
Public Improvement Design & Construction Standards



City of Madras, Oregon

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SECTION 1 GENERAL STANDARDS AND REQUIREMENTS

1-1 Purpose

This section, General Standards and Requirements, establishes criteria that apply to all sections of these Standards & Specifications. In case of conflicts among the rules, and various stated standards and sections, the most stringent requirements shall prevail.

1-2 Summary

This section is to be used in conjunction and coordination with all other sections of these Standards & Specifications.

1-3 Undue Burden/Excessive Demand

Development redevelopment/construction shall not create an undue burden/excessive demand on the public transportation (or other public) utility infrastructure. Construction plans will assist the City in confirming that the existing infrastructure has adequate capacity to support the proposed development. Construction plans are additionally used to determine whether the applicant will be required to assume financial responsibility for any public improvements necessary to accommodate the proposed development in cases where undue burden would be placed upon the City's infrastructure. When required by the City, an applicant/development will be required to perform capacity analysis studies and/or traffic impact analysis to determine if an undue burden will be created by the new development. The City will reserve the right to review all inputs and calculations and will require corrections when the City's review determines improper analysis. When the City determines that the development may overburden the system, the applicant/development will be responsible to design and construct capacity improvements within, adjacent, downstream, or upstream of the development in accordance with City plan review and approval.

As part of a land use application, including, but not limited to: zone change, site plan, subdivision, change of use, conditional use, and partition application, the City Public Works Director shall consider the need for street and other improvements necessary for the general welfare and safety of the public. Any improvements deemed necessary by the Public Works Director shall be the responsibility of the Applicant as a condition of application approval.

New development is not allowed to create excessive demand on public facilities and services. The Applicant will be required to conduct capacity analysis when proposed development impacts public infrastructure or creates excess demand (through infill and use of the infrastructure) on the public utility and/or transportation system.

Improvements may be required, including but not limited to: paving, curbing, installing of traffic signals, constructing sidewalks, striping bike lanes, or other improvements to the street system which serves the proposed use where the existing street system will be burdened by the proposed use.

1-4 Plan Reviews, Inspection and Fees

Approval to start work will not be issued until all engineering plans for that work are approved by the Public Works Department and required agreements, bonds, or guarantees have been submitted. It is the developer's responsibility to acquire all permits, licenses and easements that may be required by another entity (i.e. other than the City of Madras, such as Oregon Department of Transportation, Department of Environmental Quality, North Unit

Irrigation District, or Jefferson County) that affects the construction of dedicated infrastructure.

Per Land Use Decision approval or miscellaneous right-of-way permit approval, the applicant or its designee is responsible for all required inspections and testing for street & utility improvements in compliance with the guidelines set by the City of Madras. All phases of the work are to be inspected and approved before commencement of the next phase of construction. The Public Works Department shall be notified two working days in advance for inspection of each phase of the work (i.e. utility trench, subgrade, base rock, concrete, and paving. Upon completion of the work, the applicant or designee shall notify the Public Works Department two working days in advance for a final inspection. Quality Control testing and documentation is to be submitted to the City of Madras during construction per the latest edition of the Oregon Standard Specifications for Construction guidelines for the following activities or at the request of the Public Works Director or Planning Commission (frequencies identified in the ODOT Field Test Procedures Manual):

- A. Embankment – Proctor Curve, Density and/or Deflection testing.
- B. Utility Trenches – Proctor Curve, Density testing.
- C. Subgrade – Proctor Curve, Density and/or Deflection testing.
- D. Aggregate Base Rock – Proctor Curve, Density testing.
- E. HMAC – Mix Design, Density, Gradation and Oil Content.
- F. City Water Lines (when applicable, Contact Deschutes Valley Water otherwise) – Pressure, Bacterial and Chlorine Testing requirements.
- G. Sanitary Sewer Line – Air Pressure Test, Mandrel, TV Inspection and Manhole Vacuum Test.
- H. Storm Line – Mandrel and TV Inspection.
- I. Concrete Sampling and Testing – Commercial Grade Concrete testing for use in curb, gutter and sidewalk.
- J. Per Madras Resolution, the applicant will be required to make a “Quality Assurance, Inspection and Testing Permit” deposit with the Public Works Director prior to the review of any plans, and no infrastructure work shall be allowed to start without such deposit first having been made.

1-5 Performance Security & Warranty

The following is applicable to all Land Use Decisions that are conditioned to perform public improvements.

When public improvements are required, no application shall be granted final plat approval unless the applicant has already constructed the improvements, and the City Public Works Director has accepted the required improvements or the applicant has executed an improvement agreement pursuant to the provisions listed below. If the applicant chooses to construct the improvements, it shall also file with the City a warranty bond executed by a surety company to cover the one-year warranty period following acceptance by the City. Said bond shall be in the amount of ten percent (10%) of the total value of the improvements.

For commercial and industrial building projects the Public Works Director may elect to waive the improvement agreement requirement on public improvements and instead place a

restriction on providing final occupancy and water/sewer access until the public improvements are completed and accepted by the Public Works Department.

Submittal Requirements

The applicant shall provide an itemized estimate for the cost of the public improvements for review and approval of the Public Works Department. The final approved estimate will be used to determine the amount of the quality assurance permit fee for plan review, assurance administration, and construction inspection work.

1-5.1 Improvement Agreement

The applicant may, in lieu of completion of the required improvements and repair to existing streets and facilities, request the City Administrator to approve an agreement between the applicant and the City detailing the schedule and completion date of required improvements and repairs. Provided, however, any agreement for the schedule of improvements agreed to must not exceed three (3) years from the date the final plat is recorded (for a subdivision), and no later than final occupancy for other developments such as site plans, change of uses, or conditional uses. The agreement shall also contain the following:

1. A list of all the contractors who will construct or complete the improvements and repairs required, and the cost of the project.
2. That applicant must post a performance bond or other security acceptable to the City and that the City may call upon the security filed to construct or complete the improvements and repairs if the schedule of improvements is not adhered to.
3. That the City shall recover the full cost and expense of any work performed by the City to complete construction of the improvements and repairs including, but not limited to attorneys' and engineering fees.
4. That a warranty bond for one (1) year shall be deposited with the City following acceptance of the improvements. Said bond shall be in the amount of ten percent (10%) of the total value of the improvements as determined by the Public Works Director.
5. A waiver of remonstrance against formation of a local improvement district if the required improvements are not timely completed
6. Such other provisions as deemed appropriate by the City.

The City Administrator has the authority to reject an agreement authorized by this section at his sole discretion.

Park, trail, and other public improvements are typically to be completed by the time period identified in the Land Use Decision, or generally prior to final occupancy for site plan development or prior to final plat approval for subdivision. For sequencing in multi-phase subdivisions, the Land Use Decision shall specify if the improvements can be completed in phases or not.

Any dead-end streets that are built in phases must have a fire approved turn around in place as an interim measure until full build-out.

1-5.2 Bond, Cash Deposit or Guarantee

In order to assure full and faithful performance, of an improvement agreement, the applicant must submit one of the following:

1. A surety bond executed by a surety company authorized to transact business in the State of Oregon in a form approved by the City Attorney;
2. A cash deposit in a City account at an approved lending institution; or
3. Other security satisfactory to the City.

The value of the security provided by the applicant must be for 120% of the total cost of the improvements and repairs as approved in amount by the Public Works Director.

If the applicant fails to carry out the provisions of the agreement, the City may call upon the bond, cash deposit, or other security to finance any cost or expenses resulting from said failure. The City may also elect to form a Local Improvement District to lien the properties in accordance with the relevant provisions of Oregon State Law and Madras City Code. If the amount of the deposit or bond exceeds the cost and expense incurred by completing the improvements, the City shall release the remainder. If the amount of the deposit or bond is less than the cost incurred by the City for the improvements and repairs, the applicant is liable to the City for the difference.

1-6 Handling of Explosives

In the handling of explosives, the Contractor must comply with Federal, State, and local laws, and the City will in no way be responsible for any non-compliance therewith or for damages to property or injury to persons resulting from accidental or premature explosions.

1-7 Cooperation with Utilities

The contractor shall, at least forty-eight (48) hours (two business days) in advance of performing any work in the immediate vicinity of utility lines, contact the utilities to request the location and marking of buried utility facilities. Oregon uses a "one call" system for notifying all owners of utilities of work being performed in the vicinity of their facilities. The "one call" system telephone number is 1-800-332-2344 or call 8-1-1. All markings from the utility companies shall be removed upon completion of the work at no cost to the City.

1-8 Temporary Traffic Control

Temporary traffic control will be required for all construction/improvements that are identified (in the construction plan review/approval process and/or Traffic Impact Analysis) to negatively impact traffic flow and/or traffic control during work performance. Temporary protective and directional traffic control measures shall be in conformance with the latest edition of the Federal Highway Administration's "Manual on Uniform Traffic Control Devices" and current ODOT Standard Detail Traffic Drawings.

The contractor is required to maintain one-way traffic through the project during normal working hours. All barricades and objects shall be removed from the roadway and all traffic lanes shall be open during non-working hours at the discretion of the Public Works Director or designee. However, one-way traffic operation will not be permitted until such time as the contractor has labor, equipment, and materials on the project necessary to proceed without delaying the work. Once one-way traffic is established, the Contractor shall perform the construction work in a continuous and efficient manner. Access will always be provided to all properties/businesses except for coordinated permitted times of closure for specific frontage construction. Notification and coordination to property owners/businesses affected by the construction/development is a required responsibility of the contractor.

The Contractor shall have a dedicated representative on the job during working hours and on call at all other times, which shall have the responsibility to maintain all directional and warning devices in proper position. The City will be provided by the Contractor with a name

and 24-hour contact telephone number. The Public Works Director may allow up to full road closure for as long as is needed to protect the safety of workers and the public.

Failure to comply with this section, may result in the City issuing a stop work for project until compliance.

1-9 Land and Easement Dedication

A land and/or easement dedication is the dedication of land by the applicant/property owner for the creation or enlargement of streets or other infrastructure where the existing street system will be impacted by or inadequate to handle the additional burden caused by the proposed use.

Per the City's Subdivision Ordinance, "Public Park Dedication/Park Fund," the Public Works Director can either require land donation of 8% of the total development area or an equivalent land value deposit to the parks fund for the value of the 8% area prior to development. Applicants may be required to dedicate land and/or easement to the City for public improvements per the City's Zoning Ordinance.

1-10 Prior to Construction

Applicant shall submit a letter of intent to provide service from all utility companies planned for the subdivision. This should include gas, power, cable, internet and phone services.

Applicant shall provide a letter of approval from North Unit Irrigation District & the Bureau of Reclamation, if applicable, for prior to approval of the subdivision plans.

Formal plans, reports and specifications to be submitted for all construction. Applicant shall submit as-built plans (11"x17" - Hard Copy and Electronic – ACAD & PDF electronic files) as sections of work are completed. Wastewater system plans to be submitted to and approved by the City of Madras and by DEQ (only pump/lift station and forcemain for DEQ). Once the final plans are approved, schedule a pre-construction meeting with the City of Madras Public Works Department.

The plan review process does not begin until a complete submittal is submitted to the City. A complete submittal includes the following:

1. Construction plans and specifications that conform to applicable ordinances, standards and Land Use Decision.
2. Storm drainage report that follows the steps outlined in Section 4 of these standards.
3. Sewer calculations.
4. Fire flow analysis.
5. Full QA permit fee deposit per resolution schedule and Public Works approved cost estimate for public improvements. If any of the items are missing, the submittal will be deemed incomplete and the review will be put on hold pending receipt of the missing documentation; and
6. Any capacity analysis reports and mitigation measures.

After public improvement construction plans are approved by the City and prior to construction starting, attend a preconstruction meeting with the City of Madras Public Works Department. A construction schedule is to be submitted by the contractor at the preconstruction meeting along with contact information (including emergency contact phone numbers) provided to the City. The Public Works Department will outline requirements such as workdays, hours, haul routes, dust & weed abatement requirements and other conditions

for conformance to City Ordinances and policies. The person or firm doing the work (Contractor) must maintain the following insurance during construction of the project including acceptance by the City and during the one year warranty period (a) general liability insurance for all losses or claims arising out of or related to Contractor's performance of its obligations under this Agreement (including, without limitation, damages as a result of death or injury to any person or destruction or damage to any property) with limits of not less than \$1,000,000 per occurrence, \$2,000,000 in the aggregate; (b) workers' compensation insurance in form and amount sufficient to satisfy the requirements of applicable Oregon law. Insurance certificate must list the City as additional insured. All other agency permits and fees (i.e. State, County) are to be gathered and submitted to the City prior to the start of construction.

1-10.1 Right-of-Way Permitting

Prior to any work being done in a public right-of-way, a right-of-way permit shall be obtained from the Public Works Department. A minimum of one week prior to the desired commencement date of the project, the applicant shall deliver to the Public Works Department the following:

A. A completed permit form (attached in Appendix A) containing the following:

1. Applicant's name, address, and telephone number.
2. Name, address, and telephone number of the contractor and foreman or other person responsible for the work if different from the contractor. Applicant is responsible to notify Public Works 48 Hours in advance of doing work to notify emergency services.
3. Location of project including:
 - a) Physical Address Street Name
 - b) Nearest Intersecting Streets
4. Type of facility being constructed.
5. The proposed starting and completion dates.
6. And other fields of questions.

B. Two sets of construction plans showing all pertinent construction details.

C. A plan for traffic control; in the case of street closure, a proposed detour and/or other method of controlling traffic.

D. A certificate of insurance meeting the requirements identified on the permit.

E. Copy of current business license with the City of Madras.

F. In granting any permit, the Public Works Department may attach such other conditions thereto as may be reasonably necessary to prevent damage to public or private property or to prevent the operation from being conducted in a manner hazardous to life or property or in a manner likely to create a nuisance. Such conditions may include but shall not be limited to:

1. Limitations on the time of the year in which the work may be performed, as well as the days and hours of work.
2. Restrictions as to the size and type of equipment.
3. Designation of routes upon which materials may be transported.

4. The place and manner of disposal of excavated material.
5. Requirements as to the control of dust, the cleaning of streets, the prevention of noise and other results of offensive or injurious impacts to the neighborhood, or the general public.
6. Regulations as to the use of streets in the course of the work.

1-10.2 Public Improvement Construction Sequence

Street sections will be reviewed and approved for sequencing at time of Land Use Decision approval. Prior to use by new tenants (prior to final occupancy or prior to final plat), street improvements must be completed.

The Public Works Director and Fire Marshall require Fire Apparatus Access Roads to be in place prior to combustible construction beginning. Contact the Jefferson County Fire District for their requirements on Fire Apparatus Access Roads.

Lot corners are to be surveyed and staked for building inspection reference.

1-11 Utilities Standards

- A. Minimum Standards Established. ORS 374 and 758, set forth the minimum standards governing the placing, relocation, building, maintenance and construction of all facilities and appurtenances, within public rights of way.
- B. All new utilities, on site and/or adjacent to the property, shall be placed underground unless overhead utilities are permitted as a result of a land use action.
- C. Typical utility locations and depths are listed below; however, you must consult other relevant Sections for detailed specifications.
 - a. Water alignment – West or North sides of the road section (approx. 5'-6' off curb).
 - b. Sewer alignment (3 foot minimum depth, 30 inches at the lot connection) – Centerline of roadways.
 - c. Stormwater alignment – Opposite side of street from water.
 - d. Other services (phone, gas, electric, cable, etc.) – planter strip section or granted public utility easement (P.U.E) behind sidewalk.
 - e. Minimum utility cover is 30 inches. Minimum cover over sanitary sewer main pipe is to be three (3) feet and laterals at property line shall be thirty (30) inches unless otherwise approved by the City.
 - f. Sanitary sewers are to be centered in a dedicated public right-of-way or deeded property (conveyed to the City) with a minimum width of 20 feet. No curved sewers will be accepted.

Any variations shall be reviewed and approved by the Public Works Director.

1-12 Construction

The work to be performed under this permit shall be carried out in accordance with the current Oregon Standard Specifications for Construction.

Work authorized by a right-of-way permit and/or construction plan approval shall be performed between the hours of 7:00 a.m. and 6:00 p.m., Monday through Friday. Other work on weekends, night work, or work on holidays must be by written request and will be

reviewed on a case-by-case basis and will only be approved if City staff is available. The Public Works Director may further limit the hours of construction where such construction may affect public safety or otherwise be unnecessarily disruptive. Public complaints will be considered in the City's allowance of work on weekends. In the commercial and industrial zones, night work will be required when conditioned by the City, to reduce the impact to daytime business operations. For work impacting State Highway facilities, additional permitting may be required through the regional ODOT office. Access must always be maintained to businesses to the maximum extent possible.

Access to private driveways shall be provided except during working hours when construction operations prohibit provision of such access. If private driveway accesses are to be closed or limited, contractors must coordinate such events with the property owner/tenant.

Free access must always be provided to fire hydrants.

Monuments of concrete, iron or other lasting materials set out for the purpose of locating or preserving the lines of any street or property subdivision, or precise survey reference point, or a permanent survey bench mark within the County shall not be removed or disturbed or caused to be removed or disturbed unless permission to do so is first obtained in writing from the Jefferson County Surveyor. Permission shall be granted only upon condition that the applicant shall pay all expenses incidental to the proper replacement of the monument.

1-12.1 Excavation

The minimum cover between the top of a buried utility and street or ground surface shall be thirty inches (30"). When required by the City or State, underground utilities shall be jacked or bored under streets when crossing same. Water jetting will not be allowed.

No opening or excavation in any street shall extend beyond the centerline of the street before being backfilled and the surface of the street temporarily restored.

No more than two hundred fifty feet (250') of trench, measured longitudinally, shall be opened along a street at one time.

Excavated materials shall be laid along the side of the trench and kept trimmed, in accordance with OSHA safety practices.

All utility facilities shall be potholed/located sufficiently ahead of trench excavation work to avoid damage to those facilities and to permit their relocation, if necessary.

1-12.2 Conformance for All Developments

Stormwater discharge from the proposed project must be designed to produce no significant adverse impact to the drainage system of the downhill property. Outfalls to natural drainages or ditches shall have energy dissipaters. A "bubble up" catch basin or curb drain (depending on site conditions) will be required for discharge to City streets when determined necessary by the Public Works Department.

Where no existing conveyance system (either piped or open channel) exists at the adjacent downstream property line of the development and the discharge was previously unconcentrated flow OR if discharge to the existing conveyance system (pipe, natural drainage, ditch, etc.) will produce a significant adverse impact (e.g. increased erosion), the applicant shall install a conveyance system across the downstream properties to an acceptable discharge point with drainage easements secured from the downstream owners and recorded prior to issuance of the Site Construction Permit.

Discharging across sidewalks and streets is prohibited.

1-13 Submittal Requirements for Drawings and Specifications

1-13.1 Preliminary Drawings and Specifications

As part of the construction approval process, the City may require applicants to attend a pre-consultation design meeting prior to preparing preliminary design drawings and specifications. The meeting is intended to provide an overview of the submittal process and to answer questions related to the submittal requirements and City Standards. Afterwards, drawings and specifications shall be submitted to the Public Works Director for review. Refer to Section 9 and other pertinent sections for drawing submittal requirements.

1-13.2 Final Design Drawings and Specifications

Prior to construction approval, final design drawings and specifications shall be submitted to the City for review and approval. Refer to Section 9 and other pertinent sections for drawing submittal requirements.

1-13.3 As-Built Drawings

Refer to Section 9 and other pertinent sections for drawing submittal requirements.

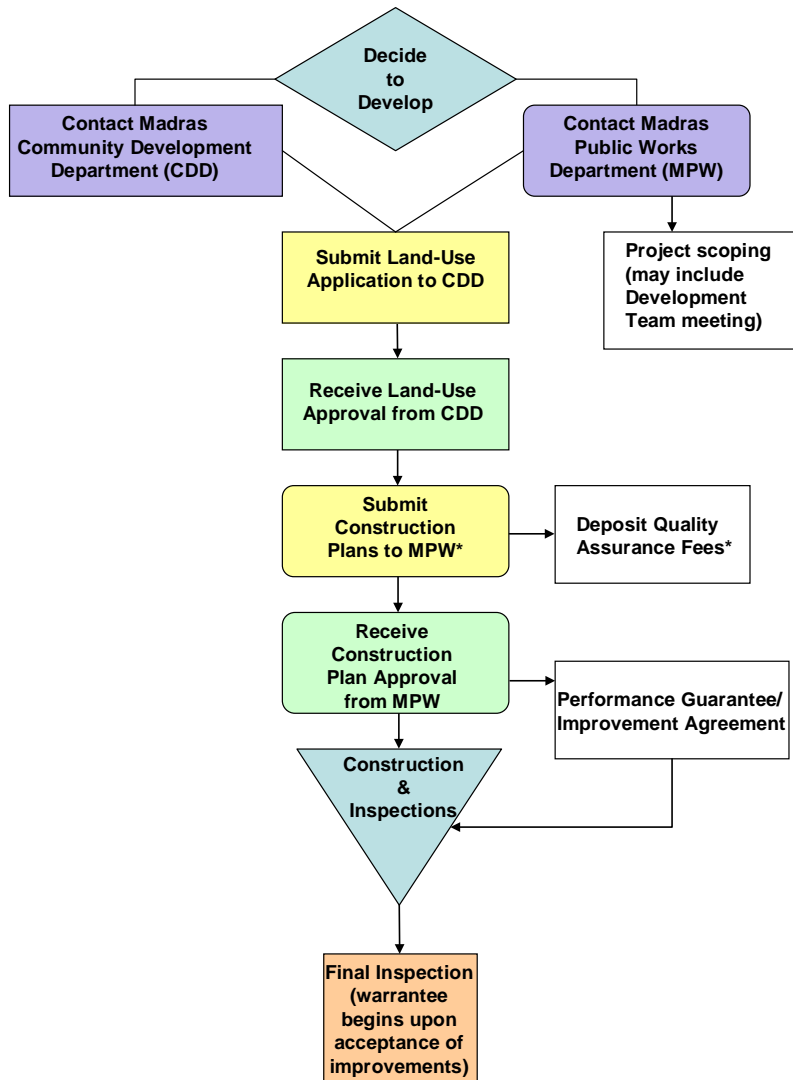
SECTION 2 OVERVIEW OF THE DEVELOPMENT PROCESS

2-1 Purpose

This section is provided to familiarize applicants, developers, consultants, contractors and other parties with the approval and permit policies and procedures for all proposed development projects within the City of Madras. Property owners outside the City limits, but within the Urban Growth Boundary area, who need to extend City water and/or sanitary sewer mains, are also required to follow the process of this section. In addition, this section is intended to provide a brief overview of the permits required for construction within the City limits.

2-2 Summary

Table below: Typical City of Madras Process of Development



*Construction Plan Review will not start until quality assurance fees are deposited to the City.

As shown in the table above, Land Use Approval may be required for development. Contact the Community Development Department to determine what necessary permits are needed for a proposed development. As shown in the figure above, Land Use Approval is required

prior to Construction Plan Approval and any construction, unless otherwise specifically allowed in writing by the Public Works Director.

Development within the City limits can be divided into two discrete review and approval processes: 1) Land Use approval and Construction Plan Approval, 2) Miscellaneous Public Improvement Permits (See Section 2-4).

The Land Use Approval is the review of all proposed development within the jurisdiction of the City of Madras Zoning, Subdivision, and other applicable Ordinances determined by the Community Development Director. The Land Use Approval process is managed by the Community Development Department.

In general, Construction Plan Approval is required for most construction work within the City limits. All residential subdivision, commercial, and industrial development are required to follow the same review and approval procedures. The Construction Plan Approval process is the review and conditional acceptance of the technical and engineering details of any proposed construction associated with improvements within the public right-of-way (including on-site grading, erosion and stormwater) or associated with any project that has been issued a Land Use Decision. The Construction Plan Approval process for on-site grading, stormwater, erosion control, and public improvements is administered by the Public Works Department. The Building Official reviews improvements on private property. The City's Construction Plan Approval process, and any conditions required as a result thereof, are independent of the Building Department.

When the development does not require Land Use Approval or Construction Plan Approval, Miscellaneous Public Improvement permit(s) is required for any work within public right-of-way.

Approval to start work will not be issued until all engineering plans for that work are approved by the Public Works Department and required agreements, bonds, or guarantees have been submitted. It is the developer's responsibility to acquire all permits, licenses and easements that may be required by another entity (i.e. other than the City of Madras) that affects the construction of dedicated infrastructure.

2-3 Public Works Development Process

2-3.1 Construction Plan Approval

In general, construction plan approval is required for public improvements associated with subdivision, partition, site plan review, conditional use, deeds of right-of-way dedication, public utility easements, and utility improvement and maintenance applications.

Development/redevelopment/construction shall not create an undue burden on the public transportation (or other public) utility infrastructure. Construction plans will assist the City in confirming that the existing infrastructure has adequate capacity to support the proposed development. Construction plans are additionally used to determine whether the applicant will be required to assume financial responsibility for any public improvements necessary to accommodate the proposed development in cases where undue burden would be placed upon the City's infrastructure. In some cases, a traffic impact analysis will be required.

Construction Plan Approval will be required for all sites that are required per the land use decision approval or when the proposed improvements may, in the City's determination, have a potential impact on stormwater runoff, downstream water quality, ADA compliance, or those developments that intend to dedicate infrastructure to the public or

improve/repair utility infrastructure within the public right-of-way. This approval also integrates other miscellaneous permits issued by the Public Works Department including sidewalk/driveway approach, sewer/water connections, utility work in the right-of-way, etc. Additional agency approval will be required when certain thresholds are met for the typical agencies such as the Department of Environmental Quality, Department of State Lands, Fire Department, North Unit Irrigation, Jefferson County School District, State Historical and Preservation Office, Deschutes Valley Water District, and the Army Corps of Engineers.

In summary, approval will be required for any development if any of the following apply to the site:

- Excavation, fill, or grading is in/adjacent to any drainage course, wetland, or flood plain.
- Infrastructure will be constructed and dedicated to the City.
- Private improvements that serve more than one lot or parcel.
- A curb cut is made for a driveway location.
- Excavation will occur within a public right-of-way.
- Utility installation, repair, or upgrade.
- Sidewalks are constructed or replaced within a public right-of-way; or
- The sites will be converted from an existing use to a higher demand use on the public transportation and/or utility system.

The application for a construction plan approval triggers the review process to determine if the proposed construction meets the land use decision (whenever applicable) and the Standards & Specifications established by the City. This approval must be issued prior to initiating all construction activities on a site. The approval can be issued to a developer, landowner, or the developer/landowner's agent (e.g. general contractor, project manager or project engineer). Public Works Department administers this construction plan approval for onsite grading, storm water, erosion control, and all public improvements. For certain miscellaneous public improvement permits, such as sidewalk replacements/construction, excavation and curb cuts, the Public Works Department may allow, in lieu of engineered stamped drawings, a scaled adequate detail drawing accompanied by ODOT Standard Detail Drawing(s) and/or City of Madras Standard Detail Drawing(s) for approval. The determination of whether standard detail drawings or engineered stamped drawings are required will be at the sole discretion of the Public Works Department.

2-3.1.1 Inspection and Fees

The City of Madras' costs for plan review, assurance administration, legal fees, professional services, and field inspection costs must be paid by the applicant. Those costs shall be based on a schedule of charges on file in the City Public Works Department.

The City charges an estimated fee (i.e. QA Permit Fee) for initiating the construction approval process. This fee offsets time and resources involved in land use decision approval process, quality assurance administration, plan review, meetings, and professional services including legal counsel, inspections, and construction administration. The fee is based on the anticipated and actual cost(s) by the City but

in the case that it costs more, the applicant/developer is responsible for the additional cost. The applicant will be billed for these additional costs.

For miscellaneous public improvement permits, such as sidewalk/driveway approaches, connections to sewer and water, the determination of an applicable fee will be determined by the City's adopted fee resolution.

The City will inspect public right-of-way and utility connection work to ensure that construction is performed in accordance with the approved plans and specifications and/or according to the City's Standards & Specifications.

The applicant shall identify a contact person to act as the liaison between the contractor and the City of Madras. Once construction plans are approved, and prior to the start of construction, the developer and his/her contractor will schedule a pre-construction meeting with the Madras Public Works Department.

The Public Works Department reserves the right to attach other conditions after approval of the construction plans that are reasonably necessary to prevent damage to public or private property or to prevent the operation from being conducted in a manner hazardous to life or property or in a manner likely to create a nuisance. Such conditions may include but shall not be limited to:

1. Limitations on the time of the year in which the work may be performed.
2. Restrictions to the size and type of equipment.
3. Designation of routes upon which materials may be transported.
4. The place and manner of disposal of excavated material.
5. Requirements as to the control of dust, the cleaning of streets, the prevention of noise and other results of offensive or injurious impacts to the neighborhood, or the general public.
6. Regulations as to the use of streets in the course of work; and
7. Control upon the hours of work (typical construction activity period is Monday-Friday 7am-6pm with written permission by the City required to work outside of those hours).

At the completion of the development project the engineer of record shall submit a set of Record Drawings (As-built) to the City before the city will accept any infrastructure improvements that were constructed. Prior to accepting the work, the City will create a punch list for deficiencies and unfinished work. Public infrastructure improvements will not be accepted by the City for maintenance, and the start of the one-year warranty period on materials and workmanship will not occur, until the satisfactory completion of all punch list items.

2-3.1.2 Expirations

Approved plans and miscellaneous permits expire one year after approval. Extensions of permits may be requested from the City. Permit extensions must comply with any changes or revisions made to the City's standards from the date of the original issuance. Extensions are not granted on expired permits. For further information, see the City's Fee Resolution.

2-4 Miscellaneous Public Improvement Permits

The City of Madras Public Works Department issues permits for a variety of right-of-way public improvements such as for sidewalk, driveway approaches, sewer/water connections, utility work in the right-of-way, and more.

The following is a list of other City permits that are issued by the Public Works Department, and can be found in Appendix A of this document:

2-4.1 Right-of-Way Permit

Right-of-way Permits are required when any person desires to perform work within the public right-of-way. A review and recording fee is required. Any temporary closure of a public right-of-way to vehicular or pedestrian traffic requires City approval prior to the proposed closure. Closures include street/alley, traffic lane, parking lane, bicycle lane and sidewalks that are not covered by a permit issued under Section 2 of this manual.

2-4.2 Sanitary Sewer Connection/Inspection Permit

Fees are charged for setting up a service account as well as inspection of the service connection. Any homes that are located outside the City limits that need or are required to connect to City sewer service must sign a consent to annex and pay applicable fees.

2-4.3 Water Connection/Inspection Permit

Water permits are required when new water meters must be installed. Applicants/Developers/property owners are required to pay the fee for this permit at the time that construction plans are submitted. For fee rates, refer to the City's Fee Resolution which may be obtained from the Public Works Department.

2-4.4 Plan Review, Quality Assurance Administration, and Inspection Fee (aka. QA Permit)

Deposit required prior to review of plans and will be held by the City through end of project. Actual costs will be taken from deposit and any remaining amount will be refunded. If costs exceed the calculated minimum deposit, the developer/applicant is responsible to pay the additional services provided by the City. Deposit minimum amount determined by using the table found in the City's Fee Resolution.

SECTION 3 GRADING AND EROSION CONTROL

3-1 Purpose

The purpose of this standard is to reduce the amount of sediment and pollutants reaching the storm and surface water system and reduce damage to other public infrastructure resulting from activities that accelerate erosion. Two additional factors include dust and weed abatement control. The objective is to control erosion and pollution at its source to maintain and improve water quality, reduce downstream impacts and protect natural drainages. The purpose is also to protect natural drainages with new grading and to also protect newly formed lots and adjacent properties.

3-2 Summary

- Review of rough grading and erosion control during the Community Development Department review process.
- Review of final grading and erosion control during the construction plan approval process.
- In addition, this section also specifies the following:
 - Inspection procedures for grading and erosion control on sites requiring construction plan approval,
 - Design criteria for grading and erosion control,
 - The owner's/developer's/contractor's responsibilities for meeting erosion control performance criteria.

3-3 Other Agencies May Require Grading and/or Erosion Control Plans

It is not the intent of this section to supersede the requirements of the Building Department with respect to grading and/or erosion control requirements that may be required as a condition of the building permit. The intent of this section is to ensure that the City's minimum design requirements are met. The City defers to the Building Department for review of the structural integrity of retaining walls or other concrete structures associated with grading/erosion control that are located on private property. The Public Works Department will review and approve these structures in the public right-of-way. The applicant, however, will be required to demonstrate to the City that such structures have been reviewed and approved by the Building Department prior to their construction.

Depending on the location and nature of the work, permits may also be required from the Oregon Department of Environmental Quality (DEQ), Oregon Division of State Lands (DSL), the Army Corps of Engineers, the Oregon Department of Fish and Wildlife (ODFW), or US Fish and Wildlife. If such permits are required, the applicant shall provide evidence to the City that a permit has been obtained prior to any clearing, grading, or excavation activities. Any work within the 100-year flood plain will require an administrative review flood plain permit through the City Community Development Department.

3-4 Land Use and Site Construction Approval Process

3-4.1 Plan Review

If the applicant falls within the requirements of site plan or subdivision review, then the applicant shall submit a grading plan for review and approval prior to land use approval. The plan shall be prepared by an engineer licensed in the State of Oregon. The purpose

of the grading plan is to provide the City with a tool that will allow assessment of the impact of any proposed clearing, grading, or excavation on adjacent properties, right-of-way and public infrastructure. Complete design documents, including revisions as required by the City, shall be required before receiving construction plan approval for each phase of construction. The construction plan is valid for the period that the land use decision approval is valid.

Design drawings shall be prepared in accordance with the requirements in Section 1 and Section 9, and shall show the following:

- Property lines, existing buildings or structures, easements, utilities, and drainage courses, existing trees (six inches in diameter and larger) and the location of any building or structure within 25 feet of the property boundary (location may be approximate);
- Contours showing the topography of the existing ground (Contour lines shall extend a minimum of 25 feet beyond the limits of the site. Contour lines outside the site boundaries may be approximate);
- Contours, elevations, dimensions, locations, extent, and the slopes of all proposed rough grading. Label slopes 4:1 and steeper. Due to the conceptual nature of the plan, these may be approximate in nature.
- Survey shall show topography and neighboring structures for 500 feet around the perimeter of a site plan or subdivision.
- Locations of retaining walls and other structures to be constructed as part of project.
- Estimated quantities of excavation and fill (cubic yards, including estimated import and export quantities), top and toe of cut and fill slopes, direction of sheet and concentrated drainage.
- Anticipated locations of storm water conveyance/detention facilities.
- Proposed types of permanent cover to be established on disturbed areas of site (e.g. lawn, native vegetation, rockery, gravel, asphalt, etc.); and
- Phasing of proposed grading work (e.g. Will work be phased? What work will be done in each phase of development?).

3-4.2 Site Construction Plan Approval

A Site Grading and Erosion Control Plan will be required for the site and if the site is categorized to require additional agency permits. The Site Grading and Erosion Control Plan shall be submitted for review and approval prior to issuance of the City's construction plan approval.

3-4.2.1 Grading and Erosion Control Plan Requirements

A Site Grading and Erosion Control Plan shall be submitted for review and approval for all sites (see Appendix A DEQ 1200-C Permit) prior to issuance of the City's construction plan approval. It shall be prepared by an engineer licensed in Oregon and qualified to perform the work submitted within the plan. Geotechnical engineering reports, surveys, and other specialized work shall be performed (and stamped or otherwise certified) by professionals licensed/certified to perform such work.

The applicant shall include construction documents (refer to 3-4) showing the following:

- Property lines, existing buildings or structures, easements, utilities, and drainage courses, existing trees (six inches in diameter and larger) and the location of any building or structure within 500 feet of the property boundary (location may be approximate);
- Contours (2-foot interval maximum) with existing elevations to show existing topography (Contour lines shall extend a minimum of 500 feet beyond the limits of the site. Contour lines outside the site boundaries may be approximate). Contours and elevations shall be used on NAD 83 or a County approved benchmark or temporary benchmark if the work will construct dedicated infrastructure.
- Elevations, dimensions, locations, extent, and the slopes of all proposed grading shown by contours and/or other means (label slopes 4:1 and steeper);
- Locations of retaining walls and other structures to be constructed as part of project (label wall height);
- Identify areas where engineered fill is required.
- Provide amount of excavation and fill (cubic yards) to neat line, top and toe of cut and fill slopes, direction of sheet and concentrated drainage.
- Locations of existing and proposed stormwater conveyance/detention facilities including inlets immediately downstream of site (for the purpose of evaluating drainage patterns during and after construction);
- Location of gravel construction entrance.
- Limits of clearing.
- Location for storage of excavated materials, wastes, and other construction materials.
- Placement of other erosion control devices including installation details and maintenance criteria (Incorporate these into the plans and specifications and reference *City of Madras Stormwater Master Plan*, ODOT Hydraulics Manual, and Central Oregon Stormwater Manual);
- Proposed types of permanent cover to be established on disturbed areas of site (e.g. lawn, native vegetation, rock/mason work, gravel, asphalt, etc.) and conditions for reaching satisfactory establishment as determined by the City;
- Project phasing (if applicable to project); and
- Recommendations of geotechnical engineering and engineering geology reports.

3-4.2.2 Supporting Documentation

The following supporting documentation shall be submitted to the City for review and approval prior to the issuance of the site construction plan approval:

- A current record of survey that establishes or re-establishes the property corners.

- A construction schedule showing the relative sequence of major stormwater and erosion control activities relative to other construction activities; and
- An erosion control narrative – The purpose of this narrative is to address each of the requirements and briefly address how this will be met. Include calculations for sizing BMPs (if applicable) and information on proposed BMPs that are not in the referenced manual.
- A cost estimate and a plan review, quality assurance administration and inspection fee are required when public grading improvements, installation, and maintenance of erosion control measures occur.

3-4.2.3 Final Design Drawings

Prior to issuance of the site construction plan approval, final design and construction documents shall be submitted to the City for review and approval. Approval will not be granted until the City has been satisfied that the requested design modifications have been made. The design submittal shall include all drawings, specifications and supporting calculations needed to verify that the proposed grading and erosion control align with the concepts approved in the land-use findings and decision and meets the City's design standards as specified herein.

The City will not accept any new infrastructure constructed prior to issuance of the site construction plan approval, or infrastructure not inspected at the site and certified by the City as meeting the required standards.

3-4.2.4 Performance and Warranty Security

See Section 1 of this Manual.

3-4.2.5 How Long is a Grading and Erosion Control Plan Valid?

Once approved by the City, the Site Grading and Erosion Control Plan is valid for the same period of time that the land-use approval is valid. At the end of that time, if final construction plans have not been approved and substantial site grading activities have not been completed, then the Site Grading and Erosion Control Plan approval shall be null and void and become effective only after reapplication for land-use approval and Public Works Department approval. All re-submitted plan(s) shall be subject to the standards and fee schedule effective at the time of the re-submittal. Phases of the project that have been previously accepted by the City are not subject to revisions of this standard unless the new plan requires modification to the existing City accepted improvements.

3-4.3 Public Works Review and Inspection Procedures

Fixed fees are charged for review and inspection of site grading and erosion control. Refer to Section 2 of this manual.

At a minimum, the following inspections will be performed:

- Initial site review during Site Construction Permit application and/or planning-level review,
- Inspection of erosion control measures prior to initiating clearing/grading (It is the applicant's responsibility to contact the inspector 48 hours prior to requiring an inspection. Construction may not proceed until the inspection has been performed.)

- Spot inspection(s) during construction as required (the number of inspections is at the discretion of the inspector).
- Final inspection once site work is complete and site is stabilized (It is the applicant's responsibility to contact the inspector 48 hours prior to requiring an inspection. Erosion control measures must remain in place until the inspection is completed and approval is given by the City inspector).

3-4.3.1 Professional Inspection

Professional inspection of grading operations shall be provided by the civil engineer, geotechnical engineer, and/or the engineering geologist at the applicant's expense if requested by the City. Typically, the City will only request this for sites where failure to meet precise specifications may pose a hazard (e.g. fill sites on steep slopes or deep fills). City resources and professional services for inspection will be reimbursed per the plan review, quality assurance administration and inspection fee.

3-4.4 As-Built Drawings

Refer to Section 1 and Section 9 for the submittal requirements.

3-5 Grading Policies and Criteria

3-5.1 Referenced Standards

The grading requirements of this section are focused on protection of water quality and drainage courses and to also protect newly formed lots and adjacent properties. In cases where additional clarification is needed for acceptable grading practices, the City and applicant will reference Part 200 and Part 300 of the latest edition of the Oregon Standard Specifications for Construction. In cases of conflict, the provisions of this section will govern.

Grading plans must conform to the following design criteria unless approved otherwise by the City. To justify a variance from these requirements, the applicant will be required to furnish a geotechnical engineering or engineering geology report (or both) which states that the site has been investigated and that a less-restrictive criteria will not create an unstable condition posing a hazard to public or private property. These reports must be submitted to the City for its review and final approval.

3-5.2 Embankments and Fills

3-5.2.1 Slopes

Cut and fill slopes adjacent and behind sidewalks shall not exceed a 1 foot vertical to 2 feet horizontal slope (50% slope) after a minimum of a 2-foot zero slope setback behind sidewalks. For stormwater facilities such as ponds or swales, refer to the Stormwater Facilities Section of these Standards & Specifications. The City may consider approval of a proposed slope that is steeper than the criteria stated herein provided that a stamped geotechnical engineering report clearly states that the site-specific soils conditions are capable of supporting the proposed fill and that all recommendations of said report are incorporated in the site design. Any approved modification to the slope criteria will not exempt fill areas from the requirement of erosion stabilization as outlined herein. Approval of steeper fill slopes than a 2:1, from the setback behind sidewalks, will require additional pedestrian safety mitigation

measures such as handrail or alternate protection method as allowed by the City and meeting all ADA and OSHA requirements.

3-5.2.2 Fill Material

The type of soil utilized for fill shall have shearing, slumping, and similar characteristics necessary to support the structure intended. Fill materials that may present a water quality problem on site or within the surrounding area, due to their physical characteristics or contamination from oil, industrial waste or similar pollutants, shall not be permitted.

3-5.2.3 Compaction

Fill shall be compacted to accepted engineering standards enough to support the structure intended and existing water shall be allowed to settle prior to development upon the site. Fill shall be placed and compacted in lifts of not more than eight inches, unless on-site testing supports thicker lifts. Follow the requirements under Part 300 of the Oregon Standard Specifications for Construction.

3-5.3 Grade Breaks

Changes in slopes shall be rounded and cut and fill slopes shall be stabilized with material suitable to prevent erosion or similar soil instability problems.

3-5.4 Existing Vegetation

Existing vegetation shall be preserved when to do so will not adversely affect the engineering soundness of the cut or fill involved.

3-5.5 Drainage Courses

The alignment and capacity of major drainage courses (i.e. Willow Creek, canal systems, FEMA Firm map courses, and natural regional drainage courses) shall not be modified by grading activities. Any proposed modifications to a drainage course must be reviewed and approved by the City Engineer, but in any case, modifications will not reduce the capacity and will not create adverse effects upstream or downstream of the original drainage course. Installation of culverts shall meet the requirements of Section 4.

3-5.6 Setbacks

Cut and fill slopes shall be set back from drainage courses a minimum of 25 feet from the top of bank. Additional setbacks may be required by other regulatory agencies such as Oregon Department of State Lands, Oregon Department of Land Conservation and Development, and Federal Emergency Management Agency.

Cut and fill slopes shall be set back from site boundaries as described below:

- Top of Cut Slope. The top of cut slopes shall not be made nearer to a site boundary line than one fifth of the vertical height of cut with a minimum of 2 feet and a maximum of 10 feet. The setback may need to be increased for any required interceptor drains.
- Toe of Fill Slope. The toe of fill slope shall be made not nearer to the site boundary line than one fifth the height of the slope with a minimum of 2 feet and a maximum of 20 feet. Where a fill slope is to be located near the site boundary and the adjacent off-site property is developed, special precautions shall be

incorporated in the work as the City deems necessary to protect the adjoining property from damage as a result of such grading. These precautions may include, but are not limited to:

- Additional setbacks.
- Provision for retaining or slough walls.
- Mechanical or chemical treatment of the fill slope surface to minimize erosion.
- Provisions for the control of surface waters

3-5.7 Drainage and Terracing

For cut and fill slopes steeper than 1 foot vertical to 3 feet horizontal, the following minimum requirements apply unless more stringent requirements are recommended in the geotechnical engineering report.

3-5.7.1 Terraces

Terraces at least 6 feet in width shall be established at not more than 30-foot vertical intervals on all cut or fill slopes to control surface drainage and debris except that where only one terrace is required, it shall be at mid-height. For cut or fill slopes greater than 60 feet and up to 120 feet in vertical height, one terrace at approximately mid-height shall be 12 feet in width. Terrace widths and spacing for cut and fill slopes greater than 120 feet in height shall be designed by a civil engineer and approved by the City. Suitable access shall be provided to permit proper cleaning and maintenance.

Swales or ditches on terraces shall have a minimum gradient of 5 percent and must be paved with reinforced concrete not less than 3 inches in thickness or an approved equal paving. They shall have a minimum depth at the deepest point of 1 foot and a minimum paved width of 5 feet.

A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (projected) without discharging into an approved underground storm drainage system or other approved point of discharge.

3-5.7.2 Subsurface Drainage

Cut and fill slopes shall be provided with subsurface drainage as necessary for stability.

3-5.7.3 Disposal

All drainage facilities shall be designed to carry waters to the nearest practicable piped stormwater system or drainage course approved by the City. For guidance on discharge locations, refer to Section 4 of this manual.

3-5.7.4 Interceptor Drains

Paved interceptor drains shall be installed along the top of all cut slopes where the tributary drainage area above slopes toward the cut and has a drainage path greater than 40 feet measured horizontally. Interceptor drains shall be paved with a minimum of 3 inches of concrete and reinforced. They shall have a minimum depth of 12 inches and a minimum paved width of 30 inches measured horizontally across the

drain. The slope of drain shall be approved by the City. Alternate methods for preventing erosion on cut and fill slopes will be evaluated on a case-by-case basis.

3-6 Erosion Control Policies and Criteria

3-6.1 General

The required best management practices (BMPs) listed in this section are minimum measures. To meet the erosion control performance standard, the developer will be required to design and implement erosion control measures. The City will review Site Grading and Erosion Control Plans for completeness and compliance with the requirements of this section. However, it is the responsibility of the applicant to meet the following erosion control performance standard:

Erosion control measures shall be designed and implemented as required to prevent visible and measurable erosion of sediment.

3-6.2 Referenced Standards

For erosion control best management practices (BMPs), this standard reference the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Storm water Manual*.

3-6.3 General Site Requirement Best Management Practices (BMPs)

The BMPs listed below are required for all general sites.

3-6.3.1 Mark Clearing Limits

Clearing and grading of the site should be planned properly. It is important to clear only the areas needed, thus keeping exposed areas to a minimum. Clearing should be phased so that only those areas that are actively being worked are uncovered. Clearing limits shall be flagged prior to the initiation of clearing.

3-6.3.2 Stabilized Construction Entrance

A stabilized construction entrance shall be the sole entrance or egress from the site. Prior to initiating construction, construct a stabilized construction entrance. Refer to the ODOT Standard Drawing for details. Do not install gravel on paved surfaces. Immediately clean up any mud, gravel, or sediment that is tracked onto paved surfaces.

Perform maintenance on construction entrance as follows:

- Additional gravel shall be added as required to maintain function of the pad.
- Additional measures may be required if mud and dirt tracking is evident on access road.

3-6.3.3 Protect Stockpiles and Staging Areas

Soil and material stockpiles shall be situated so that the material does not erode into the street or adjacent properties, drainage courses, or storm systems. Excavated basement soil and material stockpiles are to be located a reasonable distance behind the curb (10 feet, minimum). This practice will increase the distance eroded soil and stockpiled material must travel to reach the stormwater conveyance system.

If applicable to the site, concentrated flows shall be diverted away from staging areas and stockpiles using best management practices from the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Stormwater Manual*. Soil and material stockpiles shall be covered when not in use (e.g. when not accessed for 48 hours or more) during the period of October 1st to April 30th. This requirement may be waived for soil and gravel stockpiles on flat (<5%) slopes if in the opinion of the Public Works Department, the risk of erosion is minimal.

3-6.3.4 Install sediment barrier at toe of disturbed area and material stockpiles

Erosion and sediment control devices, including sediment barrier, are to be installed according to Section 280 of the Oregon Standard Specifications for Construction.

3-6.3.5 Backfilling

For private property improvements, basement walls are to be backfilled as soon as possible and the lot rough graded. This practice will eliminate large soil mounds that are highly erodible and prepares the lot for temporary cover which will further reduce erosion potential. Excess soil should be removed from the site as soon as possible after backfilling. Special permits from other agencies will be provided to the City when the size and volume of work triggers permitting, such as work within a flood plain, or disturbing one acre or more, requiring a DEQ permit.

3-6.3.6 Storm Drain Inlet Protection

Protect storm drain inlets immediately downstream from sediment using best management practices from the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Stormwater Manual*.

3-6.3.7 Slope Protection and Temporary Cover

Slope stabilization measures (for slopes 3H:1V and steeper) must be initiated within 14 calendar days after construction activities in that portion of the site where earthmoving activities have temporarily or permanently ceased. Un-established slopes shall be covered using mulch, erosion control matting, or other methods described in the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Stormwater Manual*. Follow guidelines for securing mulch or matting. Slopes must be protected while permanent cover is established.

3-6.3.8 Remove Sediment

Visible deposits of sediment that leave the site shall be cleaned up within 24 hours and placed back on the site or properly disposed.

Under no condition shall sediment from the construction site be washed into sewers, drainage courses, or other portions of the conveyance system.

3-6.3.9 Establish Permanent Cover

Prior to removal of erosion control measures, permanent cover must be established on the site. Once construction is complete and permanent cover is established, call for final inspection from the City. Remove temporary erosion control measures when approved by the City inspector. In the establishment of permanent cover, the property owner is responsible to comply with all the provisions of the City's Weed Abatement Program during establishment and after establishing cover.

3-6.4 Additional Measures for Subdivisions and Site Plan Developments

In addition to meeting the general requirements above, further minimum requirements for subdivision and site plan development erosion control are described in this section. Review the BMPs in the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Stormwater Manual* and apply them as required to meet these minimum requirements. Due to variations in site conditions and construction timing, the BMPs required will vary by site. Maintenance of BMPs shall be as specified in the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Stormwater Manual*.

3-6.4.1 Delineation of Clearing Limits

Follow the BMP guidelines in the *City of Madras Stormwater Master Plan*, *ODOT Hydraulics Manual*, and *Central Oregon Stormwater Manual*. Show clearing limits on construction plans and mark them in the field prior to the initiation of clearing and grading. Show phasing in construction schedule (e.g. “Install sediment fence below area A” then “Clear and rough grade area A” followed by “Seed, mulch, and install erosion control matting on slopes of area A,” etc.)

3-6.4.2 Prevent Pollution from Equipment and Material Storage and Maintenance

Specify locations on site for equipment storage and maintenance, and storage of construction materials and wastes. Protect this location from surface water run-on and flooding. Review the ODOT Hydraulics Manual BMPs and implementation measures from Section 280 of the Oregon Standard Specifications for Construction. Specify the types of materials stored on-site (e.g. fuel or fertilizer) which may pose a water quality hazard and specify measures to be taken to prevent pollution. Covering of construction equipment is not required. Covering materials and stockpiles may be required depending on type of material and downstream controls. Protect stockpiles on slopes greater than 5 percent using perimeter controls at the base. Locate stockpiles a minimum of 10 feet away from property boundaries or stormwater conveyance systems.

3-6.4.3 Surface Water Controls

Surface water controls shall be installed to intercept all concentrated flow from disturbed areas, convey it to an appropriate sediment trap or pond, and discharge it downstream of any disturbed areas. However, areas at the perimeter of the site that are small enough to be treated solely with perimeter protection do not require surface water controls. Significant sources of upstream surface water that drain onto disturbed areas shall be intercepted and conveyed (in a non-erosive pipe or channel) to a stabilized discharge point downstream of the disturbed areas. Surface water controls shall be installed concurrently with or immediately following rough grading. Special caution shall be used in protecting stockpile, material storage and equipment maintenance areas to prevent surface water from flooding these areas. Select BMPs for controlling surface water from the ODOT Hydraulics Manual. Show surface water controls on plan.

3-6.4.4 Perimeter Sediment Controls

Perimeter protection to filter sediment from sheet flow shall be provided downstream of all disturbed areas. Perimeter protection may include preserving vegetated strips as well as more conventional constructed measures such as sediment fences, straw

bales, and bio-filter bags (refer to the ODOT Hydraulics Manual BMPs and implementation measures from Section 280 of the *Oregon Standard Specifications for Construction*). Such protection shall be installed prior to upslope grading.

