be utilized).

APPLICATION:

Disturbed areas that are at final grade and which will not be disturbed by continuing activities on site. Also areas that are not at final grade but which will be left untouched in excess of one year.

RECOMMENDED SEED MIX:

The recommended seed mix will be dependent on site specific information such as elevation, exposure, soils, water available and topography. Check with the County Extension Service for recommended mixes for site specific conditions:

Utah State University Extension Service
51 South University Avenue, Suite 206
Provo, Utah 84601
phone (801) 370-8460

LIMITATIONS:

- Limited to areas that will not be subject to traffic or high usage.
- May require irrigation and fertilizer which creates potential for impacting runoff quality.
- May only be applied during appropriate planting season, temporary cover required until that time.

INSTALLATION:

- Roughen soil to a depth of 2 inches. Add fertilizer, manure, topsoil as necessary.
- Evenly distribute seed using a commonly accepted method such as broadcast seeding, drilling or hydroseeding.
- Use a seed mix appropriate for soil and location that will provide rapid germination and growth. Check with County Extension Service for recommended mix and application rate.
- Cover area with mulch if required due to steep slopes or unsuitable weather conditions.

MAINTENANCE:

- Provide irrigation as required to establish growth and to maintain plant cover through duration of project.
- Reseed as necessary to provide 75% coverage
- Remediate any areas damaged by erosion or traffic.
- When 75% coverage is achieved inspect monthly for damage and remediate as necessary.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

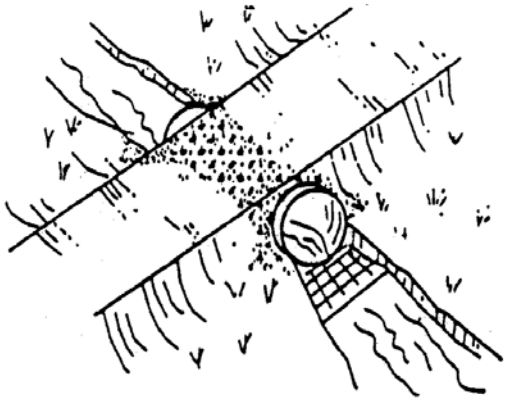
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Temporary Stream Crossing

TSC



DESCRIPTION:

A temporary access stream crossing is a temporary culvert, ford or bridge placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not intended to be used to maintain traffic for the general public.

APPLICATIONS:

Temporary stream crossings should be installed at all designated crossings of perennial and intermittent streams on the construction site, as well as for dry channels which may be significantly eroded by construction traffic.

INSTALLATION/APPLICATION:

Requires knowledge of stream flows and soil strength and should be designed under the direction of a Utah registered engineer with knowledge of both hydraulics and construction loading requirements for structures.

LIMITATIONS:

- May be expensive for a temporary improvement.
- Requires other BMP's to minimize soil disturbance during installation and removal.
- Fords should only be used in dry weather.
- A Stream Alteration Permit may be required, contact the Utah Division of Water Rights before implemention.

MAINTENANCE:

- Inspect weekly and after each significant rainfall, including assessment of foundations.
- Periodically remove silt from crossings.
- Replace lost aggregated from inlets and outlets of culverts.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☒ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

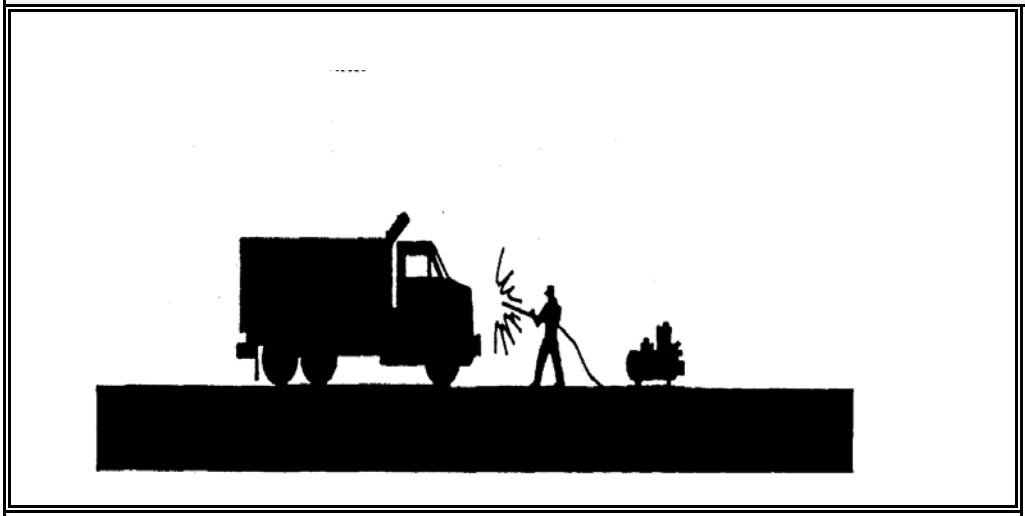
IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Vehicle And Equipment Cleaning