3-6.4.5 Remove Excess Soil

Excess soil should be removed from the site as soon as possible after earthwork is completed in a manner consistent with the Land Use decision and the Public Works Department Standards & Specifications. The developer is also to follow conditions set by other agency permits for significant excavation and disposal projects.

3-6.4.6 Dust Control

Preventative measures to minimize wind transport of soil shall be implemented when a nuisance or traffic hazard may be created or when sediment transported by wind may be deposited in water resources. Reference the *ODOT Hydraulics Manual*, and the *Oregon Standard Specifications for Construction* Section 280 for BMPs.

3-6.5 Project Types Requiring Special Consideration

Projects such as roads or utilities will require special consideration for meeting the erosion control performance standard. An erosion and sediment control plan will be required from the Engineer of Record that is to be implemented and managed by the general contractor. One way of performing adequate erosion control is to stabilize construction as the work proceeds. For example, on a road the base rock may be placed on the first portion of the road before the rough grading is complete at the end. At a minimum, the following measures are required for these types of projects:

- Protect downstream storm drain inlets (or if site drains to a ditch system, install check dams or other devices to retain sediment).
- Protect stockpiles and work site from concentrated flows.
- Remove excess soil and materials as soon as possible.
- Filter dewatering pump effluent.
- Remove sediment/debris from the right-of-way and conveyance system (including gutters) at the end of the day.
- Cover material and soil stockpiles when not in use or when windy conditions may cause a nuisance or hazard due to dust.
- Protect for weed abatement (see the City's Weed Abatement Ordinance); and
- Protect slopes and establish permanent cover as required.

SECTION 4 STORMWATER FACILITIES

4-1 Purpose

Stormwater management in the City of Madras is necessary to promote the general health, welfare, and economic wellbeing of our community as well as to protect the health of the Willow Creek Watershed (a sub-basin to the Deschutes River Watershed). The potential effects of failure to manage stormwater include increased water pollution, flooding, damage to public and private infrastructure, regulatory fines, and increased costs to remedy problems in the future.

The City of Madras has adopted the *Central Oregon Stormwater Manual* (COSM) to be used in conjunction with the *ODOT Hydraulics Manual* and *Stormwater Master Plan* except as modified below. Specific points of emphasis are also included. Modifications to these adopted standards may be modified on a case-by-case basis by the Public Works director.

4-2 Summary

The City has adopted the *Central Oregon Stormwater Manual* except as modified below. Other standards may be used on a case-by-case basis for unusual circumstances and at the discretion of the Public Works Director.

Specific modifications and emphasis to stormwater standards are as follows:

- The pre-developed condition shall be as defined as the COSM (native soils and vegetation).
- Detention design shall limit the 2-year/24-hour post-developed peak flow to the 2-year/24-hour pre-developed flow and the 25-year/24hour post-developed peak flow to the 25-year/24-hour pre-developed peak flow.
- Discharge from a site must be to a well-defined natural, channelized, or piped drainage course as approved by the Public Works Director.
- Detention systems that discharge runoff must provide water quality design. A sediment manhole or similar approved structure is a Best Management Practice that meets the water quality design criteria. A sediment manhole is the water quality treatment method for a drywell or other UIC.
- Runoff coefficients shall be per the NRCS ARC III condition (see Table 5-2 of the COSM).
- Private sites may use an approved UIC design to discharge stormwater runoff. The UIC must be registered with Oregon DEQ and shall not be placed within the 2-year time of travel zone of a domestic well or within 500 feet of a City or community water supply well.
- A design infiltration rate shall be supported by infiltration testing. The testing method shall be per the COSM, the EPA falling head method, or as approved by the Public Works Director.
- In order to aid in the design of drywells, the City has performed infiltration testing throughout the site and allows the designer to use the following tables below. The designer may also perform their own independent design if so desired.

Public Improvement Design & Construction Standards

	Excavation Method	Excavated Material			
		Soil/River Rock (near Willow Creek)	Hard Pan/Caliche Clay	Rock	Cinders
Design Infiltration Rate (in./hr.)	Drilled & Shot	1	5	10	10
	Excavated/Hammered	1	2	2	10
30 CY Drain Rock Max. Imp. Area	Drilled & Shot	4,000	8,000	10,000	10,000
	Excavated/Hammered	4,000	6,000	6,000	10,000
60 CY Drain Rock Max. Imp. Area	Drilled & Shot	8,000	14,000	18,000	18,000
	Excavated/Hammered	8,000	10,000	10,000	18,000
90 CY Drain Rock Max. Imp. Area	Drilled & Shot	10,000	20,000	25,000	25,000
	Excavated/Hammered	10,000	12,000	12,000	25,000
120 CY Drain Rock Max. Imp. Area	Drilled & Shot	12,000	25,000	32,000	32,000
	Excavated/Hammered	12,000	15,000	15,000	32,000
150 CY Drain Rock Max. Imp. Area	Drilled & Shot	15,000	30,000	40,000	40,000
	Excavated/Hammered	15,000	18,000	18,000	40,000
180 CY Drain Rock Max. Imp. Area	Drilled & Shot	18,000	35,000	50,000	50,000
	Excavated/Hammered	18,000	22,000	22,000	50,000

The above table provides the design infiltration rate for a UIC and the maximum amount of impervious area (square feet) that can be routed to a UIC based on the column of drain rock that is placed.

- The maximum volume of drain rock that can be specified in an UIC is 180 CY.

- UIC's and drywells designed according to the above design table do not need to be flow tested. Volume of drain rock shall be verified by load tickets, measurements, or other means that confirms the volume of drain rock has been provided.
- Custom-designed UIC's shall include a testing method approved by the Public Works Director.
- Swales and ponds shall have their volume verified by a licensed surveyor and infiltration rate verified by a test according to the COSM or the EPA Falling Head Method.
- Private stormwater runoff from attached or detached single family dwellings can be directed into the public right-of-way and public storm drainage facilities provided such facilities are sized for that impact.
- Private stormwater runoff from multi-family, commercial, industrial, and institutional areas shall be treated and detained on site unless otherwise approved by the Public Works Director.
- Prior to design, a public stormwater facility concept shall be approved by the Public Works Director.

4-3 Pipe Systems

Pipe systems are networks of storm drainpipes, catch basins, manholes, inlets, and outfalls designed and constructed to convey storm and surface water. The hydraulic analysis of flow in storm drainpipes is typically limited to "gravity flow." The following subsections give design criteria for different components and aspects of pipe systems.

4-3.1 Pipe Materials

Unless otherwise specified, all storm sewer pipe with less than 24 inches of cover to finish grade shall be AWWA C900, 8" thru 12", or AWWA C905, 14" through 24" water pipe meeting the requirements of AWWA specifications for **Poly Vinyl Chloride (PVC) Water Transmission and Distribution Pipe**. Pipes with more than 24 inches of cover to finish grade may be PVC meeting the requirements of ASTM D3034 SDR 35 for diameters up to and including 15 inches. Pipes larger than 15 inches with more than 24 inches of cover shall meet the requirements of ASTM F679 PS46. Otherwise, joints, gaskets, and protective treatment shall conform to *Oregon Standard Specifications for Construction* Section 445.

Culverts (Public)

HDPE, PVC, reinforced concrete, and ductile iron installed per manufacturer's specifications.

Culverts (Private)

HDPE, PVC, reinforced concrete, ductile iron, galvanized corrugated steel pipe, or galvanized aluminum installed per manufacturer's specifications.

4-3.2 Pipe Sizes, Slopes and Velocities

No storm drain pipe in the public right-of-way shall be less than 8 inches in diameter.. Minimum size of culverts shall be 12 inches within the public right-of-way unless approved by the City.

The minimum velocity in any pipe or culvert flowing full shall be 3.0 feet per second.

Minimum slopes are 0.05 feet per 100 feet (0.5%).

The maximum allowable velocity at design flow in any pipe shall be 15 feet per second. For slope section exceeding four percent (4%), the energy grade line must be checked to confirm if bolt-down manhole lids are required.

Downstream decrease in pipe size will not be allowed.

4-3.3 Pipe Location

Refer to **Section 4-12.5 General Design Route Requirements**, and Section 1.

4-3.4 Pipe Alignment/Cover

Line and grade to be established per the current *Oregon Standard Specifications for Construction*, Section 445.40 (b).

Minimum utility cover is 30 inches. PVC and HDPE pipe shall not be exposed where damage may occur from ditch cleaning, fire, or traffic.

12 inches minimum vertical and 5 feet minimum horizontal clearance (between outside surfaces) shall be provided between storm drainpipes and other utility pipes and conduits, except for the greater separation to water lines as required by Oregon law.

Construction per the current *Oregon Standard Specifications for Construction*, Section 445.

Testing will follow the procedures outlined in the current *Oregon Standard Specifications for Construction*, Section 445.

4-3.5 Manholes, Catch Basins, and Curb Inlets

CG-3 curb inlets are required on all major collectors and all sections of streets with established or proposed bike lanes. CG-2 catch basins are required at all sag locations and G-2 catch basins are required on all other City streets where curb is used.

Catch basins and inlets shall be spaced as required to prevent ponding or flooding of the roadway during the design storm. Install a tubular reflective removal marker at each catch basin in the curb line. Catch basins and inlets shall be provided at street intersections and placed upstream to any sidewalk ramp without bypass of gutter flow. The ODOT Hydraulics Manual methodology shall be used to determine catch basin/inlet spacing.

Catch basins/inlet or manholes shall be located at all changes in pipe slope, alignment or size. At a minimum, a catch basin/inlet or manhole shall be located every 400 feet for all pipe-to-manhole systems. All catch basins/inlets and manholes shall be accessible to maintenance vehicles.

Connections to a pipe system shall be made only at catch basins/inlets or manholes except as approved by the City.

Connections to existing catch basins/inlets and manholes shall be similar to those required in Section 5 of this manual for connection to existing sewer manholes.

Manholes and catch basins/inlets shall be constructed in accordance with Madras Standard Drawing 4-1 and current *ODOT Standard Drawings and Details*.

Catch basin/inlet and manhole diameter shall be determined by pipe size and orientation at the junction structure. A plan view of the junction structure, drawn to scale, will be required when more than four pipes enter the structure on the same plane, or if angles of

approach and clearance between pipes is of concern. The plan view (and sections if necessary) must insure a minimum solid concrete wall distance between pipe openings of 8 inches for 48 inch and 54-inch catch basins and 12 inches for 72 inch and 96 inch catch basins.

Evaluation of structural integrity for H-20 loading may be required for multiple junction catch basins and other structures.

Materials, construction, and testing for manholes, catch basins, and inlets are according to the current Oregon Standard Specifications for Construction Section 470.

Standard pre-cast manholes and cones shall conform to Madras Standard Drawing 4-1 Flat covers shall conform to the current *ODOT Standard Drawings and Details* for storm manholes.

All manholes, catch basins, and inlets shall have a minimum drop of 0.10 feet between the inlet invert and the outlet invert to account for energy losses.

Connections to new or existing manholes and catch basins shall be as shown in the Standard Drawings (refer to Section 10). The contractor shall verify all invert elevations of existing manholes and catch basins prior to construction. The contractor in conjunction with the Engineer of Record shall submit any proposed changes to the approved design for review and approval by the City. If core drilling is required, the contractor shall core drill manholes and catch basins/inlets for an opening to match the size of pipe to be inserted. Jackhammers shall not be used. All openings must provide a minimum of 1 inch and a maximum of 2 inches clearance around the outside circumference of the pipe to create a water-tight connection i.e. grouting or seals.

4-3.6 Frames/Lids/Grates/Covers

In general, frames and grates for catch basins shall be furnished as shown in the current *ODOT Standard Drawings and Details*. Frames and covers for manholes shall be furnished as shown on Madras Standard Drawing 4-1.

The cover or grating of a manhole or catch basin shall not be grouted to final grade until the final elevation of the pavement, gutter, ditch, or sidewalk in which it is to be placed has been established, and until permission thereafter is given by the City to grout the cover or grating in place.

Lids, grates, and covers shall be seated properly to prevent rocking. The City may require locking frames and lids or grates in some conditions.

Round lids on all storm drain structures shall have "STORM DRAIN" OR "SD", cast into the lid. Lids marked to denote sanitary sewer are NOT allowed, on storm drains.

4-3.7 Restrictor and Orifice Devices

The minimum orifice size diameter allowed for use in the City of Madras is one inch (1"). Multiple flow restrictors and orifices in a flow control structure shall be provided at various levels as required in this Section to limit release rates to 2- and 25-year predevelopment rates. Flow control structures shall be designed with an emergency overflow weir or a spillway to release excess flow during a 100-year storm.

4-3.8 Debris Barriers and Safety Access Restriction Grate

Debris barriers (trash racks) are required on all ditch inlets entering a closed pipe system, including pipes entering or leaving a control/restrictor manhole or catch basin from a surface-type BMP (ditch inlet, detention pond, infiltration basin, wet pond,

biofiltration swale, etc.). For pipes 18 inches in diameter and larger, safety access restriction grates are required.

4-3.9 Pump Stations and Forcemains

Due to maintenance concerns, pump systems (includes the pumps, forcemains, electrical equipment, structures, and appurtenances) are not allowed for publicly maintained stormwater systems unless approved by the City. If a new stormwater pump station within the publicly maintained system will be added or retrofitted, the developer will be required to meet City requirements for pump types, configuration, instrumentation and controls, and startup and testing. If a pump station and forcemain is required, refer to Section 5-2.6.

4-3.10 Culvert Design Criteria

4-3.10.1 Headwater

The minimum culvert dimension at any intersection or street crossing shall be 12 inches in diameter.

To design culverts larger than 18 inches in diameter, follow Chapter 9 of the *ODOT Hydraulics Manual*. The City or the Engineer of Record will determine when a design analysis is required.

4-3.10.2 Ditch Inlets and Outlets

For culverts 12 inches in diameter and larger, the embankment around the culvert inlet and outlet shall be protected from erosion as specified in the *ODOT Hydraulics Manual* Chapter 15.

Trash racks/debris barriers are required on culverts that are over 18 inches in diameter.

In order to maintain the stability of roadway embankments, concrete headwalls, wing walls, or tapered inlets and outlets may be required if right-of-way and/or easement constraints prohibit the culvert from extending to the toe of the embankment slope. Normally, concrete inlet structures/headwalls installed in or near roadway embankments must be flush with and conform to the slope of the embankment.

4-3.11 Outfall Design Criteria

4-3.11.1 General

The City requires a designated discharge location for stormwater overflow. The 10-year predevelopment release rate along with overflow stormwater will either go into an approved open space or the nearest public conveyance system so as to protect adjacent properties from overflow for storm events larger than the 25 year design storm event.

General In-fill developments are required to follow the Building Department Code for stormwater mitigation. In lot grading, the property owner is responsible for onsite stormwater management to protect adjacent properties. This can be handled on a case by case basis by the Public Works Department and conformance to applicable zoning regulations.

Discharge across sidewalks and streets are prohibited because ice formation will result in a safety hazard.

All outfalls (at a minimum) shall be provided with rock protection as specified in the *ODOT Hydraulics Manual* Chapters 11 (Energy Dissipation) and Chapter 15 (Bank Protection).

Mechanisms which reduce velocity prior to discharge from an outfall are required.

Engineered energy dissipaters are required and may include stilling basins, drop pools, hydraulic jump basins, baffled aprons, and bucket aprons.

Inlet control will usually dictate outfall pipe system capacity. The inlet conditions must be carefully examined, particularly in the case when the pipe system becomes plugged or capacity is exceeded.

4-3.11.2 Outfall Systems Traversing Steep Slopes

For the purposes of this section, “steep slopes” may be eight percent (8%) or greater or as determined by the City Engineer.

Outfall systems constructed of pipe segments which are banded and/or gasketed are not acceptable for traversing steep slopes.

Continuously fused, welded or flange bolted mechanical joint pipe systems (such as ductile iron pipe with flange-bolted mechanical joints) with proper anchoring shall be used for outfall systems traversing steep slopes.

In general, outfall pipes systems shall be installed in trenches with standard bedding on slopes up to 20 percent. On slopes greater than 20 percent, outfall pipe systems shall be placed on the ground surface with proper pipe anchorage.

Flows of very high energy will require a specifically engineered energy dissipater. Flows of very high energy will be determined at the discretion of the City Engineer.

4-3.12 Open Channel Design Criteria

Open channels, either natural or constructed, may be used to convey stormwater on and from a site. However, many of the natural drainage courses within Madras are susceptible to erosion from increases in flow (magnitude and/or duration). The City will inspect and determine what constitutes a natural drainage course. The applicant will be required to provide additional quantity and quality controls in order to discharge to a natural drainage course. Altering the flow path or piping natural drainage courses through a site is discouraged; however, proposals to relocate or otherwise alter natural drainage courses will be reviewed and approved on a case-by-case basis.

Constructed channels are those built in upland areas specifically to convey storm and surface water. In general, the criteria in this section do not apply to biofiltration swales, which are primarily designed to treat stormwater runoff.

When constructing approved channels, vegetation-lined channels are preferred when properly designed and constructed. Rock-lining, flow spreaders, concrete-lined slope protection (splash pads and stilling basins), and maximum steepness of slopes (typically 4H:1V) will be required along the length of channels or at specific locations (such as bends and outfalls) when a vegetative lining will not provide adequate protection from erosive velocities.

4-3.12.1 Constructed Channel Design Criteria

Channel design in general will follow the *ODOT Hydraulics Manual* Chapter 8 (Channels).

Water quality swale design will follow the *Central Oregon Stormwater Manual* Chapter 6 (Water Quality Treatment Design), and the *ODOT Geo-Environmental Bulletin GE09-02(B)* and as updated.

Water quality swale design will follow the minimum soil type and dimensions and mitigation measures as outlined in the Standard Details of Section 11 water quality swale exhibit.

Channels shall be designed to provide required conveyance capacity while minimizing erosion and allowing for aesthetics and preservation of riparian habitat.

Channel section geometry shall be trapezoidal. Side slopes shall not be steeper than 4H:1V for vegetation-lined channels and 3H:1V for rock-lined channels, unless the channel is engineered specifically for steeper slopes and allowed by the City.

Vegetation-lined channels shall have a minimum slope of 0.5% and maximum velocity of 2 fps and detailed as further described in the *ODOT Geo-Environmental Bulletin GE09-02(B)* and as updated.

An established grass, vegetated lining, or other approved erosion control measure (e.g. riprap) is required before the channel can be used to convey stormwater.

If the design velocity of a channel to be vegetated by seeding exceeds 2 fps, flow spreader spacing will be decreased to compensate for the additional velocity.

A filter blanket or riprap geotextile is required for rock lined channels.

The table below summarizes required channel type and freeboard by design velocity:

Velocity at Design Flow (fps)	Channel Type	Min. Height Above Design Water Surface (freeboard)
0 – 5	Grass lining /Bioengineering	0.5 ft
>5 – 8	Riprap /Bioengineering	1 ft
>8 – 12	Riprap	2 ft
>12	Site specific design to be submitted and approved by the City	

4-3.12.2 Riprap Lining Design

Engineers designing riprap lined channels shall follow procedures developed by the *ODOT Hydraulics Manual* Chapters 8 (Channels) and 15 (Bank Protection) for selecting the median stone size and gradation of riprap.

4-3.12.3 Filter Blankets and Riprap Geotextile

Riprap shall be underlain by a sand and gravel filter (or geotextile fabric) to keep the fine materials in the natural or artificial channel from being washed through the voids in the riprap. Likewise, the filter material must be selected so that it is not washed through the voids in the riprap. For additional information and procedures for specifying filters of riprap and general guidance, refer to the *ODOT Hydraulics Manual* Chapter 8 (Channels) and 15 (Bank Protection).

4-3.13 Drainage Easements and Access

Piped drainage systems that will be maintained by the City shall be centered in a dedicated public right-of-way or within deeded property conveyed to the City. The width of the right-of-way or property shall be a minimum of 20 feet or twice the depth of the pipe invert, whichever is greater. Vehicle access on an all-weather paved or gravel surface shall be provided to all structures requiring maintenance.

For open channels, a maintenance access easement 20 feet wide (minimum) is required along all publicly maintained channels located on private property. However, required easement widths and building setback lines may increase with channel top width. A minimum 25-foot setback must be provided between any structures and the top of the bank of the channel.

Private pipes or channels crossing another separate private property must establish a private drainage easement.

4-4 Control Water Quality

As runoff passes through urban areas, it collects and transports pollutants to downstream receiving waters. Common urban pollutants include:

- Sediment (from erosion).
- Heavy metals (lead, copper, zinc, and cadmium).
- Nutrients (phosphorous and nitrogen).
- Bacteria and Viruses; and
- Organics (oil, grease, hydrocarbons, pesticides, solvents).

4-4.1 How can site design reduce pollution?

Generally, site design can reduce pollution by two mechanisms:

- Source Control BMPs: Eliminating exposure of pollutants to stormwater (e.g. covering bulk material storage so it is not exposed to stormwater); and
- Treatment BMPs: Treating stormwater to remove pollutants (e.g. installing a treatment swale or other treatment BMP).

4-4.2 What is required?

The City encourages designers to incorporate best management practices to treat stormwater runoff into site design. Use of vegetated swales or other BMPs incorporated into parking lot landscaping to treat runoff is highly recommended. Incorporating treatment into quantity control facilities is also recommended.

Except as specified in Section 4-4.3 (Site Uses/Characteristics Requiring Source Control BMPs), Section 4-5 (Perform Erosion Control), and as needed to meet the requirements of off-site discharge, water quality BMPs are encouraged at this time.

4-4.3 Site Uses/Characteristics Requiring Source Control BMPs

Source control BMPs will be required for the site uses/characteristics listed below. Consult Public Works if there is any question as to whether any of these apply to your site. Specific requirements will be developed on a case-by-case basis. Guidance will generally be taken from the Oregon DEQ. Structural controls will be emphasized due to their permanent nature.

The following site uses/characteristics require source control BMPs:

- Fuel dispensing facilities: Places where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers (including fuel islands, above ground fuel tanks, fuel pumps, and the surrounding pad).
- Exterior storage of liquid materials: A place where one or more above-ground storage tanks are used for outside storage of any type of liquid chemicals, waste oils, solvents, petroleum products, or food product.
- Storage, use and transportation of hazardous/toxic materials: A place where the total quantity of stored or transported toxic compounds, confirmed carcinogens, halogenated solvents, or chemicals with a pH less than 6.0 or greater than 9.0 is expected to exceed 200 gallons or 1,000 pounds.
- Exterior storage of bulk materials: Non-contained storage of materials that may adversely affect water quality. Examples are fertilizers, scrap and recycling materials, food items and wastes, soil and sand stockpiles, other raw materials and byproducts.
- Material transfer areas/loading docks: An area designed to accommodate a truck/trailer being backed up to or into them and used specifically to receive or distribute materials to/from trucks/trailers. This includes loading/unloading facilities with docks, and large bay doors without docks.
- Sites with existing or proposed interior floor drains.
- Vehicle or equipment washing facilities: Areas designated for equipment or vehicle washing or steam cleaning.
- Stormwater disposal from development on a contaminated site: Land that currently or previously has had pollutants detected in the soil or groundwater at concentrations that exceed state/federal cleanup standards.
- Non-contained exterior solid waste storage areas.

4-4.4 General Principles of Source Control

- Eliminate pathways that may introduce pollutants to stormwater.
- Capture acute releases and reduce chronic contamination.
- Drain wastewater discharges, and areas with the potential for relatively consistent wastewater discharges (such as vehicle washing facilities) to the sanitary sewer system.
- Drain areas that have the potential for acute releases or accidental spills, and are not expected to regularly receive flow or require water use (such as covered fuel islands or covered containment areas) to a dead-end sump or other containment device.
- Contain spills on-site; and
- Provide permanent structural solutions to address the range of potential impacts resulting from multiple site uses and tenant turnover.

4-4.5 NPDES/WPCF Industrial Stormwater Permits

If an industrial permit (i.e. NPDES or WPCF) is required, the applicant will be required to submit a copy of the permit and supporting documentation to the City. The DEQ is the authority on determination for stormwater permitting.

4-5 Perform Erosion Control

The applicant shall submit a Site Grading and Erosion Control Plan if required by Section 3 of this manual.

4-6 Provide for Maintenance and Operation

Maintenance and operation of all drainage facilities on private property is the responsibility of the applicant/property owner, except those facilities for which the City of Madras is granted a deeded property or easement and assumes maintenance and operation as described below:

- The general policy of the City is to require dedication of conveyance and storage systems that drain the area within a public right-of-way or other public facility.
- The City does not normally assume maintenance responsibility for conveyance systems that are outside of the improved public road right-of-way. However, in cases where the City does assume maintenance responsibility, the requirements of Section 4-13.11 apply.
- Private detention ponds for commercial and industrial sites shall be operated and maintained by the property owner.
- Private stormwater pipes within the public right-of-way that drain individual properties or other parcels to a City manhole, catch basin or ditch are the responsibility of the landowner. Driveway culverts across roadside ditches are the responsibility of the landowner.
- In some cases, the City may require the dedication of drainage easements for drainage courses or other large conveyance systems that serve multiple parcels. The purpose of this dedication will be to ensure adequate maintenance of large systems that serve many properties and have the potential for flooding/erosion/water quality impacts.

Contact the Public Works Department for more information.

4-6.1 Dedication Submittal Requirements

The engineer shall submit the following:

- A map and/or narrative proposing the portions of the stormwater system to be dedicated to the City. Show proposed easements, right-of-way and access in accordance with Section 4-3.13.

SECTION 5 SANITARY SEWERS AND WASTEWATER LIFT STATIONS

5-1 Purpose

The purpose of these standards is to provide criteria and guidance for the design of sanitary sewer collectors, connections, pre-treatment requirements, and wastewater lift stations. Criteria and guidance are provided to improve the safety, quality, reliability, durability, efficiency, maintainability, and operability of the City’s facilities and to effectively convey and treat wastewater in full compliance with regulatory requirements.

It is also the intent of these standards to provide designers, engineers and developers information about the City’s Ordinances and policies governing pretreatment and connection requirements. In addition, the City’s Wastewater System Master Plan specifically outlines expansion of the current wastewater collection and treatment system. It provides planning level information regarding the general expansion of infrastructure necessary to support development within current planning and zoning designations, preliminary sizing of future wastewater collection and conveyance systems and allocation of interceptor and treatment capacity to the various areas served by City infrastructure. The infrastructure construction outlined in the Master Plan will be development driven and the need for new facilities and/or upgrades are the responsibility of each new development.

5-1.1 Planning and Design Approval

The contractor/developer is welcome to set-up a predevelopment meeting to guide them through the approval process prior to submitting a land use application and construction plans. At that time, the contractor/developer may produce preliminary construction drawings for sanitary sewers and wastewater lift stations and receive guidance regarding potential changes that would lead to construction approval. See Section 2 for a flow chart of this process.

Any new public sewer system constructed must have construction plans prepared by an Oregon licensed professional engineer.

The Public Works Director reserves the right to require a sewer capacity analysis study for any new development. The study will define the amount of remaining capacity, or if none, the downstream mitigation options to offer capacity for the development. Prior to commencing the study, the developer’s engineer will have the scope of analysis work approved by the City Engineer, before proceeding.

Any downstream mitigation requirements to provide capacity for the new development and the associated costs are the responsibility of the developer.

5-1.2 Construction Approval

Final design and construction documents shall be submitted to the Public Works Department for review and approval for all new sanitary infrastructures and any proposed connection(s) to existing City sewer. Approval will not be granted until the City is satisfied that any requested design modifications have been made. The design submittal shall include all drawings, specifications and supporting calculations needed to verify that the proposed sewer collection system aligns with the concepts approved in the Development Review process and meets the City’s design standards as specified herein. Proposed infrastructure agreements between the Developer and the City regarding cost sharing, advance financing, utilization of SDC credits, etc. shall be presented in written form and signed by all parties prior to Construction Approval.

5-1.3 City Ordinance on Sewer System

The City Sewer System Ordinance regulates the use of public and private sewers and drains, private sewage disposal, the installation of and connection of building sewers, the discharge of waters and wastes into the public sewer system, and providing penalties for violations thereof, enabling the City to comply with State and Federal Laws required by the Clean Water Act and amendments. Customers connecting to the City wastewater system are subject to provisions of the Sewer System Ordinance. Commercial and industrial wastes are required to pretreat prior to discharge when fats, oils, greases, heavy metals, toxic chemicals, or other heavy industrial/commercial uses are proposed by the development. Inquiries about this ordinance are directed to the City of Madras Public Works Department.

5-1.4 City Ordinance and Fee Resolution

The City's Sewer System Ordinance outlines the rules and procedures for use and charges. To refer to the most current resolution regarding City fees, contact the City of Madras Public Works Department.

5-2 Summary

This section provides design criteria and guidance for sanitary sewers and related collection system structures, lift stations and pumping stations for pumping of wastewater, and for wastewater treatment and reclamation facilities consisting of multiple processes for conventional primary and secondary treatment, tertiary treatment and reclaimed water production. They are provided to support the City's growth and economic plans and in anticipation of future regulatory requirements as described in the Wastewater System Master Plan.

5-2.1 Design Criteria

The City of Madras, as conditionally authorized by the Department of Environmental Quality (DEQ), is exempt from the DEQ plan review requirements for gravity sewer projects set forth in OAR 340-52-015 under several conditions including, but not limited to the following:

- The design of sanitary sewer lift stations and forcemains shall meet the requirements of OAR 340 Division 052 including all Guidelines and Standards. Refer to Water Quality Program Rules - Division 052: Review of Plans and Specifications.

Web Site Links:

<http://www.deq.state.or.us/wq/rules/div052guides.htm>

[Guidelines for Writing Pump Station Operations and Maintenance Manuals](#) PDF

[Guidelines for Making Sewage Pump Station Plan-Review Submittals](#) PDF

[Sanitary Sewer Design Notes](#) PDF

[Standards for Design and Construction of Wastewater Pump Stations](#) PDF

[Design Notes For Air Injection Stations and Sewage Forcemains](#) PDF

[Guidelines for Hydrogen Sulfide Tests](#) PDF

[Operations and Maintenance Notes for Gauges on Sewage Pumps](#) PDF

In case of conflicts among the rules and various stated standards, the most stringent requirements shall prevail.

Pressurized collection system projects shall be designed and constructed in accordance with approved City standards and shall conform to the rules set forth by the DEQ. Plans, specifications, O & M manuals for pump stations shall be prepared by an Oregon registered professional engineer and reviewed by qualified sanitary engineering staff and DEQ.

Public gravity sewer systems, including sanitary sewer mains, side sewers, sanitary sewer manholes and sanitary sewer facilities, shall be constructed in accordance with the latest issue or revision of the Oregon Standard Specifications for Construction and Oregon Department of Environment Quality Standards for sanitary sewers. All connections to City facilities shall conform to City Standards. Sanitary sewer main extension(s) shall be required when the property does not front on a sewer main, or when the existing sewer main is not adequately sized for the use proposed.

The contractor shall have plans which have signature approval by the City's Public Works Department, and have obtained all City, County, State, Federal and other required permits, and shall have posted all required bonds prior to the start of any construction activities.

5-2.1.1 Size/Velocity

The minimum pipe diameter shall be eight inches (8") for gravity sewer lines and four inches (4") for forcemains. Each sewer line shall be sized to carry flows from its tributary areas with minimum capacities as follow:

- 8-inch through 15-inch flowing 50% full
- 18-inch through 27-inch flowing 75% full
- 30-inch and larger flowing 90% full

In general, gravity lines and forcemains shall be sized based on the following criteria:

- 2.5 feet per second minimum velocity (full pipe flow) for gravity sewers and 3.0 feet per second minimum velocity for forcemains. In dead end mains not projected to be extended, the slope of the last sanitary sewer run shall be increased to provide a minimum velocity of 3 feet per second.
- Maximum velocity of 10 feet per second for gravity lines and 6 feet per second for forcemains at peak flows.

5-2.1.2 Design Calculations

All subdivisions are required to show design calculations of proposed sanitary sewer systems and shall be submitted to the Public Works Department. The applicant shall submit a design stamped by an Engineer licensed by the State of Oregon. Single family residential services, provided they are not part of a larger development project, are not required to submit calculations to the City if they meet the minimum slope requirements. The calculations shall include the following items:

1. A plan showing the proposed street system, tributary sub-areas, existing and future tributary areas, outside the project limits, zoning, projected land use, and any features affecting the system design.
2. Minimum and maximum velocities at the proposed slope and design flows for the proposed development.

3. Load calculations for any shallow installation applications or where heavy traffic loads on the piping system is anticipated.

5-2.1.3 Other Design Criteria

5-2.1.3.1. Flows

1. Peak flows shall be calculated with a minimum peaking factor (ratio of peak hour flow to average daily flow) of 3.5 for commercial and industrial developments and 3.0 for residential development.
2. Design flows at major junction points shall include flows coming from their respective tributary areas within and beyond the project limits.
3. The average residential flows shall be computed on a per-dwelling basis as outlined in the City of Madras Wastewater System Master Plan (available for viewing online).

Gravity Sewers Slope

All gravity sewers shall be designed and constructed to give mean velocities, of not less than 2.0 feet-per-second when flowing 90% full. A Manning’s coefficient of 0.013 shall be used for design calculations. The minimum slopes shall be provided to meet the velocity requirement, but in no case shall be less than those shown below.

<u>Sewer Size (inches)</u>	<u>Minimum Slope (feet per 100 feet)</u>	<u>Slope (foot per foot)</u>
8	0.4	0.0040
10	0.25	0.0025
12	0.19	0.0019
15	0.14	0.0014
18	0.11	0.0011
21	0.09	0.0009
24	0.08	0.0008

5-2.1.4 Location and Depth

Refer to Section 1.11.

5-2.1.5 Manhole Spacing

Maximum spacing of manholes shall be 400 feet for any size of pipe without approval of the Madras Public Works Department. All manholes shall be accessible to maintenance vehicles by providing a graveled unpaved access route. Manholes shall be spaced at no greater than 200 feet where the slope of the pipe is greater than seven percent (7%).

Manholes are required at any change in pipe slope, alignment, or size. Manholes are not allowed in a fill section unless the base is on a cut section or well compacted fill. A manhole is required at the ends of all sewer mains, unless a clean-out is specifically approved by the Public Works Director.

5-2.1.6 Odor and Corrosion Prevention

The developer is required to use non-corrosive materials for the manhole and sewer connections if odor and corrosion problems have been identified in the connecting trunk or interceptor connection. In addition, ventilating the pipe and discharging the foul air through a biofilter is required at the proposed connection point to the sewage collection system if the City anticipates a potential odor problem at the connection. All proposed pumping and lift stations shall be equipped for chemical addition (bioxide or other approved treatment) to control sulfides. Odor and corrosion controls shall meet the requirements of DEQ. Specific application of odor control and corrosion control shall be evaluated on a case-by-case basis.

5-2.1.7 Design Life

All sanitary sewer pipe systems shall be designed and installed with a design life of not less than 50 years.

5-2.2 Easements

Any proposed sewer main located in a dedicated easement on property where a multi-family, (triplex or larger), commercial or industrial buildings can be built, shall be centered within the easement. Easements shall be a minimum of 20 feet in width. Easements are to be accurately located with off sets and dimensions shown on the plan sheets. All easements shall be agreed to between the applicant and the City before the issuance of the approval of final construction plans. If the easement is not formally described as part of a subdivision or land partition plat, the developer is to convey a sewer facility easement to the City of Madras that will be formally recorded in the Jefferson County Clerk's office.

No permanent structures can be constructed within the easement area, unless specific written permission, with conditions, is granted by the Public Works Director.

Landscaping within sanitary sewer easements shall be approved by the City.

5-2.3 Construction Drawings

5-2.3.1 General

Plans shall show inlet and outlet invert elevations at manholes, slopes for sewer lines, and surface elevations of the manhole lid (north rim). The profile view shall also show the finish ground elevation over the pipe, as well as crossings of other existing or proposed utilities. Laterals or stub-outs shall be shown with their stationing from the downhill manhole.

Refer to Section 1 and Section 9 for other requirements.

5-2.4 Manholes, Sewer System Structures

Manholes shall be constructed in accordance with the City Standards.

5-2.4.1 Materials

Manhole covers shall have two pick holes and be marked "SEWER", or "SS" on the cover.

Manholes shall be constructed of pre-cast units in accordance with the City's Standards Details. Any request to deviate from these Standard Details must be reviewed and approved by the City.

All manholes and components, including steps, shall be in accordance with the City of Madras Standard Detail Drawings.

All pre-cast concrete shall be Class 4000. Manhole channels shall be Class 4000 concrete. Concrete (masonry) grade rings may be used for adjustment of the casting to final street grade.

Standard pre-cast cones shall provide diameter reduction from 48 inches to 24 inches. Grade rings shall be placed above the cone section, not less than 2 inches or more than 12 inches in height.

Standard flat top covers shall be a minimum of 8 inches thick and shall conform to the outer dimension of the standard sections upon which they are to be placed.

5-2.4.2 Bedding

All manholes shall be constructed with pre-cast base sections placed to grade upon 12 inches (minimum depth) of aggregate base per section 641 of the current Oregon Standard Specifications for Construction. The base course must be compacted to 95% maximum density (AASHTO T-99).

5-2.4.3 Joints

Joints between pre-cast manhole elements shall be watertight gasketed.

5-2.4.4 Manhole Channels

All manholes shall be channeled unless otherwise approved by the City. Channels shall match existing sewer grades. Channels shall converge smoothly and well-rounded into well finished junctions. Channel sides shall be carried up vertically to the crown elevation of the various pipes. Concrete shelves between channels shall be smoothly finished.

All manholes shall have a minimum drop of 0.10 feet to a maximum drop of 2.0 feet between the inlet invert and the outflow invert. Invert drops greater than 2 feet shall require an energy dissipation device.

5-2.4.5 Manhole Pipe Connections

Refer to the City of Madras Standard Detail Drawings.

Sewer pipe connections to manholes shall provide a watertight connection such as a rubber coupler and/or gasket or equivalent and have a flexible joint 18" from the manhole wall.

5-2.4.6 Connections to Existing Manholes

Connections to the existing manholes shall be detailed, subject to the approval by the City.

The contractor shall verify invert elevations on all existing manholes prior to construction. The contractor shall submit any required changes to the approved design for review and approval by the City.

The contractor shall core drill an opening to match the size of pipe to be inserted. Jackhammers shall not be used. All openings must provide a minimum of one inch (1") and a maximum of two inches (2") clearance around the outside circumference of the pipe.

5-2.5 Sewer Interceptors and Mains

5-2.5.1 Sewer Main, Interceptors and Forcemains

5-2.5.1.1. Materials

Sanitary gravity and pressure pipe shall meet the following requirements:

Gravity Sewers

<u>Pipe Diameter, inches</u>	<u>Depth, feet</u>	<u>Material</u>
8 to 15	D<10 feet	PVC
18 and over	D>= 10 feet	PVC *

** PVC preferred; other materials must be approved by Public Works Department.*

Forcemains

<u>Pipe Diameter, inches</u>	<u>Depth, feet</u>	<u>Material</u>
4 to 12	D>3 feet	PVC, HDPE
14 or larger	D>3 feet	PVC, HDPE, DI

1. Polyvinyl Chloride (PVC) gravity sanitary sewer pipe shall be ASTM 3034 green in color for pipe up to 15 inches in diameter and ASTM.
2. Ductile Iron pipe shall be Class 50; double cement mortar lined and meet the requirements of AWWA C151 unless load conditions dictate Class 52.
3. Pipe materials for small diameter forcemains shall be PVC C900 for pipes up to 12 inches in diameter and PVC C905 or high-density polyethylene (HDPE), or ductile iron for pipes larger than 12 inches. The selection of the appropriate pipe material depends on economics, corrosion potential, and suitability for pressure conditions and is subject to the City's approval.

Selection of pipe joints and restraint method will depend on the maximum design pressure and the pressure specified for leak testing. The City will supply the applicant with the required test pressure upon review of the specific wastewater and hydraulic application.

PVC pipe joints may be restrained with Meg-a-lug type joints. An analysis should be performed to determine how many joints need to be restrained before there is adequate skin friction developed to allow push-on joints. Likewise, ductile iron pipe may be also restrained with Meg-a-lug joints. Field lock gaskets should be used with caution because pipe flexibility is reduced, and pressure rating is limited. However, field lock gaskets are economical to install. HDPE pipe is joined by heat fusion and therefore all joints are essentially restrained.

A surge analysis should be performed to determine the maximum pressure that the pipe will need to withstand. The surge analysis

should also address the placement and sizing of air and vacuum relief valves. A complete analysis should be submitted to the City for approval during the design.

4. Concrete sewer pipe will not be allowed in geological areas with high ground water or where high sulfur levels may exist, unless specifically approved by the City.
5. No broken or defective sewer pipe and related materials will be allowed.

5-2.5.1.2. Underground Utilities

Activities such as trench excavation, tunneling or boring, pipe embankment, backfilling, compaction and pavement patching, whether for public or private utilities, shall conform to the requirements set forth in the current Oregon Standard Specifications for Construction, Part 400 Drainage and Sewers for the Materials, Construction, and Inspection.

5-2.5.1.3. Laying Sewer Pipe

All sewer main installations shall conform to the requirements set forth in the current Oregon Standard Specifications for Construction, Part 400 Drainage and Sewers for the Materials, Construction, and Inspection. All sewer main installations shall have line and grade set by a professional licensed engineer or land surveyor, prior to construction. Staking shall show each manhole, and cuts to all inverts. All mains are to be laid straight between manholes. All types of sanitary sewer pipe shall be laid bell-end upstream.

The contractor shall use an accepted method which would allow accurate transfer of the control points provided by the surveyor or engineer in laying the pipe to the designated alignment and grade.

Trenches shall be excavated to a depth and grade required. Pipe bedding shall be placed to provide a uniform and continuous bearing and support for the pipe on solid undisturbed or compacted ground.

Sewer lines shall be laid upgrade from the starting point of connection on the existing sewer or from a designated starting point, as approved by the City. Sewer pipe shall be installed with the bell end forward or upgrade. After placing a length of pipe in the trench, the spigot shall be centered in the bell and the pipe seated within and brought to correct line and grade. During joining, the pipe shall be partially supported to minimize unequal lateral pressure and to maintain concentricity. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing and dislocating the gasket. Any disturbed or dislocated gaskets shall be removed, cleaned, replaced and lubricated before joining the sections.

No rubber couplers ("fernco's") shall be allowed between manhole runs except for connecting to an existing manhole. Any other use of rubber couplers shall be approved by the City prior to installation.

5-2.5.1.4. Plugs and Connections

All fittings shall be capped or plugged with approved material and gasketed with the same gasket material as the pipe unit, or the pipe shall

be fitted with an approved mechanical stopper, or the pipe shall have an integrally cast knock-out plug. The plug shall be able to withstand all test pressures without leaking.

5-2.5.1.5. Jointing

Where it is necessary to break out or connect to an existing sewer during construction, only new pipe having the same inside diameter will be used in reconnecting the sewer. Where joints must be made between pipes with a mismatched wall thickness, the contractor shall use flexible gasketed coupling, adapter, or coupling-adapter to make a watertight joint.

5-2.5.1.6. Cleaning and Testing of Sanitary Sewers

Testing per the current Oregon Standard Specifications for Construction Section 445 prior to final acceptance.

5-2.5.1.7. Camera/Televise Wastewater Infrastructure

In addition to mandrel and air testing of wastewater pipelines, wastewater infrastructure that is either proposed for dedication to the City of Madras or required by formal agreement for potential dedication to the City of Madras shall be televised (aka. "TV" or "camera/videoed") prior to acceptance by the City.

5-2.5.2 Sanitary Sewer Laterals

5-2.5.2.1. General

It shall be the owner's, or applicants, responsibility to furnish and install the private sewer lateral from the building to the City public sewer main. In the event of a blockage or damage to the sewer lateral located between the City public sewer main and the property line, the City shall make the repair and/or unblock the line. The property owner or applicant will be liable for costs associated with unblocking/repairing the lateral if it is determined the cause of the blockage/damage was due to the property owner or applicant.

A clean-out with a service box shall be installed to surface grade in the Public Utility Easement or Public Right-of-Way directly behind the sidewalk or curb.

Stormwater runoff, including roof drains, shall not be connected to or discharged into a sanitary sewer.

The Systems Development Charge must be paid prior to any connections to the sanitary sewer main.

All laterals shall be plugged with flexible jointed caps, or acceptable alternate, securely fastened to withstand the internal test pressure. These plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

5-2.5.2.2. Materials

<i>Oregon Standard Specifications for Construction</i>	
Reference Topic	Section No.
Excavation, bedding and backfill	445
Sanitary Sewer Pipe	445
Manholes	470
Work on existing sewers and structures	490
Trench resurfacing	495
All other drainage and sewer materials	PART 400

All pipes shall be clearly marked with type, class, and/or thickness, as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

Jointing shall be with approved flexible gasketing.

Flexible gasketing shall be construed to include rubber, synthetic rubber-like and plastic materials specially manufactured for the joint and pipe size.

5-2.5.2.3. Sizing Laterals

That portion of a lateral located within the public right-of-way shall have a minimum diameter of four inches (4") for residential, single or multi-family. Commercial or industrial may require larger size pipes. It is the responsibility of the developers engineer to properly size the lateral for the development.

There shall be no more than one service connection per lateral.

5-2.5.2.4. Fittings & Cleanouts for Laterals

All fittings shall be factory-produced and shall be designed for installation on the pipe to be used.

Laterals shall be connected to the wye provided in the public sewer where such is available, utilizing approved fittings or adapter. Where no wye is provided or available, connection shall be made by core drilling and installing an approved sewer saddle connection.

5-2.5.2.5. Tracer Wire

Locator wire shall be installed over all lateral pipes. The locator wire shall be placed one foot above the top of the lateral sewer pipe, and it shall extend its full length to the City service box and clean-out. Excess tracer wire shall be coiled 12" – 18" inside the box. Tracer wire shall be 12 AWG single strand, copper encased in green sheathing.

5-2.5.2.6. Sanitary Sewer Lateral Televising

Wastewater infrastructure that is either proposed for dedication to the City of Madras or required by formal agreement for potential dedication to the City of Madras shall be televised prior to acceptance by the City.

5-2.6 Wastewater Lift Stations to be Dedicated to the City

5-2.6.1 Sites

No permanent structures shall be constructed within 100 feet (unless otherwise allowed by the Public Works Director) of any lift station that is to be dedicated to the City. This provides for a buffer zone, maintenance access, landscaping and unobstructed radio telemetry.

Adequate access must be furnished for vehicles of such size as may be necessary to deliver, or to remove station equipment. The site configuration and pad elevation shall be as required by the City to avoid drainage runoff problems from the surrounding area.

The site shall be fenced with six foot (6') green vinyl coated, high chain link fencing with three (3) strands of barb wire on top, and a three foot (3') wide pedestrian gate and double wide vehicle access gate recessed a minimum of 20 feet. Contained within and leading up to the fenced site shall be an all-weather surface capable of supporting vehicles having a GVW up to 50,000 pounds.

The lift station site shall have an area lighting system with on-off control by a photocell and a motion detector and with a manual override switch. The site shall also be monitored with a security camera that will transmit video signals to the City's central monitoring station.

5-2.6.2 Pump/Lift Stations

Pump/lift stations shall be submersible configuration conforming to the applicable standards and City requirements.

5-2.6.3 Design Capacity

The station's initial pumping capacity may be less than the ultimate design depending upon the size of the service area and the phasing of development. In such an installation, allowances for larger or additional pumping equipment must be made for future modification. If the initial design capacity is in excess of anticipated initial flow, the effects of the minimum flow conditions must be estimated to be sure that the retention of sewage in the wet well will not create an odor or corrosion nuisance, and that the pumping equipment will operate with reasonable frequency.

5-2.6.4 Wet Well

Unless the station is of such size that variable speed drive pumps are justified, the shape of the wet well shall be cylindrical and the detention time should be such that the deposition of solids is minimized and the sewage does not become septic. An access hatch (4' x 4' minimum) with an approved safety grate shall be provided at the top of the deck as required by the City. The bottom of the wet well shall slope toward a flat bench area wide enough for the worker to stand on without depending on the sloped area as a footing surface.

5-2.6.5 Pumps

Pumps shall be Flygt submersible pumps, which have been the City standardized equipment. Pump suction and discharge size shall be a minimum of 4-inch diameter. Pump drive units shall be electric. Two or more pumping units shall be installed to

provide a firm pumping capacity for peak wet weather flows with any one unit out of service. Provisions for telemetry shall be included in the station control system.

5-2.6.6 Station Piping

Suction, discharge and header piping within the station shall be sized to adequately handle flows. Piping less than 4 inches in diameter shall not be used for conveying sewage. Each pump discharge shall have a check valve and plug valve in a separate underground vault with aluminum hatches readily accessible for maintenance and removing of valves and piping. The discharge main leaving the station shall be equipped to receive discharge from a bypass line through a tee riser, flow valve and blind flange.

5-2.6.7 Odor Control

All stations shall have electrical and water connections provided for the purpose of chemical addition on the upstream gravity line and/or the forcemain. Adequate provisions shall be made for the safe handling and storage of chemicals. All forcemains shall have a tap for introduction of chemicals whether or not the odor control equipment is initially installed.

5-2.6.8 Forcemains

Forcemain designs shall be such that velocities normally fall within a range of from 3 to 6 feet per second. If initial capacity of the station is considerably less than the ultimate, consideration should be given to the undesirable effect of extensive detention time within the forcemain. The feasibility of installing dual forcemains to accommodate initial and ultimate flows should be investigated in such situations. Provision shall be made for introducing a cleaning pig into all forcemains.

5-2.6.9 Electrical/Instrumentation

All electrical components shall be protected from wet weather, station flooding, and corrosion to the satisfaction of the City. All stations shall be designed with an enclosed full-time backup generator with sound attenuation, an automatic transfer switch, and a fuel supply capable of operating the station for 24 hours. The control panel shall include standard City telemetry system and remote monitoring and controls at the City's South Wastewater Treatment Plant. A magnetic flow meter in a vault shall be required at each lift station. The station shall be a fully integrated station with the wet well, wet well pumps and piping, electrical power and power controls, redundant level controls, emergency backup power, fuel system, pumping station system appurtenances, etc.

5-2.6.10 General Design Details

General design details will minimally meet DEQ regulations and requirements for lift stations as well as conform to that which is approved by the City Engineer.

5-2.7 Connection to Public Sewer and On-Site Sewer Systems

On-site Septic systems within City limits are not allowed by ordinance except where existing on-site systems operating properly are typically allowed to continue until requiring permitting. When a permit is required from Jefferson County to alter or replace the on-site septic system, and City public sewer is adjacent to the property, connection to the City public sewer and decommissioning of the on-site septic system will be

required. In the event that City public sewer is available within 1 foot to 300 foot of the property line, the Public Works Director will make the determination if the property shall connect to public sewer in accordance with the City's Sewer Use Ordinance.

5-2.7.1 New Subdivision/Development Sewer Storm Pipes Televised

It shall be the contractor/developer responsibility to flush, clean, and televise new constructed sewer and storm lines prior to performing the televising inspection, as the City will not provide these services.

A Public Works staff, acting as witness, will certify the "entire" sewer and storm pipe construction has passed a mandrel and pressure test prior to performing the required televised inspection.

The contractor/developer will record the televising inspection and forward the recording and associated paperwork to the City's Wastewater Department for review of the sewer and storm pipes. The Wastewater Department shall notify the contractor/developer of any pipe defects and of acceptance of the pipe systems.

5-2.8 Pretreatment Requirements, Grease Traps/Interceptors

Grease traps and interceptors shall be sized according to the criteria in the Oregon Plumbing Specialty Code (OPSC) Grease traps and interceptors shall be installed downstream of those businesses or uses which in the opinion of the County Building Official or the City will discharge significant fat and oil materials into the public sewer system. Grease trap and interceptors shall be located on private property, and they shall remain privately owned and maintained at the owner's or occupant's expense. These facilities shall be available for the inspection by the City with a 24-hour verbal notification to the occupant or property owner.

Sewer users connected to the City public sewer are advised that sewer use is regulated under the City of Madras Wastewater Ordinance, which should be consulted for regulations, limits, and standards.

5-3 Wastewater Treatment and Reclamation Systems

5-3.1 Wastewater Treatment and Reclamation Facility Siting and Impacts

Siting of new wastewater treatment and reclamation facilities will be guided by the City of Madras Wastewater Master Plan which considers future growth and development, zoning requirements, need for buffer zone separation for visual disturbance, noise, odor control, traffic, impact on human, archeological and natural resources, and flood potential. The siting process shall provide for future expansion of facilities to meet the demands of water quality regulations and planned development. The siting process shall include adequate public participation to provide for successful siting and initiation of a positive, long-term, good neighbor relationship with affected citizens.

The City requires development of a regional wastewater collection and treatment system and therefore does not allow siting of on-site or package plant wastewater treatment systems to serve individual developments or economic development projects. If improvements of the City's existing treatment and reclamation facility are required to meet the growth demand, the City will have the design completed by the City's selected consultant and the developer shall be responsible for the associated engineering and improvement costs.

Industries with potential to generate high strength wastes with loading in excess of available treatment capacity, will be required to obtain an Industrial Wastewater Contribution Permit and to provide pretreatment before discharging to the public sanitary system. The City will require industries generating high strength wastes to build, own and operate pretreatment facilities. These facilities may serve one or more industrial sewer users in planned industrial developments. Costs of design, construction, operation and maintenance of pretreatment facilities shall be borne by users proportionally to flow and load.

Reference the City Wastewater Ordinance for permit requirements and additional information.

5-3.1.1 Industrial Waste Treatment

Facility planning shall consider current and proposed commercial and significant industrial users requiring treatment service. Assessment of the existing industries' and the City's philosophy, policies and plans for development and growth is required to assure adequate treatment capacity is provided to balance economic development with protection of water quality. Quantity and strength of industrial wastes will determine if a new or expanding industry's waste load can be treated within the available capacity of the City's system. Pretreatment of wastes will be required to meet pretreatment program effluent limitations and/or reduce wastewater loadings.

SECTION 6 WATER FACILITIES

6-1 Purpose

The City owns and operates its water system as a public utility. As such, the City is responsible for ensuring the safe and reliable production and distribution of potable water to its customers.

The standards provided herein are intended to protect the integrity of the existing system and ensure that the future system operates efficiently. The City reserves the right to approve or reject any materials and devices proposed to be incorporated into the water system. The City also reserves the right to require that any proposed addition(s) to the water system comply with reliability, redundancy, construction and capacity requirements as outlined in these standards.

6-2 Summary

These standards represent the minimum requirements for the design and construction of water production and distribution facilities within the City’s water system.

For non-City water utility suppliers (i.e. Deschutes Valley Water District), the utility grid alignment, trenching, pipe bedding, backfilling, and trench surface repair are to follow the City of Madras standards. The installation and testing of the actual water system will be according to the standards and specifications established by the water utility provider.

All improvements and additions to the potable water system will comply with the current and applicable requirements of the following standards:

1. The current Oregon Revised Statutes.
2. The Oregon Health Authority, Public Health Division, of the Oregon Administrative Rules for Public Water Systems.
3. The current American Water Works Association (AWWA) Standards for the design and construction of public water systems.
4. All applicable City of Madras Ordinances.
5. Oregon Standard Specifications for Construction.

Refer to the requirements outlined in the current Oregon Standard Specifications for Construction, Part 1100 as well as applicable City of Madras Standard Detail Drawings and the approved engineered plans for installation details and requirements. In case of a conflict between standards, the design criteria of the City as presented herein shall govern.

6-2.1 Site Plan Review

A water system concept (preliminary utility plan) will be submitted to the City with the Site Plan Application for all proposed development that will result in water supply demands. The site plan shall include preliminary demand calculations and/or modeling reports that estimate initial, phased, and ultimate domestic and fire demand required by the development, unless this requirement is waived by the City. The site plan shall include general locations of any proposed connection to the existing water system, identification of proposed pressure zones, and preliminary locations of any booster

station(s) and/or reservoir(s) required to ensure adequate domestic and fire service pressures to the development.

This information will assist the City, Fire District, and Building Department in confirming that adequate water capacity is available at the proposed connection point(s). In addition, the information will be used in conjunction with actual flow tests to determine if capacity improvements are required by the new development or redevelopment project. The City reserves the right to require a more comprehensive (larger design review and flow test study area) system capacity analysis if, in the City's opinion, the proposed development has the potential of operational, supply or hydraulic impact on the current water production or distribution system.

As part of the site plan review, the development is required to:

1. Coordinate and perform fire hydrant layout and sizing, and fire flow requirements with the Public Works Department & Jefferson County Fire Department;
2. Conduct hydrant flow tests and a fire flow analysis to estimate the capabilities of water mains and to determine the improvement needs; and
3. Design and construct capacity improvements as required to meet the projected demands by the new development.

Hydrant flow tests shall be conducted in accordance with NFPA 291 to provide the basis for fire flow analysis under a worst-case scenario (i.e. low static system pressures). To obtain satisfactory test results of theoretical calculation of expected flows or rated capacities, sufficient discharge should be achieved to cause a drop in pressure at the residual hydrant of at least 25 percent, or to flow the total demand necessary for firefighting, whichever is worse. The flows and residual pressures from the hydrant tests shall be adjusted to account for the peak summer water demand scenario.

6-2.2 Requirements Prior to Construction Plan Approval

Prior to the City's issuance of construction plan approval, design calculations and construction documents shall be submitted to the City for review and approval for any proposed connection or water system improvements regardless of development size. The plans will be revised according to the City's review comments and re-reviewed for compliance with review comments and the land use decision. Final construction plans will not receive approval from the City until compliance occurs with City review comments and land use decision requirements.

The submittal shall include a design stamped by an Engineer licensed by the State of Oregon and include all information necessary for the City to verify that the proposed facilities meet all design criteria defined in these standards. The plan will include detailed notes describing all pertinent construction phases, areas of responsibility, standard references and specific instructions that will affect the successful completion of the project. The plan shall meet the City's design and drafting standards.

The approval of construction plans will not be granted until the City has been satisfied that all requested design modifications have been addressed by the applicant and that all required easements and deeds of dedication have been granted to the City. The design submittal shall include all drawings, specifications and supporting calculations needed to verify that the proposed water system improvements and/or connections align with the water system concept (utility plan) approved during the City's site plan review

process (land use findings and decision) and that the design meets the City's standards as specified herein. All proposed agreements between the applicant and the City regarding cost sharing, advance financing, utilization of SDC credits, etc. shall be signed by all parties prior to the issuance of the approval of construction plans. The City will not accept water system improvements that an applicant intends to dedicate to the public unless the improvements are reviewed and approved by the City prior to the start of construction.

6-3 Production Facilities

These will be reviewed and approved per the City Engineer's requirements on a case-by-case basis.

6-4 Distribution Systems

6-4.1 Location and Depth

Refer to Section 1.11 and current Oregon DEQ standards, OAR Division 61.

6-4.2 Water Mains - Potable Water

All new water mains shall be Class 200 Polyvinyl Chloride (PVC) Pipe, according to AWWA C900. Fittings shall be ductile iron. PVC mains shall be colored blue, throughout the entire composition of the pipe. Class 50 Ductile Iron Pipe can be used if approved by the City. Ductile iron pipe and fittings shall have double-thickness cement mortar lining conforming to AWWA C104 and bituminous exterior coating in conformance with AWWA C151. Cement mortar shall conform to ASTM C150, Type II. Provide polyethylene encasement on Ductile Iron Pipe and fittings conforming to AWWA C105. The City, at its discretion, may entertain or direct changes to these material standards where pressure considerations or ground conditions warrant modification.

The City has standardized two nominal pipe sizes for mains, 8- and 12-inch diameter pipe. Other sizes approved on a case-by-case basis as approved by the Public Works Department. Pipe selection shall be based on this standardization and these velocity limitations.

Water mains will be sized to meet the following flow criteria:

1. Velocity shall be less than four and one-half (4.5) feet per second during the peak usage hour, calculated using the saturation build-out EDUs, and shall be less than ten (10) feet per second, during fire flow on the peak usage day (at saturation build out EDUs).
2. Water mains in residential areas shall be a minimum of eight-inch (8") nominal diameter.
3. Water mains in areas serving commercial/industrial zonings will be a minimum of twelve-inch (12") nominal diameter.
4. Pipe size selection will not decrease the residual pressure within the existing distribution system below 20 pounds per square inch, during a fire situation or 42 pounds per square inch during normal usage periods.

Thrust and Restrained Joints – The City requires mechanical restrained joints. Any other thrust restraint requires approval by the Madras Public Works Department. The Engineer shall provide calculated restrained lengths for all bends, tees and appurtenances requiring thrust restraint.

Water main extensions that will be dedicated to the City will be installed so that the main extends a minimum of twenty lineal feet past the development to be served.

Mains will be placed and constructed as indicated on the approved engineered plan. Back filling, compaction and surface restoration will be as required by the Agency having jurisdiction of the right-of-way.

6-4.2.1 Tapping Main Lines

When tapping existing water main lines, the contractor shall use a Romac SST Tapping Tee or approved equivalent. Ductile Iron tapping sleeves are not acceptable for use, except on Ductile Iron pipe.

When tapping existing water main lines, the contractor shall make provisions to continuously flush and purge water through the non-pressurized side of the tapping valve (toward the bottom), or through the tapping machine. Using a corporation stop on the testing tap on the tapping sleeve is not acceptable.

The purpose of this procedure is to prevent the fouling of valves, regulators, meters and other equipment with chips and other debris to drinking water.

City personnel must be present any time a tap is made on the City's existing water main lines.

6-4.3 Valves and Appurtenances

Resilient seated gate valves shall be used for water mains twelve-inch and smaller. Gate valves shall meet the requirements of AWWA C509 or C515 and shall have epoxy lining and coating according to AWWA C550. Butterfly valves will only be permitted when gate valves may not allow adequate "surface to operator nut" clearance.

Rubber seated butterfly valves shall be used for water mains larger than twelve-inch. Butterfly valves shall meet the requirements of AWWA C504, Class 150B shall have epoxy lining and coating according to AWWA C550. Shaft seals shall be standard O-ring seals, designed for replacement under line pressure.

Isolation valves will be installed on all City mains at intervals no greater than 500 linear feet. At water main intersections, two valves shall be installed on a tee fitting and three valves shall be installed at a cross fitting.

Submittal data will be required for all valves installed in the City system.

Valve boxes will be cast iron Tyler model 6855 or approved equal.

Valve extensions are required if the valve nut is deeper than 36" from finish grade.

6-4.4 Services

All water, fire and irrigation services will be installed by the developer at the time of original construction. See City of Madras Standard Drawings and the approved engineered plans for installation details and requirements.

Where existing mains are in place, a City approved contractor will establish individual services (i.e. tapping the main). The materials for services larger than two inches shall correspond to requirements for mains and appurtenances.

6-4.5 Fire Hydrants

All fire hydrants will be installed by the developer at the time of original construction. All fire hydrants will be Kennedy K-81 D or Mueller Centurion fitted with a 5¼” valve.

6-4.6 Pressure Zone Control

If a pressure reducing valve (PRV) is required within a development to provide appropriate residential pressure, the developer will design and install an approved PRV station as part of the water facilities provided. PRV station design and hydraulic capabilities are specific to the distribution area to be served. The PRV station design shall be submitted to the City for approval prior to the issuance of the Site Construction Permit. The submittal shall include all engineering calculations necessary for the City to verify that the station meets the City’s hydraulic and material requirements. In addition, the submittal should address any anticipated hydraulic impacts on the existing water system.

Flow modeling may be required when a PRV station is necessary. The modeling effort will evaluate both existing system characteristics and system characteristics after the proposed PRV installation. If the additional flow volumes created by any proposed development result in velocities that exceed those stated in Section 4, the developer will be required to provide larger or additional water distribution facilities.

6-4.7 Air-Vacuum Control

An air-vacuum control (AVC) device is required on any City Water main where a “high spot” exists at any point between lower portions of the main. A “high spot” is any location at which the main rises more than one-half (.5) times the nominal pipe diameter, and then descends to the previous elevation.

6-4.8 Flush Outs/Fire Hydrants

A fire hydrant is required on all dead-end portions of City mains.

6-4.9 Backflow Control

All services that present a potential for cross contamination risk to the public water supply must be equipped with a backflow prevention assembly approved by the Oregon Health Authority. Designers are to refer to the current edition of the current Oregon Standard Specifications for Construction, Part 1100.

6-4.10 Appurtenances

All fittings needed to provide a fully functional water distribution system, not specifically covered in these specifications are to be manufactured and installed according to the latest edition of the AWWA Standards.

6-4.11 Disinfection of Facilities

Following completion of new facilities, including wells, valves, pumps, water mains and service connections, which will be in contact with the water delivered to users, said facilities shall be disinfected before they are placed into service. Disinfection shall be by chlorination according to Oregon Administrative Rules 333-061-0050(10) and AWWA Standards C651 through C654, and refer to the current Oregon Standard Specifications for Construction, Part 1100.

Disinfection shall include but not be limited to the introduction of a chlorine solution with an initial concentration of 25mg/l into the facility in a manner that will result in a thorough wetting of all surfaces. The solution shall remain in place for 24 hours. After the 24-hour period, the free chlorine residual must be checked and found to be 10 mg/l or greater. The chlorine solution shall be drained, and the facility flushed with potable water. A minimum of one sample shall be collected from the facility for microbiological analysis. Should any test fail, the facility shall be flushed, re-chlorinated and rechecked until a sample free of coliform organisms is obtained. Other disinfectants may be used if demonstrated that they can also achieve the same results.

6-5 Facilities, Infrastructure and Property

6-5.1 Site Enclosures

All City Water wells, reservoirs, pump stations and buildings will be contained within a limited access enclosure. Enclosures will be (minimum) six-foot tall, nine-gauge, chain link fencing with a heavy-duty top rail and 12.5-gauge stranded bottom tension wire. Enclosures will be equipped with at least one 16-foot “drive through” double gate and one 36-inch “walk through” gate. When appropriate, enclosures will include three-wire “anti-climb” top barrier. Fences (or other enclosures) will be positioned so that a service truck, with a standard 160-inch wheelbase, can travel around all buildings or facilities without reversing direction.

Site enclosure requirements may be altered depending on the specific usage or location of the property or facility. Additional costs associated with requirements that are more stringent will be the responsibility of the developer.

6-5.2 Buildings

All City water buildings and structures that house mechanical, electrical, electronic or other temperature and humidity sensitive equipment shall contain central climatic control apparatus. Atmospheric conditions inside the structures shall be maintained according to the recommendations of the equipment manufacturers. No climatic control equipment will be installed without approval of the City.

6-5.3 Access

All City water properties and facilities shall be accessible by way of an improved roadway connecting to a public right-of-way. The minimum requirements for access driveways outside the City limits include: a minimum width of 20 feet; base course of at least eight inches of $\frac{3}{4}$ inch minus compacted to 95% of AASHTO T-99; over the top of subgrade geotextile, and drainage that meets the requirements of Section 4 of these Standards. The minimum requirements for access driveways within the City limits include a minimum width of 20 feet; base course of at least 8 inches of $\frac{3}{4}$ inch minus, compacted to 95% of AASHTO T-99 Method A, asphalt paving level II or III, $\frac{1}{2}$ inch dense HMA with PG64-28 oil (3 inch thickness minimum), and drainage that meets the requirements of Section 4 of these Standards.

All access driveways shall be in areas wholly controlled by the City through a dedicated easement. Shared usage will be permitted, but the access needs and requirements of the City will have precedence over all others. All easements or private usage agreements will be recorded with the appropriate governmental authority and will be non-revocable.

6-5.4 Property

All City water buildings or other structures (not located in right-of-way) will be located on property deeded to the City. Easements or private usage agreements will not be considered as viable alternatives to City ownership. Water system improvements required as a condition of public dedication of infrastructure will be constructed on property that is deeded to the City. Property will be free of encumbrances, as reported in a title search provided by the developer and approved by the City attorney.

SECTION 7 STREETS & RELATED WORK

7-1 Purpose

The standards provided herein are intended to protect the integrity of the existing transportation system, ensure that the future system operates efficiently, and that all alterations and modifications to the City's right-of-way reflect the qualities and amenities set forth by the Madras City Council.

7-2 Plan Review

If the applicant falls within the requirements of site plan or subdivision review, then the applicant shall submit a street system plan for review and approval prior to Land Use approval. The plan shall be prepared by an engineer licensed in the State of Oregon. Complete design documents, including revisions as required by the City, shall be required before receiving construction plan approval for each phase of construction. The construction plan is valid for the period that the Land Use Decision approval is valid.

A street system plan will be submitted to the City with the Land Use Decision application for all proposed development that intends to dedicate the road and street infrastructure to the public. The Land Use Decision application plan shall include the proposed layout of initial, phased, and ultimate build-out of the street system, location(s) of snow storage areas, fire access and drainage concepts. The plan shall also include general location(s) of proposed connection to the existing City street system, grades of the road network and proposed pedestrian and vehicular safety improvements. The plan shall also identify the anticipated location of contractor's construction staging area(s).

This information will assist the City in confirming that the surrounding street network has adequate capacity to support the proposed development, assess whether a comprehensive traffic study is warranted and assist in the City's determination if the site presents the potential for erosion and road stability problems. In addition, the information will be used to determine whether the proposed development shall assume the financial responsibility for any public safety improvements necessary to accommodate the proposed development.

7-2.1 Site Construction Plan Approval

Prior to the City's issuance of the site construction plan approval, design calculations, soils reports, traffic impact analysis, pavement design, utility notices of intent to serve, other agency permits, and construction documents shall be submitted to the City for review and approval for any proposed public dedication and/or improvement regardless of development size. The submittal shall include a design stamped by an engineer licensed in Oregon and include all information necessary for the City to verify that the proposed facilities meet all design criteria defined in these standards and the Land Use Decision for the development. The plan will include detailed notes describing all pertinent construction phases, areas of responsibility, standard references and specific instructions that will affect the successful completion of the project. The plan shall meet the Public Works Standards & Specifications.

The construction plan approval will not be granted until the City has been satisfied that all requested design modifications have been addressed by the applicant and that all required easements and right-of-way have been granted to the City. The design submittal shall include all drawings, specifications and supporting calculations needed to verify that the proposed street improvements and/or road connections align with the road system plan approved during the City's Land Use approval process and that the design meets the City's Public Improvement Design and Construction Standards as specified

herein. As determined by the Public Works Director an improvement agreement may be required for developments that are required to perform public improvements. The agreement will explain the responsibilities of the developer, and any shared obligations by the City when applicable (i.e. define responsibility through Land Use Decision) prior to the issuance of the construction plan approval. The City will not accept any road or street improvements that an applicant intends to dedicate to the public unless the improvements are reviewed and approved by the City prior to the start of construction. See the Overview of the Development Process section for more details for design drawing criteria.

7-2.2 Augmentation of Standards

The City will augment its Public Improvement Design and Construction Standards with the latest editions of the following design documents: If there are any conflicts among these documents, the more stringent requirements shall apply unless otherwise allowed by the City.

American Association of State Highway and Transportation Officials (AASHTO) "Policy on Geometric Design of Highways and Streets."

*ODOT Oregon Standard Specifications for Construction latest edition
Oregon Bicycle and Pedestrian Plan*

Madras Ordinances including Subdivision, Zoning, Flood plain, Street Tree, and Sidewalk Ordinances

*The Madras Transportation System Plan
Manual on Uniform Traffic Control Devices, Federal Highway Administration Guide for Design of Pavement Structures, AASHTO*

*Roadside Design Guide, AASHTO
A Policy on Geometric Design of Highways and Streets, AASHTO*

*ADA Standards for Accessible Design
Public Rights-of-Way Accessibility Guidelines (PROWAG)*

*The Asphalt Handbook, Asphalt Institute
Highway Capacity Manual, National Research Council*

Design and Control of Concrete Mixtures, Portland Cement Association

*Traffic Engineering Handbook, Institute of Transportation Engineers
Jefferson County Road Functional Classification Table 3.2*

*Jefferson County Transportation System Plan
ITE Trip Generation Manual, Handbook and User's Guide, 10th Edition*

The City, at its sole discretion, may also alter its Public Improvement Design and Construction Standards pertaining to traffic control device placement and use with the latest editions of the recommended policies, procedures and standards of the following (in order of preference):

- Federal Highway Administration "Manual on Uniform Traffic Control Devices" with any modifications from the Oregon Department of Transportation.
- The Institute of Traffic Engineers (ITE) Trip Generation Manual and design manuals.
- Illumination Engineering Society (IES) Design Manual.

7-3 Traffic Studies

All proposed development(s) will submit a traffic impact analysis when the development meets the minimum thresholds as further defined in the Guidelines for Transportation Impact Analysis section (Section 10) of these standards.

7-4 Roadway Classification

The City's roadway classifications are shown in the Standard Detail Drawings section of these standards. Criteria for minimum right-of-way, roadway widths and other design criteria are listed for each classification. Additional right-of-way, turn lanes, traffic signals, safety enhancements, and other level of service and/or safety mitigation improvements will be required to accommodate turning movements in coordination with pedestrians and bicyclists at intersections and as identified through traffic studies for proposed projects.

The City's policy is to require publicly dedicated streets for access to all zoned lots within the City. Private streets are not allowed, however in special circumstances, the City, at its sole discretion, may review exception requests. If the City grants this exception, the width and improvements shall follow all the City's and Fire Department's requirements for an all-weather access. The access easement shall be a minimum of 30 feet with a 20-foot paved section (2 inch thick AC over 8 inches base rock) with appropriate stormwater drainage and shoulder treatment in a manner as approved by the City Engineer.

The City's roadway classifications will follow the City's Transportation System Plan and when new development creates additional burden (i.e. additional traffic flow) on the City's street system, the Jefferson County TSP table below will be used to reclassify streets. When traffic conditions warrant a higher classification roadway, new development or redevelopment, when conditioned through the Land Use Decision process, are required to provide improvements according to classification of roadway at build out of the new development or redevelopment according to the average daily trips listed in the table below. For purposes of translating average daily trips to peak hour traffic, the City uses one peak hour trip to equal 9.6 average daily trips. Developments are also required to add turn lanes, signals, and safety improvements when determined by the Public Works Department and when also determined by the applicant's traffic impact analysis. Any appeal of conditioned public improvements will follow the City's Development Ordinance appeal process and will be checked for proportionality and nexus.

Public Improvement Design & Construction Standards

The following table applies for classifications of City streets: Source: Jefferson County Transportation System Plan.

Functional Classification	Description	Typical ADT Range
Arterial	Arterials are the highest class of road. Their primary function is to carry high levels of regional through vehicular traffic at high speeds, serve interstate movement of freight, and emphasize traffic movement over local land access. Arterials are characterized by full access control, with access limited to interchanges and widely spaced access points. Arterials may have medians. Pedestrian and bicycle traffic is discouraged or prohibited.	5,500 – 7,500
Major Collector	Major collectors are the intermediate road class, carrying lower traffic volumes at slower speeds than arterials. Their primary function is to collect traffic from the local street system and distribute it to the arterial street system. Major collectors provide some access to adjacent properties, but where possible should provide extended continuous stretches of road to facilitate traffic circulation.	2,500 – 6,000
Minor Collector	The primary function of a minor collector is to connect traffic to arterials and major collectors. Minor collectors have slower speeds than major collectors and arterials, and may provide more local land access.	500 – 2,500
Local Road	Local roads are the lowest road class. Their primary function is to provide direct access to adjacent land. Local roads are characterized by low traffic volumes.	0 - 500

7-5 Right-of-Way/Easements

Dedicated right-of-way is required for all public street and roadway improvements. All portions of the traveled way, curb, gutters, sidewalks, medians, bike lane(s), drainage facilities and other required improvements shall be located within the right-of-way.

Where existing right-of-way width is not enough to construct the required improvements, the developer shall obtain the necessary additional right-of-way and arrange for dedications to the City according to a form prescribed by the City attorney.

Easements for the purpose of construction, access, maintenance, sight distance preservation, roadway slopes, or for utility line and storm drain installation may be required, in addition to required right-of-way in conjunction with street and roadway improvements. It shall be the applicant's responsibility to obtain necessary easements and provide recorded copies of such easements to the City, before the issuance of construction plan approval.

Permanent easements for access, maintenance, and construction are required for all public and private street systems serving more than one property located outside of public right-of-way. Legal descriptions for easements shall be submitted with a professional land surveyor's stamp thereon. A current title report covering the properties to be encumbered by the easements shall accompany said description.

When off-site and/or on-site easements for extension of approved comprehensive street plans are required, they shall be approved and recorded prior to construction plan approval. The same conditions shall apply regarding legal descriptions and title reports.

7-6 Street Names

All street names shall have approval of the Jefferson County Building Department. No street name shall duplicate or be confused with the existing street names within the City or County except for continuations of existing streets where applicable.

7-7 Bike Lanes

Bike Lanes standards are to conform to the Oregon Bicycle and Pedestrian Plan. The minimum width for a bicycle lane shall be five feet (5') unless otherwise allowed by the City. Applicant shall dedicate to the City the additional right-of-way and easements necessary to comply with the standards for bike lanes, trails and paths in a manner consistent with the City's adopted Transportation System Plan, Trails Plan, and Safe Routes to School Plan.

7-8 Street Design Criteria

Street design standards are based on the functional and operational characteristics of streets such as travel volume, capacity, operating speed and safety. They are necessary to ensure that the system of streets, as it develops, will be capable of safely and efficiently serving the traveling public while also accommodating the orderly development of adjacent lands.

The typical roadway cross sections comprise the following elements: right-of-way, travel lanes, bicycle and pedestrian facilities, drainage, and landscape strips. Illustrated cross sections are intended for planning and design purposes for new road construction as well as for those locations where it is physically and economically feasible to improve existing streets.

Typical cross section standards allow flexibility in defining the actual roadway width. The use of on-street parking would be at the sole discretion of the City of Madras, which would

determine whether such amenities are required on a given street. The table below summarizes the street design standards for the different roadway classifications.

The City of Madras at its sole discretion may allow narrower local streets in their development projects, thereby creating an ability to reduce impervious surface and provide site-specific standards for roadway improvement projects that reflect local conditions. Narrower streets may also be desirable in some neighborhood areas to deter cut-through or speeding traffic on local streets. The Public Works Director shall be the final authority on the allowance of narrower streets. Typically, the allowance for narrower streets will be in short block sections or in sections next to open space where on-street parking is not considered needed. It should be noted that ODOT has the ultimate authority as to which improvements are made along US 26, US 97 and Highway 361.

Following are typical street cross sections. The Public Works Director will require or allow variations as specified in the rest of Section 7.

Urban Expressways: will have a right-of-way of 98 feet in the Urban Fringe and 114 feet outside of that zone as determined by the City and ODOT. The City Expressway cross-section will be consistent with the ODOT Expressway cross-section and consist of two 12-foot-wide travel lanes in each direction, a raised 12-foot median, and a separated 10-foot multi-use path. In addition, landscape strips will be provided on both sides of the facility.

Arterial streets: will have a right-of-way requirement of 80 feet. The street cross-section will consist of two 12-foot-wide travel lanes, an optional center left-turn lane, and appropriate pedestrian and bicycle facilities. On-street parking is not allowed on arterial streets.

Major collector streets: will have a right-of-way requirement of 70 feet and a required cross-section consisting of two 12-foot-wide travel lanes and required center left-turn lane/median landscaped section. Bike lanes are required. Landscape strips are required, and on-street parking may be allowed, at the discretion of the City, with additional right-of-way provided by the development.

Minor collector streets: will have a right-of-way requirement of 60 feet and a required cross-section consisting of two 12-foot-wide travel lanes. No bike lanes will be required; however, landscape strips and on-street parking can be required at the discretion of the City.

Local streets: will have a right-of-way requirement of 55 feet, a 32-foot-wide paved cross section, and 6-foot wide sidewalks. Adjacent landscape strips are required.

Public Improvement Design & Construction Standards

Table C2: Street Design Standards (See Standard Street Cross Sections in Other Sections)

Classification	Cross Section	Minimum ROW	Turn Lanes	Travel Lanes	Bike Lane	Sidewalks	On-Street Parking	Landscape Strip
Expressway	4 lanes	114 feet	Yes ¹	12 feet	Yes ²	No ²	No	Optional
Urban Other	4 lanes	98 feet	Yes ¹	12 feet	Yes	Yes	No	Optional
UBA	2 lanes	56 feet	Optional ¹	12 feet	Yes	Yes	No	Optional
STA	2 lanes	70 feet	Optional ¹	12 feet	Yes	Yes	Yes	Yes ⁵
Urban Expressway	4 lanes	98 feet	Yes ¹	12 feet	Yes ²	No ²	No	Yes
Arterial	2 lanes	80 feet	When Conditioned ¹	12 feet	Yes	Yes	No	Yes
Major Collector	2 lanes	70 feet	Yes ³	12 feet ⁶	Yes	Yes	No	Yes
Minor Collector	2 lanes	60 feet	When Conditioned ³	12 feet ⁶	No	Yes	Optional ⁴	Yes
Industrial Roadway	2 lanes	60 feet	When Conditioned ³	12 feet ⁶	No	When Conditioned	When Conditioned	Yes
Local Street	2 lanes	55 feet	No	Not striped (32 feet paved width)	No	Yes	Yes	Yes

Any variance from the requirements in this table must be approved by the Public Works Director.

¹ *Minimum width = 14 feet*

² *Bicycle and pedestrian traffic are to be accommodated by a 10-foot multi-use path on one side and a standard 6-foot walk on the other side.*

³ *Minimum width 12 feet.*

⁴ *When a minor collector classification is applied to a commercial zone with a middle turn lane, there cannot be any on street parking with the available pavement width to accommodate travel and middle turn lanes.*

⁵ *In the commercial zone, tree planter wells are required in lieu of a planter strip. Planter strips can be incorporated in special areas as approved through the Land Use approval process.*

⁶ *Minimum width = 12 feet*

7-8.1 Additional General Design Criteria

The City reserves the right to require written clarification from the School District on any designated bus stop needs or improvements adjacent or within the development, redevelopment, or change of use in question.

Street signs are required. Provide construction plans detailing sign locations, dimensions, type, and post specifications meeting the requirements of Public Works Department and Oregon Standard Specifications for Construction.

Continuation, “to and through”, or appropriate projection of existing streets in surrounding areas shall be provided; or

In occasions where topography (or another such situation) is found to be an issue, development must still conform to the *City’s Transportation System Plan* with an alternate alignment route as per City approval.

A tangent at least one hundred feet long shall be included between reverse curves on arterial and collector streets.

Curb lines at street intersections shall be rounded with a radius providing a minimum clearance and ADA access within the public right-of-way or of a greater radius where the City may deem it necessary. The City may permit comparable cutoffs or chords in place of rounded corners.

Partial width streets or half streets shall not be allowed. Three-quarter (3/4) street improvements (from back of sidewalk to opposite side curb and gutter) are required.

The centerline of street improvements shall coincide with the centerline of the right-of-way.

Super elevation shall be designed in accordance with AASHTO specifications, but with the maximum super elevation being four percent (4%) except at intersections which will be ADA compliant.

When a turn lane is required, it shall be a minimum of twelve (12) feet in width for collector streets (14’ at intersections with arterials). For street classifications higher than collector streets, minimum 14foot turn lanes will be required depending upon the classification. Additional right-of-way will be required when conditioned through the Land Use Decision process.

All structures that carry a street or cross over a street shall be designed to have a 100-year life span. All designs must be approved by the Public Works Director and other affected public or private agencies.

All new developments shall have all public streets within them constructed to the City of Madras Standards & Specifications.

7-8.1.1 Landscape Strips (General)

Irrigation and maintenance will be provided by the adjacent lot owners for the plantings and trees in the landscape strip between curb/edge of pavement and property line (see standard detail 7-16). Typical landscaping for planter strips has been sod with trees and irrigation, but other decorative types of landscaping is allowed. At a minimum, the planter strips shall be landscaped with a ground cover that is vehicle and pedestrian friendly as approved by the public works department and shall include 25% of the area in plantings (i.e shrubs, bushes) and street trees placed either one per each residential unit or every 35 feet of spacing. Shrubs shall

be placed a minimum of 1 per 5 linear feet of the landscape strip arranged in a manner approved by the Public Works Director. Aggregate in the public right-of-way smaller than 3 inch will not be allowed. Aggregate must be clean, angular, durable with no more than 10% passing the $\frac{3}{4}$ sieve. Provide a public water meter system for irrigation in the median planter strip of the major collectors (where applicable). Provide at least one tree per residential unit or a tree every 35 feet of spacing with irrigation between the curb and sidewalk. The tree planting plan needs to be per the City's approved street tree list as approved by the Madras Urban Forestry Commission. Check with the Public Works Department for the current approved street tree list.

Adjacent landscape strips (to streets) will be required as per the cross section illustrations, Landscaping strips will be located between street and sidewalk to provide a buffer between cars and pedestrians. Providing a landscaping strip between the street and sidewalk will allow for an area with no obstructions or impediments that would prevent or discourage pedestrian movements. Further, the landscape strips will be used for the location of street signs, power poles, and utility easements to provide for unimpeded pedestrian movements.

A landscaping deposit as set by the Fee Resolution will be required at the time of building permit application to ensure that landscaping occurs along the lot's frontage in the planter strip and in conjunction with the planning department's requirement for a landscaped lawn area (or lot landscaping in the condition for a site plan approval).

7-8.2 Side Slope

The maximum grade slope for any lot or street side slope is 2H: 1V. Steeper slopes may be permitted with a geotechnical evaluation approved by the public works director, and/or a retaining wall. When the height of a retaining wall exceeds the standard building official limit (4 feet), provide engineered retaining wall drawings and calculations for review and approval by the Jefferson County Building Department for individual lots and to the City of Madras for any roadway retaining walls.

7-9 Roundabout Construction

Modern roundabouts are a form of intersection design that provides safe and efficient flow of traffic within a certain range of traffic volume. Numerous research studies in the US and abroad have shown that the operation of roundabouts is highly dependent on its geometric design and the characteristic of the traffic volume it serves. The detailed information on the safety, operations and design of roundabout is provided in *Roundabouts: an Informational Guide*, published by the Federal highway Administration (FHWA). The document stipulates that before the details of the geometry are defined, two fundamental elements must be determined in the preliminary design stage:

1. The optimal position; and
2. The optimal alignment and arrangement of approach legs.

The document also highlights the following critical design principles for roundabouts:

- Speed Profiles
- Design Speed
- Vehicle Paths
- Speed-Curve Relationship

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- Speed Consistency

Other design considerations like design vehicle and non-motorized design users, among others, are also discussed in detail in the document. A volume-to-capacity (v/c) ratio of .85 is the operational standard of a roundabout. Exception to the v/c ratio standard is on a case-by-case basis determination by the City Engineer.

The City of Madras and Jefferson County will have planned several modern roundabouts around the city in their current TSP plan (at intersections of all major collectors). To ensure proper engineering standards are used when constructing roundabouts in and around the City, the following design guidelines will be followed:

1. *Roundabouts: an Informational Guide* published by FHWA.
2. *A policy on Geometric Design of Highways and Streets* (Green Book), published by AASHTO.
3. *Manual on Uniform Traffic Control Devices*, published by FHWA.

Table 1 shows the inscribed circle diameter ranges design standard:

Site Category	Typical Vehicle	Design	Inscribed Circle Diameter Range*
Rural Single Lane	WB-67		180-200 feet
Rural Double Lane	WB-67		180-200 feet

* Assumes 90-degree angles between entries and no more than four legs.

Intersections of roadway facility types will consider all forms of intersection to ensure safe operating environment. A modern roundabout is the required form of intersection between two or more major collectors otherwise allowed by City of Madras.

Standard roundabout design consists of an inscribed circle diameter of one hundred ninety feet (190'). Two hundred sixty feet (260') minimum diameter right of way shall be dedicated as default. A right of way with a larger diameter may be required to accommodate an intersection due to various site-specific constraints. A safety and operational analysis will be conducted at proposed/planned roundabouts before a final design is approved when conditioned by the City. In some cases, a lesser standard roundabout design can be approved at the discretion of the Public Works Director but only if it can be proven that a WB-678 design vehicle will not need use of the intersection.

Planned Roundabouts

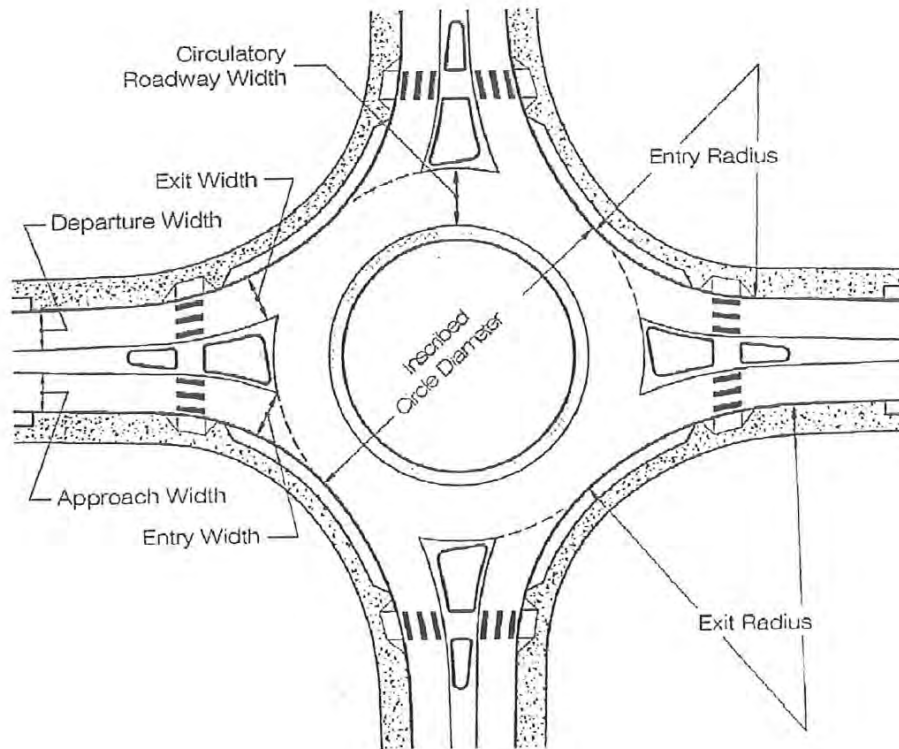
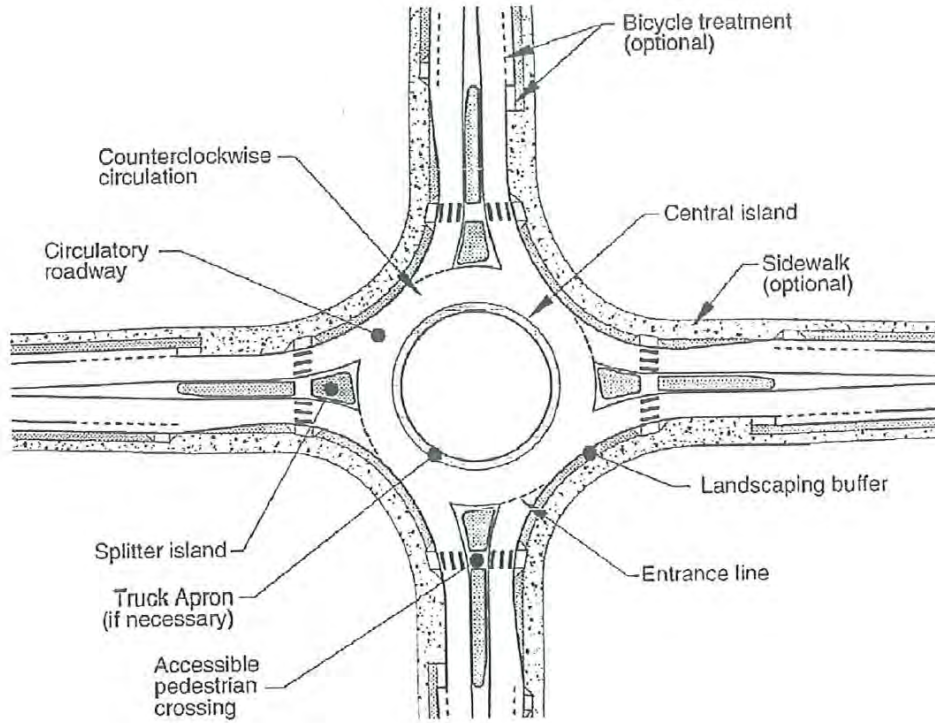
City of Madras and Jefferson County currently have modern roundabouts planned at the following locations:

- Kinkade Avenue/Oak Street/City View Street
- Kinkade Avenue Extension/Bean Drive Extension
- J Street extension/Bean Drive extension
- 10th Street/Buff Street/McTaggart Road
- B Street/City View Street
- Fairgrounds Road Extension/Grizzly Road

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- Fairgrounds Road Extension/McTaggart Road
- McTaggart Road/J Street

Refer to Modern Roundabout Design and Operation Consideration, City of Madras Roundabout Standard, and Planned Roundabouts, added by passage of Ordinance No. 785, December 12, 2006.]



7-10 Improvements to Public Right-of-Way

The developer of a subdivision, partition, change of use (when intensity of use increases), conditional use, or site plan will be required to improve all public ways that are adjacent to the development, within the land development, or that serve as a primary access to the development.

All improvements within public right-of-way shall conform to the improvement standards designated for the applicable street classification. The applicable street classification is determined by evaluating the full build-out condition of the affected street system as further detailed through a development's traffic impact analysis.

7-11 Primary Access Streets

The determination of which street is the primary access will be made by the Public Works Director. Primary access streets can either be adjacent or offsite from a new development. All new subdivisions shall have a primary access street improved to the classification standards of the primary access as determined through full build-out traffic conditions. The limits of improvement will be proportional to the size of the development and the burden it places upon the City's transportation system. In the event of an appeal of either the requirement to improve or the limits of the primary access improvement work, a fair and proportional analysis (such as Nolan & Dolan case law framework) will be used to determine whether an improvement and/or level of improvement requires modification.

7-12 Secondary Access Streets

When necessary, a secondary access street shall be constructed to the subdivision. Construction shall conform to the standard consistent with the City's Transportation System Plan for that street, or if not identified in the TSP, then built according to the level of traffic and length of the planned access. The local Fire Marshal shall be the final authority on when a second access is necessary.

7-13 Horizontal/Vertical Alignment

Landings shall not have a grade greater than two percent (2%) at stop-controlled intersections and five percent (5%) at non-stop controlled intersections. A minimum landing length of 50 feet when measured from centerline shall be provided at each intersection. Vertical curves shall be designed to be consistent with and complementary to the horizontal curves.

Grade breaks up to 4% are permitted at stop-controlled intersections. Through intersections and all other areas shall permit 1% grade breaks with minimum 50-foot tangents. If over one percent (1%), implement a vertical curve with a minimum length landing for both vehicle queuing (design vehicle - school bus) and crosswalk ADA compliance.

When reducing local residential street width to 32 feet, the street shall be designed so as not to extend more than 1,320 feet and cannot be extended in the future to function as a minor collector/industrial collector street.

Alignment of roadways shall conform to the table below.

Public Improvement Design & Construction Standards

Type of Street	R/W Width (ft.)	Level of Paving	Paving Section AC (in)	Design Speed (mph)	Max Grade (%)	Minimum Horizontal Curve	Minimum Vertical Curve
Multiuse Path	30	2	2 over 6	na	Na	As approved	See AASHTO
Public/Private Alley	20	2	2 over 8	na	10	As approved	
Local Street	55	2 or 3	4 over 6	25	10	50	
Minor Collector	60	3	4 over 8	25	8	150	
Major Collector	70	3	4 over 10	35	8	380	
Industrial Collector	60	3	4 over 10	35	8	380	
Industrial Local	60	3	4 over 8	25	8	150	
Expressway	Design to follow ODOT requirements and SECT. 745 of the Oregon Specifications and Standards						

1. AC Paving thickness over 3" requires multiple lifts (i.e. 4" thickness requires two 2" lifts).
2. Horizontal curves will be measured from centerline unless separated by a median or turn lane in which case the measurement will be made at the centerline of the interior lane.
3. Pavement design and geometry shall be at the input values as approved by the Public Works Department based on the primary vehicle use and load ratings.
4. The paving radius of a cul-de-sac shall be 50 feet centered in a right-of-way radius of 57 feet unless otherwise approved by the Fire Marshal and the City.
5. The minimum grade for any street shall be no less than 0.5%. For streets with grades less than 0.5%, curb and gutter is required in lieu of standard curb.
6. At least two street name signs shall be provided at opposing corners of all intersections.
7. Sidewalks will be provided on both sides of a street unless alternative pedestrian routes or a ¾ improvement is approved. Sidewalks will be a minimum of six feet in width for residential streets and ten feet for Downtown 4th and 5th Corridor between Couplets.
Multi-use paths will be a minimum of ten feet in width.
8. ODOT highways and require individual engineering analysis.
9. Base material for all paved sections will meet dense graded specifications outlined in Section 00641 of the *Oregon Standard Specifications for Construction*.
10. Paving to be ½" dense graded with PG 58-34 oil with the level specified in the above table.
11. The Public Works Director, at his/her sole discretion, may allow in special circumstances a local street width reduction to 28 feet when a local street is designed to not extend more than 600 feet. When a local street is designed to extend more than 1,320 feet, the street shall be designed and constructed to the next higher classification - Minor Collector.
12. The Public Works Director may recommend that the Planning Commission allow higher grade.
13. Industrial Collector criteria are minimums. A required pavement design will provide specific criteria based on use and loading.

7-14 Typical/Structural

The City may require the final lift of asphalt to be bonded for and delayed for up to one year to accommodate weather and/or other encumbrances that may impact the final quality of construction. For all work within the flood plain, or when conditioned for Land Use approval, a geotechnical study and subsequent recommendations will be required for any proposed new road construction, widening of existing roadways or major repair and overlay work. If the development occurs within the flood plain or improves an industrial collector, the Public Works Department will need a Geotechnical and Asphalt Design report prepared with inputs approved by Public Works for the new site and associated street improvements. The applicable standard for preparing the asphalt design thickness is the most current version of the *Guide for Design of Pavement Structures, American Association of State Highway & Transportation Officials*. The developer shall be responsible for providing such reports, prepared by the corresponding field of licensure, an engineer licensed in the Oregon, for review by the City.

Modifications to the minimum road structural sections may be required to address site specific soil conditions, drainage and vehicle loads. Where higher than normal truck traffic is projected, the developer's geotechnical engineer will evaluate the adequacy of the proposed section and recommend any additional specific measures necessary to provide a minimum 20-year design life for the new pavement section.

Typical/Structural sections of roadway appurtenance are according to the following roadway classification requirements:

7-14.1 Local Streets

Minimum of 55 feet of publicly dedicated right-of-way (ROW) required. 12-inch curb with 6-inch exposure per Standard Detail 7-15. 6 inches of aggregate base (3/4 inch – 0), 4 inches of Level II or III, 1/2 inch Dense, HMAC (double lift) with PG 58-34 oil required.

- 6-foot sidewalk (minimum 4 inch thick)
- 5.5-foot planter (measured from edge of sidewalk to front face of curb)
- 7-foot parking lanes
- 18-foot common travel lane for both directions of traffic
- *32-foot width paving face of curb to face of curb
- 55 feet total ROW– Sidewalks property tight

* *Pavement width may be reduced to 28-foot wide with parking allowed on one side and 24-foot wide with no on-street parking allowed. May be constructed only in conjunction with creation of covenants, conditions and restrictions (CCR's) and the establishment of a homeowner's association (HOA) for the development. The CCR's shall provide that the primary responsibility for parking enforcement and snow plowing shall be the HOA, with the City of Madras being acknowledged in the CCR's as a beneficiary for such parking enforcement as a violation of the land use decision and/or city code. All streets less than 28 feet wide shall be no longer than 300 feet in length, unless such streets include at least one (1) parking bay per lot, located along each lot frontage for the entire length of such street, up to the maximum block length. Streets 300 feet or less in length shall not have any direct driveway access. In no case shall any street less than 28 feet wide intersect with any other street less than 28 feet wide.*

7-14.2 Minor Collector (Parking, When No Middle Turn Lane)

Minimum of 60 feet of publicly dedicated right-of-way (ROW) required. 14 inch curb with 6 inch exposure per Standard Detail 7-15. 8 inches of aggregate base (3/4 inch – 0), 4 inches of Level III, 1/2 inch Dense, HMAC (double lift) with PG 58-34 oil required.

- 6-foot sidewalk (minimum 4 inches thick)
- 5.5-foot planter (measured from edge of sidewalk to front face of curb)
- 7-foot parking lanes
- 11.5-foot travel lanes
- 37-foot width paving face of curb to face of curb
- 60 feet ROW – Sidewalks property tight

7-14.3 Minor Collector (When Middle Turn Lane, No Parking)

Minimum of 60 feet of publicly dedicated right-of-way (ROW) required. 14 inch curb with 6 inch exposure per Standard Detail 7-15. 8 inches of aggregate base (3/4 inch – 0), 4 inches of Level III, 1/2 inch Dense, HMAC (double lift) with PG 58-34 oil required.

- 6-foot sidewalk (minimum 4 inches thick)
- 5.5-foot planter (measured from edge of sidewalk to front face of curb)
- Minimum 12-foot travel lanes
- 12-foot middle turn lane
- 37-foot width paving face of curb to face of curb
- 60 feet ROW– Sidewalks property tight

7-14.4 Major Collector

Minimum of 70 feet of publicly dedicated right-of-way (ROW) required. 14 inch curb with 6 inch exposure per Standard Detail 7-15. 10 inches of aggregate base (3/4 inch – 0), 4 inch of Level III, 1/2 inch Dense, HMAC (double lift) with PG 58-34 oil required.

- 6-foot sidewalks (minimum 4 inches thick)
- 5.5-foot planter (measured from edge of sidewalk to front face of curb)
- Minimum 5-foot bike lanes
- Minimum 12-foot travel lanes
- 12-foot median planter/turn lane
- 47-foot paving face of curb to face of curb width
- 1-foot access restriction easement to the City on each side
- 70 ROW – Sidewalks property tight

7-14.5 Downtown 4th and 5th Corridor between Couplets

The proposed improvements within the corridor shall have a 6-foot sidewalk with a 4-foot paver strip and tree grating, trees, power to the trees, irrigation, and decorative street lighting as required by the City.

7-14.6 Industrial Local Roadway

Minimum of 60 feet of publicly dedicated right-of-way (ROW) required. 14 inch curb with 6 inch exposure per Standard Detail 7-15. 8 inches of aggregate base (3/4 inch – 0), 4 inches of Level III, ½ inch Dense, HMAC (double lift) with PG 58-34 oil required. The City may require pavement design and improvement by the applicant when warranted by concentration of truck traffic.

- 6-foot sidewalks when conditioned
- 5.5-foot planter (measured from edge of sidewalk to front face of curb)
- 7-foot parking lanes
- 11.5-foot travel lanes
- 37-foot width paving face of curb to face of curb
- 60 feet ROW – Sidewalks property tight

7-14.7 Industrial Collector Roadway

Minimum of 60 feet of publicly dedicated right-of-way (ROW) required. 14 inch curb with 6 inch exposure per Standard Detail 7-15. 10 inches of aggregate base (3/4 inch – 0), 4 inches of Level III, ½ inch Dense, HMAC (double lift) with PG 58-34 oil required. The City may require pavement design and improvement by the applicant when warranted by concentration of truck traffic.

- 6-foot sidewalks when conditioned
- 5.5-foot planter (measured from edge of sidewalk to front face of curb)
- 12-foot turn lane
- Minimum 12-foot travel lanes
- 37-foot width paving face of curb to face of curb
- 60 feet ROW – Sidewalks property tight

7-14.8 Public/Private Alley

Minimum 16 feet of paved width surface (2-inch Level II or III, ½ inch dense, PG 58-34 oil HMAC) over 6-inch depth of ¾ inch-0 crushed rock. Alley may be a shed section

7-14.9 Bicycle/Pedestrian Trail

Minimum of a 30-foot multi-use path dedication to the City of Madras. 10 feet of paved width surface (2-inch Level II or III, ½ inch dense, PG 58-34 oil HMAC) over 4-inch depth of ¾ inch-0 crushed rock. Vertical and horizontal alignment requirements shall be in accordance with the Oregon Bicycle and Pedestrian Plan, PROWAG and ADA standards. Landscaping (trees, irrigation, plants, mulch) and trail lighting are required adjacent to trail improvements.

The trail design shall include trail lighting per City standards, trees with bubbler style irrigation, landscaping plan, electrical plan, irrigation plan, trail alignment plan meeting PROWAG and ADA requirements.

7-14.10 Other Roads

Expressway, State Highways, special transportation area, unique infill, and large lot/large setback properties shall be reviewed and approved by the City and ODOT (as applicable) on a case-by-case basis.

7-15 Sight Distance

Standard Detail Drawings (see Section 11) show the sight distance triangle. The area within this triangle shall be subject to restrictions necessary to maintain a clear view on the intersection approaches. Driveways shall also observe the sight triangle restrictions, including landscaping and placement of view obstructions consistent with the City's Zoning Ordinance except for higher order streets such as major collectors and larger. For these higher order streets, the clear vision area shall be the greater of the City's Zoning Ordinance or *AASHTO Policy on Geometric Design of Highways and Streets*.