VEC



DESCRIPTION:

Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment cleaning by using off-site facilities, washing in designated, contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and/or training employees and subcontractors.

INSTALLATION/APPLICATION:

- Use off-site commercial washing businesses as much as possible. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute storm water. If you wash a large number of vehicles or pieces of equipment, consider conducting this work at an off-site commercial business. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work off-site can also be economical by eliminating the need for a separate washing operation at your site.
- If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with storm water, creeks, rivers, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground.
- Use as little water as possible to avoid having to install erosion and sediment controls for the wash area. Use phosphate-free biodegradable soaps. Educate employees and subcontractors on pollution prevention measures. Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations.

LIMITATIONS:

- Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.
- Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance.

MAINTENANCE:

- Minimal, some berm repair may be necessary.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

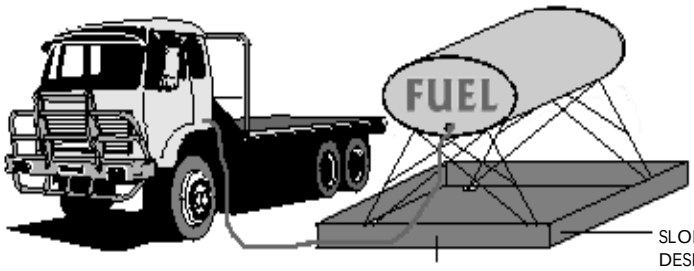
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Vehicle And Equipment Fueling

VEF



SLOPED OR OTHERWISE DESIGNED FOR EASY REMOVAL OF LEAKED FUEL

DESCRIPTION:

Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

INSTALLATION/APPLICATION:

- Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute storm water. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.
- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of storm water and the runoff of spills. Discourage"topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks. Place a stockpile of spill cleanup materials where it will be readily accessible. Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Carry out all Federal and State requirements regarding stationary above ground storage tanks.(40 CF Sub. J) Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time. Train employees and subcontractors in proper fueling and cleanup procedures.

LIMITATIONS:

Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance.

MAINTENANCE:

- Keep ample supplies of spill cleanup materials on-site.
- Inspect fueling areas and storage tanks on a regular schedule.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

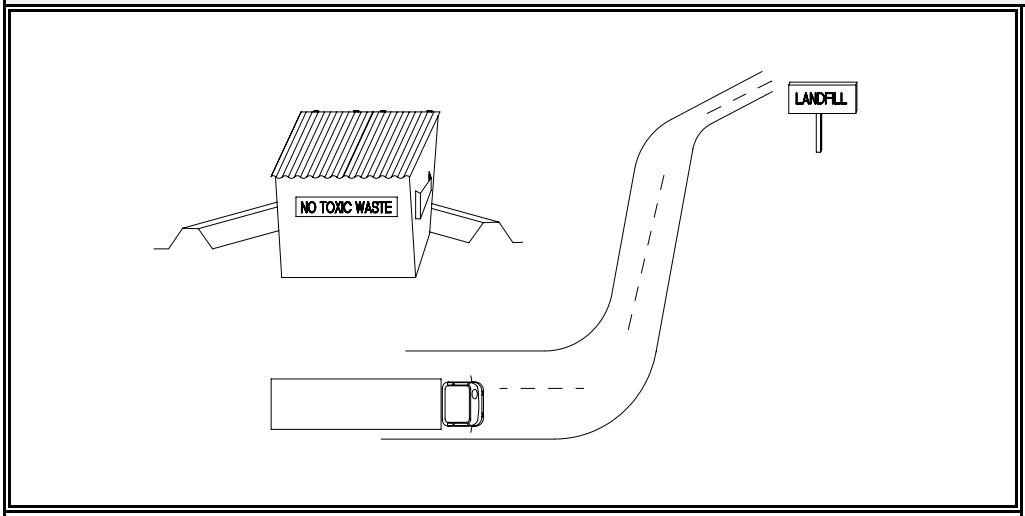
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Waste Disposal

WD



DESCRIPTION:
Controlled storage and disposal of solid waste generated by construction activities.