Other factors such as vertical and horizontal curves and roadway grades also need to be considered. Such factors may allow necessary modification to the intersection sight distance requirements.

Sight distance shall be measured using the methods described in the *AASHTO Manual, A Policy on Geometric Design of Highways and Streets*. Sight distance shall be measured from an eye height of 3.0 feet to an object height of 3.0 feet.

The vertical clearance area within the sight distance triangle shall be free from obstructions to a motor vehicle operator's view between a height of 3.0 feet and 10 feet above the existing surface of the street.

7-16 Intersections

Every intersection shall be designed to meet functional standards of the highest classified street forming a part of the intersection; however, the City may make exceptions to address local conditions. Intersections with a segment of state highway will be designed according to state standards. All elements of the intersection, including turning lanes and channeling islands, shall be designed so that a design vehicle will not encroach onto curbs, sidewalks, traffic control devices, channeling islands, or center divisional medians, or encroach into the travel lanes of opposing traffic flow.

Centerline offsets for arterial and collector street intersections shall be three hundred feet, and one hundred fifty feet for local streets. Streets will be designed to intersect at right angles.

The following table applies from the City of Madras Transportation System Plan:

Public Improvement Design & Construction Standards

Table C8: Minimum Intersection Spacing Standards¹

Functional Classification	Public Street (feet)	Private Access Drive (feet)
City Expressway	Full-Access shall only be provided at the following locations ² : US 97, US 26, "C" Street-Canyon Road, "J" Street, Fairgrounds Road, OR 361, and US 26/97 South Junction	No access shall be allowed to properties with alternative access. Properties without alternative access, will be allowed temporary right-in/right-out approaches ⁴ .
Arterial	600 ¹	300 ⁽⁵⁾⁽²⁾
Major Collector	300 ¹	100 ⁽⁵⁾⁽²⁾
Minor Collector	200 ¹	50 ²
Local	150 ¹	N/A ²

¹ Access spacing measured from centerline to centerline.

² Access spacing measured from edge of access to edge of access and be no closer than 2 feet from the edge of the driveway flare to flare

³ All other public street access points shall be restricted to right-in/right-out access only through the installation of raised longitudinal medians.

⁴ All private access roadways or driveways shall be restricted to right-in/right-out access only through the installation of raised longitudinal medians.

⁵ Private access to arterials and major collectors will not be allowed unless no reasonable alternative access exists for a parcel.

⁶ No portion of any private access, including end slopes, shall be permitted closer than 20 feet to the end of the curb return.

7-17 Curb Return Radii

For the intersection of two local streets, the minimum allowable curb radius shall be 20 feet, which is to be measured from the radius point to the face of curb. For the intersection of a local street with any collector or arterial, the minimum radius shall be 25 feet. On all other street intersections, the minimum allowable radii shall be 30 feet.

Radii of 40 feet or more shall be provided where large truck combinations and buses turn frequently. Radii of 40 feet or more should be designed to fit the paths of appropriate design vehicles. Larger radii may be desirable where speed reductions would cause problems, but final design authority will be by the City Engineer. When larger radii (i.e. greater than 30 feet), are required, additional right-of-way will be required by the development to accommodate sidewalk and ADA ramp placement within the public right-of-way.

7-18 Street Ends & Cul-de-Sacs

When a street dead ends but extends more than 150 feet from the nearest intersection, a cul-de-sac will be the primary street end design component. Cul-de-sacs are to meet the criteria required by the fire department, this will include a minimum of a 50 foot paved radius and a minimum of a 57 foot right-of-way dedication radius (not counting additional slope area needs behind sidewalk) unless otherwise approved by the Fire Marshal and the City.

When cul-de-sacs are determined not feasible by the City, a fire department alternative turn around design is required on all permanent or temporary street ends. The turn-around design shall be subject to the review and approval of the Fire Marshal and City. Structural section for turn-around shall support a standard fire truck and will not be less than the minimum structural requirements for a local street section.

Any proposed street that terminated at a development boundary shall be constructed with a paved cul-de-sac bulb according to local Fire Department-approved dimensions.

Cul-de-sacs shall have a length of less than six hundred feet (600'). For Cul-de-sacs intersecting with arterial or collector streets, they shall be a minimum of one hundred feet (100') from the center of the bulb to the intersection with the main street. The maximum grade on the bulb shall be four percent (4%).

7-19 Driveways & Access Management

Access locations on roadway sections need to be properly located to ensure safe and efficient travel along a given transportation facility. Access locations should be placed appropriately to limit potential conflicting turning movements, weaving maneuvers over short distances, and congestion along facilities.

Access onto public right-of-way or change in type of access shall require a Right-of-Way permit from the Public Works Department. Access shall be denied at locations that do not meet sight distance criteria. Residential lots are granted one access per lot. The number of accesses for commercial and industrial properties will be approved through the site plan approval process or as coordinated by the Public Works Department during a street improvement project.

7-19.1 Access Restrictions & Limitations

Creation of access onto arterials and major collectors is prohibited. In any event, residential access onto arterials and major collectors shall not be permitted within one hundred feet (100') of an intersection or the maximum distance obtainable on the parcel, whichever is less. On major collector and higher order streets, a one foot access restriction easement will be granted to the City, as a condition of Land Use approval, to ensure access management on high order streets.

7-19.2 Access Management

As the City of Madras continues to develop, the arterial/collector/local street system will become more heavily relied on for a variety of travel needs. Consequently, it will become increasingly important to manage access on the existing and future arterial/collector street system as new development occurs. Access locations on roadway sections need to be properly located to ensure safe and efficient travel along a given transportation facility. Access locations shall be placed appropriately to limit potential conflicting turning movements, weaving maneuvers over short distances, and congestion along facilities.

The Oregon Transportation Planning Rule (TPR) defines access management as a set of measures regulating access to streets, roads, and highways from public roads and private driveways. The TPR requires that new connections to arterials and state highways be consistent with designated access management categories. One objective of the TSP Update was to develop an access management policy that maintains and enhances the integrity (capacity, safety, and level of service) of the City's streets. From a policy perspective, ODOT has legal authority to regulate access points along US 26, US 97, and Oregon Highway 361 within the City's UGB. The City of Madras will manage

access on other collector and local streets within its jurisdiction to ensure the efficient movement of traffic and to enhance safety.

Access management standards vary depending on the functional classification and purpose of a given roadway. Roadways in the upper echelon of the functional classification system (i.e. arterials) tend to have stringent spacing standards, while facilities ranked lower in the functional classification system allow more closely spaced access points. The following discussion presents the hierarchical access management system for roadways in Madras.

The City's Transportation System Plan will be the governing document for access management, intersection spacing, and general driveway standards which is further than incorporated into these standards.

A safety island of not less than ten feet of full height curb shall in all cases be provided between driveway approaches under one ownership or where practicable under separate ownership. Multi-family housing complexes, commercial, and industrial zoned lots are granted accesses as approved through the site plan review and Land Use Decision process. The number of accesses for multi-family housing complexes, commercial, and industrial zoned lots will depend upon the size of the development, circulation needs, and lot configuration. The final authority on the number, location, and size of accesses will remain with the jurisdiction responsible for the associated access/approach (City of Madras, ODOT, and Jefferson County).

Any driveway approach in excess of the maximum lengths set forth in these standards must receive the approval of the Public Works Department prior to construction.

No driveway approach shall project beyond the extension of the side property line to the curb.

In cases where driveway approaches are constructed on corner lots, no portion of any driveway approach, including end slopes, shall be permitted closer than 20 feet to the end of the curb return.

Driveway approaches located within five feet of the existing curb return at an alley intersection may be merged with the alley intersection pavement, thus requiring the removal of the existing curb return. The total apron length plus the alley width, measured at the curb line of the apron to the opposite alley line shall not exceed 40 feet.

City street right-of-way may not be used for private residential or commercial purposes. A permit for the construction of driveway approaches shall not be issued unless vehicles to be served or serviced can be parked entirely within the private property lines.

All existing driveway approaches not meeting current standards shall be reconstructed by the owners of the property served by such approaches to conform to these standards upon approval of any new development.

In reconstructing and remodeling the driveway approaches to conform to the provisions of this chapter, sidewalks, curbs, and gutters shall be replaced according to the Sidewalk Ordinance of the City and in accordance with these Standards & Specifications.

7-19.3 ODOT Access Management Standards

The Oregon Highway Plan specifies an access management classification system for state facilities and has classified US 26 and US 97 as being "Statewide Highways". The City's TSP classifies the state highways as arterials. Access management categories for these facilities will be required to follow the guidelines of the most currently updated

edition of the Oregon Highway Plan and standards set forth in Oregon Administrative Rule (OAR) 734-51.

7-19.4 Impact on Local Development Activities

Future developments along both US 26 and US 97 (zone changes, comprehensive plan amendments, redevelopment, new development, and/or changes in existing uses) are required to meet the access management spacing standards for state highways as outlined in the OAR 734-51. OAR 734-51 spacing standards for statewide and district highways are presented in Tables C4 and C5, respectively. For example, as shown in Table C4, a new development shall maintain a 990-foot spacing (centerline-to-centerline), when possible, between accesses for an Urban Other statewide highway segment with a posted speed of 45 mph. Variances will be reviewed on a case-by-case basis between the City and ODOT.

Table C8 identifies the minimum public street intersection and private access spacing standards for the City of Madras roadway network as they relate to new development and redevelopment. These access spacing standards shall be applied to all facilities within the City of Madras, except for the segments of US 26, US 97, and OR 361 that are not defined as Urban Expressways. These non-Urban Expressway segments shall comply with OAR 734-51. Table C9 identifies standards for private access driveway widths. In cases where physical constraints or site characteristics limit the ability for the access spacing standards listed in Tables C8 and C9 to be met, the City of Madras retains the right to grant an access spacing variance. County facilities within the City's UGB and up to one mile outside the City's UGB per the City/County Urban Growth Area Management Agreement shall be planned and constructed in accordance with these street design standards.

7-19.5 Access Variance (Deviation) Process

Except as otherwise established in OAR 734-51 for State highways, access variances may be provided to parcels for which roadway frontage, topography, or location would otherwise preclude issuance of a conforming permit and which either have no reasonable access or cannot obtain reasonable alternative access to the public road system. In such a situation, a request for deviation from adopted management standards and policies may be granted by the City of Madras for a single connection to a property that cannot be accessed in a manner that is consistent with the spacing standards. All access variances to City Expressways shall be temporary in nature, and the access to the City Expressway shall be restricted to right-in/right-out access only through the installation of raised longitudinal medians. These temporary approaches will be removed once alternative access is provided to the property.

Under the variance process, the permit will carry a condition that the access will be closed at such time that reasonable access to a local public street becomes available. Approval conditions will also require a given landowner to work in cooperation with adjacent land owners to provide either joint access points, front and rear cross-over easements, or a rear access on future redevelopment. In addition, approval of a conditional permit shall require turning movement design standards to ensure safety and managed access. All conditions are at the discretion of the Public Works Department.

Public Improvement Design & Construction Standards

**Table C4: Access Management Spacing Standards
(in feet*) for Statewide Highways ^{(1) (2) (3) (4)}**

Posted Speed ⁽⁵⁾	Rural		Urban			
	Expressway	Other	Expressway	Other	UBA	STA
≥55	5,280	1,320	2,640	1,320		
50	5,280	1,100	2,640	1,100		
40 & 45	5,280	990	2,640	990		
30 & 35		770		770	720	(6)
≤25		550		550	520	(6)

Source: (OAR 734-051-0190) As State standards are amended, this table shall be considered amended accordingly. Refer to the latest State standards.

Note: The numbers in parentheses [(1)] refer to explanatory notes that follow Table C7.

** Measurement of the approach road spacing is from center to center on the same side of the roadway.*

**Table C5: Access Management Spacing Standards
(in feet*) for District Highways ^{(1) (2) (3) (4)}**

Posted Speed ⁽⁵⁾	Rural		Urban			
	Expressway	Other	Expressway	Other	UBA	STA
≥55	5,280	700	2,640	700		
50	5,280	550	2,640	550		
40 & 45	5,280	500	2,640	500		
30 & 35		400		400	350	(6)
≤25		400		400	350	(6)

Source: (OAR 734-051-0190)

Note: The numbers in parentheses [(1)] refer to explanatory notes that follow Table C7.

** Measurement of the approach road spacing is from center to center on the same side of the roadway.*

Existing legal, permitted or grandfathered driveway connections and public street intersection spacing are not required to meet the spacing standards immediately upon adoption of this TSP Update. However, existing permitted or existing development connections that do not conform to the design goals and objectives of the roadway classification will be upgraded as use of the property changes in nature or intensity requiring application for a new approach permit. Modifications to an approach can be required at any time to address a safety problem or capacity issue that exists or becomes apparent. By statute, the City of Madras and ODOT are required to ensure that all safety and capacity issues are addressed. Proposed Land Use actions that do not comply with the designated access spacing policy will be required to apply for either a major or minor deviation from standards adopted by ODOT.

Public Improvement Design & Construction Standards

In cases where proposed highway approaches/accesses are unable to meet the spacing standards listed in Tables C4 and C5, proposed Land Use actions will be required to apply for either a Minor or a Major Deviation to the spacing standards per OAR 734-51. Summaries of the Minor Deviation spacing limits for statewide highways and district highways are presented in Tables C6 and C7. Any request to deviate beyond these limits is considered a major deviation.

Table C6: Access Management Spacing Standard
Minor Deviation Limits (in feet*) for Statewide Highways ^{(1) (2) (3) (4)}

Posted Speed ⁽⁵⁾	Rural		Urban			
	Expressways	Other	Expressways	Other	UBA	STA
≥55	(none)	(950)	(none)	(870)		
	[none]	[1,150]	[none]	[1,000]		
50	(none)	(700)	(none)	(640)		
	[none]	[900]	[none]	[810]		
40 & 45	(none)	(560)	(none)	(530)		
	[none]	[810]	[none]	[740]		
30 & 35		(400)		(350)	(350)	
		[675]		[600]	[600]	
≤25		(280)		(250)	(250)	
		[525]		[400]	[400]	

Source: (OAR 734-051-0190)

Note: The numbers in parentheses [(1)] refer to explanatory notes that follow Table C7.

* Measurement of the approach road spacing is from center to center on the same side of the roadway.

 = Driveway Spacing Minor Deviation Limit.

 = Public Street Spacing Minor Deviation Limit.

Table C7: Access Management Spacing Standard
 Minor Deviation Limits (in feet*) for District Highways ^{(1) (2) (3) (4)}

Posted Speed ⁽⁵⁾	Rural		Urban			
	Expressways	Other	Expressways	Other	UBA	STA
≥55	(none)	(650)	(none)	(650)		
	[none]	[660]	[none]	[660]		
50	(none)	(475)	(none)	(475)		
	[none]	[525]	[none]	[525]		
40 & 45	(none)	(400)	(none)	(400)		
	[none]	[475]	[none]	[475]		
30 & 35		(275)		(275)	(250)	
		[325]		[325]	[305]	
≤25		(200)		(200)	(175)	
		[245]		[245]	[200]	

Source: (OAR 734-051-0190)

Note: The numbers in parentheses [(1)] refer to explanatory notes that follow Table C7.

* Measurement of the approach road spacing is from center to center on the same side of the roadway.

 = Driveway Spacing Minor Deviation Limit.

 = Public Street Spacing Minor Deviation Limit.

Notes on Tables C4, C5, C6, and C7: (Source: OAR 734-051-0190)

(1) These access management spacing standards are for unsignalized approaches only. Signal spacing standards supersede access management spacing standards for approaches.

(2) These access management spacing standards do not retroactively apply to legal approaches in effect prior to adoption of OAR 734-051-0010 through 734-051-0480, except or until any redevelopment, change of use, or highway or interchange construction projects, highway or interchange modernization projects, or any other roadway project as determined by the Region Manager, such as preservation, safety and operation projects that affect curb placement or sidewalks, which affect these legal approaches occurs. At that time the goal is to meet the appropriate access management spacing standards, but at the very least to improve current conditions by moving in the direction of the access management spacing standards. (See OAR 734-051-0190(2)(b).)

(3) When in-fill development occurs, the goal is to meet the appropriate access management spacing standards. This may not be possible and at the very least the goal is to improve the current conditions by moving in the direction of the access management spacing standards. Thus, in-fill development should not worsen current approach spacing. This may involve appropriate mitigation, such as joint access. (See OAR 734-051-0190(2)(c).)

(4) In some cases an approach will be allowed to a property at less than the designated access management spacing standards or minor deviation limits, but only where a right

of access exists, the designated access management spacing standards or minor deviation limits cannot be accomplished, and that property does not have reasonable access, thus the property would become landlocked without the approach to the state highway. See OAR 734-051-0320(3). Other options should be considered such as joint access. (See OAR 734-051-0190(2)(d).)

(5) Posted (or Desirable) Speed: Posted speed can only be adjusted (up or down) after a speed study is conducted and that study determines the correct posted speed to be different than the current posted speed. In cases where actual speeds are suspected to be much higher than posted speeds, the Department reserves the right to adjust the access management spacing accordingly. A determination can be made to go to longer access management spacing standards as appropriate for a higher speed. A speed study will need to be conducted to determine the correct speed.

(6) Minimum access management spacing for public road approaches is the existing City block spacing or the City block spacing as identified in the local comprehensive plan. Public road connections are preferred over private driveways and in STA's driveways are discouraged. However, where driveways are allowed and where Land Use patterns permit, the minimum access management spacing for driveways is 175 feet (55 meters) or mid-block if the current City block spacing is less than 350 feet (110 meters).

7-19.6 Driveway Width Standards

Table C9: Private Access Driveway Width Standards

Land Use	Minimum (feet)	Maximum (feet)
Single-Family Residential	12	24*
Multi-Family Residential	24	30
Commercial/Industrial	24	40

**The maximum width for a single-family residential unit may be adjusted for homes with garages for three or more vehicles.*

7-19.7 Commercial/Industrial

The City shall have the authority to restrict the number, size and location of access driveways. Direct access to a main arterial will not be granted if access through a minor or collector arterial is available. The City encourages all proposed commercial and industrial development to explore common use driveways with adjacent property owners on principal arterials.

On local, collectors, arterials and alleys where on-street parking is limited, additional off-street parking space(s) will be required according to the City’s Subdivision and Zoning Ordinance requirements.

Commercial driveways shall not be located within 150 feet from the approach to an arterial intersection and shall not be closer than 100 feet on a collector. Both shall be signed and marked “Right Turn Only” unless otherwise approved by the City.

For Commercial Driveway Width and Location/Spacing standards, refer to Table C9 above. Width of the driveway is measured at the throat and does not include the wings.

Number of driveways, width, and location/spacing will be determined by the City’s Zoning Ordinance, City TSP and the Land Use Decision approval. For driveways

accessing State Highway right-of-way, the applicant will need to permit through the Oregon Department of Transportation for the access width and location/spacing.

The maximum recommended grade is 5% however grades up to 10% may be allowed subject to the approval of the Fire Marshal and City. Vertical curves should be used for smooth transitions at significant grade differentials.

7-19.8 Residential

Access into residential properties may not be less than twelve unobstructed feet (12'). Paved access shall be twenty-four feet (24') maximum width per Table C9.

7-19.9 Concrete Driveways

Driveway and alley returns shall be designed in accordance with these specifications, the ODOT Standard Detail Drawings (See Section 11) and the *Oregon Standard Specifications for Construction*.

Driveway aprons shall be constructed per ODOT Standard Detail Drawings (See Section 11) as applicable. In all cases, sub-grade and rock grade shall be approved by the City prior to concrete being placed.

In locations where a new driveway is to be constructed and the sidewalk, curb and gutter already exist, existing curb, gutter and sidewalk must be totally removed and replaced to driveway standards. The curb and gutter must be removed to the nearest expansion joint and replaced to driveway standards.

A non-remonstrance agreement is required where curbs do not exist in the street right-of-way adjacent to the property being developed, according to the provisions of the City's Sidewalk Ordinance.

7-20 Curb Sections

Curb is required for all public streets. Provide curb extensions at each intersection that extend to the edge of the parking lanes where required, but in no cases allow the intersection to be narrower than 24' at the narrowest point. Where curb extensions are provided, provide removable reflectors (minimum 24" height) to identify the edge nearest to the travel way for snow plow awareness.

The City of Madras Standard section shall be used, see the Standard Detail Drawings in Section 11. Curb sections intended for use in parking lot areas, temporary road sections and other locations are subject to the review and approval of the City. The amount of exposure/reveal on the curb section is seven inches (7") for Arterials/Collectors and six inches (6") for all other streets. For public/private alleys, mountable curbing is required to ensure protection of pavement edges.

Curb shall be Portland cement concrete and shall meet the requirements of the Oregon Standard Specifications for Construction (Section 759 "Miscellaneous Portland Cement Concrete Structure"). All new curbs shall be placed over not less than 2 inches of $\frac{3}{4}$ inch- 0 State Spec. aggregate base compacted to 95% maximum density AAHSTO T-99 Method A.

7-20.1 Curb Ramps/ADA Ramps

Sidewalk ADA ramps shall be accordance with Section 00759 of the Oregon Standard Specifications for Construction. Coordinate correct option selection with the City Engineer. Show individual ramp details indicating compliance with current ADA

accessibility guidelines (i.e. front and back of ramp elevations, slopes, ramp lengths, etc.).

Curb ramps shall be provided at all pedestrian crossings with curb sections. It is required that when a ramp is constructed giving handicap access to the roadway area, the corresponding ramp at the opposite side of the roadway will also be required. Exact locations at each curb return will be determined as a condition of construction plan approval.

Curb ramps shall be constructed in accordance with the construction plans and Section 00759 of the Oregon Standard Specifications for Construction. The Engineer of Record shall survey and provide appropriate elevations in the plan detail to verify ADA compliance. Curb ramps shall be constructed where shown on the drawings. If differing field conditions (i.e. plan details do not work with actual field conditions for ADA compliance and/or constructability) are discovered by the contractor, the Engineer of Record shall inspect the site, revise the drawing detail, and have approved by the City the proposed changes prior to the contractor proceeding with installation. This work shall include curb ramps installed in new sidewalks and curb ramps to be installed in existing sidewalks. Existing sidewalks shall be neatly saw-cut full depth prior to construction of curb ramps.

Curb ramps shall be constructed separately from the sidewalk to produce a definite break line between the ramp and the sidewalk. A ½ inch non-extruded joint material shall be installed between the curb ramp and the sidewalk with edging. Curb and Gutters shall be isolated by isolation joint material on all sides.

Truncated Domes shall be an ADA compliant type set into fresh concrete. The City requires the use of insertable cast iron tiles per East Jordan Iron Works or approved equal for the texturing of the ramp. Submit proposed product for review and approval by the Public Works Department and incorporate into the construction plan's typical sections.

Curb ramps will be inspected upon completion using ODOT Standard Forms to verify compliance with ADA. Curb ramps that fail to meet the requirements will not be accepted by the City.

7-21 Alleys

All alleys, public or private, will follow the same standards for construction. Dedication area for alleys must be a minimum of 20 feet. For residential alleys, a minimum of a 16-foot width paved section (2 inches HMAC over 6 inches aggregate base) is required. For commercial alleys, a plan shall be submitted to the City for review and approval, that adequately addresses business access, stormwater drainage, utility protection, and minimum structural section (3 inches HMAC over 6 inches aggregate base). The width in the commercial zones shall be a minimum of a 17-foot paved surface unless approved in alternate format by the City. If the fire apparatus must use an alley way to gain adequate access to a building, the alley way would need to be a minimum of 20 feet width with No Parking Fire Lane signage or other approved alternate way of notification such as red curbing etc. Therefore, the width of an alley way shall be determined based on the fire code requirements and subject to the Fire Marshal approval on a case-by-case basis.

7-22 Traffic Control Signing & Striping

All traffic control devices, signing, striping and other pavement delineation shall utilize the most current version of the *Manual on Uniform Traffic Control Devices* as a guideline when preparing designs and traffic control plans. The Engineer of Record and/or contractor may

also use/implement the ODOT Standard Detail Drawings for common traffic control plan needs. It shall be the developer's responsibility to furnish all materials and labor as necessary to install all permanent and temporary traffic control to satisfy project requirements. All required signage (traffic control and street name signs), striping, and other delineation, shall be shown on the construction plans prior to approval. All signals shall be equipped with pre-emption that is compatible with the equipment used by the fire department (511, 562 series 3M opticom/ODOT Standard). (See the Standard Detail Drawings Section 11).

7-23 Fire Department Access

As required by the City and the State Fire Marshal, every building constructed shall be accessible to the Fire Department, both during and after construction, by way of Fire Apparatus Access Roads approved by the Fire Department. The Fire Apparatus Access Road shall have at a minimum 20 feet of unobstructed, approved turnaround if longer than 150 feet in length, 8 inches of compacted aggregate base, adequate roadway turning radius, be capable of supporting the imposed loads of fire apparatus, and provide adequate drainage. The minimum allowable vertical clearance shall be 13.5 feet. Maximum grade for its access shall be as required by the Fire Marshal.

7-24 Guardrails & Handrails

Guardrails and handrails shall be provided where necessary to conform to requirements of the Americans with Disabilities Act (ADA) and to protect pedestrians from vehicular traffic.

The height for guardrails and handrails shall meet the requirements of the most current IBC code. Roadway guardrails shall be provided at locations determined during the project design and plan review process and shall conform to Oregon Standard Drawings RD400 series. Alternative methods proposed by the developer/contractor for providing roadway vehicle and pedestrian protection will be considered by the City on a case-by-case basis.

Guardrails shall be hot dipped galvanized. Handrails shall be powder coated.

7-25 Mailboxes

Mailboxes are the responsibility of the property owner. Installation of Post Office mailboxes is to be coordinated with the Post Master and Public Works Department. All mailboxes will be mounted on an approved Postmaster stand or box system in accordance with Oregon Standard Drawings RD100 and RD101. The location shall not inhibit clear vision area, pedestrian accessibility (e.g. minimum five-foot clearance of adjacent walkway or multi-use path), and general operations including snow removal. Details must be provided for City review. Prior to construction, the staked location shall also be reviewed by the Public Works Department.

7-26 Improvement in Area of Limited Street Improvements

Paving between the property line and the street pavement may meet the street pavement at a point ahead of the curb opening in order to provide for safe deceleration of vehicles turning into the applicant's premises. If applicant's paving is extended beyond the property line into a street right-of-way at an intersection or crossroad, the City may require the applicant to construct a suitable traffic island or curb to provide for the protection of such municipal facilities as may be necessary. A person proposing to improve the public right-of-way for access improvements will at a minimum apply for a right-of-way permit.

7-27 Monuments (Property Corners) and Construction Staking

Monuments for new subdivisions and partitions shall be set according to Oregon Revised Statutes and the Jefferson County Surveyor. Disturbance or removal of survey monuments through the course of construction shall be reset by a professional land surveyor licensed in Oregon and according to Oregon Revised Statutes.

Preliminary and final surveying shall be furnished by the developer/contractor at no expense to the City. It is required that, as a minimum, survey stakes be set for new curb construction, for both horizontal and vertical control. Water, storm drain, or sanitary sewer mains which are to be constructed in easements or public right-of-way, are to have survey offset stakes set prior to starting work. Any deviation from that staked line must be left uncovered and resurveyed to realign easement as required and for as-built “construction corrected record” information.

7-28 Rockeries and Rock walls

Rockeries or rock walls with facing height of four feet (4') or less shall be designed in accordance with ODOT Standard Detail Drawings (See the Standard Detail Drawings Section 11) if used for erosion control or the containment of cuts and embankments. Rockeries four feet (4') and over in height must be designed by an engineer licensed in Oregon. Additional geotechnical analysis and recommendations will be required for use in design and construction. All rockeries or rock walls shall be designed with footing drain systems and day lighted to a location approved by the City.

7-29 Street Cuts

The City street cut policy has been established to ensure the integrity of new and/or upgraded infrastructure. Limitations have been set as follows:

- A. All resurfaced, newly constructed or fully reconstructed streets shall not be cut for a period of not less than 5 years from final construction acceptance by the City. The City may consider allowing street cuts in these streets but will require half street or full street overlay (or grind out/inlay).
- B. All surfaced streets that are cut will require “T-Patch.” See the Standard Detail Drawing 1-1. All excavations of street sections shall be saw cut to provide a clean edge for new asphalt.

7-29.1 Asphalt Concrete Pavement & Pavement Patching

Asphalt concrete paving and the patching of various types of pavement cuts, shall be in accordance with these Specifications and the *Oregon Standard Specifications for Construction*, and City of Madras Standard Detail Drawings.

7-29.2 Temporary Pavement Patching

The contractor shall furnish, place and maintain temporary pavement patching, at locations as directed by the City, until such time as a permanent pavement patch can be made. Generally, the permanent patch shall be completed within two weeks of the completion of trenching and road repairs, unless an extension is granted by the City.

Temporary pavement patch shall consist of asphalt cold mix compacted to at least 90% of maximum density as determined by the City. Other temporary material may be considered by the City.

Temporary asphalt patching shall be required where roadway or walk is needed for vehicular or pedestrian traffic during the construction period, until permanent pavement and sidewalks can be constructed.

In the event that the temporary surface subsides after the initial placement, additional cold mix and crushed surfacing shall be applied to maintain the surface. It is the contractor's responsibility to monitor and maintain the area for settling until the area has been completely repaired and accepted by the City.

7-29.2.1 Materials

All materials shall conform to the requirements specified for material in other sections of the *Oregon Standard Specifications for Construction* as follows:

- Asphalt concrete pavement shall conform to 0745 of the *Oregon Standard Specifications for Construction* and or the requirements of the Public Works Department.
- Paving for roadways shall utilize a Level 2 or Level 3 HMAC Mix with PG 58-34 oil for all local streets and private/public alleys. For collector and industrial roads, use a Level 3 HMAC Mix with PG 58-34 oil.
- Asphalt concrete pavement patch shall match the existing material that is in place if unknown, use the mix types listed in item "B" above.
- Asphalt for temporary patch shall meet the requirements *Oregon Standard Specifications for Construction*.
- Tack coat shall be emulsified asphalt grade CSS-1.
- Crack sealing material shall be of hot polymer type.
- Geotextile fabric for pavement reinforcement shall be needle-punch non-woven 100% polypropylene Products such as "Petromat" or "Supac" as manufactured by Phillips Fiber Corporation are acceptable. Other products may be submitted by the developer/contractor to the City for review "as equal" substitution.
- Asphaltic binder for use with geotextile fabric shall conform to the manufacturer's recommendations for the fabric used. Cutback asphalts cannot be used with polypropylene fabrics due to reactions with solvents at high temperatures.
- Crushed surfacing base course (aggregate base) shall be in accordance with *Oregon Standard Specifications for Construction*.
- Shoulder rock backfill and trench backfill shall be in accordance with *Oregon Standard Specifications for Construction*.
- Portland Cement Concrete pavement patch shall be in accordance with *Oregon Standard Specifications for Construction*.

7-30 Construction

The placing and compaction of the trench backfill and the preparation and compaction of the sub-grade shall be in accordance with the various applicable sections of the *Oregon Standard Specifications for Construction*, unless otherwise modified by these specifications.

Compaction of the sub-grade shall be completed prior to the required asphalt placement work as determined in the *Oregon Standard Specifications for Construction*.

Paving shall be scheduled to accommodate the demands of traffic and shall be performed as rapidly as possible to provide maximum safety and convenience to public traffic.

Before repairing or replacing a section of asphalt pavement, the pavement shall be saw cut so that the marginal edges of the replacement section will form a rectangular shape with straight edges and vertical faces.

When required, cold planing along the edge of existing roadways and at interfaces with existing pavements, shall be completed to the widths and depths established in the plans and specifications.

Cold plane pavement removal at a length of 15' for every 1" of overlay depth is required at the project ends to match the new overlay pavement into the existing. Cold plane pavement tapered from the depth of the overlay to zero inches for a minimum width of 7' feet is required when overlaying a curb and gutter section.

Hot Polymer Crack sealant is required at all trench patches. If the edge of the trench is less than 2 feet from the curb or the edge of gutter pan, the trench patch shall be extended to the face of curb or to the edge of gutter pan.

Geotextile fabric materials, when required in the plans and specifications, are to be an ODOT approved QPL product. Geotextile shall be installed according to the manufacturer's recommendations including minimum overlap.

7-31 Asphalt on Granular Base

After the aggregate base section has been leveled and compacted, Asphalt Concrete Pavement shall be placed to the thickness indicated on the plans. Asphalt base lifts shall be compacted to minimum 91% of maximum density. All other lifts of asphalt pavement shall be compacted to a minimum density of 92%.

Paving temperatures minimum surface temperature is 40 degrees Fahrenheit and rising. In no cases will the contractor be allowed to pave on frozen or frosted ground. Follow the requirements as outlined in 745 of the Oregon Standard Specifications for Construction, for the materials, equipment, construction, testing, and inspection.

7-32 Portland Cement Concrete Patching

Streets which have Portland cement concrete pavements surfaced with asphalt concrete shall be patched as shown on Standard Detail Drawing (See the Standard Detail Drawings Section 11). After crushed surfacing top course for the pavement has been constructed and compacted to line and grade, the cement concrete pavement patch shall be placed and struck off to a thickness of 1 inch greater than the existing pavement or 8 inch minimum, whichever is greater. All work shall be in accordance with *Oregon Standard Specifications for Construction*, except as modified by the Specifications and Standard Detail Drawing (See the Standard Detail Drawings Section 11).

The cement concrete portion of the patch shall be 5000 psi, 6-sack and shall match the existing PCC finish. The thickness shall be 1 inch thicker than the existing concrete base or 6 inches whichever is greater. The top surface of the concrete patch shall match the top surface of the existing concrete base; in no case shall the top of the concrete be higher than the top of the existing concrete base. Joints shall be placed to match existing or as directed by the engineer.

Through joints and dummy joints shall be placed to match existing or as directed by the City. The surface of the concrete patch shall be finished and brushed with a fiber brush to

improve bonding with the asphalt overlay. Approved curing compound shall be placed on the finished concrete immediately after finishing.

7-33 Trenching

Trench backfill, bedding, dewatering, excavation, foundation, and resurfacing will be according to Section 00400 of the Oregon Standard Specifications for Construction and City of Madras Standard Drawings. The developer or its agent shall furnish, install, and operate all necessary equipment to keep excavations above the foundation level free from water during construction, and shall de-water and dispose of the water so as not to cause injury to public or private property or nuisance to the public. Enough pumping equipment in good working condition shall be available at all times for all emergencies, including power outage, and shall have available at all times competent workmen for the operation of the pumping equipment.

During trenching operations, one lane of traffic shall remain accessible to emergency vehicles.

Where trench excavation equals or exceed a depth of four feet (4'), the developer/contractor shall provide, construct, maintain and remove, as required, safety systems that meet the requirements of the Oregon OSHA. Trench safety systems shall be designed by a qualified person and meet accepted engineering requirements. A competent person will always be onsite to direct the proper installation, use, and removal of OSHA approved trench systems at all times unless previous arrangements with the City have been approved. The developer/contractor shall not interfere with any existing utility without the written consent of the City and the utility company or person owning the utility. If it becomes necessary to remove an existing utility, this shall be done by its owner. No utility owned by the City shall be moved to accommodate the developer/contractor unless the cost of such work is borne by the developer/contractor. The cost of moving privately owned utilities shall be similarly borne by the developer/contractor who must provide appropriate bonding.

The developer/contractor shall support and protect by timbers or otherwise all pipes, conduits, poles, wire or other apparatus which may be in any way affected by the excavation work, and do everything necessary to support, sustain and protect them under, over, along or across the work. In case any of the pipes, conduits, poles, wires or apparatus should be damaged, they shall be repaired by the agency or person owning them, and the expense of such repairs shall be charged to the developer/contractor, and his or its their bond shall be liable therefore.

The developer/contractor shall be responsible for any damage done to any public or private property by reason of the breaking of any water pipes, sewer, gas pipe, electric conduit and other utility, and its bond shall be liable. The developer/contractor shall inform itself as to the existence and location of all underground utilities and protect the same against damage.

The developer/contractor shall always and at their own expense preserve and protect the public from injury and protect any adjoining property.

7-33.1 Pipe Zone

Pipe Zone shall be in accordance with section 00400 of the Oregon Standard Specifications for Construction and City of Madras Standard Detail Drawing 1-2.

7-33.2 Trench Backfill

Trench backfill shall be Class B backfill in accordance with section 00400 of the Oregon Standard Specifications for Construction. An alternative mechanical processed material

may be used in cases where the depth from the top of pipe zone to the bottom of subgrade is more than 6 feet and the trench width at the top of pipe zone is more than 4 feet. The material must be uniform and meet compaction requirements per this section and approved by the public works department before it can be used for trench backfill. Unsuitable backfill material shall be removed from the site and hauled to an approved disposal site. The Contractor shall provide the City with the location of all disposal sites to be used and copies of the permits and approvals for such disposal sites.

7-33.3 Compaction

Trench backfill shall be spread in layers and compacted by mechanical tampers of the impact type approved by the City. The backfill material shall be placed in successive layers with each layer not to exceed 6 inches in the pipe zone, and the following layers not exceeding 12 inches in loose thickness, with each layer being compacted to the density specified below:

- For the improved areas such as streets and sidewalks, trench backfill shall be compacted to at least 95% of maximum dry density. Compaction tests shall be performed in accordance with *AASHTO T99*. Water jetting or settling of backfill in trenches is not permitted.
- Compaction tests of backfill shall be conducted every 300 feet per 12" lift of a continuous trench.

7-33.4 Pavement Restoration

When trenching through existing pavement, open cuts shall be saw cut with neat straight lines. T-Patching is required, according to City Of Madras Standard Detail Drawing No. 1-1. Backfill of trenches require a minimum 18" of Controlled Low Strength Material (CLSM) under the pavement patch.

Cold mix shall be used for all temporary pavement patches. Steel plates may be used only when Cold mix patch is unavailable or when re-entry is anticipated within 24 hours. All temporary patches are the responsibility of the applicant/developer/utility provider who is performing the work. Other temporary materials may be approved at the sole discretion of the City.

Permanent asphalt replacement shall be constructed in accordance to City of Madras Standard Detail Drawing No. 1-1.

7-34 Boring, Jacking, Auguring or Tunneling

The developer/contractor shall be liable for damage to any existing facilities as a result of the boring, jacking, auguring, or tunneling installation work. Prior to boring, all existing utilities being crossed will be potholed. Potholing will be done by approved methods, such as vacuum truck set up. Casings or carrier pipes may be required to protect the integrity of the road system if soil and/or load conditions are of concern to the City. Approvals from other agencies or companies may be required for the proposed work. The developer/contractor shall obtain all necessary permits, approvals and easements as may be necessary and shall provide copies to the City during the Construction Plan Approval process.

7-35 Public Safety

The developer/contractor shall erect such fence, railing or barriers about the site of the work to prevent danger to persons using the City street or sidewalks, and such protective barriers

shall be maintained until the work is completed or the danger removed. At twilight there shall be placed upon such place of excavation and upon any excavated materials or structures or other obstructions to streets suitable and enough lights which shall be maintained throughout the night for the entire construction period. It is unlawful for anyone to remove or tear down the fence or railing or other protective barriers or any lights provided there for the protection of the public.

The developer/contractor shall not permit any excavation to remain unguarded or open and shall not have any machinery, equipment or other device having the characteristics of an attractive nuisance likely to attract children and hazardous to their safety or health.

7-36 Portland Cement Concrete Sidewalks

Sidewalks, curb ramps and bus shelter pads, including excavation for the depth of the sidewalk and sub-grade preparation shall be concrete designed in accordance with ODOT Standard Detail Drawings (see the Standard Detail Drawings Section 11) and the Oregon Standard Specifications for Construction. Sidewalks constructed adjacent to City streets/roadway shall provide handicap access, including ramps, landings and handrails as necessary.

Sidewalk Drains shall be provided when determined necessary by the City and when approved in the construction plans. ADA compliant concrete steps and handrails shall be provided where necessary. Sidewalks shall meet the required designs of the current ADA, PROWAG and Oregon Bike/Pedestrian Plan.

A minimum distance of five feet (5') is required from the back of curb to any obstruction on or within the sidewalk unless otherwise noted. Mailboxes shall be set at locations approved by the Postmaster and City. Objects will not be allowed to reduce the horizontal walkway area for pedestrians in a manner that does not maintain a five-foot (5') ADA compliant clearance path. Sidewalk minimum widths shall be as follows:

- Residential/Local streets – six foot (6') wide,
- Arterial and collector streets – six foot (6') wide
- Zoned Commercial – minimum eight foot (8') wide, when curb tight and not accompanied by a five and a half foot (5.5') minimum width planter strip between curb and sidewalk. Minimum six-foot (6') sidewalk if accompanied by a five and a half foot (5.5') minimum width planter strip between curb and sidewalk. These are the minimum requirements. Wider sidewalks may be allowed on a case-by-case basis as approved by the City.
- Downtown Corridor (Highway 26/Highway 97, street segments connected the two, in between the North Y and the South Y) – minimum six foot (6') wide sidewalk accompanied by four foot (4') paver strip with street trees and tree grates per these standards. These are the minimum requirements. Wider sidewalks may be allowed on a case-by-case basis as approved by the City.

Materials shall meet the requirements of the following section of Oregon Standard Specifications for Construction. The use of calcium chloride as an admixture is prohibited.

The curb shall be placed prior to the placement of the sidewalk section unless otherwise directed by the City. (see the Standard Detail Drawings Section 11). Aggregate base placement and compaction shall be approved by the City prior to concrete being placed. Generally, ¼ inch deep V-grooves are to be placed on five-foot (5') centers, but at the discretion of the City. This may be changed to make for a better match with the surrounding area (City Pattern in Downtown Core). In the City's Commercial Zones where decorative

sidewalk (i.e. colored and stamped concrete, pavers, etc.) details have been incorporated, new development or redevelopment shall follow the same theme in sidewalk construction.

Contraction joints shall be placed at a maximum interval of 15 feet. The contraction joints shall be formed by sawing to a depth of at least one third the thickness of the sidewalk. When the sidewalk is eight feet (8') or greater in width, a longitudinal joint shall be provided at the center.

Expansion joints shall be constructed of ½ inch Preformed Expansion Joint Filler at a maximum spacing of 200' or at the locations and of the dimensions specified on Oregon Standard Drawing RD700. When adjacent to buildings, provide a double thickness of Preformed Expansion Joint Filler at the back of the sidewalk. Place ½ inch Preformed Expansion Joint Filler longitudinally along the back face of the curb and gutter. All other obstructions will require ½ inch Preformed Expansion Joint Filler, as directed by the Engineer. In areas, where the sidewalk widens at the bridges, ½ inch Preformed Expansion Joint Filler shall be placed transversely across the sidewalk at the beginning of the transition and adjacent to the bridge sidewalk. The expansion joint filler shall be placed the full depth of the sidewalk.

All sidewalks shall be constructed over a minimum 4" inches of crushed aggregate base course meeting the requirements of these Standards & Specifications and of *the Oregon Standard Specifications for Construction* compacted to 95% of maximum density per the ODOT Manual of Field Test Procedures.

7-37 Parking

On-street diagonal parking on all newly constructed Streets will only be permitted at locations approved in the Land Use Decision or on a case-by-case basis by the City. Off street parking lots shall be constructed in conformance with the requirements for number of stalls and landscaping as established in the City's Zoning Ordinance. ADA parking requirements are established in City Ordinance as are loading space requirements.

Handicap parking stalls shall meet the requirements per the State of Oregon Building Code requirements and ADA. Safe, convenient handicap access is required from the street to all buildings on any proposed site.

7-38 Streetscape Accommodations

For any development or redevelopment on Highway 26, Highway 97, and street segments connected the two, in between the North Y and the South Y, a streetscape accommodation must be contributed as described below, For additional information, one may review the City of Madras Streetscape Design Report. All furnishings shall visibly bear the City's official emblem. Refer to the Street Furnishing Style Specification Guide below.

In an effort to keep Oregon dollars circulating in Oregon, developers shall consider purchasing streetscape products by Oregon manufacturers and distributors first and weigh the cost/benefit of such a purchase before making a final decision, even if that is to purchase outside the state.

Public Improvement Design & Construction Standards

Type of Street Furnishing	Style Specifications*
Bench	Will require anchoring system; type/model to be reviewed and approved by Public Works Department
Drinking fountain**	All-season model selection: type/model to be reviewed and approved by Public Works Department
Fire hydrant	This standard set forth by the Jefferson County Fire Department. Bodies of the hydrant along with the caps are painted red while the bonnet of the hydrant is painted white.
Public waste receptacles	Will require anchoring system; type/model to be reviewed and approved by Public Works Department. Decorative, metal-framed enclosure required.
Planter pot **	Auto-irrigated (from connection under the pot), plants as approved by the Urban Forestry Commission. Review and selection by the City.
Street lighting	See the Electrical, Controls, Instrumentation, Lighting, Traffic Signaling sections of these Standards & Specifications.
Special pavers	Special paving materials for undergrounding utilities or sidewalk improvements. Similar styles to those already in use will be discretionarily acceptable to the City Public Works Department.
Decorative poles and street sign markers	Review and selection by the City. Compliment coordination with street light pole and meeting <i>Manual on Uniform Traffic Control Devices</i> compliance.
Other	Other streetscape requirements than those listed here may be required at the discretion of the Public Works Department. Options will be discussed with the developer/applicant at a preconstruction meeting or as appropriately thereafter.
Stamped & colored concrete/commercial sidewalks	Similar styles to special pavers already in use will be discretionarily acceptable to the City Public Works Department.
Tree grates	4-foot by 4-foot weathered cast iron. See City of Madras Standard Detail Drawing No. 7-10

**All furnishings will be required to meet ADA and PROWAG requirements.*

***Drinking Fountains and Irrigation is to be installed according to the Oregon Plumbing Specialty Code (OPSC).*

SECTION 8 ELECTRICAL, CONTROLS, INSTRUMENTATION, LIGHTING AND TRAFFIC SIGNALING

8-1 Purpose

The purpose of these standards is to provide contractors, professional engineers and developers the City's minimum standards for all electrical installations, repairs and modifications to infrastructure owned by or those that will be dedicated to the City.

8-2 Summary

These standards shall apply as minimum requirements for work performed on infrastructure covered within this section. Deviations from these standards must be approved prior to the issuance of the construction plan approval by the City.

A street lighting plan is to be included prior to approval of the final construction plans & plat map. Clarification shall be provided to the City by the developer as to the locations for installation.

8-3 Permits

All electric work performed for the City is required to have an electrical permit issued by the County Building Department. All plans will be reviewed and approved by the City prior to commencement of work. All inspections and signoffs for these permits will be performed by the Building Department. Copies of these permits, and final sign-off of permits will be furnished to the City for all projects where the new infrastructure will be dedicated to the City or existing City owned infrastructure is modified.

8-4 Electrical

All electrical work performed will comply with the Oregon Electrical Specialty Code. All electrical work will be performed by a licensed electrician.

8-5 Controls

The City has standardized on the Allen Bradley brand of automation and SCADA (supervisory control and data acquisition) equipment and has standardized on other various brands and models of control components to maximize the City's efficiency in operating and maintaining its systems.

8-5.1 Telemetry

All new control systems must be capable of connecting to the existing City radio telemetry network, consisting of:

1. Allen Bradley SLC 500, MicroLogix 1100 PLC or MicroLogix 1400
2. Data Linc SRM 6000 radio modem

8-5.2 UPS

All Micro Processor based control systems shall include an Uninterruptible Power Supply (UPS).

1. The City standard is Best brand Patriot 425, Patriot 600 or Allen Bradley equivalent, panel mounted.

8-5.3 Power Monitors

All new control systems dealing with three-phase power shall include a three-phase power monitor.

1. The City standard is Diversified brand SLA-440-ALE for 440v power.

8-5.4 Operations

All new control systems shall be capable of manual or automatic operations by means of a selector switch with hand, off, & auto positions (H-O-A). The hand position shall cause the pump, etc. to operate independently of any Micro Processor based control.

8-5.5 Sensors

Any analog wet well level sensing means (ultra-sonic, bubbler, transducer, etc.) shall include a digital backup (float switch, inductive probe, etc.) for emergency control and alarming.

8-5.6 Variable Frequency Drives

Any variable frequency drive (VFD) used shall include a line reactor.

8-5.7 Voltage

All new control systems shall be 120v AC or 24v DC or smaller.

8-5.8 System Design

New control systems shall include full schematics, process and instrumentation diagrams (P & IDs), and both paper and electronic copies of any PLC programs.

8-6 Instrumentation

All instrumentation shall produce 4-20mA signals where applicable.

8-6.1 Operation/Maintenance Manuals

All instrumentation used shall include all manuals and schematics and be provided to the City upon dedication of the system.

8-7 Street Illumination

All new developments and subdivisions are required to provide street lighting compatible with City standards. The City's luminary post top designs shall meet Dark Sky requirements.

Street lighting shall be designed to minimize up-lighting and light pollution and shielded if necessary, to avoid spillage onto private property. As a minimum, streetlights are generally placed in the following locations:

- The standard placement of streetlights shall be at intersections, at stripped crosswalks, in the middle of long blocks, in dead end streets, and in the end of long cul-de-sacs.
- All components of the street lighting system shall be placed within the public right-of-way.
- Streetlight poles should be located at least five feet from the wing of driveways, and twenty-five feet from street trees.

8-7.1 Poles and Luminary Classifications

Lighting Classifications	Use
1. Cobra-head style	Industrial and residential zones.
2. Decorative pole and post top	Commercial zone.
3. Decorative pole and post top	Bicycle and pedestrian trails.

The City of Madras uses three different lighting classifications depending upon zoning and Land Use. The first classification is the cobra-head style lighting for industrial and residential zones. The first classification requires installation of the light base and conduit by the applicant/development, and a work order and contract price with Pacific Power that are to be paid by the applicant/development. The second classification is for the commercial zone, which is the decorative pole and post top (see the Standard Detail Drawings Section 11). The City reserves the right to meter only through the power company and have full ownership right to decorative commercial poles at the City's discretion. The third lighting classification is a decorative pole and post top for the bicycle and pedestrian trails (see the Standard Detail Drawings Section 11). The second and third classification (Commercial Decorative/Trail Decorative) will require the light base, conduit, power meter base/cabinet, wiring, permits/inspection, and pole and post top purchase and installation by the applicant and/or the applicant's engineer.

For lighting in the Central Electric Co-op (CEC) zones, coordinate selection and installation with the City and CEC.

For classification one, new street lighting systems shall be metal poles mounted on approved concrete bases. Classification two and three are per referenced exhibits above. Wood poles are not acceptable if the lighting system is to be dedicated to the City.

8-7.1.1 Requirement Descriptions

The following are examples of the luminary and posts required of decorative street and trail lighting classifications. Here, the specifications as follows were provided to us by Pacific Power from the manufacturer Holophane. The City of Madras uses these demonstrated specifications below to better aid developers. The City of Madras does not have bias for the manufacturer. All proven equivalent products will be acceptable as determined by the City Public Works Department.

Use directional/controlled (rather than flood or wide-angle lenses) lighting at each intersection. A full cut-off light head is required on Cobra Head style posts. On decorative post tops, a cut-off level of light control is required. Spacing is optimally 275' for cobra head style poles and 100' for decorative poles. In any case do not exceed more than 50% wider spacing (i.e. 400' or 150') on any street classification.

8-7.2 City Tree Lighting

In the City's Commercial Zones, tree lighting is a requirement in a style and light color as approved by the City. Private development is responsible for providing the tree, power outlet, and outlet power supply. Minimally the City requires maintenance and upkeep of the tree and power outlet.

8-7.3 Wiring

All wiring for street lighting shall be installed underground in conduit. All wiring is required to be placed in the right-of-way or properly designated utility easement.

8-7.3.1 Disconnect Location

Circuits feeding street lighting shall have a disconnection means outside of Pacific Power & Light transformers.

8-7.4 Luminaire Size

Classification 1 Per Pacific Power or CEC lighting plan for the development or project, LED.
Classification 2 80 watt, 5K series LED
Classification 3 70 watt, 4K series LED

8-7.5 Placement of Luminaires

Proposed design including spacing of luminaries for any new lighting system to be dedicated to the City shall be submitted to the City for approval prior to installation. Spacing of luminaries shall be in accordance with current *IES (Illumination Engineering Society)* standards, and further coordinated with the applicable power company (Pacific Power or CEC). Streetlights shall be placed in the right-of-way within the planter strip whenever possible, or behind the walk for curb type applications. For class two and three, the height of the poles shall be 14 feet. For class one, they will be according to the power company standard.

8-7.6 Developer's Responsibility

It will be the responsibility of the developer and contractor to install the street lighting system. Two (2) copies of complete detailed street lighting plans, including, but not limited to, types of lights, sizes of lights, location of lights, location of controls, size of conduit, location of conduits, size of wire, location of disconnection means, and type of disconnection means must be supplied to the City at the time of plan review for City and Pacific Power review if the system will be dedicated to the City. The system for classification one must be inspected and signed off by the applicable power company after installation is complete. The system for classification two and three must be inspected and signed off by the building department after installation is complete. Ownership of the street lighting system will only be transferred to the City after the appropriate agency signoff and after the City has completed its final inspection.

8-8 Traffic Signals

All traffic signals shall be designed and installed in accordance with Oregon Standards Specifications for Construction and the Oregon Standard Drawings.

The website links listed below provide access to the latest editions of the traffic design documents:

- Oregon Signal Design Manual:
www.odot.state.or.us/ffp/hwy/traffic/Signal_Design_Manual.pdf
- Oregon Standard Specifications:
http://egov.oregon.gov/ODOT/HWY/SPECS/standard_specifications.shtml#2008Standard_Specifications

- Oregon Standard Special Provisions:
http://egov.oregon.gov/ODOT/HWY/SPECS/2008_special_provisions.shtml
- Oregon Standard Drawings:
http://egov.oregon.gov/ODOT/HWY/ENGSERVICES/traffic_drawings.shtml

All traffic signal designs shall be prepared by or under the direct supervision of a Professional Traffic Engineer registered in Oregon or a Professional Engineer registered in Oregon qualified to perform traffic engineering as defined by OAR 820-040-0030. The engineer must have background and experience in designing traffic signals. Each traffic signal design shall be signed and sealed by the Professional Engineer prior to advertising the project requesting bids from prospective contractors.

SECTION 9 DRAFTING STANDARDS

9-1 Purpose

The purpose of this section is to provide a minimum standard for the graphical representation of proposed improvements and final “record drawings” for all projects submitted to the City including land development projects with dedicated infrastructure.

9-2 Summary

These drafting standards include but are not limited to: sheet size and layout, layering, line types and weights, lettering fonts, title block content, title block layout, general notes, general use symbols and construction notes. The objective is to establish a graphical standard that will facilitate the incorporation of newly developed systems into existing City records. Any land development with dedicated infrastructure must submit drawings in accordance with these standards.

Submittals of final drawings shall have standard borders, title blocks and symbols. Sheet sizes, title blocks for those sizes and standard drawing symbols are available from the City in paper format or in electronic format for AutoCAD. Electronic copies of these standards will be supplied on compact disc (CD) to those who request it.

9-3 Preliminary Drawings

Preliminary drawings shall be submitted digitally in PDF format and, at the request of the City, on 20-lb. bright white paper. The City will determine the number of copies for City review (typically five copies), if needed.

For land development projects with dedicated infrastructure, submit drawings as shown on the Site Construction Permit Flow Chart, which can be obtained from the City. These drawings must be on reproducible media and will be reviewed for conformity to these standards.

9-4 Final Design Drawings and Specifications

The final design submittal shall include all drawings, specifications and supporting calculations. Final design drawings shall be full size and prepared on 20-lb. bright white paper with the appropriate professional stamp, unless approved by the City prior to submittal. Digital copies formatted in AutoCAD and in PDF (contact the City for the currently accepted versions) shall also be provided. Land development projects with dedicated infrastructure shall use the City supplied signature block on every drawing submitted. The cover sheet shall include a signature block for the City’s Public Works Director.

Capital improvement projects will use the standard City title block and drawing format available from the Public Works Department.

9-5 Record/As-built Drawings

Submitted final as-built drawings shall be on standard 20-lb bright-white paper as well as in AutoCAD and PDF electronic format. As-built Drawings shall clearly identify deviations from final design drawings using the standards established in this manual. They shall be stamped and dated or otherwise marked as such. Digital files that do not agree with the printed and signed drawings will be returned and shall be corrected at no cost or liability to the City.

9-6 Drawing Contents and Submittal Requirements

9-6.1 Plan View

1. Centerline alignment showing points of curve and point of tangent stationing on all curves, necessary curve data and bearing of tangents.
2. Dimensioning necessary to survey and relocate the streetway.
3. Right-of-way lines as shown on the final plat.
4. Existing easements and recording references.
5. Type, material type (PVC, steel, DI,, etc.), location, and size of all existing and proposed drainage and irrigation structures and utilities within the right-of-way; The applicant's engineer/surveyor shall research available utilities record information for use during the design, plan approval, and construction process, and shall arrange for underground utility locations to be marked and surveyed prior to the City's design approval and the issuance of the construction plan approval.
6. Existing and proposed utility with dimensions to right-of-way lines.
7. Location and type of all existing and proposed signs and barricades.
8. Vicinity map showing the complete streetway network complete with names of streets.
9. Toe of fills and top of cuts.
10. Scale.
11. North arrow; and
12. Stamp and signature of registered engineer.

9-6.2 Profile

1. Centerline grades and vertical curves, complete with point of intersection elevations and stations and length of vertical curves.
2. Original ground at centerline and extending five hundred feet (500') past the construction limits (and at ditch lines if a significant transverse slope exists).
3. Curb profiles, where curbs are required.
4. Super elevation transition diagrams for horizontal curves if curbs are not required.
5. Type, location and size of all existing and proposed drainage and irrigation structures and utilities within the right-of-way; and
6. Scale.

9-6.3 Cross Sections

1. Width, depth, and type of base.
2. Width, depth, and type of paving.
3. Curbs, if required.
4. Side slopes.

5. Ditch section.
6. Crown slope; and
7. Utilities.

9-6.4 Others

1. Structural and detail plans of all structures, including, but not limited to, bridges, drainage structures, irrigation structures and sewer lines stamped by a Registered Engineer.
2. A signature box with spaces provided for City approval and for approval by all affected utility companies and irrigation districts.
3. Any other information required by the Public Works Director.

9-6.5 Construction Cost Estimate

1. Submit an itemized construction cost estimate. This estimate shall include all related street work and affected utility installation and/or related relocation, and all other improvements.

9-7 Sheet Sizes

9-7.1 ANSI Drawing Sizes

In order to provide uniformity in the City's drawing file system, the City uses ANSI drawing sizes as standard. ANSI sizes are multiples of 8.5 inches x 11 inches and permit uniform folding for filing, mailing and reproduction. Standard ANSI alphabetic sheet references are as follows:

- A = 8.5 inches x 11 inches
- B = 11 inches x 17 inches
- C = 17 inches x 22 inches
- D = 22 inches x 34 inches
- E = 34 inches x 42 inches

9-7.2 City Drawing Sizes

Please note that the City uses only sizes A, B and D. Other sizes will not be accepted unless prior approval is obtained from the City. The City's standard full-size sheet for design and drafting is 22 inches x 34 inches (D size) and the half size sheet for use in construction bid documents is 11 inches x 17 inches (B size).

9-8 Drawing Layout

9-8.1 Cover Sheet Arrangement

Cover sheets should be arranged in a clear and legible format. The determination of "clear and legible" is at the sole discretion of the City. Cover sheets and plans not meeting this requirement will be returned for re-formatting.

The Vicinity Map is defined as a map showing the closest street and/or street intersection for the purpose of aiding people in driving to the site. The cover sheet should contain a project title, a list of project drawings and a legend of line types and symbols used in the project. General notes and a list of abbreviations may be placed on the cover sheet as room allows.

9-8.2 General Drawing Sheet Arrangement

Drawings submitted to the City shall conform to good drafting practices and recognized techniques. When exceptions or special conditions occur, the draftsman may adjust these arrangements as required to suit the drawing package, subject to the approval of the City. Drawing format should read left to right; top to bottom; plans to the left and top. Number and letters identifying details and sections should also read left to right, top to bottom.

9-8.3 Plan and Profile Drawing Sheet Arrangement

Plan and profile sheets shall be divided into two sections horizontally. The upper half will be used for the plan view and the lower half will be used for the profile view. Plan and profile views shall differ in scale by a factor of 10 (i.e. – plan scaled at 1" = 20', profile will be scaled at 1" = 2').

9-9 Title Blocks

9-9.1 Preliminary Drawings

The following information should be provided in the title block as a minimum: project name, sheet content, date drafted, designer's initials, drafter's initials, checker's initials, and discipline and drawing number. If the plans are for an approved development and a file number has been issued by the Community Development Department, that file will be provided in the lower right corner of the title block before submitting.

9-9.2 Final Design Drawing & Record/As-built Drawings

Final drawings being submitted, shall be drawn on standard company title blocks, appropriately filled in stamped and signed.

When submitting AutoCAD drawings to the City, files should be saved in the base AutoCAD software without ARX or proxy objects attached. ARX objects are created when using programs that interface with AutoCAD. If the City receives drawings with these objects attached, the drawings will be returned to be corrected and resubmitted at no extra cost to the City.

9-9.3 Revisions

For every submittal to the City for review or approval, a revision must be placed in a revision block in the upper right-hand corner of the title block. Submittals prior to construction shall use alphabetic designations, the final design drawing set shall use revision 0 (zero), and submittals during the bid process, construction and after construction shall use number designations.

9-9.4 Discipline/Drawing Numbers

Each drawing should have a discipline/drawing number in the lower right-hand corner of the title block when submitted. These numbers are based on industry standard letter designations for each engineering/architectural discipline and incrementally increasing numbers (numbers should start with 1 except for facility master drawings). Letter designations are as follows:

- A - architectural
- C – civil (including surveys)
- D – miscellaneous details

- E – electrical
- M – mechanical
- S – structural
- T – cover (title) sheet

Other discipline letters that do not fit within the above scheme may be used.

9-9.5 Digital File Information

Along with design and drafting information provided in the title block, information about digitally created drawings is needed. In the upper right-hand corner is an area to fill in the electronic file name (i.e., AAA.DWG) and any model views that are twisted or rotated from a standard of North being the top of the sheet. The file name should be kept short but understandable to a non-engineering individual.

9-10 Layering (For Electronic Drawing Files)

9-10.1 General

For the most part, the general categories should be easy to identify. Within these categories, text and line work should always be kept on separate layers. Beyond that, the draftsman may use his/her best judgment while attempting to keep the number of layers to a minimum. If a reasonable determination cannot be made, contact the City for assistance.

Some CAD programs auto-generate their own layers and layer names (i.e. Autodesk's Land Desktop, Bentley's Inroads and Eagle Point). The City will accept this layering convention with one caveat: the names of the layers must be recognizable to a draftsman that does not work with or use that software. An example from Land Desktop of an auto-generated layer name is P-STALB. This should be changed to Proposed-STATION(ing)-LABEL or something equivalent. Abbreviations can be used so long as a non-engineer would understand what that layer stands for.

Prior to submitting electronic files to the City, purge unnecessary layers from the files. This serves two purposes: 1) to eliminate possible proxy objects generated by high-end design software and 2) to limit the number of layers to only those used within the design/survey drawings. The reason for this is that AutoCAD lose its ability to alphabetize layer names when more than 200 layers are listed. Also, turn off, freeze or no-plot layers that are not plotted on the submitted physical drawing.

9-10.2 Colors and Line Widths

The City uses a simple color system based on plotting requirements. The first seven primary colors of the AutoCAD palette (red through white) and colors 10-15 will be used to indicate new construction, colors 8 & 9 will be used to indicate existing features (surfaces, underground and utilities) and color 255 for objects that should be turned off prior to plotting (i.e. MVIEW frames, XCLIP boundaries, etc). DO NOT place objects on the Defpoints layer for the purpose of hiding them during plotting. The Table below is a minimum guideline for establishing line widths related to colors and object representation.

The City prefers assigning line widths to colors through the plotter pen table. If electronic drawings are submitted with forced line widths (by establishing a line width through the Layers Dialogue box), be sure the View Line width (LWT) button on the bottom tool bar is turned off.

Public Improvement Design & Construction Standards

Color	Representation	% Screen	Linewidth (in, min)	Remarks
Red (1)	Existing systems	0	0.020	use for showing existing features that need a light solid line
Yellow (2)	New construction	0	0.079	
Green (3)	New construction	0	0.118	
Cyan (4)	New construction	0	0.118	
Blue (5)	New construction	0	0.118	
Magenta (6)	New construction	0	0.118	
White (7)	New construction	0	0.118	
Light gray (8)	Background	35	0.118	use for background (i.e. XREF, contours) where a screen is needed
Dark gray (9)	Background	60	0.138	use for background (i.e. XREF, contours) where a screen is needed
White (255)	Objects to be turned off before plotting	0	0.118	

9-10.3 Linetypes

Linetypes will be related to legal description, utility or discipline system. The City primarily uses CONTINUOUS, DASHED, CENTER and HIDDEN2 as standard linetypes. Unique linetypes not addressed in these standards must be approved by the City project manager before final design submittal.

9-10.4 External Reference Dependent Layers

With the advent of external reference (XREF) files, the AutoCAD layering system has become more complex. All X-ref files should follow the basic layering rules as listed previous sections above.

X-refs are primarily used as a background to draw the new or future improvements. Colors assigned to XREF dependent layers will be the same as outlined in previous sections. The VISRETAIN variable in the receiving file should be OFF.

9-10.5 Layer Features

The plotting command allows the user to indicate to the plotter layers that should not be plotted but remain displayed in the electronic file. This is accomplished through they Layer Dialogue box. Also, individual layers can be turned on and off through unique paper space viewports. Use of these techniques will be up to everyone; keep in mind that the City will be interested in using both the base CAD model as well as the finished, plotted drawings.

9-11 Lettering

9-11.1 General

While it is not the goal of the City to remove individuality from the drafting process, in order to maintain uniformity and simplicity, the City has established standards when it comes to lettering that may be used on drawings being submitted to the City.

9-11.1.1 CADD Drafting

For CADD or other computer-produced drawings, the fonts shall be generally limited to those examples illustrated in the Standard Detail Drawing. For notes, callouts, design information, General Notes, headings, section and detail identification and tabular data, the single line font ROMANS or SIMPLEX should be used. For use in the titleblock, the more complex fonts should be used. To draw special attention to specific items, the bold and italic fonts may be employed.

Font size and weight shall be sufficient so as to be readable when D size drawings are reduced to one-half size. Text height shall be a minimum of 0.10 inches (tenth inch) high. The preferred text height shall be 0.125 inches (eighth inch) high. Only CADD produced lettering will be allowed on CADD produced drawings.

Text types and fonts, in no case shall the height of letters, hand, mechanically or CAD-produced, be less than 0.08 inches in height. In no case shall the width of mechanically produced or CAD lettering be less than 60%, nor, more than 150% of normal letter width.

When submitting CAD drawings with non-standard AutoCAD fonts, the shape (.SHX) file must be included in the submittal. Include fonts/shape files used in creating company logos that have been inserted into any CAD drawing being submitted.

9-11.2 Text Plotted at Other than Full Size ANSI D Drawing

When submitting documents printed a size different than full size, the text must be of a size and quality that can be easily read after the original document has been copied one time.

When submitting documents where ANSI sheet size A or B are the full-size document, text shall be a minimum of 0.1 (tenth) inch for normal text and 0.15 (fifteenth) inch for bold text.

9-11.3 Underlining

All titles of details, sections, elevations and views should be underlined with a single line having the same weight as the lettering used. Use the text underline (%%U) feature; DO NOT use an object line to underline text.

9-11.4 Orientation

All lettering shall be done to facilitate reading from the bottom or right-hand edge of the drawing. However, in no case shall it be carried farther than ten degrees (10°) counterclockwise past vertical.

9-11.5 Dimensions

Repetition of dimensions should be avoided. However, dimensioning must be adequate to facilitate field interpretation. Dimensions pertaining to length and width shall be shown on the plans. Dimension pertaining to height and elevations shall be shown on profiles, sections and architectural elevations unless a special condition requires both horizontal and vertical dimensioning to make the drawing or detail clearly understood.

Dimension lines shall be located far enough from the drawing (plan, elevation or detail) so that the line work cannot be confused with that of the drawing. Dimension lines shall not be as strong as the objective drawing lines. They should be fine, crisp and printable.

Avoid crossing dimension lines as much as possible. When crossing is unavoidable, break the longer of the lines at the point of crossing.

Dimension text shall be parallel to the dimension line and between the extension lines whenever possible. When using AutoCAD automated dimensions, if dimensions are too long to fit between extension lines, use the “best fit” feature in the dimension dialogue box. This will allow the drafter to “flip” the dimension text on either side of the extensions. When required, long dimensions may be located to the outside with leader extension from text to dimension line. This technique should be used only as a last resort.

Fractions shall not be stacked (they should be parallel with the dimension line). This is done because the drawings will be reduced to one-half size periodically.

9-11.6 Leaders

The note end of the leader should terminate with a short horizontal bar at the mid-height of the lettering and should run to the beginning or the end of the note, never to the middle. Leaders should be drawn at an angle to contrast with the principal lines of the drawing. Thus, leaders are generally drawn at 30, 45 or 60 degrees to the horizontal plane. When several leaders are used, they should be kept parallel, if possible.

The following should be avoided wherever possible:

- Long leaders
- Crossing leaders
- Leaders in a horizontal or vertical direction (except for short bar next to text)
- Leaders parallel to adjacent dimension lines.
- Leaders parallel to extension lines or crosshatching.
- Annotations shall be left justified regardless which direction the leader is drawn from. When noting sections, details and elevations, annotations should be parallel for ease of reading

9-12 Line Work

9-12.1 Manual Drafting

Manual drafting shall not be accepted.

9-12.2 CAD Drafting

Consistent line weight is important for drawing uniformity. When submitting plan and profile drawings, the City would prefer existing facilities and services be screened back, when plotted.

Polyline width, if drawn in model space and displayed in paper space, will vary in plotted widths depending on the model view scale factor. The widths listed herein are minimum plotted widths, not widths of polylines.

9-12.3 Screening Backgrounds

On plan drawings, lines and symbols used to depict existing topographic features and underground or overhead utility lines should be screened so that the difference between them and new construction is readily apparent. All line work shall be of enough width, weight and clarity so that it can be easily read from a print that has been reduced to one-

half the size of the original D size drawing. All pencil lines shall be firm enough to show clearly on the media. CADD drawings should be plotted using the overlay plotting feature, not the merge feature. All solid CADD line work should plot over screened backgrounds.

9-12.4 Linetypes

The City receives drawings and plan sets from several sources. In order to maintain the uniformity necessary to quickly and easily recognize drawing features, the City uses a limited number of different line types. Examples of line types that may require associated design or flow information (i.e. underground line size, slope and direction of flow) are included, along with the required method of providing the necessary data. All line types used should be included in the drawing set legend.

In some rare cases, situations or circumstances may require use of other line types. Use of any line type common to a engineering discipline is acceptable with City approval and the line type definition found in the ACAD.LIN file is included in final/record drawing submittals.

Line types should be scaled so that they are easily recognizable but do not dominate the drawing or interfere with design features.

9-13 Standard City Symbols

9-13.1 Discipline-Related Symbols

For the most part, the City will accept the drafting symbolism used by the company or draftsman submitting the drawing, provided that the symbols are generally accepted in the discipline of that drawing. Non-standard discipline symbology is subject to the approval of the City. Exceptions to this are in sanitary sewer, storm drainage, domestic water supply and geothermal systems. This is necessary to facilitate incorporation of the new systems into the City-wide system drawings. All drawings submitted to the City will require a legend of all symbols used on that drawing or drawing set.

When new landscaping is required, tree symbols should differentiate between deciduous and conifer. They should also show tree size as DBH (diameter breast high) and, if available, kind (apple, fir, oak, etc.). Bush and hedge symbols should, likewise, differentiate between deciduous and evergreen.

For utilities other than those identified above, features (poles, vaults, manholes, pedestals, valves, etc.) should be identified as to utility type.

Symbols should be scaled on the drawing so that they reasonably represent the location and, to the extent possible, size of the actual feature.

9-13.2 General Symbols

9-13.2.1 North Arrows

A north arrow shall be displayed in the upper left-hand corner of all plan sheets. Preferably, north arrows should point to the top of the drawing. When this is not possible, it should point to the left. When several plans are on the same sheet, the orientation of each plan shall be indicated by a separate north arrow (small size) placed at the upper left of each plan. CADD blocks of north arrows with attributes and insertion point.

Magnetic north shall not be shown on drawings unless accompanied by variation and annual change.

When necessary, a second north arrow, representing reference or facility north, shall be used on architectural drawings.

9-13.2.2 Graphic Scales

Graphic scales are optional on drawings submitted to the City. If it is necessary to use more than one scale on the same sheet, group in the lower right-hand corner all graphical scales that apply. Place numerical scales under each plan, detail, section and elevation.

Use an engineer's graphical scale for all civil drawings and maps. Use an architectural graphical scale for all other discipline drawings.

Graphical and numerical scales should be selected so they can be physically scaled whether the drawing is plotted full size or reduced to half size. Vertical scale for profiles should not exceed 1 inch = 10 feet (i.e. 1 inch = 20 feet not acceptable).

9-13.2.3 Section-Cuts, Section and Detail Callouts

Sections-cuts on plans shall be designated with letters and the drawing on which the section is drawn. Section-cuts can be repeated on the same plan provided the individual section-cuts are drawn on different drawings.

Details called on plans shall be designated with numbers and the drawing on which the detail is drawn. Detail numbers can be repeated on the same plan or section provided the individual details are drawn on different drawings.

9-14 City Standard Hatch Patterns

9-14.1 General

These should be scaled on drawings so that they are easily recognizable but do not dominate the drawing. If appropriate, they may be screened up to 50%, provided they still accomplish their intended purpose. Non-standard AutoCAD hatch patterns may be used if they are generally accepted for use in an engineering discipline. Include the hatch pattern in the drawing set legend. Submit the hatch pattern code from the ACAD.PAT file when submitting the final/record drawing sets.

9-15 Images, Pictures, Photographs

In the AutoCAD software, it is possible to insert pictures or photographs as background to be drawn over. When using these images, do not save the Windows file path. If any adjustment to the contrast, quality and size of the image, make note in the file what these setting should be.

9-16 Electronic File Submittals

The electronic files shall include unique font shape files, CTB (color dependent plotting) files, XREFs, images (.tiff, .jpeg, .bmp), EXCEL spreadsheets, WORD documents, attached databases and programming files (such as LISP or Visual Basic) used in the viewing or plotting of a drawing. If a menu was developed and is required for the viewing or plotting of CAD drawings, submit those with the drawing set.

SECTION 10 GUIDELINES FOR TRANSPORTATION IMPACT ANALYSES

10-1 Transportation Planning and Transportation Impact Analyses

Per the City’s adopted Transportation System Master Plan, Traffic Impact Analyses (TIA’s) are required when A) 500 or more trips per day generated by a new development. TIA’s can also be required when B) an access spacing exception is required and the development generates 25 or more peak hour trips (AM or PM hours) or 250 or more daily trips C) The development is expected to impact intersections currently operating at the upper limits of the acceptable range of level of service D) Development is expected to significantly impact adjacent roadways and intersections that have previously been identified as high accident locations or areas that contain a high concentration of pedestrians or bicyclists such as school zones . Any improvements affecting ODOT transportation facilities may require a TIA as determined by ODOT. Any deficiencies offsite noted in the TIA must have a plan developed on how to correct and a cost proposal developed jointly with the City & ODOT (if applicable) on how to fund.

10-2 The Need for Transportation Analyses for Individual Developments

The City’s development review process is designed to help the City achieve its goal of managing growth in a responsible and sustainable manner. The applicant for development is required to submit full and accurate information upon which the City staff and elected officials can base decisions. A developer-submitted transportation study, which must be prepared by a professional engineer registered with State of Oregon and qualified in the traffic engineering field, is a critical tool used by the City to assess the expected transportation system impacts associated with a proposed development and the long-term viability of the transportation system. A study must highlight development-specific issues, present a mitigation plan to mitigate for traffic impacts, and alert the City to the potential need to program specific projects from the TSP into the Capital Improvement Program (CIP).

10-2.1 The Level of Analysis and Documentation

This document establishes analysis and submittal requirements for developments in accordance with their expected transportation impacts. Under certain conditions, the City can allow a lesser level of analysis and documentation for small developments. In addition, other developments meeting specific criteria are exempted from long-range analyses.

10-3 Overview

10-3.1 Different Documentation for Different Development Proposals

This document describes the City’s required content for a **Transportation Analysis Letter (TAL)** and for a **Transportation Impact Study (TIS)**. In general terms, the TAL is applicable to smaller developments that are presumed to have a lesser transportation impact. The TIS applies to larger developments that are presumed to have a greater transportation impact.

Whether the development requires a TAL or a TIS, a professional engineer must prepare it and must use appropriate data, methods, and standards. TAL and TIS documents share many common elements, but the scope of TALs is more limited. Furthermore, there will be more variability in the scope for TISs depending on the type, location, and size of the development being proposed.

10-3.2 Content of Transportation Impact Analyses Generally

It shall be required that the person responsible for preparing the transportation impact analysis, first receive approval from the Public Works Department for the scope of work for the report. The scope of work at a minimum shall identify the study area, the study area intersections as indicated below, and trip generation anticipated based on rates contained in the latest edition of the ITE Trip Generational manual. Requests for deviation from the provisions of this chapter shall be submitted in writing to the Public Works Department. Transportation analyses, whether conducted to support a TAL or a TIS, are required to provide an objective assessment of the potential modal transportation impacts associated with a specific Land Use action (e.g., the development of vacant land, the redevelopment of an existing Land Use, a comprehensive plan amendment or zoning change). The analysis and the documentation provided by the applicant must help answer several important transportation related questions including:

- What level of safety and conditions occur at the study intersections (include crash history data for latest five years and crash rate calculations in terms of accidents per million entering vehicles (MEV) per year?
- Verify intersection sight distance at the site access points and conformance to AASHTO standards.
- Will the existing transportation system accommodate the proposed development from a capacity and safety standpoint?
- What on-site and off-site transportation system improvements will be necessary to accommodate the proposed development?
- How will access to the proposed development affect the traffic operations on the existing transportation system?
- How will transportation impacts of the proposed development impact the Land Uses, including commercial, institutional, industrial and residential uses within the development's influence area?
- How will the proposed development meet current City standards for roadway design?
- How will the proposed development ensure the safe and efficient circulation on and adjacent to the site?
- How will the proposed development provide needed connections to abutting parcels (developed or undeveloped) for motorized as well as non-motorized traffic?

10-3.3 Responsibilities of Those Preparing Transportation Analyses Generally

The responsibility for assessing the traffic impacts associated with a proposed Land Use action rests with the landowner or Land Use permit applicant. Transportation analyses submitted to the City must be prepared by or under the direct supervision of a Professional Engineer with competence in traffic engineering and registered in the State of Oregon. The report shall be signed and stamped by the professional engineer.

Under state law, engineers shall always recognize that their primary obligation is to protect the safety, health, property and welfare of the public in the performance of their professional duties.

These Guidelines in no way serve as a substitute for the application of sound professional engineering judgment expected to be used by practitioners in the preparation and submittal of transportation analyses.

10-3.4 Responsibilities and Authority for the City

Throughout this document the term “City Engineer” is used as the individual with authority for certain actions and for interpretation of aspects of these guidelines. For the purposes of this document, the term “City Engineer” should be taken to mean the “City Engineer or his/her designee.”

10-4 Transportation Impact Analysis Documents

An analysis and appropriate documentation is generally required when a development application and/or application for a comprehensive plan/zone map amendment is filed with the City. A transportation impact analysis is required when application is made for land to be subdivided; when application is made for a conditional use; when new development or redevelopment is involved, and with a planning design review application.

A transportation analysis is not required for modification of a single-family dwelling or for construction of a replacement dwelling. In most other circumstances and for most other development applications, some level of transportation analysis is required.

Recognizing that not all developments will have a significant impact on the transportation system, the City of Madras has developed criteria to help determine the need for and level of transportation analysis required in relation to the proposed development.

10-4.1 Determining the Required Level of Transportation Analysis and Documentation

A Transportation Impact Study (TIS) is required for developments that are expected to have an impact on the transportation system. When specific criteria generally associated with small developments are met, a Transportation Analysis Letter (TAL) may be substituted for the required TIS.

At the discretion of the City Engineer, a TAL may satisfy the City’s transportation analysis requirements, in lieu of a TIS, when a development meets all of the following criteria:

- A. The development generates fewer than 24 peak hour trips during either the weekday AM or PM peak hour and fewer than 250 daily trips;
Two examples of common developments generating fewer trips than these threshold levels are: a subdivision containing 24 or fewer single-family residences or a general office building less than 15,000 square feet.
- B. The development is not expected to impact intersections that currently fail to meet the City’s level of service standards or intersections that are operating near the limits of the acceptable level of service thresholds during a peak operating hour. (LOS standards are defined in 8-7.9.1); and
- C. The development is not expected to significantly impact adjacent roadways and intersections that are high accident locations, areas that contain an identified safety concern, or high concentration of pedestrians or bicyclists such as school zones.

10-5 Process and Procedures

This section describes in general terms the process and procedures followed by the City in relation to the processing and review of transportation impact analyses. Nothing in this section is intended to replace or supersede the City's process, code requirements, or obligations under state law regarding Land Use actions.

10-5.1 Pre-Application Meeting

A landowner or developer seeking to develop/redevelop property, request a zone change, subdivide or partition property, or develop/redevelop property shall contact the City Community Development Department and schedule a pre-application meeting. At the pre-application meeting, an applicant should be prepared to present the following in writing:

- Type of uses within the development.
- The size of the development.
- The location of the development.
- Proposed new accesses or roads.
- Estimated trip generation including ADT and peak hour values, and source of data; and
- Proposed study area and a list of study intersections subject to discussion.

10-5.2 Establishing the Scope of Work

During, or within a reasonable time following the pre-application meeting, the City will establish whether a TAL or TIS is required. If a TIS is required, the City will provide a scoping summary detailing the study area and any special parameters or requirements beyond the requirements set forth in this document. An applicant is encouraged, but not required, to propose a scope of work and a study area using the guidance presented herein.

10-5.2.1 Potential for Expansion of the Scope of Work

In the scoping summary the City as well as ODOT and Jefferson County will establish expectations and a study area within which significant impacts of the development are expected. The City's final decision on the Land Use criteria cannot be bound by the specifications or limitations in the scoping summary because additional information or concerns may come to light over the course of the analysis that causes the City to require additional analysis or information. Ultimately, it is the applicant's responsibility to demonstrate compliance with the criteria in the Madras code.

The City Engineer reserves the right to require additional analysis, especially when the need for such analysis becomes evident from information gathered by or presented by the applicant. The applicant's engineer should be alert to this possibility and expand his/her scope of work to address issues, especially those of public safety, or at least advise the City of such issues if they arise.

The City Engineer may at his/her discretion expand the requirements and/or study area of a TIS or TAL if needed to address any issue that comes to light after the preparation of the scoping summary.

10-5.2.2 Time Limit on the Scoping Summary

The City's scoping summary and review requirements are to be considered valid for a reasonable period of time but are not to be considered binding on the City. Applicants are advised that delays of more than a few months before submitting TAL or TIS documents significantly increases the likelihood that the City will need additional information to adequately evaluate the impacts of a proposed development.

10-5.3 Completeness Review

Upon completion of the TIS or TAL, the applicant will submit three (3) copies and an electronic PDF file of the PE-stamped document to the City Community Development Department for review. The TIS/TAL is due with the proposed application. At that time, City staff will perform an initial review of the project and the document to determine whether there are obvious omissions or concerns. The City will rely upon and make use of the completed and signed TIS checklist and which is to be incorporated as one of the first inside pages of the submittal to determine whether it is "complete."

Once the overall Land Use application, including the required TAL or TIS, as appropriate, is deemed "complete," the 120-day Land Use review process will begin.

10-5.4 Technical Review

Once the application is deemed complete, the City Engineer or their agent, will conduct a technical review of the TIS to determine the adequacy and quality of the work including, but not limited to the study data sources, methods, findings and recommendations. The City Engineer and/or his/her designee will provide findings for use by the City regarding expected transportation impacts from the proposed development.

If substantive errors or omissions are discovered during review, the applicant will be notified and asked to address the comments prior to a Land Use Decision. The applicant should promptly rectify omissions and respond with any additional analysis or information; a delay or refusal to respond may result in the denial of an application if the information and analysis submitted is insufficient to show compliance with the applicable criteria.

The lack of specificity on the part of the City in the scoping summary or confusion in its interpretation does not alter the applicant's responsibility to perform a thorough and comprehensive transportation analysis nor does it preclude City decision maker from determining that a TAL or TIS that fully complies with the scoping requirement is insufficient to show compliance with all applicable criteria.

Issues or problems discovered during the Technical Review may, at the discretion of the City's decision maker, be resolved through the use of conditions of approval.

10-6 Transportation Analysis Letter Contents

If the City determines based on information provided by the applicant and in accordance with the criteria specified that a TAL is the appropriate document to submit, the following requirements shall apply.

The TAL shall be prepared by or prepared under the direct supervision of a State of Oregon Registered Professional Engineer who shall sign and stamp the TAL.

The TAL shall include the following:

1. The expected trip generation of the proposed development including the weekday AM and PM peak hour and daily traffic, and other germane periods as may be appropriate, together with appropriate documentation and references. Include listing of all land uses and sizes (number of units, square footages, etc.) and ITE codes.
1. Site plan showing the location of all access driveways or private streets where they intersect with public streets, plus driveways of abutting properties and driveways on the opposite side of the street from the proposed development.
2. Documentation that all site access driveways meet Madras Private Access Driveway Width Standards and location.
3. Documentation that all proposed public streets meet Madras' Minimum City Street Intersection Spacing Standards.
4. Documentation that all new site accesses and/or public street intersections meet AASHTO intersection sight distance guidelines.
5. Documentation that there are no inherent safety issues associated with the design and location of the site access driveways.
6. Documentation that the applicant has reviewed the City's TSP and that proposed streets and frontage improvements do or will comply with any applicable standards regarding the functional classification, typical sections, access management, traffic calming and other attributes as appropriate.
7. Discussion regarding pedestrian connectivity between the existing adjacent transportation system and the site entrance(s).

10-7 Transportation Impact Study Contents

The following information shall be included in each TIS submitted to the City. Additional information specified by the City in the scoping summary or through the pre-application meeting or other project meetings shall also be included.

1. Completed TIS checklist signed by the Professional Engineer responsible for the preparation of the TIS.
2. Table of Contents – Listings of all sections, figures, and tables included in the report.
3. Executive Summary – A summary of key points, findings, conclusions, and recommendations including a mitigation plan.
4. Introduction – Proposed Land Use action including site location, zoning, building size, and project scope. Map showing the proposed site, building footprint, access driveways, and parking facilities. Map of the study area that shows site location and surrounding roadway facilities.
5. Existing Conditions:
 - Existing site conditions and adjacent Land Uses.
 - Roadway characteristics of important transportation facilities and modal opportunities located within the study area, including roadway functional classifications, street cross-section, posted speeds, bicycle and pedestrian facilities, on-street parking, and transit facilities.
 - Existing lane configurations and traffic control devices at the study area intersections with figures illustrating the lanes and traffic control at intersections.

- Existing traffic volumes and operational analysis of the study area roadways and intersections.
 - Roadway and intersection crash history analysis.
 - Intersection and stopping sight distance related to new and impacted driveways and intersections.
6. Background Conditions (without the proposed Land Use action)
- Establishment of the background year (City to confirm).
 - Approved in-process developments and funded transportation improvements (City to furnish this data upon request, generally consisting of flow mapping of the site generated trips for the associated approved but not built developments.)
 - Traffic growth assumptions (City to provide input on the growth rate methodology).
 - Addition of traffic from other planned developments.
 - Background traffic volumes and operational analysis.
7. Full Buildout Traffic Conditions (with the proposed Land Use action)
- Description of the proposed development plans.
 - Trip generation characteristics of proposed project (including trip reduction documentation).
 - Trip distribution assumptions.
 - Full build-out traffic volumes and intersection operational analysis.
 - Site circulation and parking.
 - Intersection and site-access driveway queuing analysis using 95th percentile values.
 - Recommended roadway and intersection mitigation measures (if necessary).
8. Conclusions and recommendations
9. Appendix- with dividers or tabs
- Traffic count summary sheets.
 - Crash analysis summary sheets.
 - Existing, Background, and Full Build-out traffic operational analysis worksheets with detail to review capacity calculations.
 - Signal (peak hour warrant), left-turn, and right-turn lane warrant evaluation calculations.
 - Signal timing sheets (City or ODOT to provide intersection timing and phasing data to consultant) depicting the timing and phasing used in analysis.
 - Other analysis summary sheets such as queuing.

To present the information required to analyze the transportation impacts of development, the following figures shall be included in the TIS:

1. Vicinity Map
2. Existing Lane Configurations and Traffic Control Devices

3. Existing Traffic Volumes and Levels of Service for each required time period
4. Future Year Background Traffic Volumes and Levels of Service for each required time period
5. Proposed Site Plan, including access points for abutting parcels and for those across the street from the proposed development
6. Future Year Assumed Lane Configurations and Traffic Control Devices (if different from the Existing Conditions)
7. Estimated Trip Distribution/Assignment Pattern
8. Trip reductions (pass-by trips at site access(s))
9. Site-Generated Traffic Volumes for each required time period
10. Full Build-out Traffic Volumes and Levels of Service for each required time period

10-8 Standards and Procedures

To help ensure consistency in the preparation and review of each TIS and TAL, the City of Madras has established a set of guidelines and procedures. These standards and procedures include the following:

- Preparer qualifications
- TIS study area
- Analysis years and time periods
- Data collection guidelines
- Trip generation guidelines
- Trip distribution and assignment guidelines
- Minimum intersection operational standards
- Minimum access spacing standards
- Level of Service (LOS) analysis methodology based on the latest year Highway Capacity Manual (HCM) criteria using approved software such as Synchro version 9 (use of alternative software must be pre-approved by City); and
- Other analysis guidelines.

10-8.1 Preparer Qualifications

Each TIS and TAL shall be prepared by or under the direct supervision of a Professional Engineer registered in Oregon or a Professional Engineer registered in Oregon qualified to perform traffic engineering as defined by OAR 820-040-0030. The engineer must have background and experience in the methods and concepts associated with transportation impact studies. Each TIS and TAL shall be sealed and signed by the Professional Engineer prior to acceptance by the City for a technical review.

10-8.2 TIS Study Area

Each TIS shall include a vicinity map that shows the site, the study area, and the surrounding transportation system. A brief description of the site location and study area shall be provided. The study area shall be based on engineering judgment and an understanding of existing and future Land Use and traffic conditions in the vicinity of the site. The following considerations shall form the basis of establishing the study area It

shall be required that the person responsible for preparing the transportation impact analysis, first receive approval from the Public Works Department for the scope of work and study area. Requests for deviation from the provisions of this chapter shall be submitted in writing to the Public Works Department.

The following facilities shall be included in the study area for all TIS's:

- All site-access points and intersections (signalized and unsignalized) adjacent to the proposed site (except residential dwellings). In, if the proposed site fronts an arterial or collector street, the analysis shall address all intersections and driveways along the site frontage, including those serving parcels on the opposite side of the street(s).
- The existing street infrastructure along the property frontage and through the site (i.e., right-of-way, sidewalks, bicycle lanes, medians, driveway aprons).
- All street connection points to abutting arterials and collectors.
- Any intersection with an interchange, or ramp terminal, and any arterial-arterial intersection, arterial-collector intersection or collector-collector intersection, that is within one-mile driving distance of the site and has more than 15 peak hour trips added to any lane group. The driving distance shall be measured from each access point (driveway or street) of the development onto the transportation system.
- All intersections needed for signal progression analysis.
- Other transportation facilities required to be studied by the Transportation Planning Rule, OAT 660-012-0060.
- As indicated herein, the applicant is encouraged to propose a study area at the pre-application meeting or in response to the discussions between the applicant and the City's representatives.
- In addition to these requirements, the City Engineer may determine any additional intersections or roadway links that may be adversely affected as a result of the proposed development. The applicant reduces his risk of having an adverse staff report if the applicant reaches agreement on the scope with the City Engineer prior to the start of the transportation impact analysis.

10-8.3 Analysis Years to be Analyzed in the TIS

To adequately assess the impacts of a proposed Land Use action, several study periods should be addressed in the transportation impact analysis. These study periods or horizon years consist of the following:

- Existing Year

Background – The conditions in the year in which the proposed Land Use action will be completed and occupied, but without the expected traffic from the proposed Land Use action. This analysis should include all in-process developments, or City approved developments that are expected to be fully built out in the proposed Land Use action horizon year. It should also account for all in-process/planned transportation system improvements that are provided by the City.

Note: Depending on funding or project development issues, it may not be appropriate to assume that certain planned transportation system improvements will be in place on opening day. Applicants should contact the City Engineer to confirm appropriate assumptions.

Full Build-out – The background condition plus traffic from the proposed Land Use action assuming full build-out and occupancy.

Phased Years of Completion – If the project involves construction or occupancy in phases or for master plans, the applicant is expected to assess the expected roadway, intersection, and Land Use conditions resulting from major development phases. Phased years of analysis will be determined in coordination with City staff.

20-Year or TSP Horizon Year – For comprehensive plan amendments, zone changes, and conditional uses, the applicant shall assess the expected future roadway, intersection, and Land Use conditions resulting from deviations from approved comprehensive planning documents.

A twenty-year or TSP Horizon Year analysis will not be required for the following development proposals:

- For out-right permitted uses under the current zoning.

10-8.4 Analysis Periods to be Analyzed in the TIS

Within each analysis year, specific consideration should be directed to the time period(s) that experience the highest degree of network travel. These periods typically occur during the weekday morning (7:00AM to 9:00AM) and weekday evening (4:00 PM to 6:00 PM) peak commuting hours.

The TIS shall address the weekday AM and PM peak hours when the proposed Land Use action is expected to generate 25 trips or more during the peak time periods. If the applicant can demonstrate that the peak hour trip generation of the proposed Land Use action is fewer than 25 trips during one of the two peak study periods and the peak trip generation of the Land Use action corresponds to the roadway system peak, then only the worse of the two peak periods must be analyzed. This does not mean, however, that all aspects of the other peak period can be ignored. The applicant should consider, for example, the possibility that inbound and outbound trips at the site driveway have specific operational issues that may need to be addressed for both peak hours.

Depending upon the proposed Land Use action and the expected trip generating characteristics of that development, other time periods may be specified, either as a substitute for, or in addition to the weekday AM and PM peak hours. Examples of Land Uses that have non-typical trip generating characteristics include schools, restaurants, movie theatres, nightclubs, and churches. Applicants should assume that the City will require additional analysis periods for certain uses as summarized below:

- Schools – End of the school day (early afternoon) peak hour
- Churches and worship facilities – Peak period prior to and after worship services.
- Restaurants – Mid-day weekday peak hour
- Shopping centers, home improvement centers, superstores, and retail facilities of more than 60,000 square feet – Saturday peak hour.

When the additional hours for analysis are specified, the applicant need not necessarily carry the analysis through all steps if the data and the engineer's analysis show that some time periods clearly represent the worst case. If, for example, the mid-day peak period traffic volumes at a restaurant are lower than the other peak periods, except at the site driveway, the mid-day peak need only be analyzed for the driveway location. The engineer preparing the TIS is advised to provide thorough documentation of the reasons for reducing the scope of the extra time periods. The applicant may choose to

bring such issues to the attention of the City Engineer for discussion prior to submittal of the TIS.

The above list is not necessarily an all-inclusive list of uses for which additional analysis periods is required. The City Engineer and applicant should discuss the potential for additional study periods prior to the start of the transportation impact analysis.

10-8.5 Applications Involving Zone Changes

In the case of a Land Use proposal involving a zone change, the TIS must analyze a 20-year horizon period as required by the Oregon Transportation Planning Rule (TPR) and may require interim years in the case of a master plan that also requires a zone change. Applicants seeking a rezoning are advised that in addition to any requirements specified by the City, it is their obligation to address requirements in OAR 660-12-0060. The City's exemption from the requirement for 20-year analysis for certain rezoning actions as specified in these standards may not exempt the applicant from addressing TPR requirements.

For proposals involving rezoning, the applicant shall compare the traffic generated by his/her development proposal, a reasonable worst-case development under the proposed zoning and a reasonable worst-case development under current zoning.

10-8.6 Traffic Count Requirements

Once the TIS study area and analysis periods have been determined, turning movement counts shall be collected at all study area intersections to determine the base traffic conditions. These turning movement counts should typically be conducted during the weekday (Tuesday through Thursday) between 7:00 a.m. – 9:00 a.m. and 4:00 p.m. – 6:00 p.m. and for other periods depending upon the proposed and/or surrounding Land Uses. Historical turning movement counts may be used if the data is not more than 12 months old at the time the TIS is deemed complete for review.

Historical counts shall be factored accordingly to meet the existing traffic conditions. In high traffic locations where congestion is present or traffic peaks early or late, extended or altered count periods may be required.

10-8.7 Trip Generation for the Proposed Development

To determine the impacts of a proposed development on the surrounding transportation network, the trip generation characteristics of that development must be estimated. Trip generation characteristics should be obtained from one of the following acceptable sources:

- Institute of Transportation Engineers (ITE) Trip Generation (latest edition).
- Specific trip generation studies that have been conducted for the particular Land Use for the purposes of estimating peak hour trip generating characteristics, subject to approval by the City Engineer prior to their inclusion in the transportation impact analysis.

In addition to new site generated trips, several Land Uses typically generate additional trips that are not added to the adjacent traffic network. These trips include pass-by trips and internal trips and are separate from the total number of new trips generated by the proposed development. The procedures listed in the (ITE) *Trip Generation Handbook* should be used *where appropriate* (emphasis added) to account for pass-by trips and internal trips. The applicant's engineer shall not use any pass-by or internal trip reductions with prior approval of the method or data sources by the City Engineer.

Special Attention Items

The *ITE Trip Generation Handbook* maintains limited data regarding pass-by, diverted-linked, and internal shared trip-making characteristics. Professional judgment needs to be used in applying this data. For example, it is not appropriate to apply PM peak hour pass-by percentages to AM or daily periods where AM and daily percentages do not exist. Also, ITE's internal shared trip characteristics are based on a limited number of studies from the early 1990's in Florida. These sites included a mix of commercial, residential, retail, and other uses. For developments that contain only one or two of these uses, a maximum shared trip reduction of five percent (5%) will be allowed without appropriate justification and supporting data from the applicant.

The *ITE Trip Generation Handbook* outlines specific guidelines for use of weighted average trip rates versus regression equations. These guidelines shall be followed unless the applicant provides valid justification for deviation.

10-8.8 Trip Distribution and Assignment

Estimated site generated traffic for the proposed development should be distributed and assigned to the existing or proposed arterial and collector street network. Trip distribution methods should be based on a reasonable assumption of local travel patterns and the locations of off-site origin/destination points within the site vicinity. Acceptable trip distribution methods should be based on one or more of the following procedures:

- An analysis of local traffic patterns and intersection turning movement counts can be used if the data has been gathered within the previous twelve months.
- A detailed market study specific to the proposed development and surrounding Land Uses may be used to determine the specific influence area. Site generated traffic within the identified influence area should be distributed based on principles and concepts associated with the gravity model theory. Note that if a market study is to be used as a basis for trip distribution, the entire market study must be made available to the City and it shall become part of the public record and, as such, any client confidentiality is lost.
- Combination of the above and engineering judgment.

Special Attention Items

In the case of retail developments, the applicant shall clearly distinguish between pass-by and non-pass-by trips to allow the reviewer to understand how the pass-by trips were accounted for and applied throughout the study area. The treatment of pass-by trips at the site entrance may be most easily addressed through separate figures depicting the total site trips and the individual pass-by and non-pass-by components.

10-8.9 Intersection Operational Standards

To assess the impacts of the proposed Land Use action on the transportation system, the TIS shall compare the existing, background, and full build-out intersection traffic volumes to the minimum intersection operational standards.

The City of Madras evaluates intersection operational performance based on the Level of Service (LOS) as defined in the most current *Highway Capacity Manual (HCM)* published by the Transportation Research Board.

LOS calculations for signalized intersections are based on the average control delay per vehicle, while LOS calculations for unsignalized intersections are based on the average

control delay and volume-to-capacity (v/c) ratio for the worst or critical movement. All LOS definitions should be consistent with the most recent version of the *HCM*.

10-8.9.1 Intersection Level of Service (LOS) Standards

The City of Madras requires all intersections within the study area to maintain an acceptable level of LOS upon full build-out of the proposed Land Use action.

Madras' minimum acceptable LOS is defined as follows for signalized intersections throughout the City:

- *LOS "D" or better for the intersection as a whole and no approach operating at worse than LOS "E" and a v/c ratio not higher than 1.0 for the sum of critical movements.*

Madras' minimum acceptable LOS is defined as follows for unsignalized intersections throughout the City:

- *LOS "E" or better for the poorest operating approach and with no movement serving more than 20 peak hour vehicles operating at worse than LOS "E." In other words, LOS "F" will be tolerated for minor movements during a peak hour.*
- Study intersections occurring on ODOT's transportation system shall conform to their mobility standards as identified in the Oregon Highway Plan, Policy 1F: Highway Mobility Policy.

10-8.9.2 Intersection Design Features and Queuing Calculations

The TIS shall contain sufficient data and information derived from the traffic impact analysis to provide the roadway/intersection designer and City staff with information on which to assess intersection design features such as the length of storage required for lanes on each approach.

Queue lengths shall be calculated for each lane of all approaches to signalized intersections for the 95th percentile queue. Queue lengths shall also be calculated for unsignalized locations, such as site driveways, where standing queues can interfere with other movements, especially if such interference can contribute to safety problems. Appropriate analysis methods should be used that account for the actual arrivals of vehicles at an intersection.

Special Attention Items

The applicant's engineer shall use professional judgment in selecting the appropriate analysis tools and methods for evaluation of intersection operations. The HCM, for example, states "The [HCM] methodology does not consider the potential impact of downstream congestion on intersection operation. Nor does the methodology detect and adjust for the impacts of turn-pocket overflows on through traffic and intersection operation." If these conditions are present or can reasonably be expected to exist as a result of the proposed development, the applicant's engineer shall supplement his/her initial analysis with other analysis tools and methods that account for such conditions.

The applicant's engineer also must use reasonable signal timing and consider corridor timing plans where appropriate.

When calculating queues, Poisson distribution may be used for locations subject to random arrivals. Other analysis methods shall be used where signal systems cause

different arrival patterns and when congestion causes accumulation from one cycle to the next. Queue lengths shall be based on average vehicle length of twenty-five feet (25'), or longer where appropriate.

10-8.10 Access Spacing Standards

Access locations on roadway sections must be located to ensure safe and efficient travel along a transportation facility to limit potential conflicting turning movements, weaving maneuvers over short distances, and congestion along facilities. Access management standards vary depending upon the functional classification and purpose on a given roadway. Roadways in the upper echelon of the functional classification system (i.e. arterials) tend to have stringent spacing standards, while facilities ranked lower in the functional classification system allow more closely spaced accesses.

The applicant shall use the *Proposed Access Management Strategy* as outlined in the *Madras Urban Area Transportation Systems Plan* and discuss whether the following standards are met through their proposed development:

- Minimum City street intersection spacing (the distance between adjacent intersections)
- Minimum private access spacing (the distance between adjacent driveways and between driveways and street intersections)
- Minimum traffic signal spacing (the distance between adjacent signalized intersections)
- Minimum private access driveway widths (the measurement of the individual driveway surface)

Exception Process:

In cases where physical constraints or unique site characteristics limit the ability for the above access spacing standards to be met, the City decision maker may grant an access spacing exception. Typically, access exceptions are available only for a parcel whose roadway frontage, topography, or location would otherwise preclude issuance of a conforming permit and the parcel would either have no reasonable access or cannot otherwise obtain reasonable alternate access to the public road system. However, if the limitation or condition is one that the applicant or owner has contributed to by any previous subdivision of property, sale, building activity, or site development, the limitation or condition shall not constitute a basis for an access exception. Note also that the City may choose to prohibit some movements (e.g. left turns) at the site access location, especially if such access is in a location where an access exception is needed.

When an exception is required, the transportation impact analysis must show that the new access will not adversely impact the existing transportation system. A high burden is placed on the applicant and his/her engineer to prove that the system will not be adversely impacted, and that public safety will not be compromised.

10-8.11 Sight Distance

For all new proposed site driveways and public street intersections, an evaluation of stopping sight distance (SSD) and intersection sight distance (ISD) shall be conducted consistent with procedures outlined in the current version of the *AASHTO Policy on Geometric Design of Highways and Streets*. At the discretion of the City Engineer, the applicant may be exempted from a need to assess sight distance.