APPLICATION:
All construction sites.

INSTALLATION:
- Designate one or several waste collection areas with easy access for construction vehicles and personnel. Ensure no waterways or storm drainage inlets are located near the waste collection areas.
- Construct compacted earthen berm (See Earth Berm Barrier BMP Fact Sheet), or similar perimeter containment around collection area for impoundment in the case of spills and to trap any windblown trash.
- Use water tight containers with covers to remain closed when not in use. Provide separate containers for different waste types where appropriate and label clearly.
- Ensure all on site personnel are aware of and utilize designated waste collection area properly and for intended use only (e.g. all toxic, hazardous, or recyclable materials shall be properly disposed of separately from general construction waste).
- Arrange for periodic pickup, transfer and disposal of collected waste at an authorized disposal location. Include regular Porto-potty service in waste management activities.

LIMITATIONS:
- On-site personnel are responsible for correct disposal of waste.

MAINTENANCE:
- Discuss waste management procedures at progress meetings.
- Collect site trash daily and deposit in covered containers at designated collection areas.
- Check containers for leakage or inadequate covers and replace as needed.
- Randomly check disposed materials for any unauthorized waste (e.g. toxic materials).
- During daily site inspections check that waste is not being incorrectly disposed of on-site (e.g. burial, burning, surface discharge, discharge to storm drain).

OBJECTIVES

- ☒ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

Adapted from Salt Lake City BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ■ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ■ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

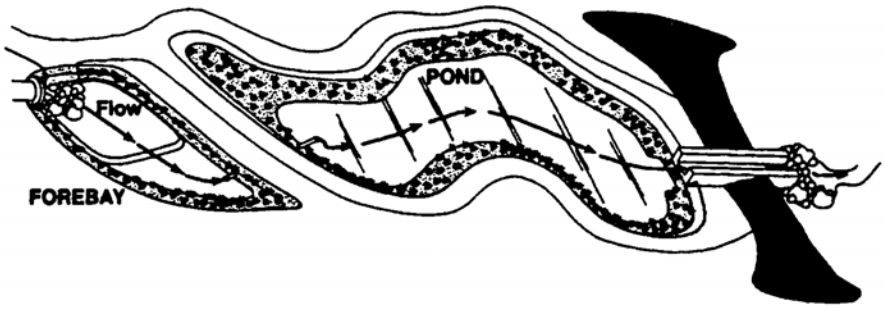
IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ■ O&M Costs
- ☒ Maintenance
- ■ Training

■ High ☒ Medium ☐ Low

BMP: Wet Ponds

WP



DESCRIPTION:

A wet pond has a permanent water pool to treat incoming stormwater. An enhanced wet pond includes a pretreatment sediment forebay.

APPLICATION:

- Need to achieve high level of particulate and some dissolved contaminant removal.
- Ideal for large, regional tributary areas.
- Multiple benefits of passive recreation (e.g. bird watching, wildlife habitat).

INSTALLATION/APPLICATION CRITERIA:

- Water depth of 3 to 9 feet.
- Wetland vegetation, occupying 25-50% of water surface area.
- Design to minimize short-circuiting.
- Bypass storms greater than two year storm.
- Establishing wetland vegetation may be difficult.

LIMITATIONS:

- Concern for mosquitoes and maintaining oxygen in ponds.
- Cannot be placed on steep unstable slopes.
- Need base flow or supplemental water if water level is to be maintained.
- Infeasible in very dense urban areas.
- May require permits from various regulatory agencies, e.g.,Corps of Engineers.

MAINTENANCE:

- Remove floatables and sediment build-up.
- Correct erosion spots in banks.
- Control mosquitoes.

CONSIDERATIONS

- ☒ Soils
- ☒ Area Required
- ☒ Slope
- ☒ Water Availability
- ☒ Aesthetics
- ☐ Hydraulic Head
- ☒ Environmental Side Effects

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☒ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☒ Oil & Grease
- ■ Floatable Materials
- ☒ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.