The City standard for new driveways and intersections requires that ISD meet the minimum distance specified in AASHTO. The applicant may apply for a design exception allowing a driveway or intersection that meets SSD rather than ISD. A high burden is placed on the applicant and his/her engineer to prove that the system will not be adversely impacted, and that public safety will not be compromised. The City Engineer may grant a design exception if the following conditions are met: 1) the intersection or driveway is proposed to intersect with a local or neighborhood collector street (not a major collector or arterial street); and 2) the approach is forecast to serve fewer than forty (40) vehicles per day; and 3) the intersection will not adversely impact the existing transportation system. The City Engineer may also grant a design exception if the intersection is forecast to serve less than 100 vehicles per day for a period of not more than twenty-four (24) months. Should the City Engineer choose to grant a design exception, he/she may place additional conditions on the applicant, such as, but not limited to placement of warning signs or the use of flaggers for manual traffic control as prescribed by the *Manual on Uniform Traffic Control Devices*.

Special Attention Items

Under AASHTO procedures, intersection sight distance are evaluated based on the roadway design speed – not the roadway posted speed. Where design speed is not known, it shall be estimated using procedures outlined in the *AASHTO Policy on Geometric Design of Highways and Streets*. This generally results in a design speed anywhere from 5 to 10 mph above prevailing posted speed.

10-8.12 Crash History

Within the study area for each TIS, a crash history evaluation shall be conducted for the most recent three-year period. Crash data shall be obtained from local jurisdictions and ODOT. The intent of the evaluation is to identify any apparent trends in the data that reflect a safety issue that may be exacerbated by the proposed development and to identify mitigation to resolve the issue(s). At a minimum, the analysis shall summarize the number of crashes per year by type and severity. Intersection crash rates shall be calculated and evaluated. The engineer shall assess the overall results of the safety analysis.

10-8.13 Safe Routes to School

For proposed residential developments, the TIS shall include a brief discussion of routes to the nearest schools. The applicant shall identify the primary walking/biking route between the proposed development and the nearest elementary, middle and high school. Specifically, the applicant shall describe the general bicycle and pedestrian environment between the proposed development and each school, including the presence and condition of pedestrian and bicycle facilities and the roadway environment (speed, lanes, etc.) along the routes. This section requires applicants to address the special need to link residential areas to area schools.

10-8.14 Warrants (Turn Lane, Traffic Control)

The following section provides guidance on evaluating turn lane and traffic signal warrants.

10-8.14.1 Traffic Control Warrants

An evaluation of traffic signal warrants shall be conducted for all unsignalized study area intersections where any approach is shown to operate at LOS E or worse under

existing, background, or total traffic conditions. Signal warrant analysis shall be conducted in accordance with the current version of the *Manual on Uniform Traffic Control Devices for Streets and Highways*.

Warrants to evaluate conversions between yield control, two-way STOP control, and multi-way-STOP control shall, as deemed necessary by the applicant's traffic engineer, comply with the *Manual on Uniform Traffic Control Devices*.

Special Attention Items

The reduction of minor street right turns is an important factor in evaluating traffic signal warrants and care must be taken to ensure the practice is not overlooked or improperly applied as it can affect warrant determinations. Both the *Manual on Uniform Traffic Control Devices* and the *National Cooperative Highway Research Program (NCHRP) Report 457- Evaluating Intersection Improvements: An Engineering Study Guide, 2001* offer detailed discussions of the proper methods to address right turn reductions.

For state highways, ODOT's Transportation Planning Analysis Unit maintains specific guidelines regarding right turn reductions that shall be applied to highway intersections. Other methods such as delay-based reduction methods may be considered if reasonably explained and justified by the applicant.

The construction of a lane to accommodate right turns shall be considered as a mitigation measure before or in addition to the analysis of traffic signal warrants for the installation of a traffic signal.

Note that Warrant 3, Peak Hour according to the *Manual on Uniform Traffic Control Devices* "shall be applied only in unusual cases." The burden of proof is on the applicant that the case is truly unusual. The applicant must evaluate the conditions using other warrants before attempting to justify the use of the Peak Hour warrant.

10-8.14.2 Turn Lane Warrants

The provision of dedicated left- and right-turn lanes on the major approach to an unsignalized intersection can significantly improve operations and safety at an intersection. The provision of a second lane on minor street approaches at unsignalized intersections can significantly reduce side street delay for right-turning motorists.

The applicant's engineer shall exercise professional judgment in evaluating the need for, and benefits of, providing dedicated left-turn and right-turn lanes. Documentation of the engineer's analysis of turn lanes shall be provided in the TIS.

The following is a non-exclusive list of conditions where an evaluation of turn lanes is appropriate:

- When no lane is currently provided for left turns and when left turn movements from the major street are predicted to increase because of the proposed development. This is especially appropriate when a turn lane is included as part of the standard cross-section for a street of this classification in the Transportation System Plan.
- When an intersection has a crash rate above 1.0 crashes per million entering vehicles and includes crash types subject to improvement from a turn lane.

- When the speed and volume of through traffic and increases predicted in right turn volumes raise concerns in the engineer's professional judgment about safety or about impeding through traffic.
- When only a single lane is provided for minor street approaches and the approach LOS is calculated to be "E" or worse.

The following are some of the references that should be considered by the applicant's engineer:

- **State Highways** - The Oregon Department of Transportation (ODOT) maintains criteria that shall be used for evaluating development of left- and right-turn lanes along state highways at Unsignalized Grade Intersections.
- **Local Streets** - Much of the published information regarding warrant criteria are centered on highway facilities and practitioners have therefore applied these criteria to local streets. The applicant shall refer to pages 686-89 of the 2001 *AASHTO Policy on Geometric Design of Highways and Streets* when evaluating turn lane warrants. Specifically, the applicant shall draw from other sources [see sources 2, 11, 12, and 13] cited by AASHTO. This criterion shall be updated coinciding with future revisions to the AASHTO Policy. An additional resource not cited by AASHTO is the *National Cooperative Highway Research Program (NCHRP) Report 457- Evaluating Intersection Improvements: An Engineering Study Guide, 2001*.

10-9 Common Errors and Omissions

The following are some common errors and omissions. Special care should be taken to address these items that are part of the TIS requirements identified herein.

- Failure to include a crash analysis.
- Failure to conduct a warrant analysis or incorrect methods, particularly a failure to account for right turns from minor streets.
- Failure to address access spacing.
- Lack of discussion of observed traffic flow.
- Failure to address intersection and/or stopping sight distance.
- Failure to discuss bicycle, pedestrian and transit facilities.
- Failure to present justification for some assumptions.
- Failure to account for downstream congestion, turn-pocket overflow, or signal timing of adjacent traffic signals (particularly regarding the selection of software analysis tools).
- Use of unrealistic signal timing.
- Use of inappropriate tools and assumptions for calculation of queues.

10-10 TIS CHECKLIST

All TISs submitted to the City of Madras must include the City's *Transportation Impact Study Checklist*. This checklist, presented on the following page, is designed to help the applicant address the City's requirements and to help the City staff determine whether it is complete as specified herein.

Public Improvement Design & Construction Standards

The completed and signed checklist shall be incorporated into the bound TIS following the inside cover page and preceding the Table of Contents.

TRANSPORTATION IMPACT STUDY CHECKLIST

Project _____ Name:

City _____ Reference _____ Code:

Provided? Page No.

Yes No _____ Study Required Comment: _____ Date: _____

BACKGROUND INFORMATION

Yes No _____ Oregon PE Stamp and Signature

Yes No _____ **INTRODUCTION AND SUMMARY**

EXISTING CONDITIONS

Yes No _____ Roadway Network - summary of roadway classifications, lanes, speeds, transit service and facilities, alternative mode service and facilities (e.g., sidewalks, bike lanes, crosswalks) and description of study area

Yes No _____ Analysis Periods Correct (AM, Mid-day, PM Afternoon _____, Saturday _____, Other _____)

Yes No _____ Existing Traffic Operations (Existing LOS, traffic volumes (new counts) , speeds , crash data)

IMPACTS

Yes No _____ Trip Generation - Daily, peak hour trips generated by site development

Yes No _____ Level of Service Analysis -projected LOS with site build out, existing, and background traffic growth

Yes No _____ Future year 20-year analysis required for zone change or conditional use

Yes No _____ Signal Warrant Analysis

Yes No _____ Turn Lane Warrant Analysis

Public Improvement Design & Construction Standards

- Yes No _____ Access Spacing Standards
- Yes No _____ Analysis of intersection and stopping sight distance at frontage road access point(s)
- Yes No _____ Identify safe route to school or school bus stop (Contact with school district)
- Yes No _____ Analysis of safe pedestrian/bicycle access to nearest transit stop (if within 1/2 mile of project site)
- Yes No _____ Identify accessibility to public transit
- Yes No _____ Account for planned roadway improvements at future build year and 20-year horizon

MITIGATION

- Yes No _____ Identify need for right/left turn lanes, storage capacity and length
- Yes No _____ Identify possible corrections of any LOS deficiencies
- Yes No _____ Identify any access deficiencies (including transit/pedestrian/bicycle connections)
- Yes No _____ Identify any TDM measures

FIGURES

- Yes No _____ Vicinity Map
- Yes No _____ Site Plan
- Yes No _____ Existing peak hour turn movement volumes (counts conducted within previous 12 months)
- Yes No _____ Trip Distribution (%) including Added Project Peak Hour Traffic Volumes (see sample)
- Yes No _____ Approved Projects Peak Hour Traffic Volumes (see sample)

Public Improvement Design & Construction Standards

Yes No _____ Programmed transportation improvements and transportation mitigation outlined in study

TABLES

Yes No _____ Intersection Performance Existing Conditions

Yes No _____ Project Trip Generation

Yes No _____ Intersection Level of Service

OTHER

Yes No _____ Technical appendix - sufficient material to convey complete understanding of traffic issues (e.g. HCM or similar analyses, trip generation calculations, signal warrant analyses, turn lane warrant analyses, queuing calculations, signal timing sheets, traffic counts, etc.)

Completed By: _____

[SEAL]

Date: _____

SECTION 11 STANDARD DRAWINGS

11-1 Referenced Standard Drawings

The following drawings are maintained and updated by the Oregon Department of Transportation (ODOT); the most updated drawings will be found at the following website: <http://www.oregon.gov/ODOT/Engineering/Pages/Standards.aspx>

-A-

Access and Ventilation	
Hardware for Concrete Box Girders	BR135, BR136
Air Release/Air Vacuum Assembly, Water System	RD266, RD270
Anchors, Pipe Slope	RD330, RD332
Approaches	RD715

-B-

Barricades (Types I, II, & III)	TM820
Barrier, Concrete, Median 35" cast-in-place	RD590
Barrier, Concrete, Standard (32" Height)	
Around Median Obstacle	RD535
At Bridge Expansion Joints	BR263
Buried in Backslope	RD526
Cast-In-Place	RD505
Median Barrier Anchoring	RD515
Precast	RD500
Securing Barrier to Roadway	RD516
Terminals	RD510
Transition to Bridge Rail	RD520
Transition to Guardrail	RD530
Barrier, Concrete, Tall (42" Height)	
Around Median Obstacle	RD575
Precast	RD545
Securing Barrier to Roadway	RD516
Transition to Bridge Rail	RD550
Transition to Standard Barrier	RD560
Transition to Guardrail	RD570
Barrier, Metal Median	RD400, RD405
Box Culvert, Concrete	
Cast-in-place	BR820, BR825, BR830, BR835
Double Box Culverts	BR840, BR841
Extensions	BR805
Modified Type 2A Guardrail	BR266
Wingwalls	BR800

Public Improvement Design & Construction Standards

Boxes		
	Trapezoidal Box Reinforcement	BR133
Bridge End Panel		BR165
Bridge Concrete Parapet		
	32" Vertical	BR221
	With Steel Post	BR214
Bridge Rail		
	2-Tube Curb Mount	BR206, BR207
	2-Tube Side Mount	BR226, BR230
	3-Tube Curb Mount	BR208, BR209
	Combination	BR223
	Concrete Post and Beam	BR212
	Flush Mount Combination	BR220
	Pedestrian	BR246
	Pedestrian On Sidewalk Mount Parapet	BR250
	Pedestrian Retrofit	BR286
	Sidewalk Mount Combination	BR216
	Sidewalk Mount Parapet with Chain Link Fence	BR253
	Thrie Beam	BR233
	Thrie Beam Retrofit	BR273
	Trailing End Connection to Guardrail	BR236
	Transition from Guardrail	BR270, BR276
	Transition to Guardrail	BR203
	Transition to Guardrail, 3'-6" Height	BR291
	Type F	BR200
	Type F 3'-6" Height	BR290
	Type F Replacement	BR280
	Type F Retrofit	BR283
	Type F with Chain Link	BR260
	Type F with Pedestrian Rail	BR256
	-C-	
Cattle Guard		
	Painted	RD110
	Steel Tube	BR175
Cattle Pass		RD110
Check Dams		RD1005
Concrete Pavement		
	Plain Dowelled	RD600
	Reinforced	RD600
Construction Entrances		RD1000
Coupling Bands for Corrugated Metal Pipe		RD326
Cross Slopes, Roadway Superelevations		RD140

Public Improvement Design & Construction Standards

Cutbanks, Rounding		RD150
	-D-	
Delineators		
Installation		
Freeways		TM575
Non-Freeway		TM576
Special Applications		TM577
Layout and Posts Types		TM570
Steel Post Details		TM571
Drainage Details		
Bore Casing		RD308
Concrete Encasement, Cradle, and Cap		RD306
Locator Post		RD334
Open Grade HMAC Details		RD314
Driveways		
Curb Line Sidewalk		RD730, RD735, RD745, RD750
Non-Sidewalk		RD715
Separated Sidewalk		RD725, RD740
	-E-	
End Pieces, Guardrail		RD415
Erosion Control		
Check Dams		RD1005
Construction Entrances		RD100
Inlet Protection		RD1010, RD1015, RD1020
Matting		RD1055
Scour hole, Temporary		RD1050
Sediment Barrier		RD1025, RD1030, RD1035
Sediment Fence		RD1040
Slope Drains, Temporary		RD1045
Tire Wash Facility		RD1060
Expansion Joints, Bridge		BR139, BR140, BR141, BR145
	-F-	
Feathering A.C. Over Existing Pavement		RD610
Fences		
Barbed & Woven Wire (Types 1, 1-5W and 2)		RD810
Chain Link		RD815
Gates		RD820
Protective		BR240, BR241, BR242
Snow, Metal		RD825
Flag Board Mounting Details		TM204

Public Improvement Design & Construction Standards

	-I-	
Illumination		TM300, TM301, TM302
Inlets		
Adjusting Existing		RD376
Concrete Cap		RD376
Concrete Type CG-3		RD371, RD372, RD373
Concrete Types G, & G-2M		RD364
Concrete Types CG & Curb Inlet Channel		RD366
Concrete Types M-E, M-O, and B		RD368
Ditch, Type D		RD370
Field or Area Drainage Basin		RD374
Open Grade HMAC Modification		RD314
Slotted CMP Drain		RD328
Type 3		RD378
Inlet Protection		RD1010, RD1015, RD1020
Islands		
Accessible Route		RD710
Traffic		RD705
	-J-	
Joint Seal, Asphaltic Plug		BR157
Also see Expansion Joints, Bridge		
	-L-	
Locator Post		RD334
Lifeline, Fall Arrest		BR190, BR191
	-M-	
Mail Box Support		RD100
Mail Box Installation		RD101
Manhole, Concrete		
Carry Through, Storm Sewer		RD354
Grate		RD356
Frame Adjustment		RD360
Outside Drop		RD352
Precast, Large		RD346
Precast, Pollution Control		RD340
Shallow		RD342
Slope Protector		RD358
Steps		RD336
With Inlet		RD348
Matting		RD1055
Median Barrier, Metal		
Assembly Details		RD400

Public Improvement Design & Construction Standards

Blocks		RD405
Bridge Deck Expansion Joint		RD400
Parts		RD415
Posts		RD405
Median and Shoulder Barriers, Concrete		
Anchoring		RD515
Cast-In-Place		RD505
Precast		RD500
Securing Barrier to Roadway		RD516
Terminals		RD510
Meter Assembly, Water System		RD278
Milepost Signing Details		TM221, TM222
Monument Box		RD115
	-O-	
Open Grade HMAC Drainage Details		RD314
	-P-	
Pavement		
Asphalt Pavement Details		RD610
Concrete, Plain		RD600
Concrete, Reinforced		RD600
Multi-Layer Construction		RD610
Pavement Markings		
Alignment Layout		TM560, TM561
Durable Markings		TM520, TM521, TM522, TM523, TM524
Freeway Ramp		TM547, TM551
Intersection		TM530
Left Turn and Median		TM539
Railroad Crossing		TM505
Raised Marking Details		TM515, TM516
Recessed Marking Details		TM517
Standard Details Blocks		TM500, TM501, TM502, TM503, TM510
Turn Arrow		TM525
Pedestrian Handrail		RD770, RD771
Pipe		
Backfill/Compaction Details		RD300, RD304
Connection Details, Unlike Pipe		RD326
Corrugated Metal Coupling Bands		RD326
Culvert Embankment Protection		RD317
Multiple Installations		RD300
Paved End Slopes		
Concrete and Metal		RD320
HDPE		RD390
PVC		RD388

Public Improvement Design & Construction Standards

Safety End Sections		
Concrete Pipe		RD324
Metal Pipe		RD322
Skew Diagram		RD316
Slope Anchors		RD330, RD332
Sloped Ends		
Concrete Pipe		RD318
Metal Pipe		RD316
Slotted Drain, Metal Pipe (CMP)		RD328
Pipe Fill Height Tables		
Concrete		RD386
High Density Polyethylene (HDPE)		RD390
Metal		
Arch		RD382
Round		RD380
Spiral Rib		RD384
Poly Vinyl Chloride (PVC)		RD388
Reinforced Polyethylene (HDPE)		RD391
Poles		
Luminaire Fixed and Slip Base Supports		TM629, TM630
Traffic Signals		TM650, TM651, TM652, TM653
Strain		TM660, TM661
Portable Barricade		TM820
-R-		
Railroad At Grade Crossing		RD445
Retaining Walls		BR705
Reinforced Concrete Gravity Walls		BR720
Roadway Cross Slopes Superelevated Sections		RD140
Rounding of Cutbanks		RD150
Root Barrier, Water Pipe		RD286
-S-		
Sampling Station, Water System		RD282
Scour Holes, Temporary		RD1050
Sediment Barrier		RD1025, RD1030, RD1035
Sediment Fence		RD1040
Sidewalk Ramp		RD755, RD756, RD757, TM458

Public Improvement Design & Construction Standards

Signs

Aluminum Panel	TM675
Attachment	TM676
Bracing Details	TM206
Directional Sign Layout	TM223, TM224
Exit	TM225
Flag Board Mounting Details	TM204
Installation Details	TM200, TM201
Mileposts	TM221, TM222
Mounts	TM677, TM678, TM679
Multi-Post Installations	TM220
Removable Legend Mounting Details	TM230, TM231, TM232, TM233
Route Makers	
Interstate Route Shields	TM211
Oregon Highways	TM212
U.S. Route Shields	TM211

Sign Supports

90° Rotational	TM605
Breakaway Location Guidelines	TM635
Cantilever	TM622, TM623, TM624, TM625, TM626, TM627
Multi-Post Breakaway	TM600, TM601
Sign Bridge	TM614, TM615, TM616, TM617, TM618, TM619, TM620
Square Tube	TM681, TM687, TM688
Triangular Base Breakaway	TM602
Variable Message Sign	TM606, TM607, TM608, TM609, TM610, TM611, TM612
Wood Post	TM670

Siphon Box

RD376

Slabs, Precast Prestressed

BR400, BR405, BR410, BR415,
BR420, BR422, BR445

Slope

Drains, Temporary	RD1045
Paving	BR115
Pipe Anchors	RD330, RD332
Protector, Concrete Manhole	RD358
Rounding	RD150

Slotted Drains, Metal Pipe (CMP)

RD328

Snow Fence, Metal

RD825

Soundwalls

Masonry (Pile Footing)	BR750, BR751
Masonry (Spread Footing)	BR730
Precast Concrete	BR740

Stairway, Concrete

RD120

Public Improvement Design & Construction Standards

Steps, Manhole Precast	RD336
Stop Lane, Truck and Bus At Railroad Crossing	RD445
Subsurface Drain	RD312
-T-	
Temporary Traffic Control	
2-Lane, 2-Way Roadways	TM850
Abrupt Edge	TM800
Barricades	TM820
Blasting Zones	TM871
Bridge Construction	TM870
Closure Details	TM840
Concrete Barrier	TM830
Freeway Sections	TM860, TM861, TM862
Impact Attenuator	TM831, TM832
Intersection Work Zones	TM841, TM842, TM843
Message Sign	TM800
Non-Freeway Multi-Lane Sections	TM851, TM852
Reflective Pavement Markers	TM810
Rumble Strips	TM830
Sign Supports	TM821
Tables, Flare Rate, Taper, Spacing	TM800
Tire Wash Facility	RD1060
Traffic	
Island	RD705
Separator, Concrete	RD706
Traffic Signals	
Color Code Chart	TM470
Controller Cabinet and Foundation	TM482
Fire Preemption Details	TM465
Interconnect Wiring Details	TM498
Junction Boxes	TM472
LED PTR Signs and Details	TM495
Loop Details	TM475, TM478, TM480
Maintenance Pad Details	RD160
Mast Arm Pole Details	TM450
Mounting Details	
Adjustable Signal Head	TM462
Spanwire	TM463
Pedestrian Crosswalk Closure	TM490
Pedestrian Signal	TM457, TM467
Pole Footing Details	
Mast Arm Pole	TM450
Strain Pole	TM452
Pole Mounts	TM680
Pole Placement at Sidewalk Ramps	TM458
Ramp Meter Details	TM492, TM495, TM497

Public Improvement Design & Construction Standards

Service Cabinet	TM485, TM488
Spanwire Design	TM463
Stabilizer Details	TM453
Strain Pole Details	TM452
Strain Pole Support	TM660, TM661
Supports	TM650, TM651, TM652, TM653
Temporary	TM455
Vehicle Signal Details	TM460
Vehicle Signal Pedestal	TM457
Trucks and Bus Stop Lanes at Railroad Crossing	RD445
Truck Scale Pit	BR182
-W-	
Walls	
Retaining Concrete	BR705, BR720
Soundwall, Masonry	
Pile Footing	BR750, BR751
Spread Footing	BR730
Soundwall, Precast	BR740
Water Systems	
Air Release Assembly, Manual	RD266
Air Release/Air Vacuum Valve Assembly	RD270
Main Dead-End Blowoff Assembly	RD262
Water Sampling Station	RD282
Wearing Surface Drain, Open Grade HMA	RD314
Wingwalls, Concrete Box Culverts	BR800
Wind Pressure Map	TM671

11-2 City of Madras Standard Drawing Details

Standard drawing details tailored to the local requirements of the City of Madras are shown in the following. These details supersede respective ODOT Standard Drawings and Standard Details.

<u>Section 1 Trenches</u>	<u>Drawing Name</u>
1-1	T-Patch
1-2	Trenching Backfill
 <u>Section 4 Storm</u>	 <u>Drawing Name</u>
4-1	Storm Manhole
4-2	Drywell Detail
4-3	Sumped Manhole

Public Improvement Design & Construction Standards

Section 5 Sewer

5-1	Sewer Manhole Detail
5-1A	Sewer Manhole Detail
5-2	Sumped Manhole
5-3	Sewer Service and Cleanout
5-4	Manhole Ring and Cover

Drawing Name

Section 6 Water

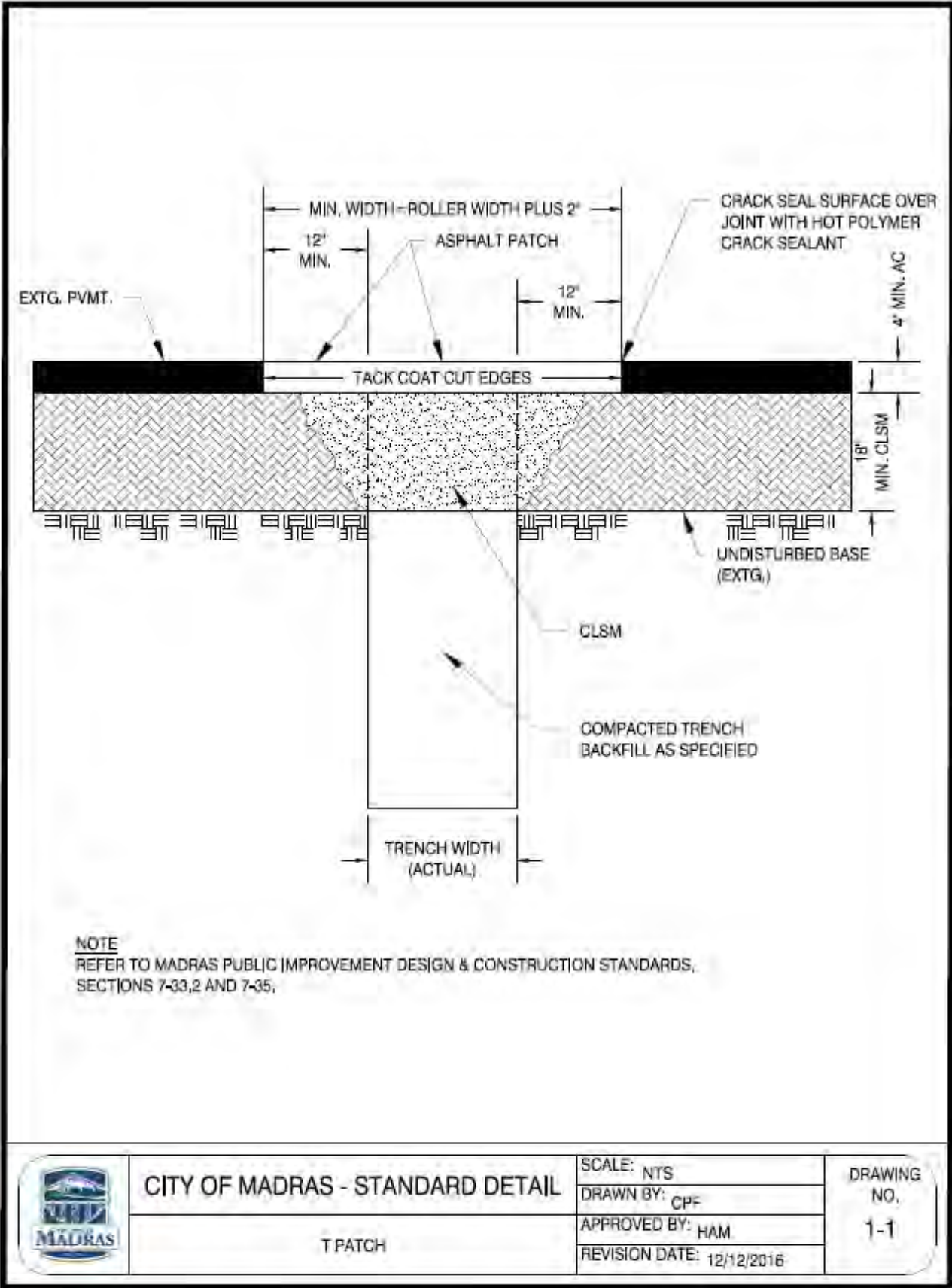
6-1	Water Service
6-2	Typical Valve and Box Install
6-3	Fire Hydrant and Gate Valve Control Detail
6-4	Bollard Detail
6-5	Thrust Blocks
6-6	Deadman Thrust Block

Drawing Name

Section 7 Streets

7-1	Street/Sidewalk/Swale Section
7-1A	Street/Sidewalk Section
7-2	Typical Downtown Sidewalk
7-3	ADA Bulb Out
7-4	Cul-De-Sac
7-5	Curb Patch
7-6	Sawcut and Match New Asphalt Detail
7-7	Typical Detectable Warning Surface
7-8	Hanging Basket, Arm, Irrigation
7-8A	Hanging Basket Mounting Bracket
7-9	Typical Downtown Tree Well Installation
7-9A	Typical Tree Well Installation
7-10	Tree Grate
7-10A	Tree Grate Frame – New Construction
7-10B	Tree Grate Frame – Retrofit
7-11	Typical Downtown Street Tree Location and Clear Vision Areas
7-12	Vision Clearance for Street Intersections and Alleys
7-12A	Vision Clearance for Commercial/Industrial Zone Access
7-13	Typical Cross Section
7-14A	Typical Hwy 97 Corridor Swale Improvements
7-14B	Typical Hwy 97 Corridor Swale Improvements
7-15	Concrete Curbs
7-16	Sidewalk Vegetation and Maintenance
7-17	Typical Street Sign Post and Anchor
-----	Decorative Street Light
-----	Decorative Trail Light
-----	Standard Power Meter Pedestal

Drawing Name

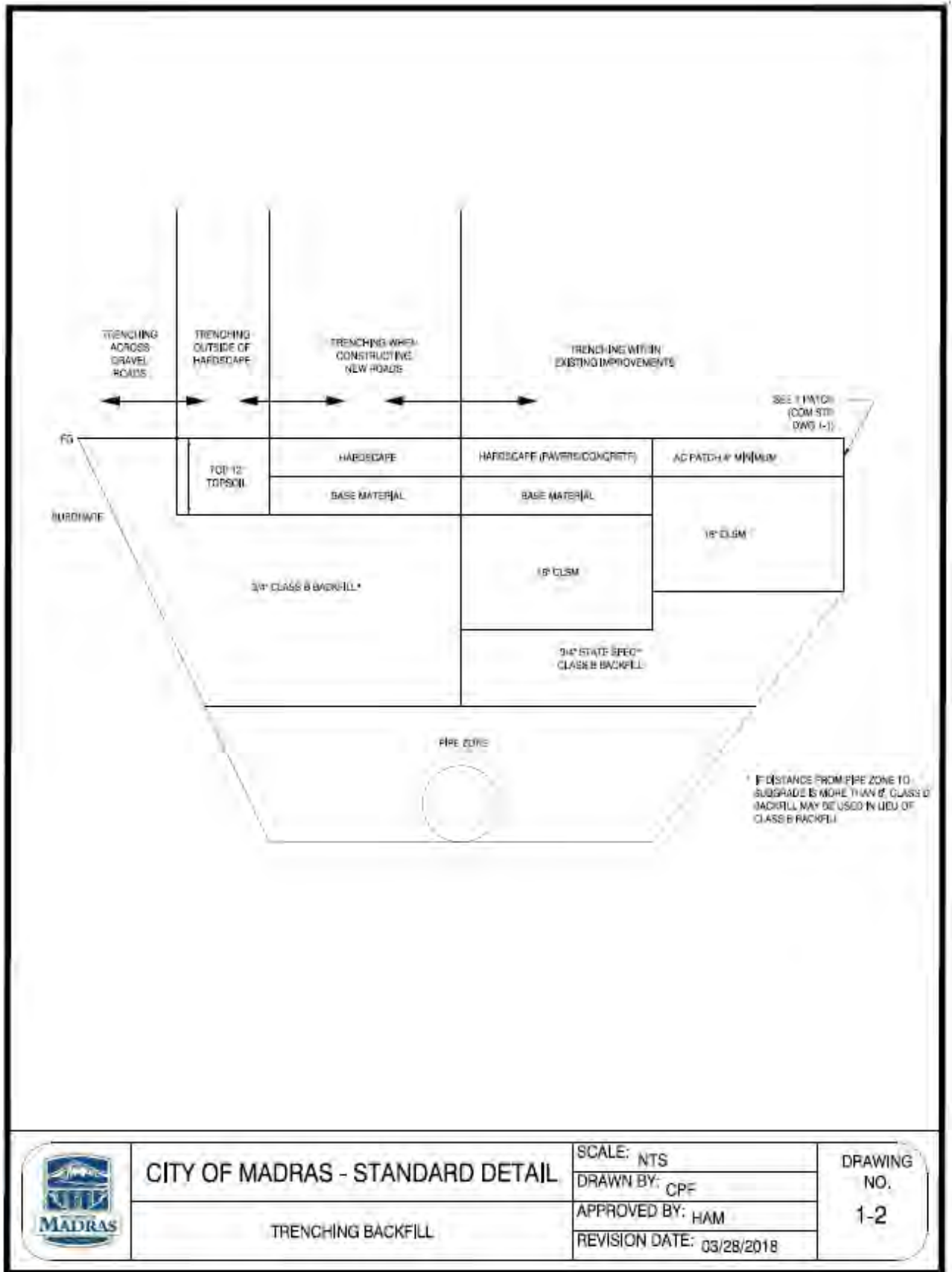


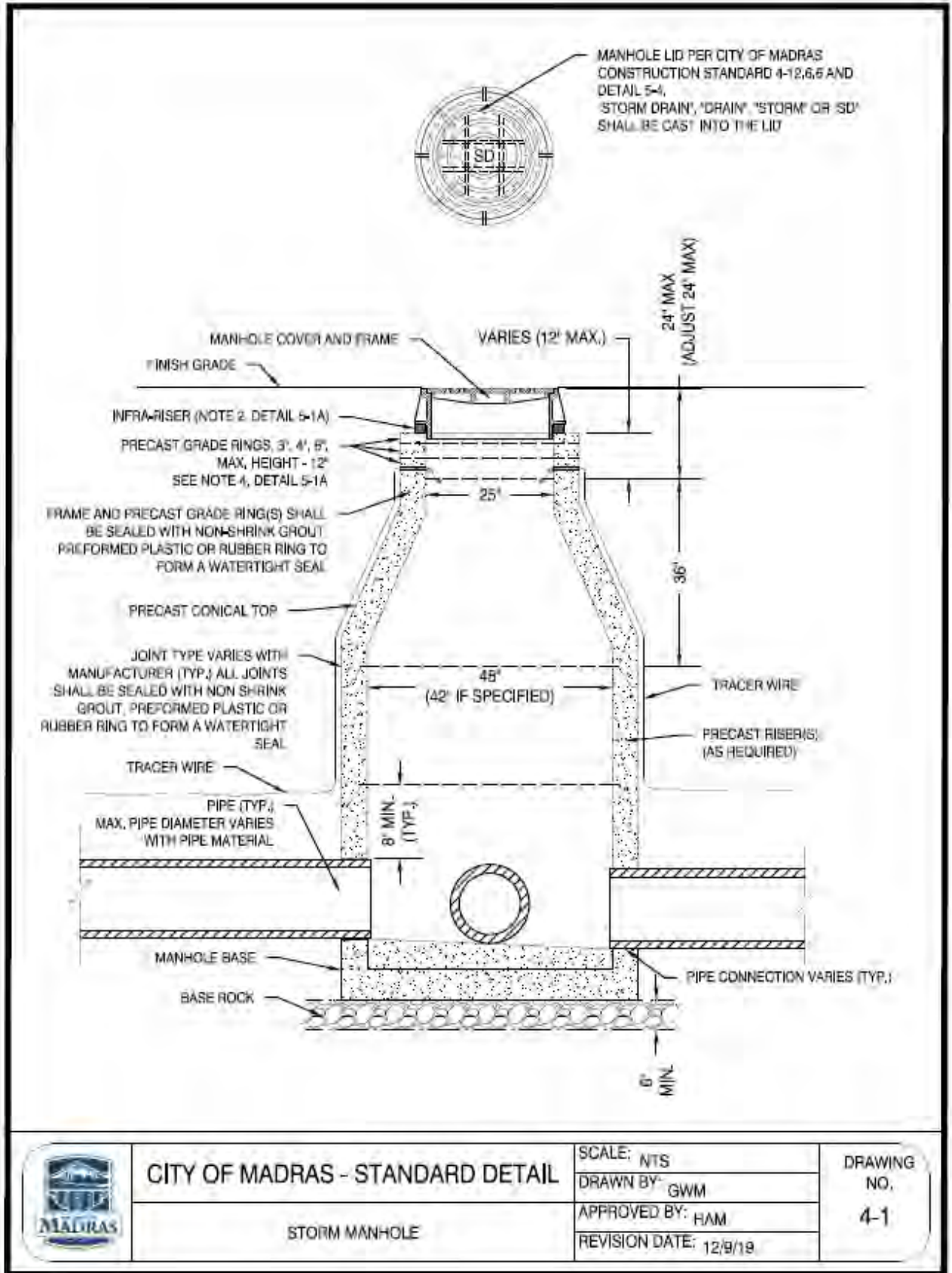
CITY OF MADRAS - STANDARD DETAIL


T PATCH

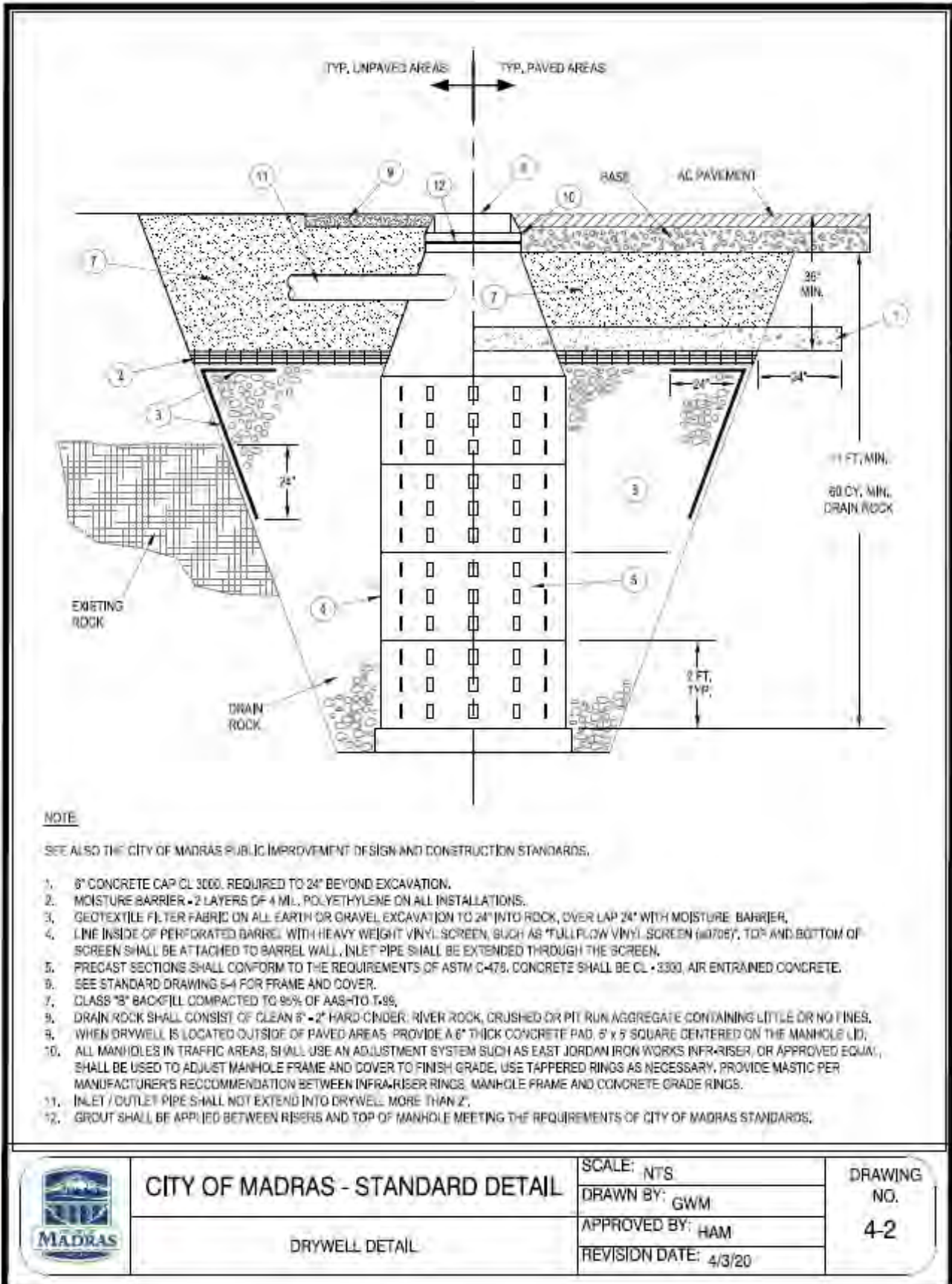
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 DRAWN BY: CPF
 APPROVED BY: HAM.
 REVISION DATE: 12/12/2016

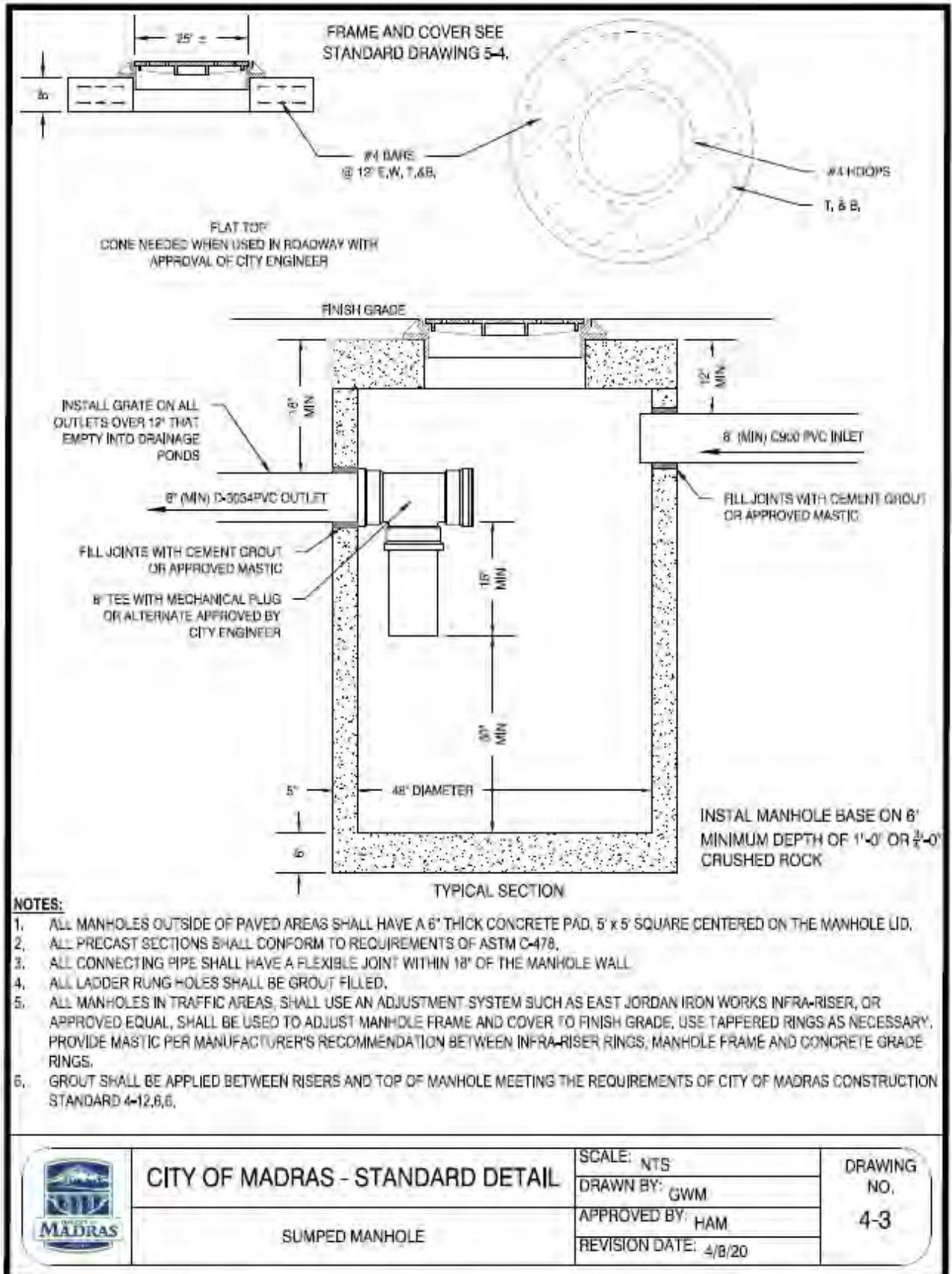
DRAWING NO.
 1-1

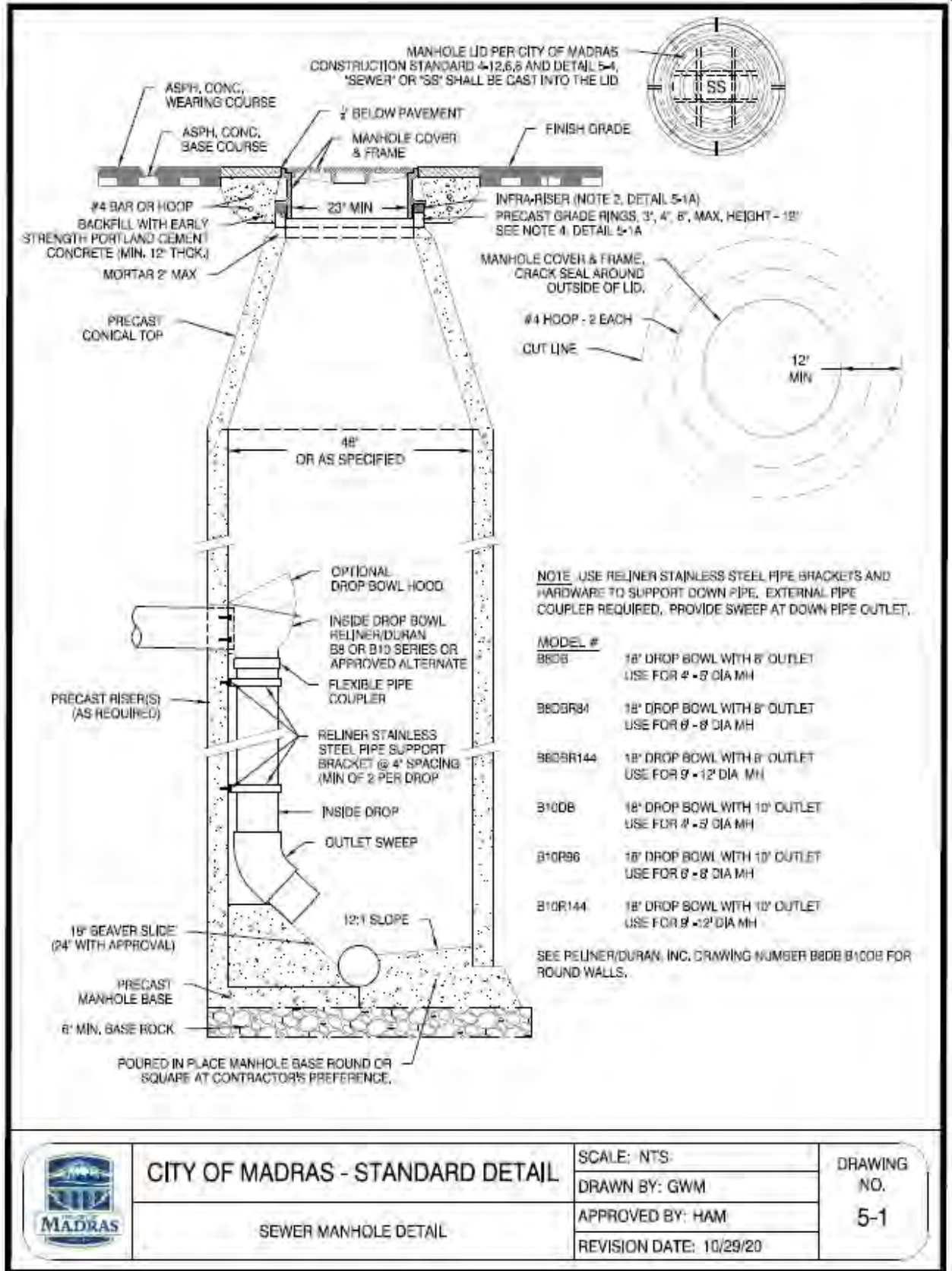




	CITY OF MADRAS - STANDARD DETAIL		SCALE: NTS	DRAWING NO. 4-1
	STORM MANHOLE		DRAWN BY: GWM	
			APPROVED BY: HAM	
			REVISION DATE: 12/9/19	





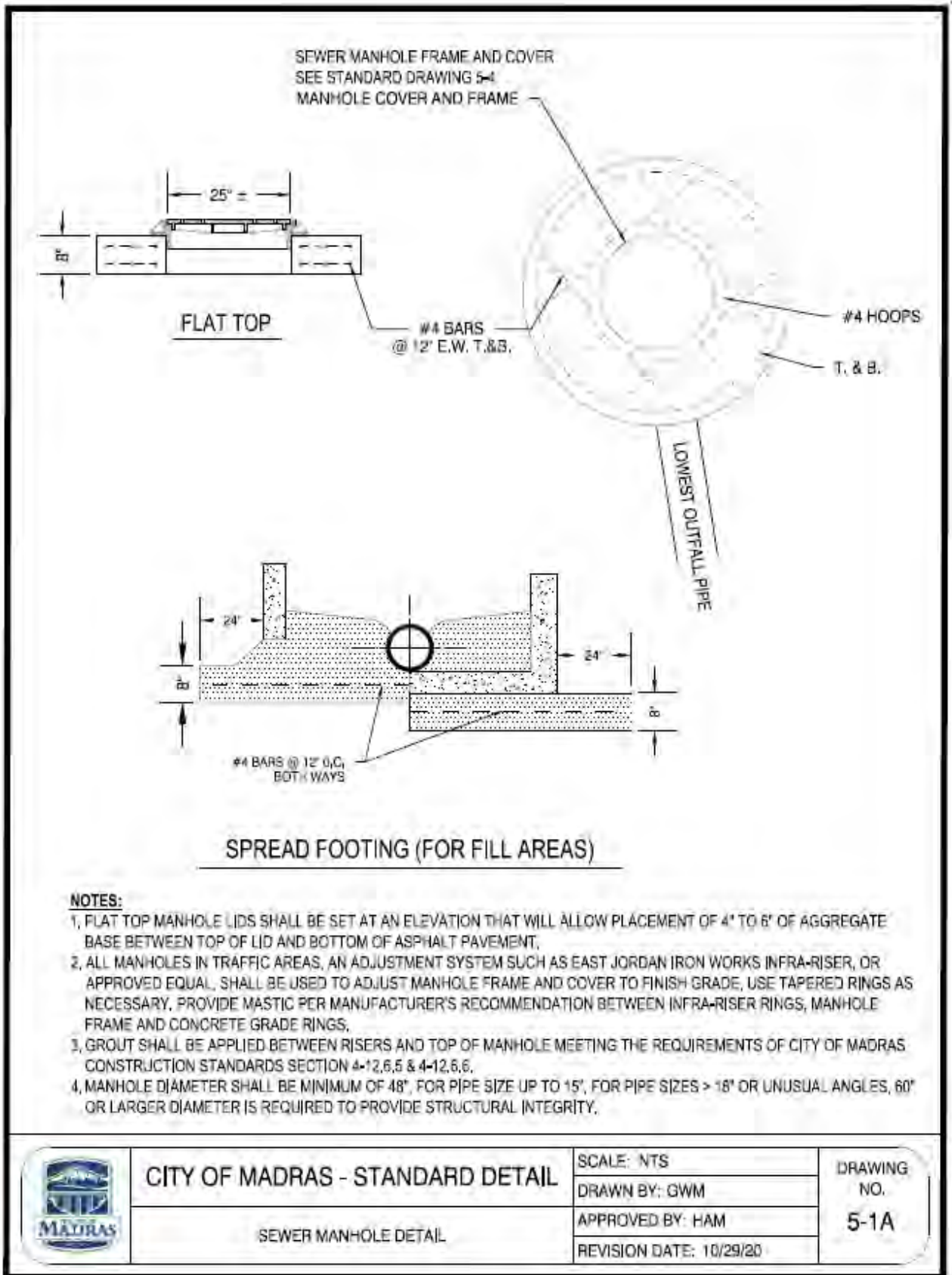


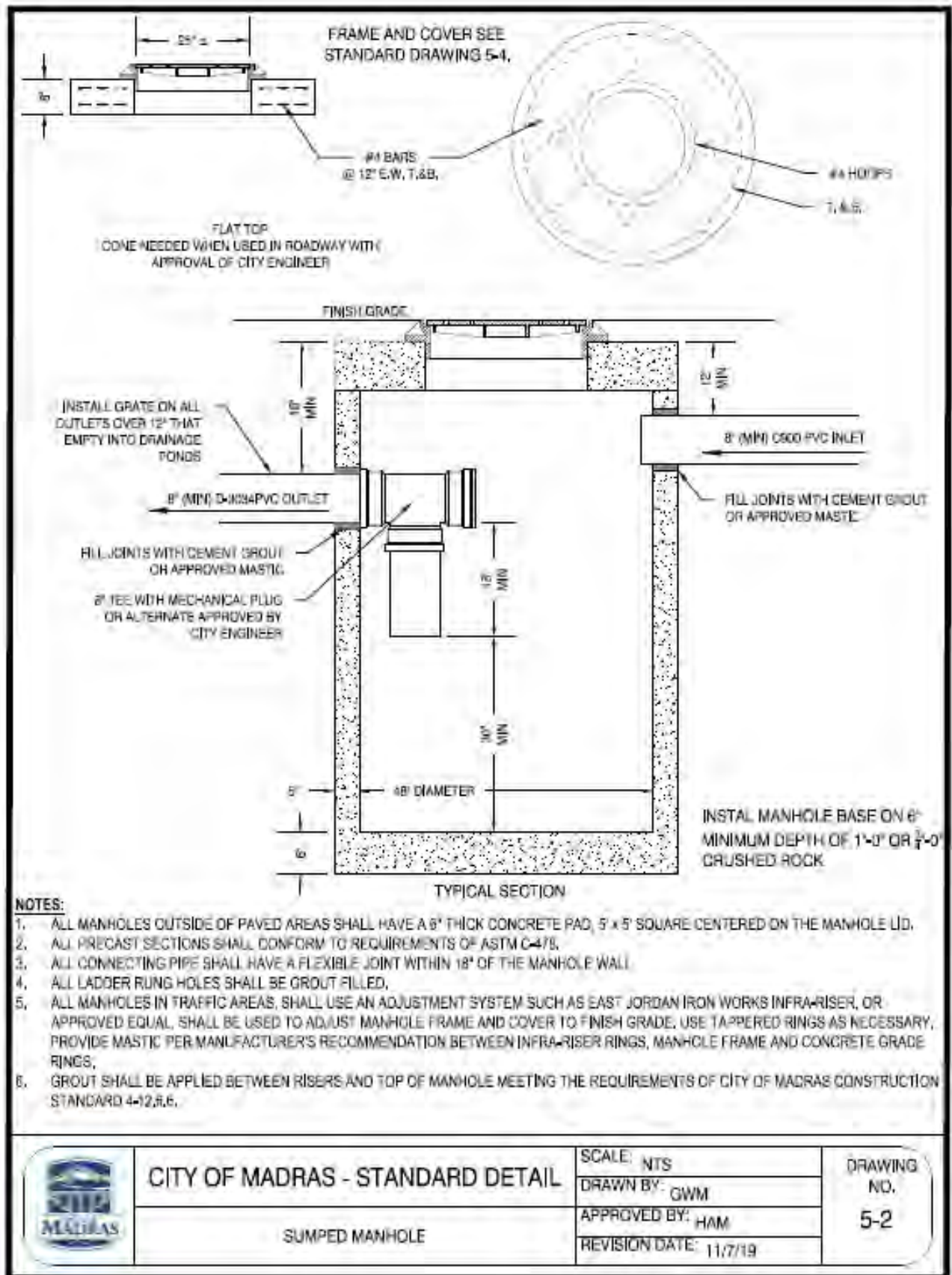
CITY OF MADRAS - STANDARD DETAIL

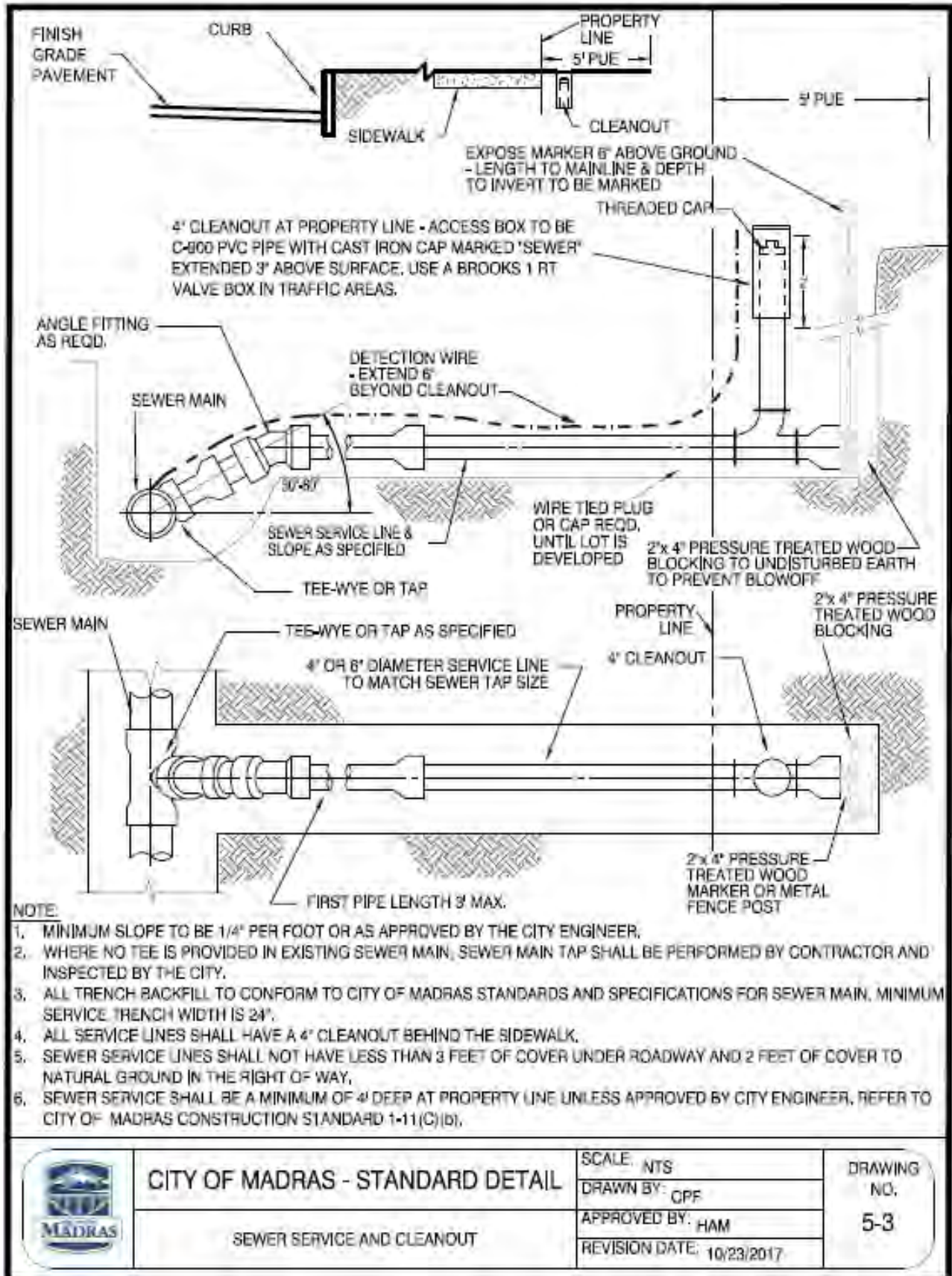
SEWER MANHOLE DETAIL

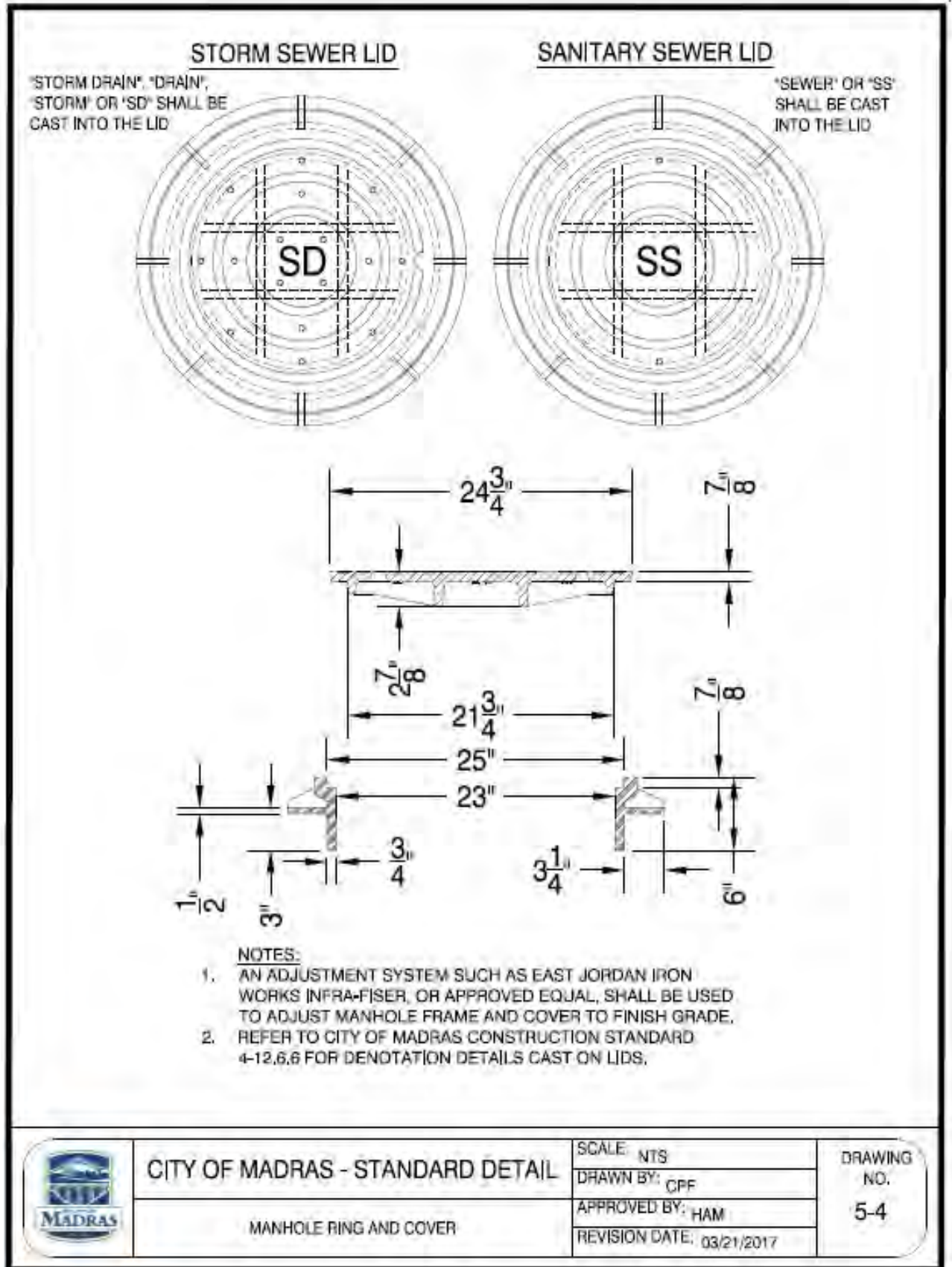
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 APPROVED BY: HAM
 REVISION DATE: 10/29/20

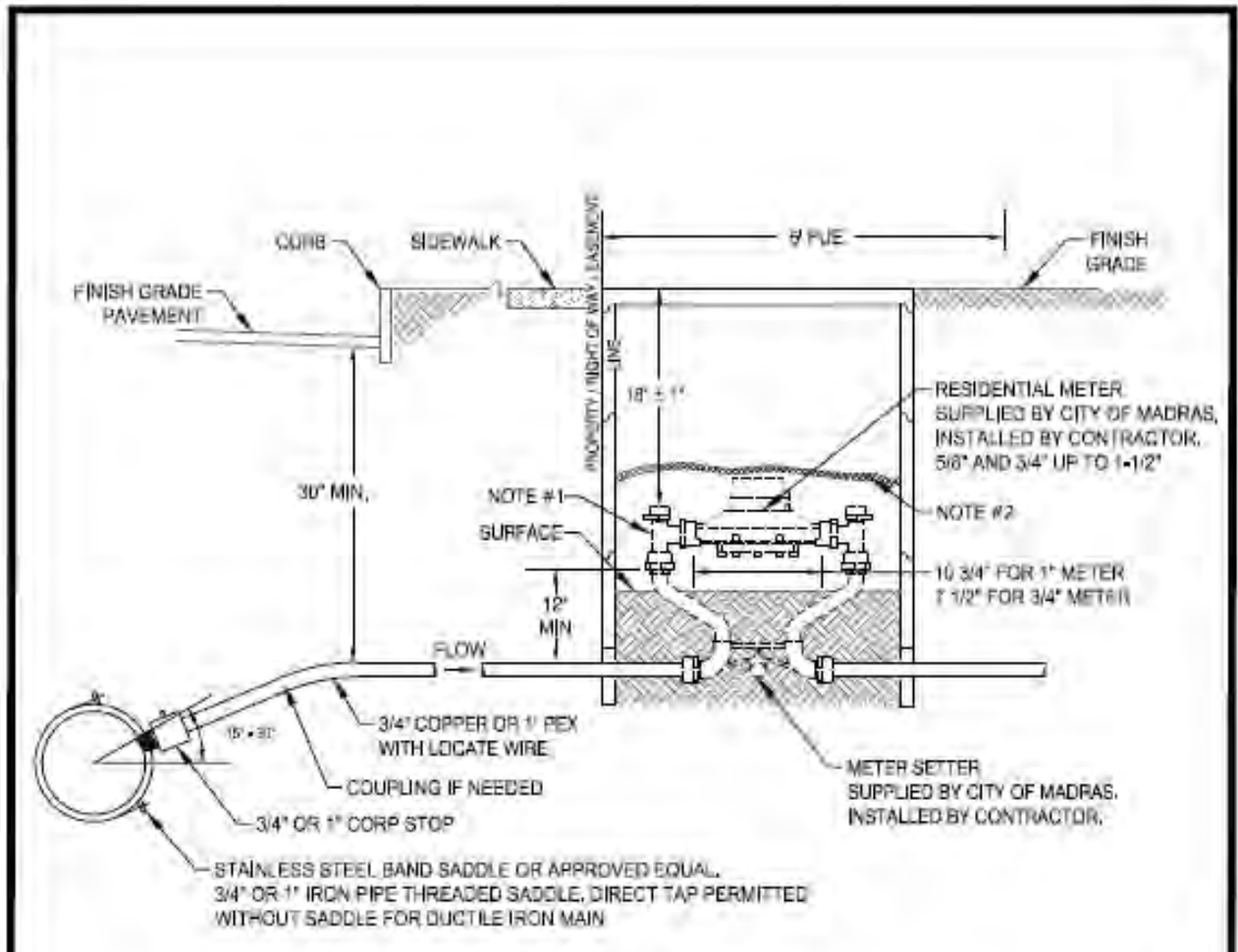
DRAWING NO.
 5-1











METER BOXES

LANDSCAPE AREAS				SIDEWALK/TRAFFIC AREAS		
METER SIZE	BOX SIZE	BOX TYPE	LID TYPE	BOX SIZE	BOX TYPE	LID TYPE
5/8"-1"	13X24	HDPE	HDPE W/CAST IRON READER OPENING	13X24	POLYMER CONCRETE - 20,000 LBS RATING	POLYMER CONCRETE - 20,000 LBS RATING W/CAST IRON READER OPENING
1.5"-2"	17X30	HDPE	HDPE W/CAST IRON READER OPENING	17X30	POLYMER CONCRETE - 20,000 LBS RATING	POLYMER CONCRETE - 20,000 LBS RATING W/CAST IRON READER OPENING
OVER 2"	*TO BE APPROVED BY CITY			*TO BE APPROVED BY CITY		

NOTE:

1. ANGLE METER VALVES ARE SUPPLIED WITH AND ATTACHED TO THE METER SETTER.
2. 1/2" GOSSLINK CLOSED CELL NATURAL T20 INSULATION, CUT TO FIT METER BOX

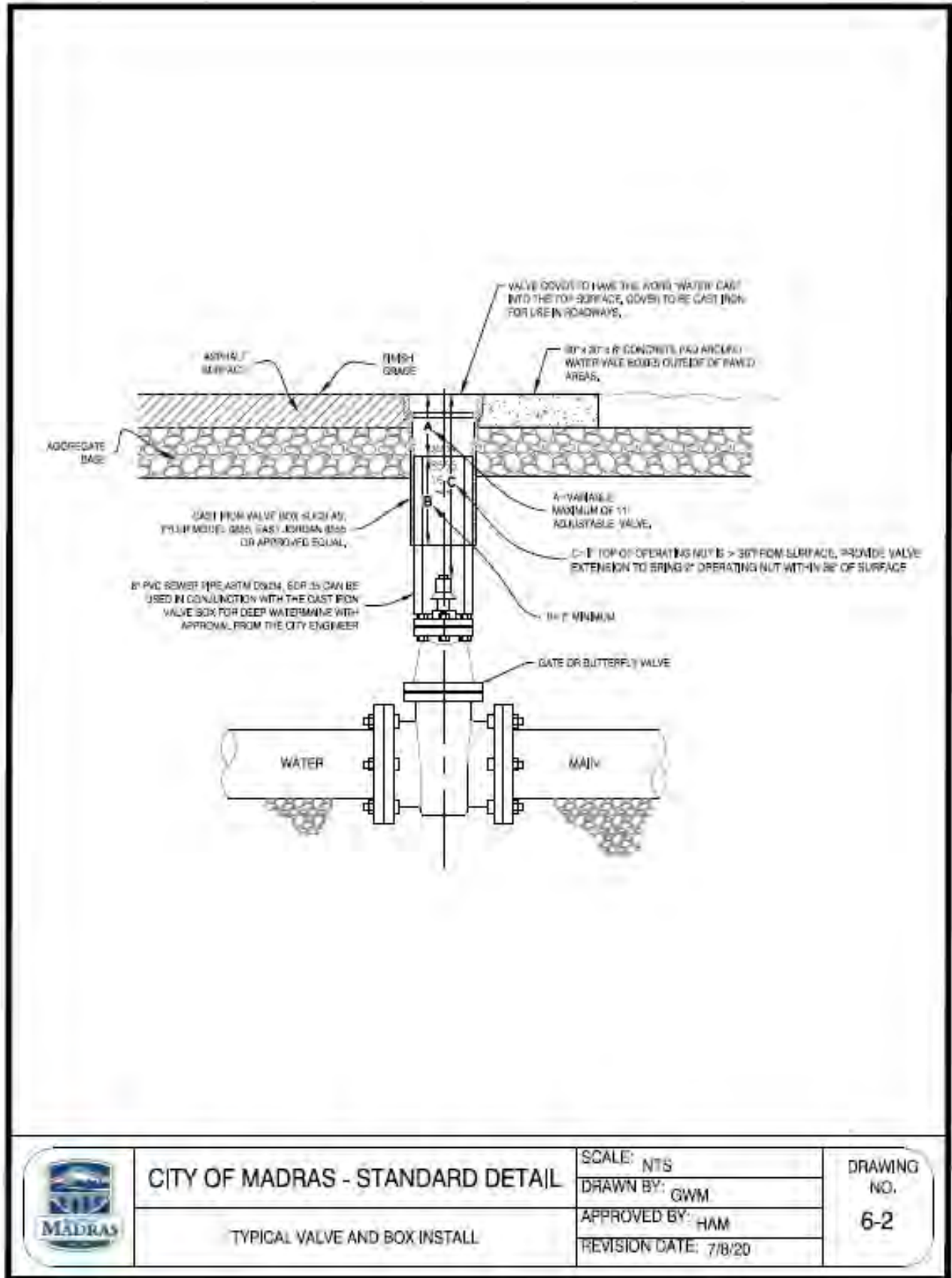


CITY OF MADRAS - STANDARD DETAIL

WATER SERVICE

SCALE: NTS
 DRAWN BY: GWM
 APPROVED BY: HAM
 REVISION DATE: 7/7/20

DRAWING NO.
6-1

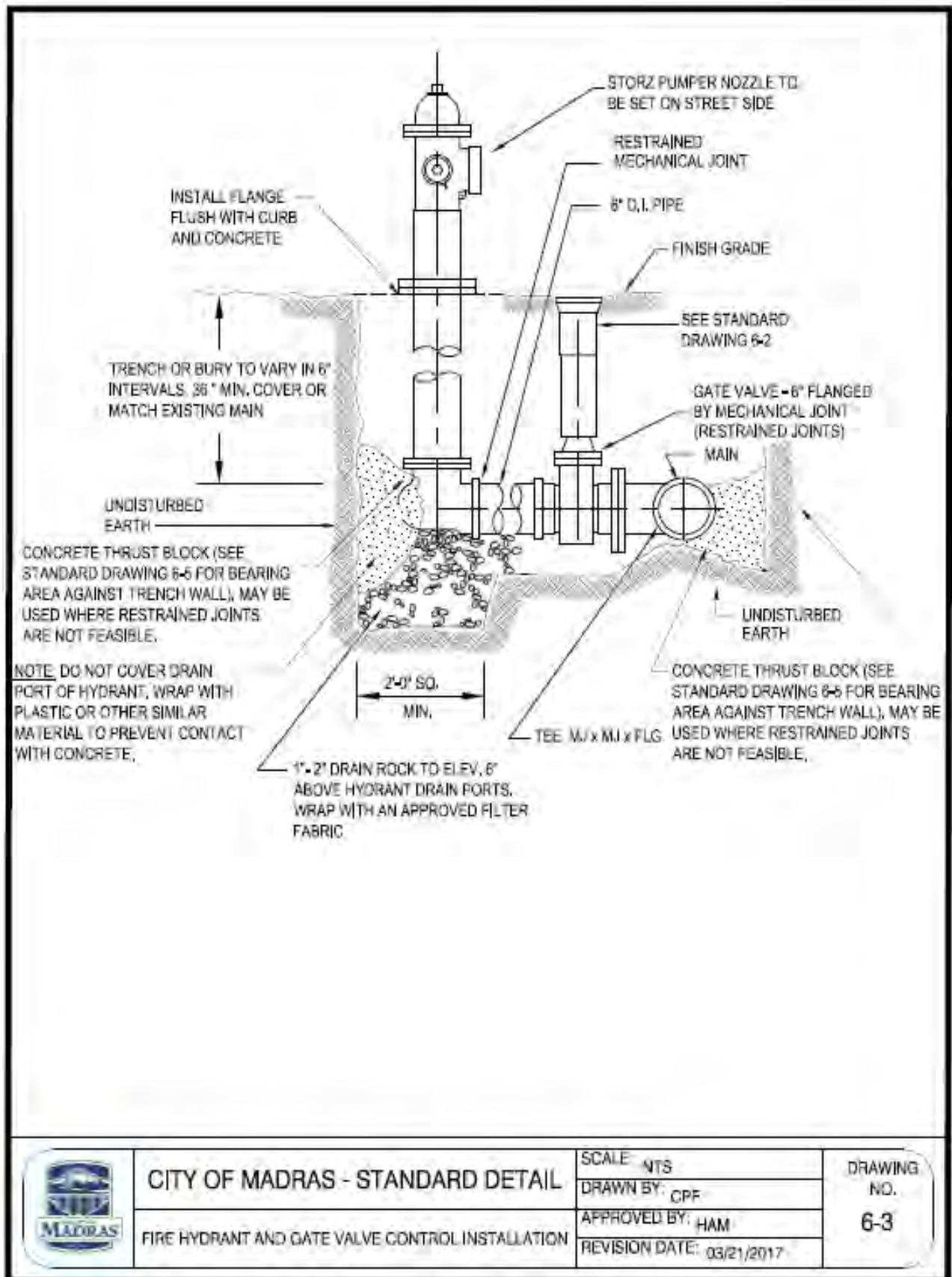


CITY OF MADRAS - STANDARD DETAIL

TYPICAL VALVE AND BOX INSTALL

SCALE: NTS
 DRAWN BY: GWM
 APPROVED BY: HAM
 REVISION DATE: 7/8/20

DRAWING NO.
6-2

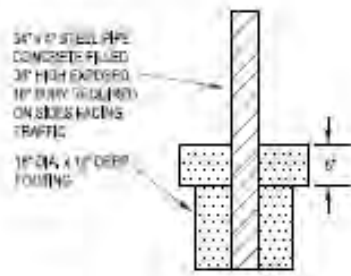
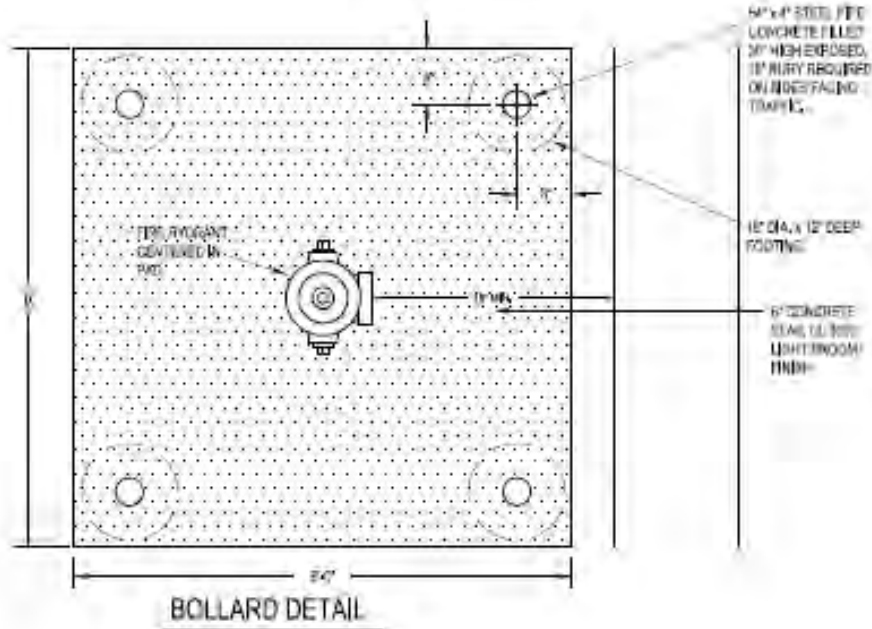



CITY OF MADRAS - STANDARD DETAIL

FIRE HYDRANT AND GATE VALVE CONTROL INSTALLATION

SCALE: NTS
DRAWN BY: CPF
APPROVED BY: HAM
REVISION DATE: 03/21/2017

DRAWING NO.
6-3



	CITY OF MADRAS - STANDARD DETAIL	SCALE: NTS	DRAWING NO. 6-4
		DRAWN BY: CPF	
		APPROVED BY: HAM	
		REVISION DATE: 12/18/2016	
BOLLARD DETAIL			

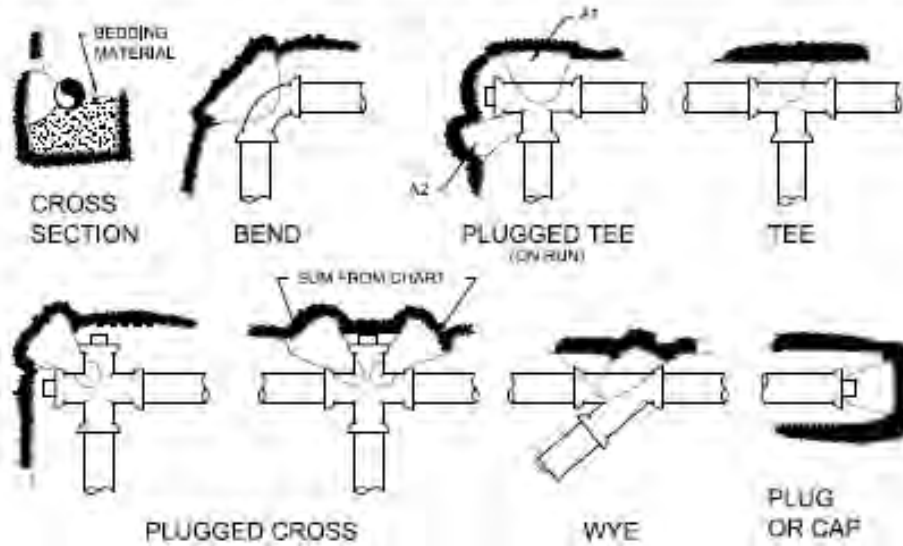


CHART A


SIZE OF FITTING (PIPE DIA.)	THRUST BLOCKING BEARING AREA (SQ. FT.)					
	TEE, WYE, PLUG, CAP	90° BEND, PLUGGED 'X'	PLUGGED TEE (ON RUN) A1 A2	45° BEND	22 1/2° BEND	11 1/4° BEND
4"	1.3	1.4	1.9	3.4	1.0	-
6"	2.1	3.0	4.3	3.0	1.5	-
8"	3.8	5.3	7.8	5.4	2.9	1.0
10"	5.9	8.4	11.8	8.4	4.8	1.2
12"	8.5	12.0	17.0	12.0	8.0	1.7
14"	11.5	16.3	23.0	16.3	8.8	2.3
16"	15.0	21.3	30.0	21.3	11.8	3.0
18"	19.1	27.6	39.0	27.0	14.5	3.8

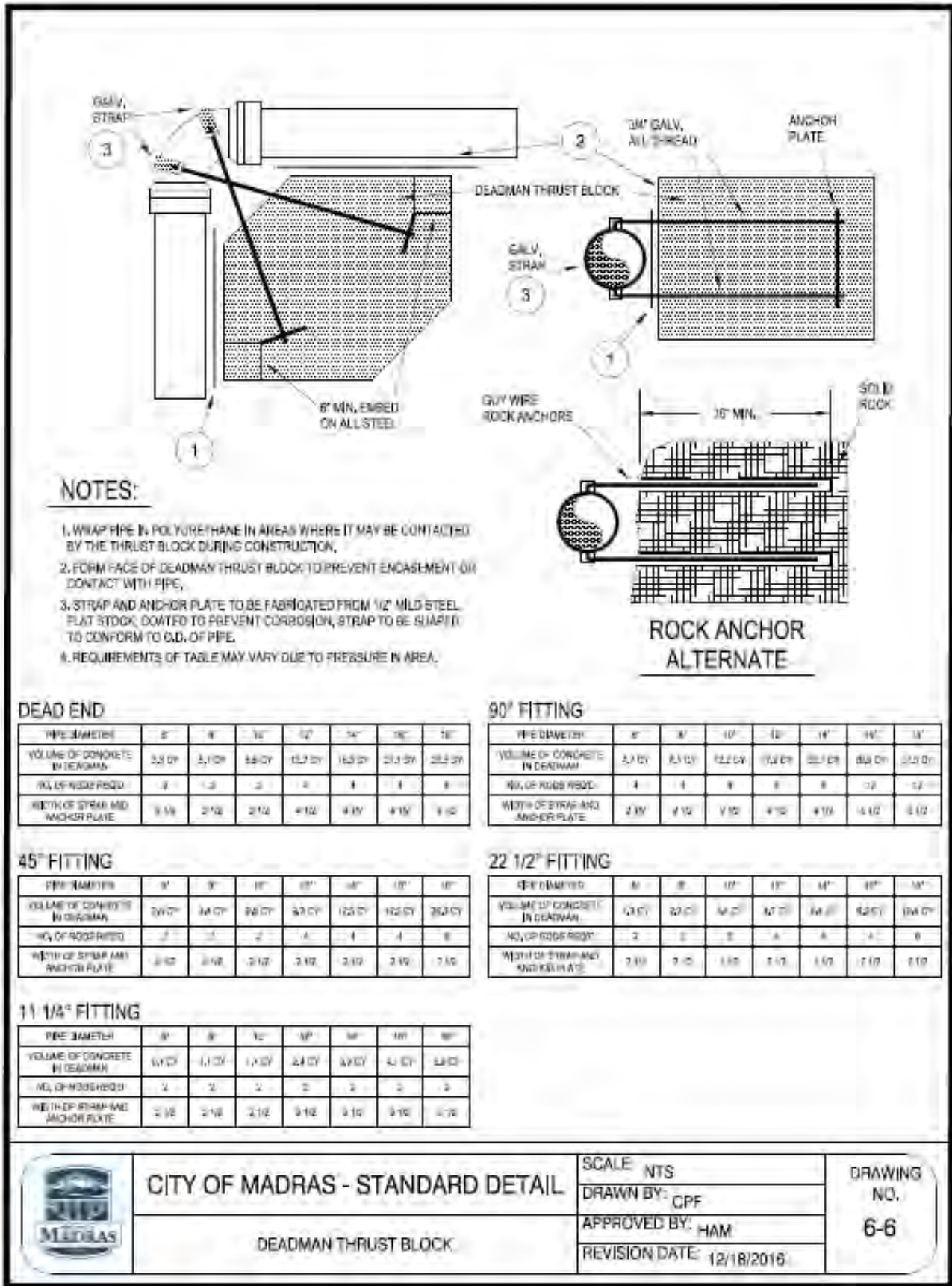
NOTES:

1. CONCRETE THRUST BLOCKING SHALL BE POURED AGAINST UNDISTURBED EARTH.
2. THE BEARING AREA SHALL BE EQUALLY DIVIDED ABOVE & BELOW THE CENTERLINE OF THE PIPE.
3. CONCRETE SHALL BE KEPT CLEAR OF JOINTS AND ACCESSORIES.
4. REQUIRED BEARING AREAS SHALL BE AS INDICATED ON CHART A, ADJUSTED WHEN NECESSARY TO CONFORM TO TEST PRESSURE(S) & ALLOWABLE SOIL BEARING STRESS(ES), SEE CHART B, SOIL BEARING.
5. CHART A IS BASED ON A TEST PRESSURE OF 150 PSI & AN ALLOWABLE SOIL BEARING STRESS OF 2,000 LBS. PER SQ. FT.
6. SAFE BEARING LOADS GIVEN IN CHART B ARE FOR HORIZONTAL THRUSTS WHEN THE PIPE COVER EXCEEDS TWO FEET.
7. IN MUCK OR PEAT, ALL THRUSTS MUST BE RESISTED BY PILES OR IRON RODS TO SOLID FOUNDATIONS, OR BY REMOVAL OF THE MUCK OR PEAT & REPLACEMENT WITH BALLAST OF SUFFICIENT STABILITY TO RESIST THE THRUSTS INVOLVED.

CHART B

BEARING LOADS FOR SOILS	
TYPE OF SOIL	SAFE BEARING LOAD (LBS. PER SQ. FT.)
HARD SHALE	10,000
SAND & GRAVEL (CEMENTED WITH CLAY)	4,500
SAND & GRAVEL	3,000
SOFT CLAY	2,000
MUCK OR PEAT, ETC.	0

	CITY OF MADRAS - STANDARD DETAIL	SCALE: NTS	DRAWING NO. 6-5
		DRAWN BY: CPF	
	APPROVED BY: HAM		
	REVISION DATE: 12/18/2016		
THRUST BLOCKS			



DEAD END

PIPE DIAMETER	6"	8"	10"	12"	14"	16"	18"
VOLUME OF CONCRETE IN DEADMAN	3.3 CY	3.1 CY	3.8 CY	13.2 CY	15.2 CY	21.1 CY	23.2 CY
NO. OF REBAR RODS	2	2	2	4	4	4	8
WIDTH OF STRAP AND ANCHOR PLATE	3.58	2.12	2.12	4.12	4.12	4.12	3.12

90° FITTING

PIPE DIAMETER	6"	8"	10"	12"	14"	16"	18"
VOLUME OF CONCRETE IN DEADMAN	3.1 CY	3.1 CY	12.2 CY	17.2 CY	20.2 CY	23.2 CY	23.2 CY
NO. OF REBAR RODS	4	4	8	8	8	12	12
WIDTH OF STRAP AND ANCHOR PLATE	2.32	2.12	3.12	4.12	4.12	4.12	3.12

45° FITTING

PIPE DIAMETER	6"	8"	10"	12"	14"	16"	18"
VOLUME OF CONCRETE IN DEADMAN	2.7 CY	3.1 CY	3.8 CY	3.3 CY	12.2 CY	12.2 CY	23.2 CY
NO. OF REBAR RODS	2	2	2	4	4	4	8
WIDTH OF STRAP AND ANCHOR PLATE	2.12	2.12	2.12	2.12	2.12	2.12	2.12

22 1/2° FITTING

PIPE DIAMETER	6"	8"	10"	12"	14"	16"	18"
VOLUME OF CONCRETE IN DEADMAN	1.3 CY	2.1 CY	3.1 CY	3.1 CY	3.1 CY	3.1 CY	12.2 CY
NO. OF REBAR RODS	2	2	2	4	4	4	8
WIDTH OF STRAP AND ANCHOR PLATE	2.12	2.12	2.12	2.12	2.12	2.12	2.12

11 1/4° FITTING

PIPE DIAMETER	6"	8"	10"	12"	14"	16"	18"
VOLUME OF CONCRETE IN DEADMAN	1.7 CY	1.1 CY	1.7 CY	2.4 CY	3.1 CY	4.1 CY	3.1 CY
NO. OF REBAR RODS	2	2	2	2	4	2	2
WIDTH OF STRAP AND ANCHOR PLATE	2.12	2.12	2.12	2.12	2.12	2.12	2.12

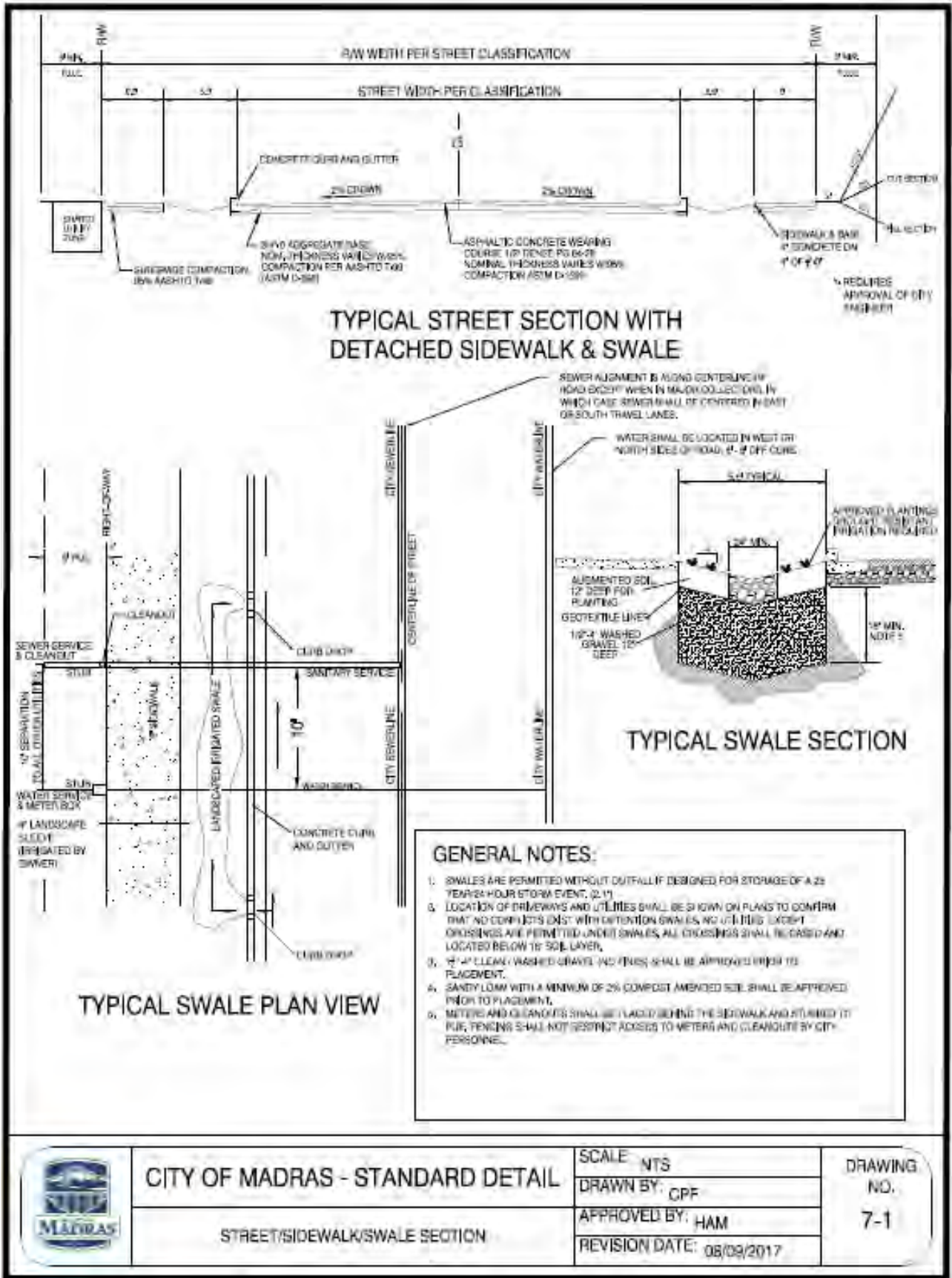


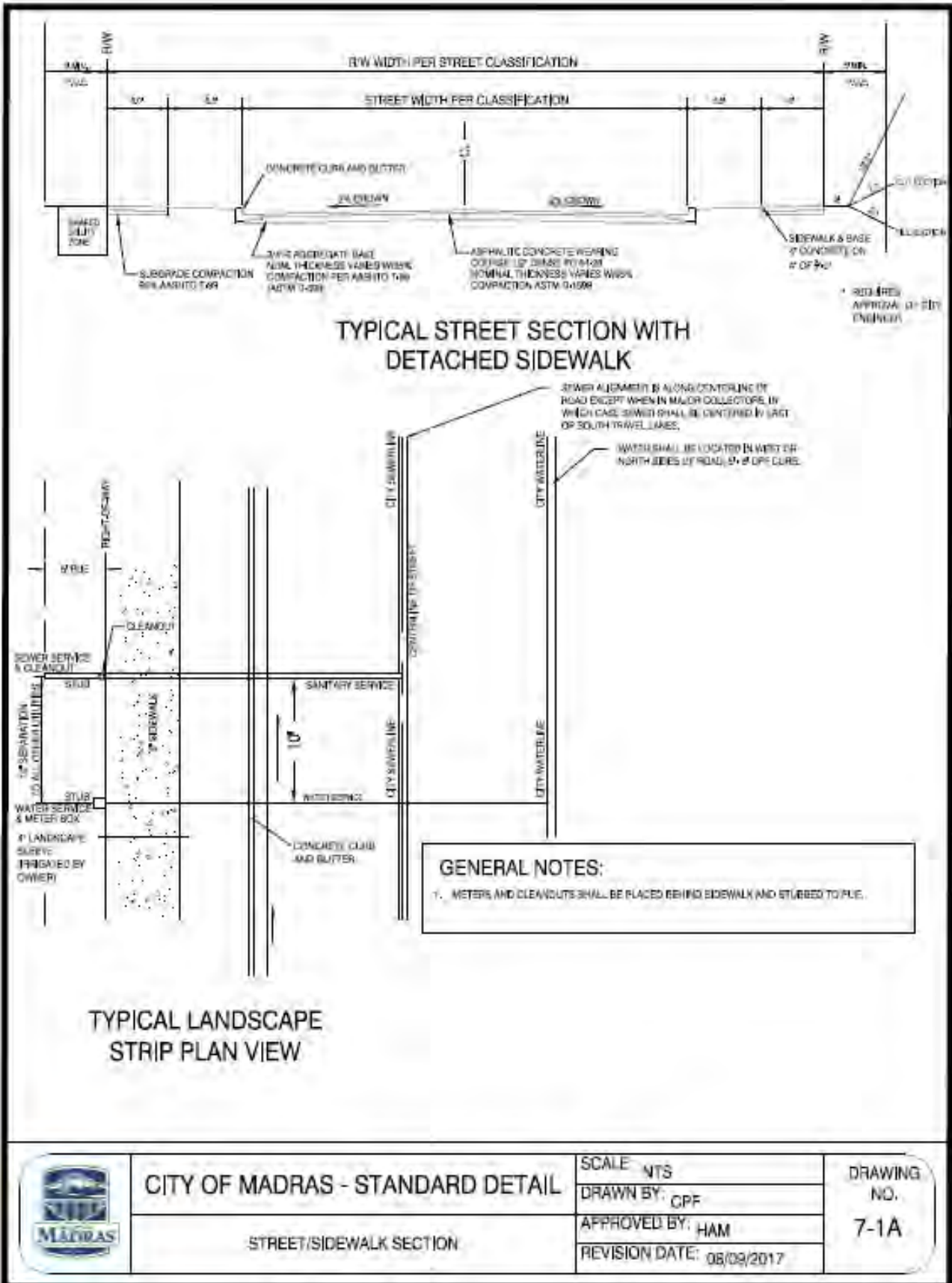
CITY OF MADRAS - STANDARD DETAIL

DEADMAN THRUST BLOCK

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 12/18/2016

DRAWING NO.
6-6



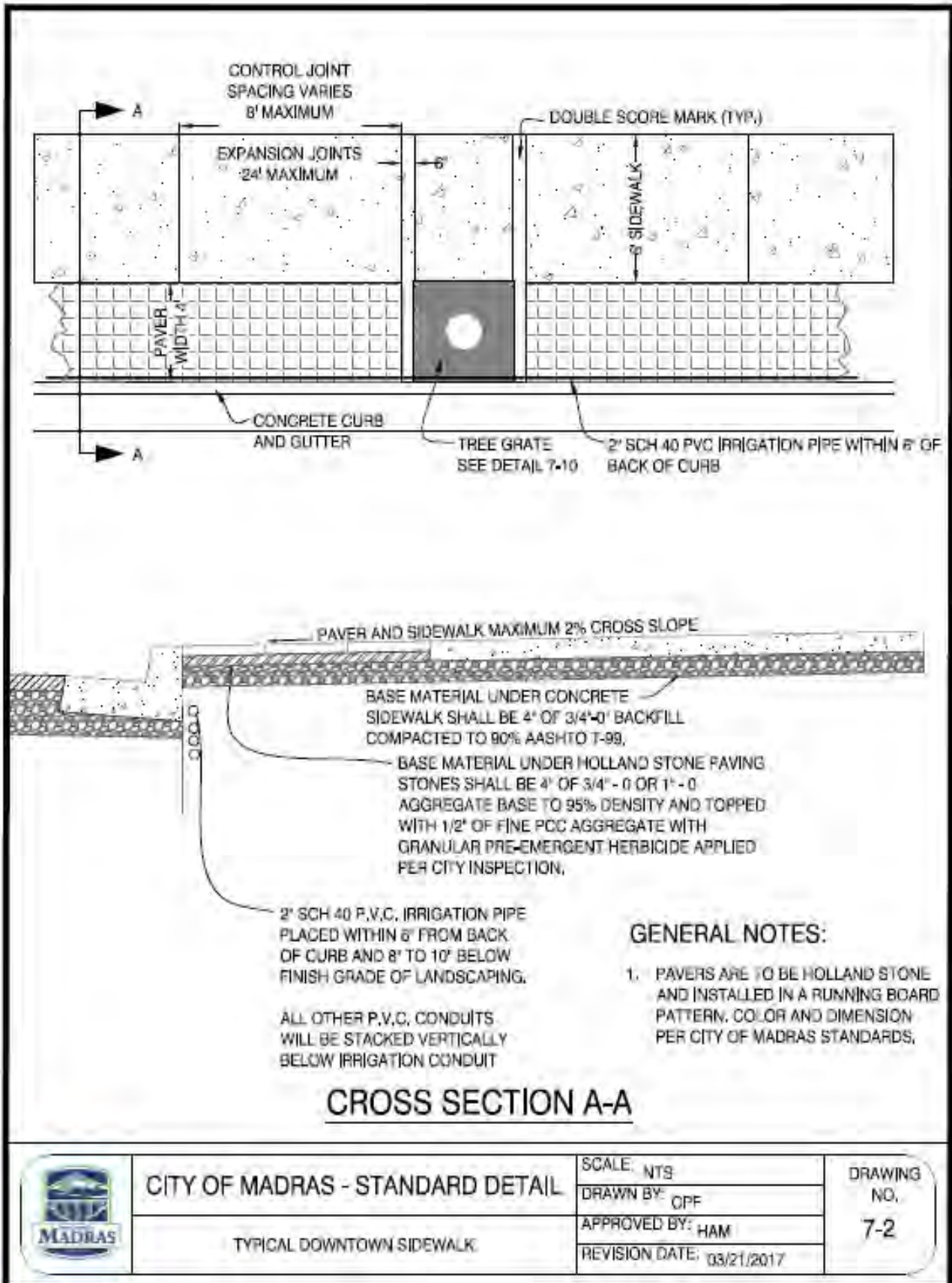


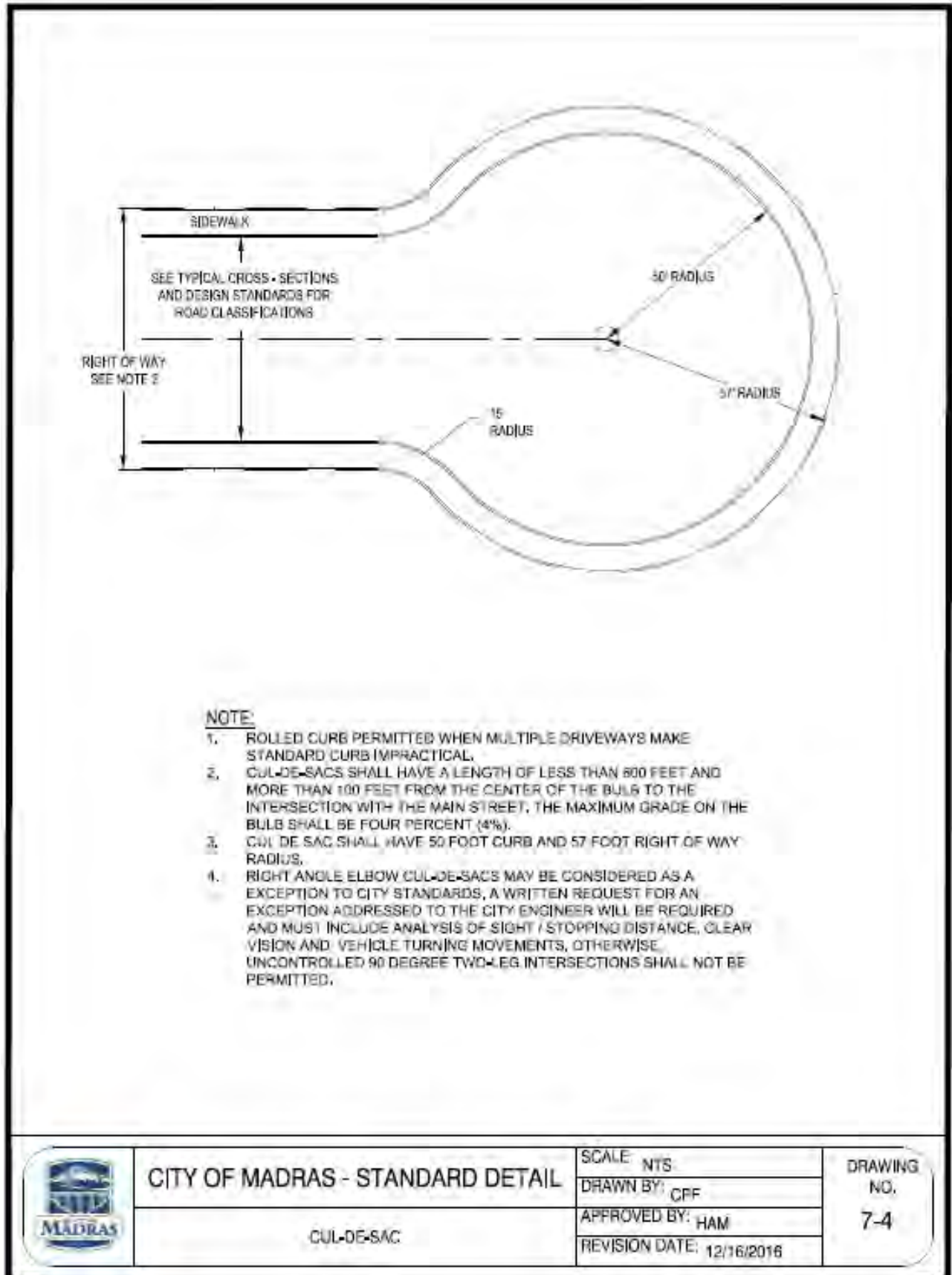
CITY OF MADRAS - STANDARD DETAIL

STREET/SIDEWALK SECTION

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 08/09/2017

DRAWING NO.
 7-1A





NOTE:

1. ROLLED CURB PERMITTED WHEN MULTIPLE DRIVEWAYS MAKE STANDARD CURB IMPRACTICAL.
2. CUL-DE-SACS SHALL HAVE A LENGTH OF LESS THAN 600 FEET AND MORE THAN 100 FEET FROM THE CENTER OF THE BULB TO THE INTERSECTION WITH THE MAIN STREET. THE MAXIMUM GRADE ON THE BULB SHALL BE FOUR PERCENT (4%).
3. CUL DE SAC SHALL HAVE 50 FOOT CURB AND 57 FOOT RIGHT OF WAY RADIUS.
4. RIGHT ANGLE ELBOW CUL-DE-SACS MAY BE CONSIDERED AS A EXCEPTION TO CITY STANDARDS, A WRITTEN REQUEST FOR AN EXCEPTION ADDRESSED TO THE CITY ENGINEER WILL BE REQUIRED AND MUST INCLUDE ANALYSIS OF SIGHT / STOPPING DISTANCE, CLEAR VISION AND VEHICLE TURNING MOVEMENTS, OTHERWISE UNCONTROLLED 90 DEGREE TWO-LEG INTERSECTIONS SHALL NOT BE PERMITTED.

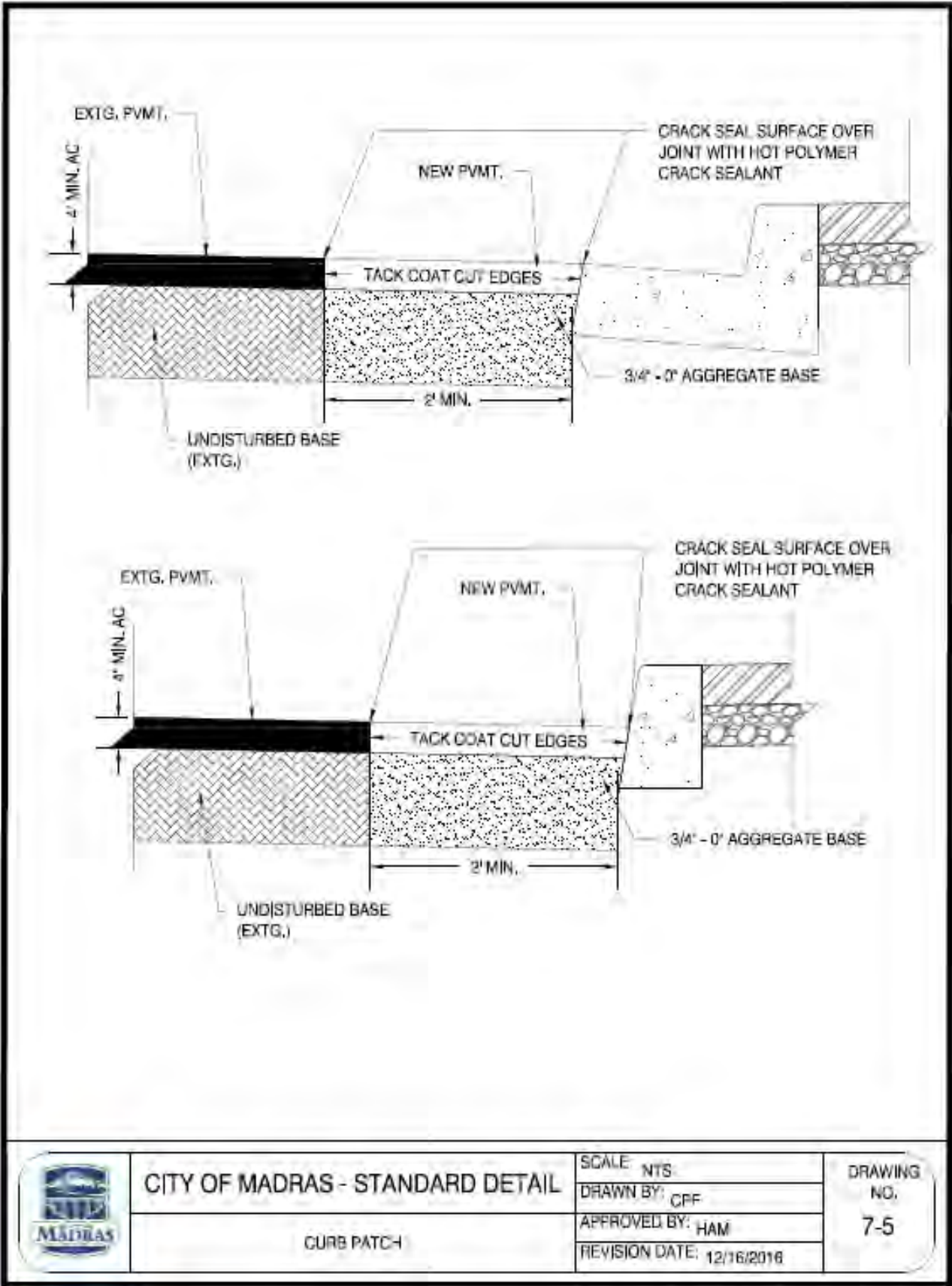


CITY OF MADRAS - STANDARD DETAIL

CUL-DE-SAC

SCALE: NTS
 DRAWN BY: CFF
 APPROVED BY: HAM
 REVISION DATE: 12/16/2016

DRAWING NO.
 7-4

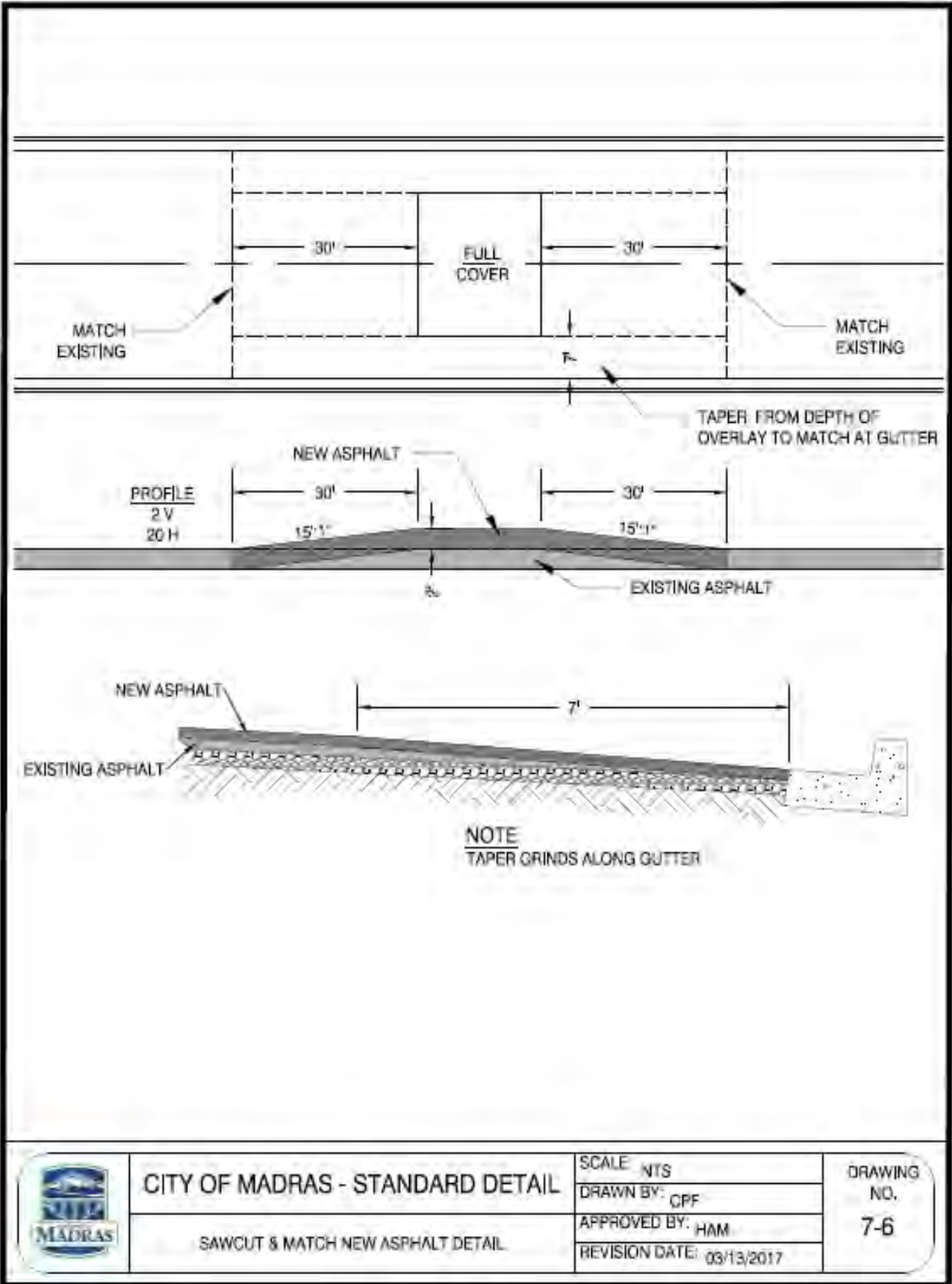


CITY OF MADRAS - STANDARD DETAIL

CURB PATCH

SCALE: NTS.
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 12/16/2016

DRAWING NO.
 7-5

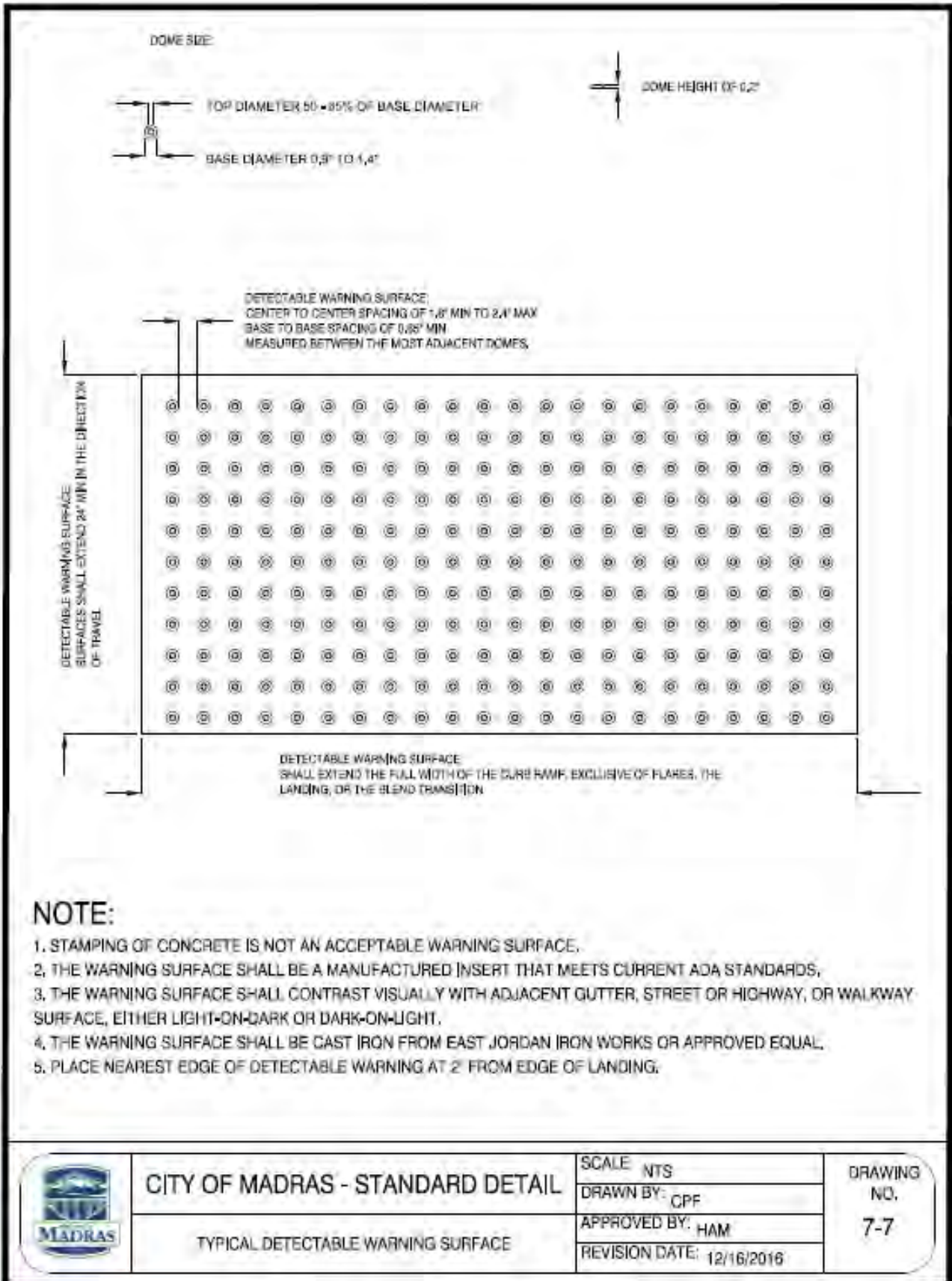


CITY OF MADRAS - STANDARD DETAIL

SAWCUT & MATCH NEW ASPHALT DETAIL

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 03/13/2017

DRAWING NO.
 7-6

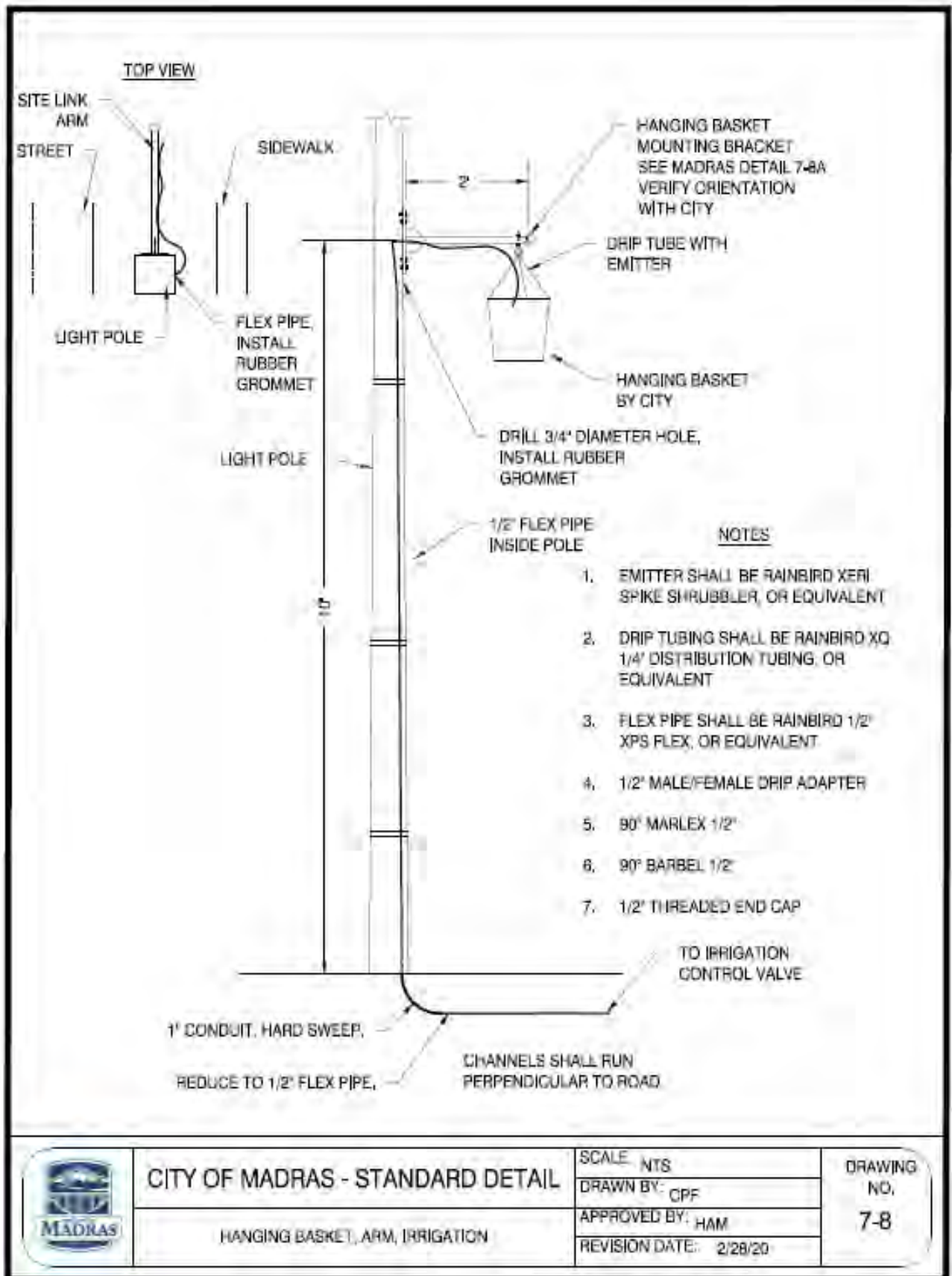


CITY OF MADRAS - STANDARD DETAIL

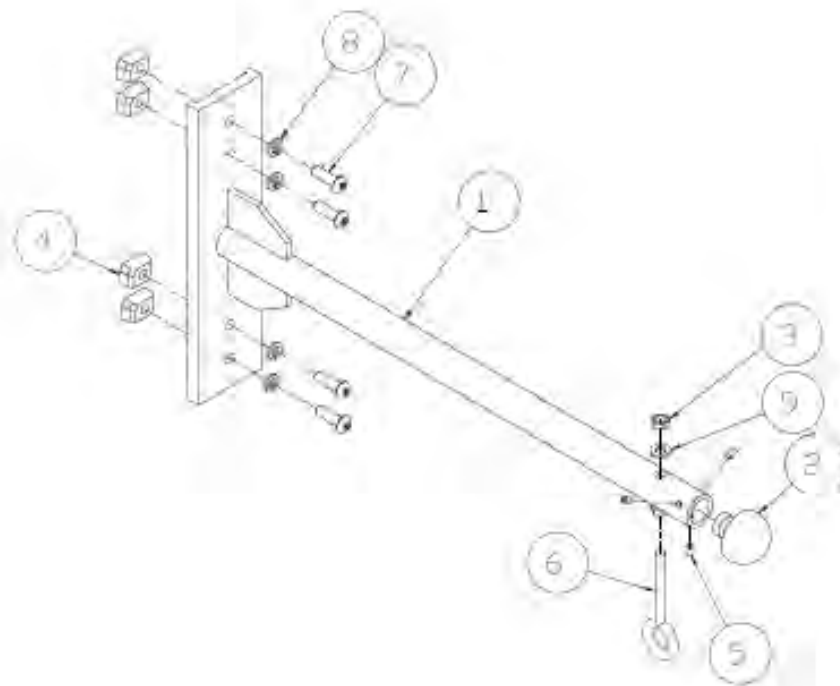
TYPICAL DETECTABLE WARNING SURFACE

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 12/16/2016

DRAWING NO.
 7-7



ITEM	QTY	DESCRIPTION
1	1	SLPBA24 1.00 SL4/S5 WELDMENT
2	1	FINIAL HALF BALL FOR 1" PIPE MACHINED
3	2	3/8-16 HEX NUT
4	4	TRACK NUT, SL4 AND SLS
5	3	SCRW, 1/4-20X1.375 SOC HD SET SK NYLOK
6	1	EYE BOLT, 3/8-16X1" W/SHLDR 304 SS
7	4	SCRW, 3/8-16X1.25 HTN HD TP SOC CAP SS
8	4	3/8 SPLIT LOCKWASHER SS
9	2	WASHER 3/8" FLAT

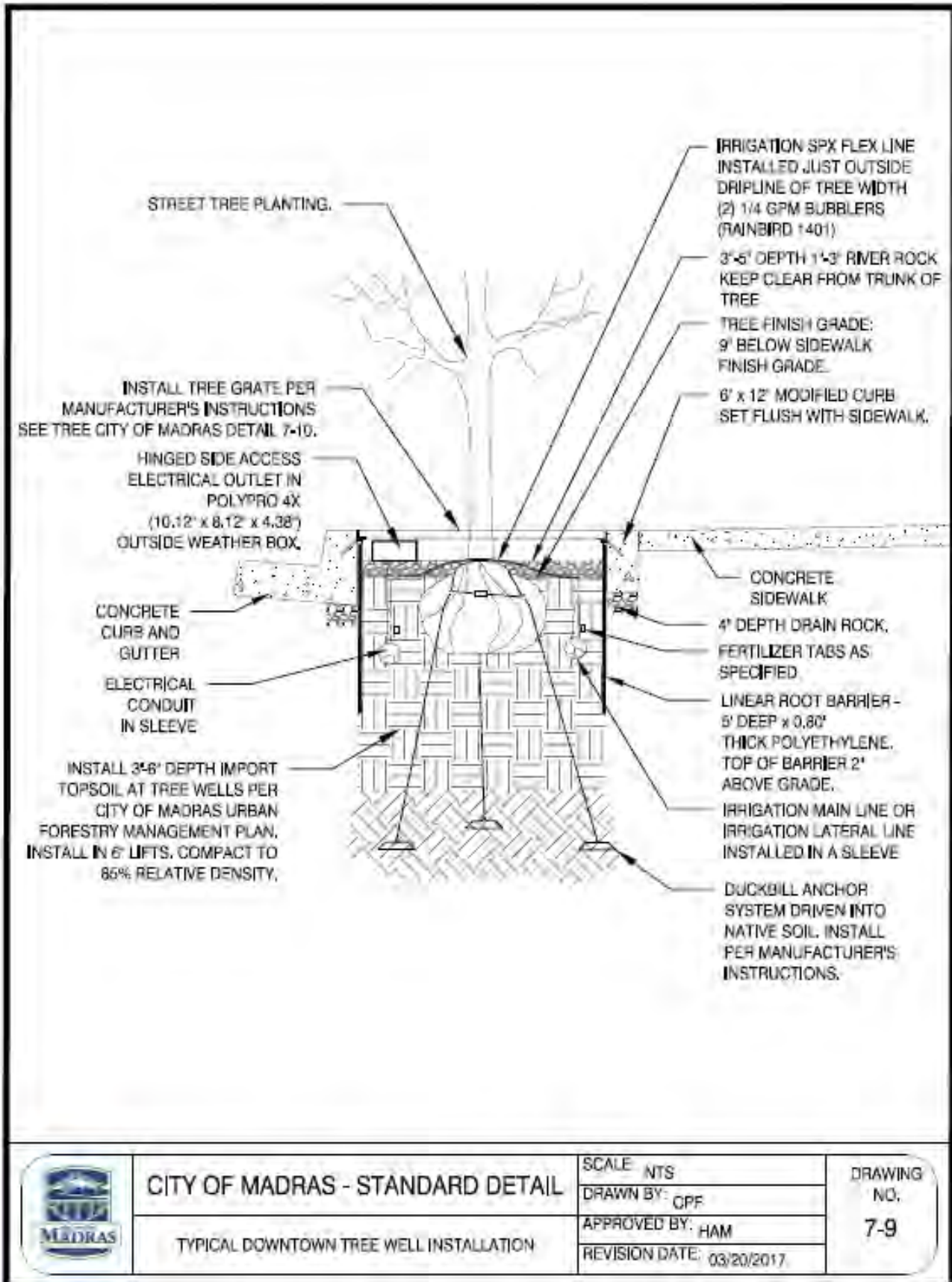


CITY OF MADRAS - STANDARD DETAIL

HANGING BASKET MOUNTING BRACKET

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 12/16/2015

DRAWING NO.
 7-8A

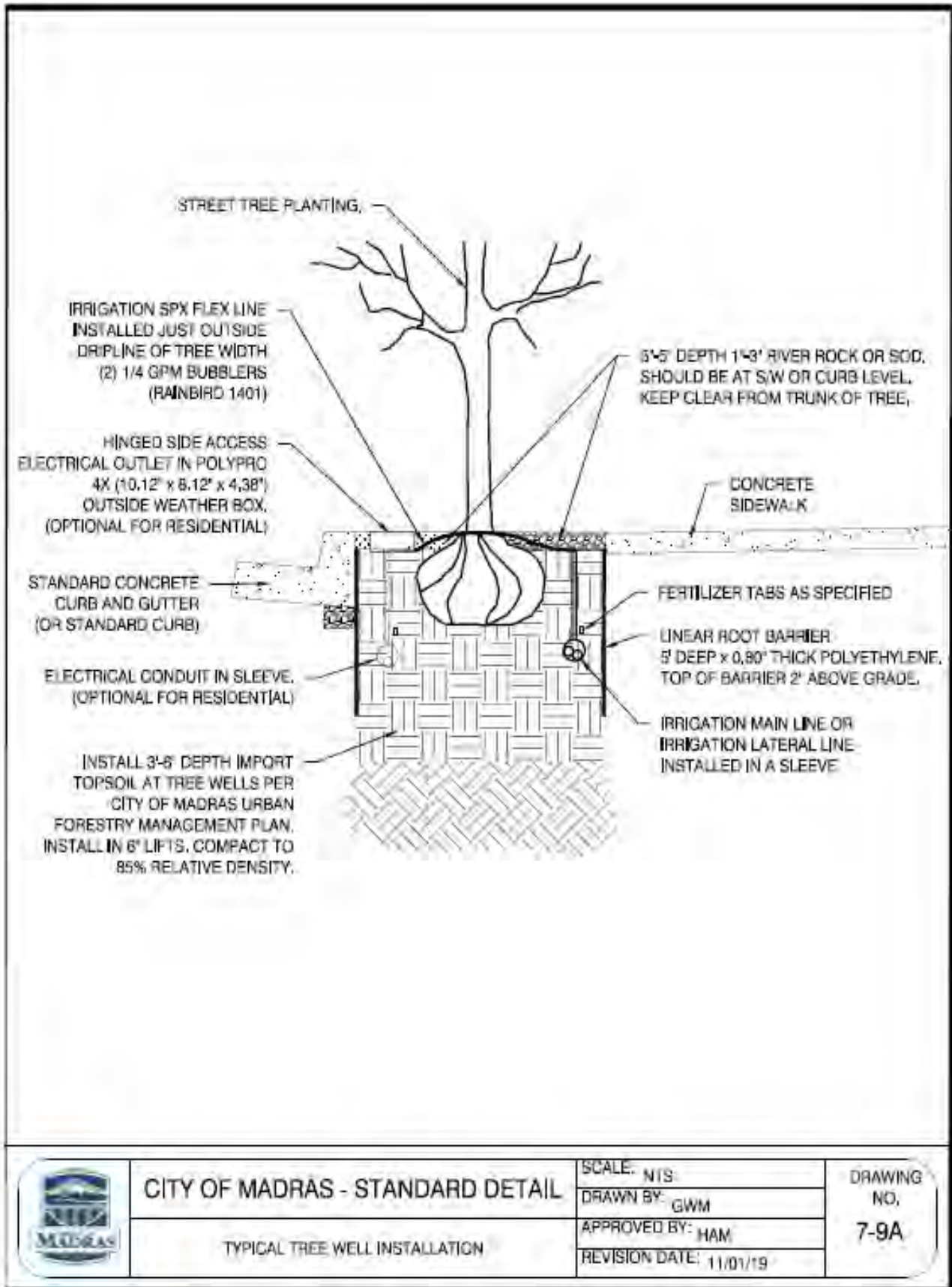


CITY OF MADRAS - STANDARD DETAIL

TYPICAL DOWNTOWN TREE WELL INSTALLATION

SCALE: NTS
 DRAWN BY: OPF
 APPROVED BY: HAM
 REVISION DATE: 03/20/2017

DRAWING NO.
7-9



CITY OF MADRAS - STANDARD DETAIL

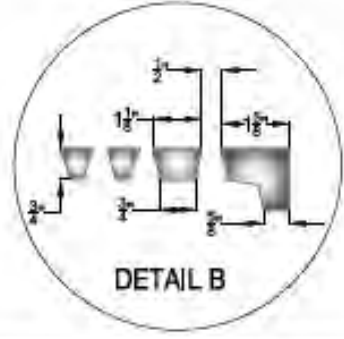
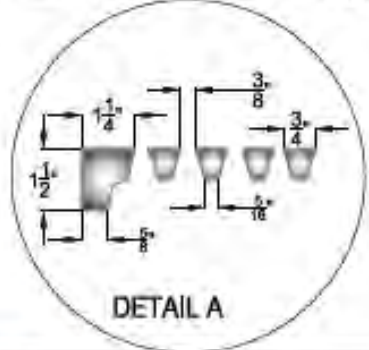
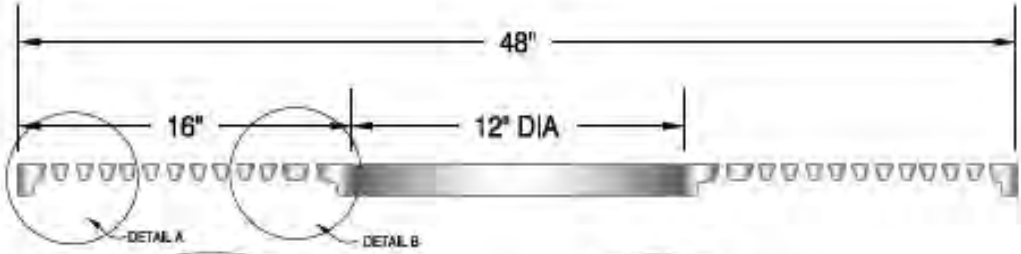
TYPICAL TREE WELL INSTALLATION


SCALE: NTS
 DRAWN BY: GWM
 APPROVED BY: HAM
 REVISION DATE: 11/01/19

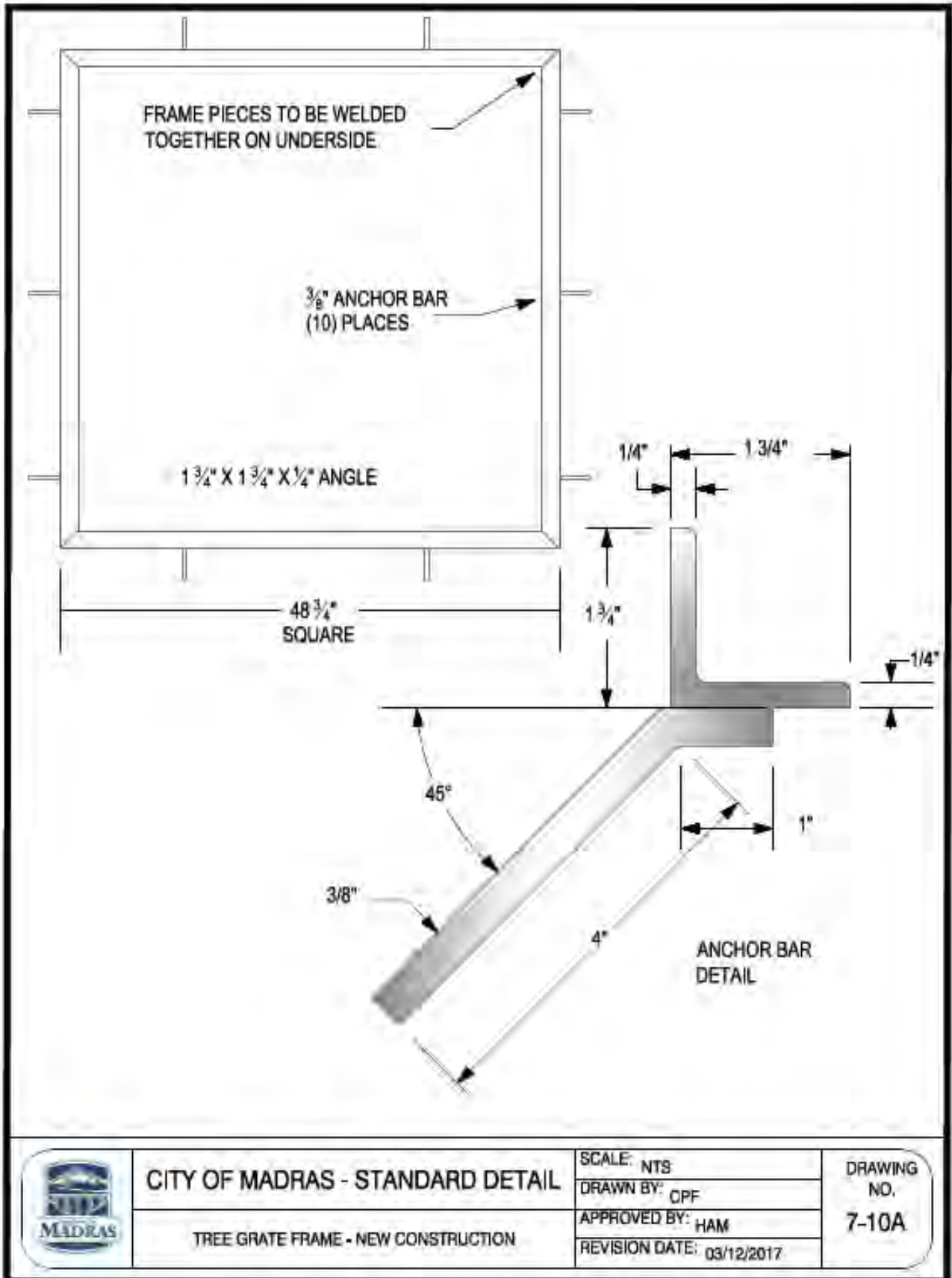
DRAWING NO.
 7-9A

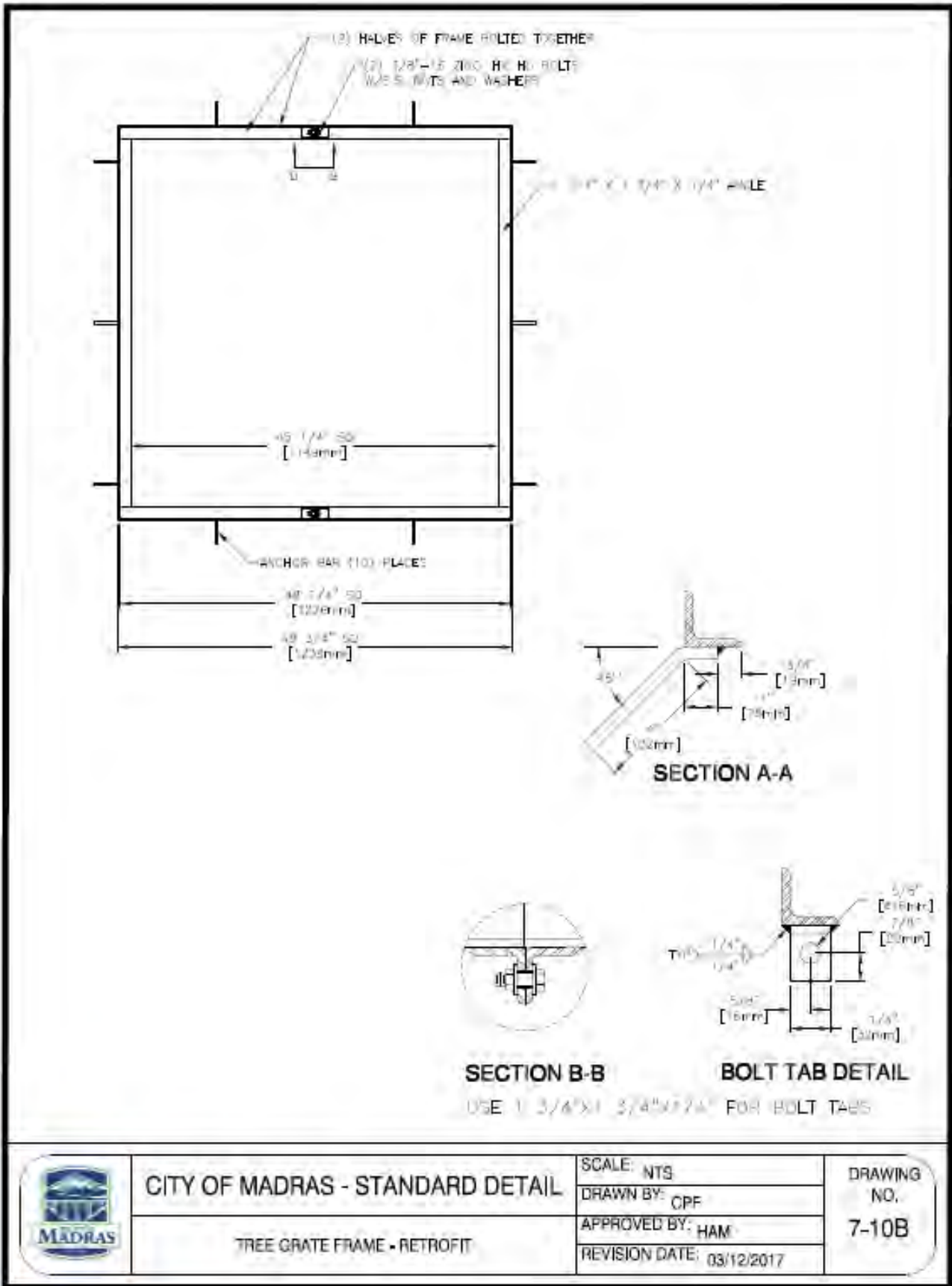


- NOTES:
1. 48" x 48" GRATE IS THE STANDARD SIZE GRATE.
 2. THE GRATE SHALL BE EAST JORDAN IRON WORKS OR APPROVED EQUAL.
 3. SEE DETAIL 7-10A FOR NEW CONSTRUCTION FRAME.
 4. SEE DETAIL 7-10B FOR RETROFIT FRAME.



	CITY OF MADRAS - STANDARD DETAIL	SCALE: NTS	DRAWING NO. 7-10
	TREE GRATE	DRAWN BY: CPF	
		APPROVED BY: HAM	
		REVISION DATE: 03/12/2017	



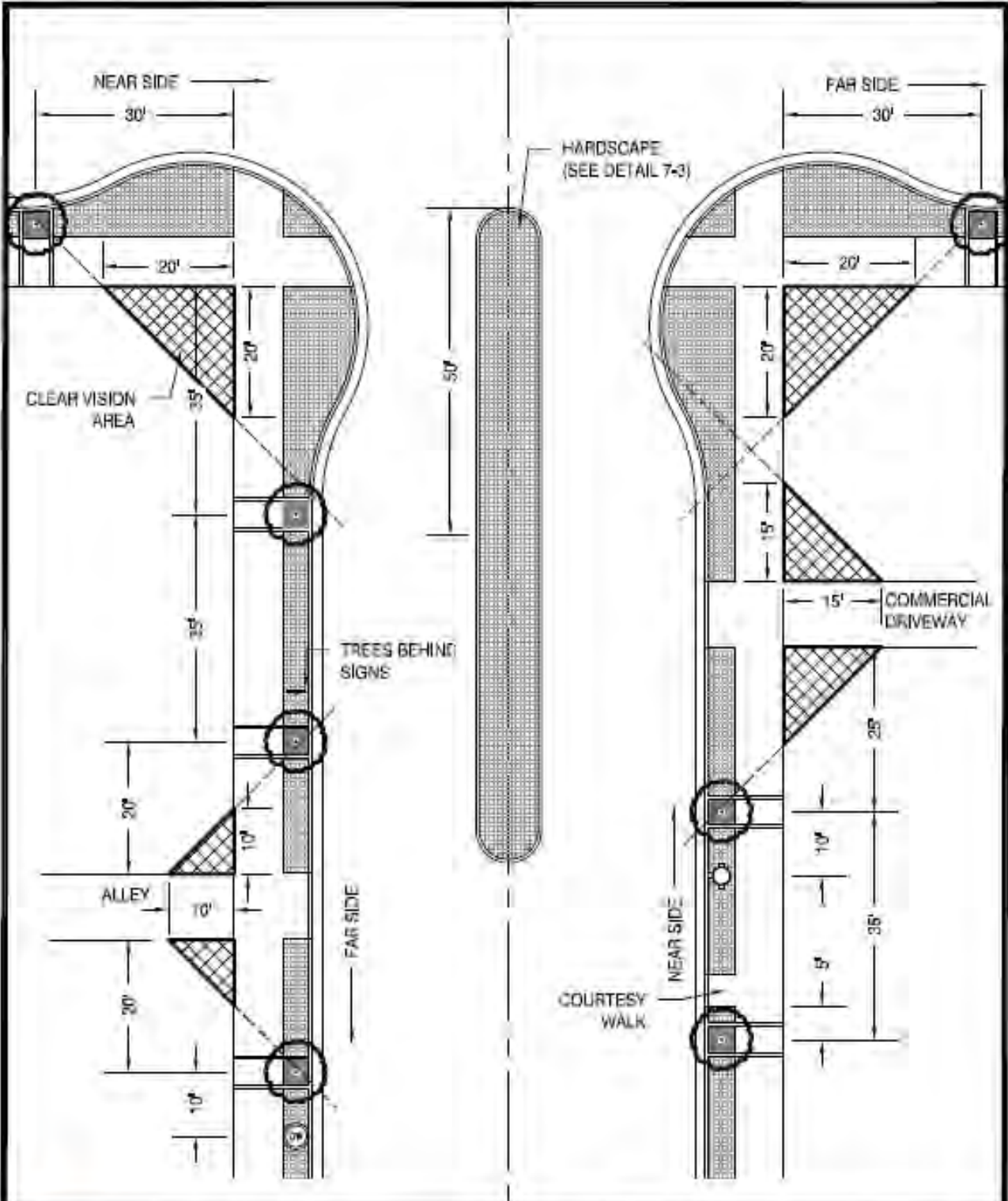


CITY OF MADRAS - STANDARD DETAIL

TREE GRATE FRAME - RETROFIT

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 03/12/2017

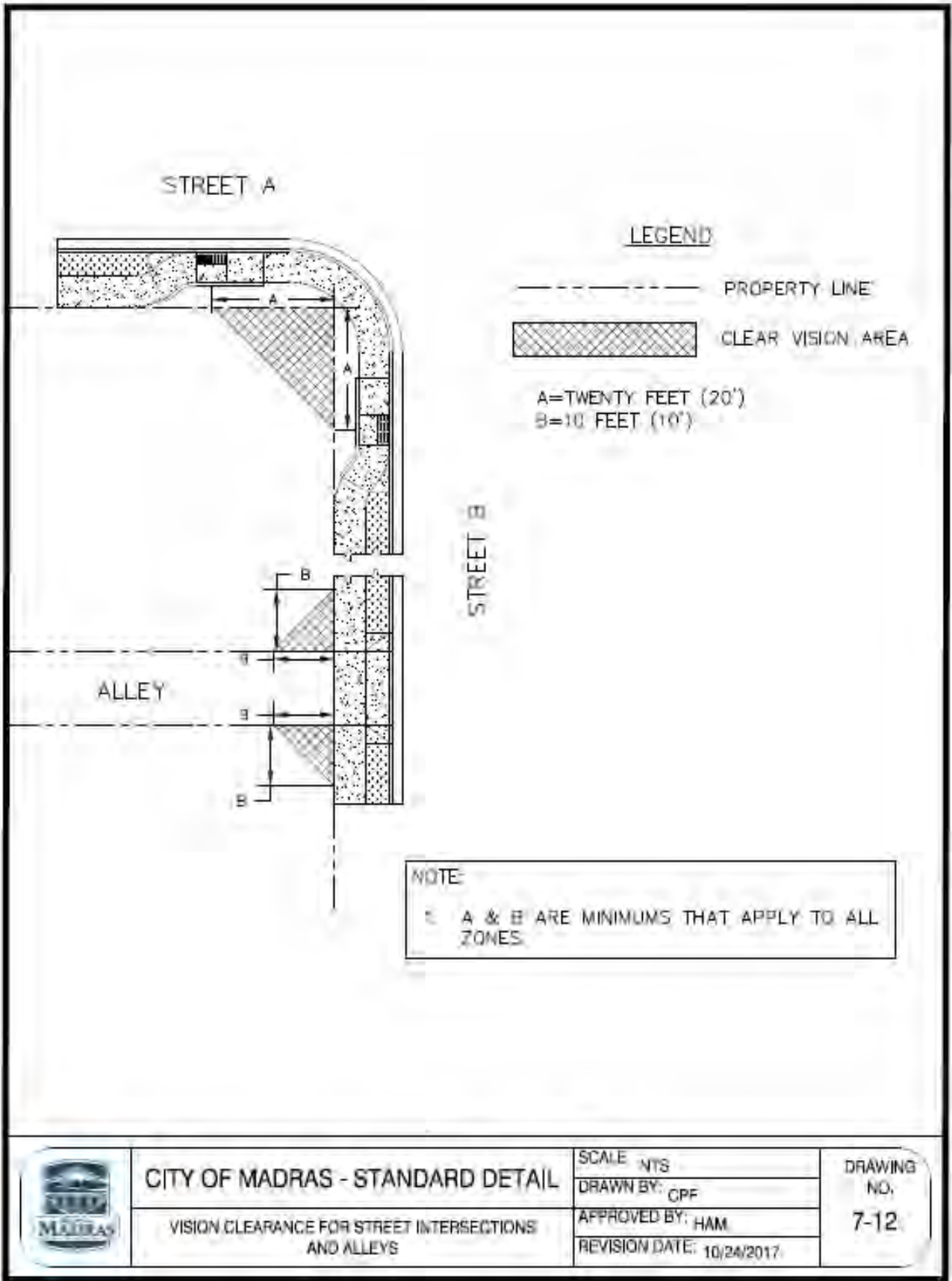
DRAWING NO.
7-10B

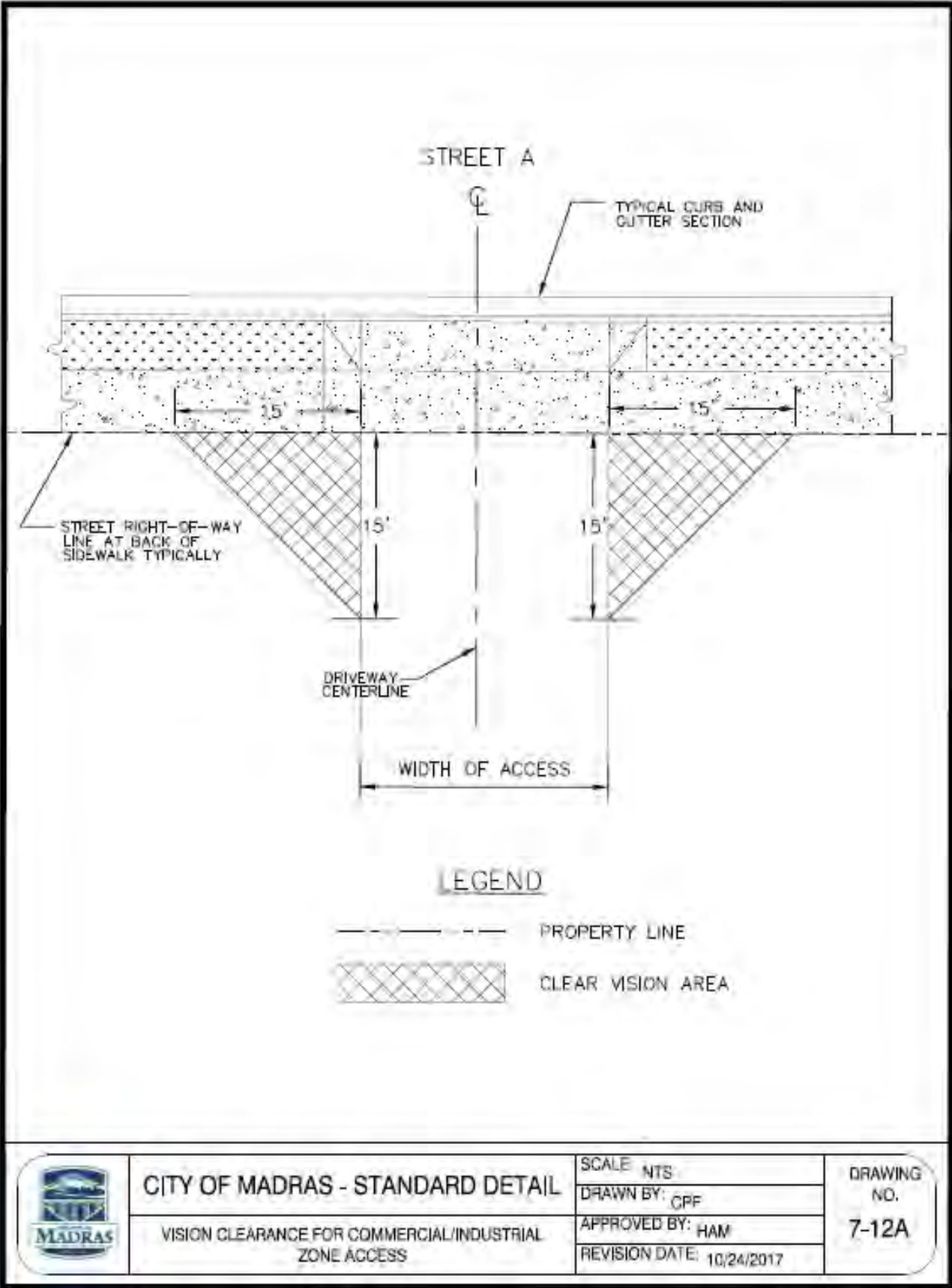



CITY OF MADRAS - STANDARD DETAIL
 TYPICAL DOWNTOWN STREET TREE LOCATION
 AND CLEAR VISION AREAS

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 05/02/2018

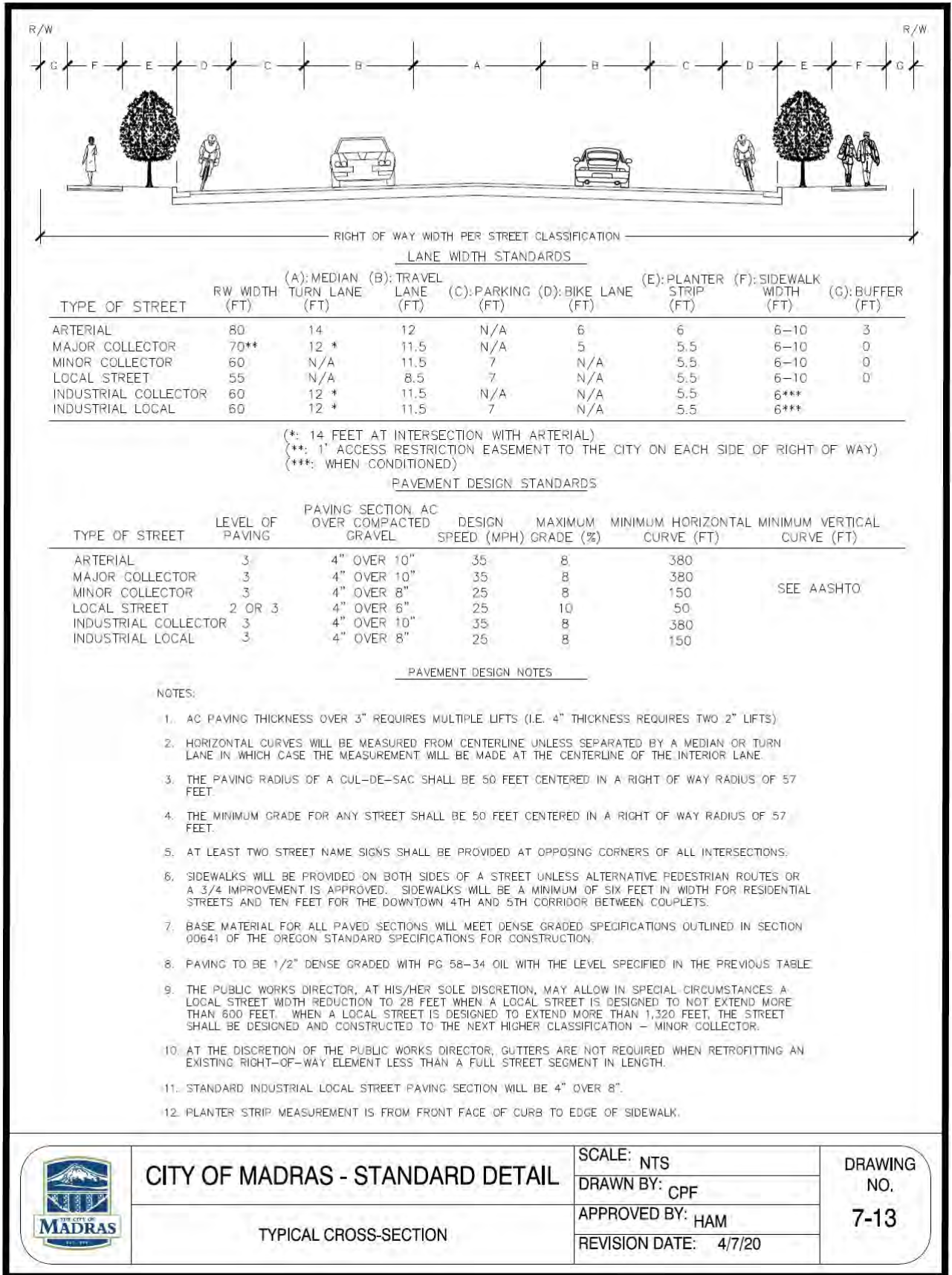
DRAWING NO.
7-11





	CITY OF MADRAS - STANDARD DETAIL	SCALE: NTS	DRAWING NO. 7-12A
		VISION CLEARANCE FOR COMMERCIAL/INDUSTRIAL ZONE ACCESS	
		APPROVED BY: HAM	
		REVISION DATE: 10/24/2017	

Public Improvement Design & Construction Standards

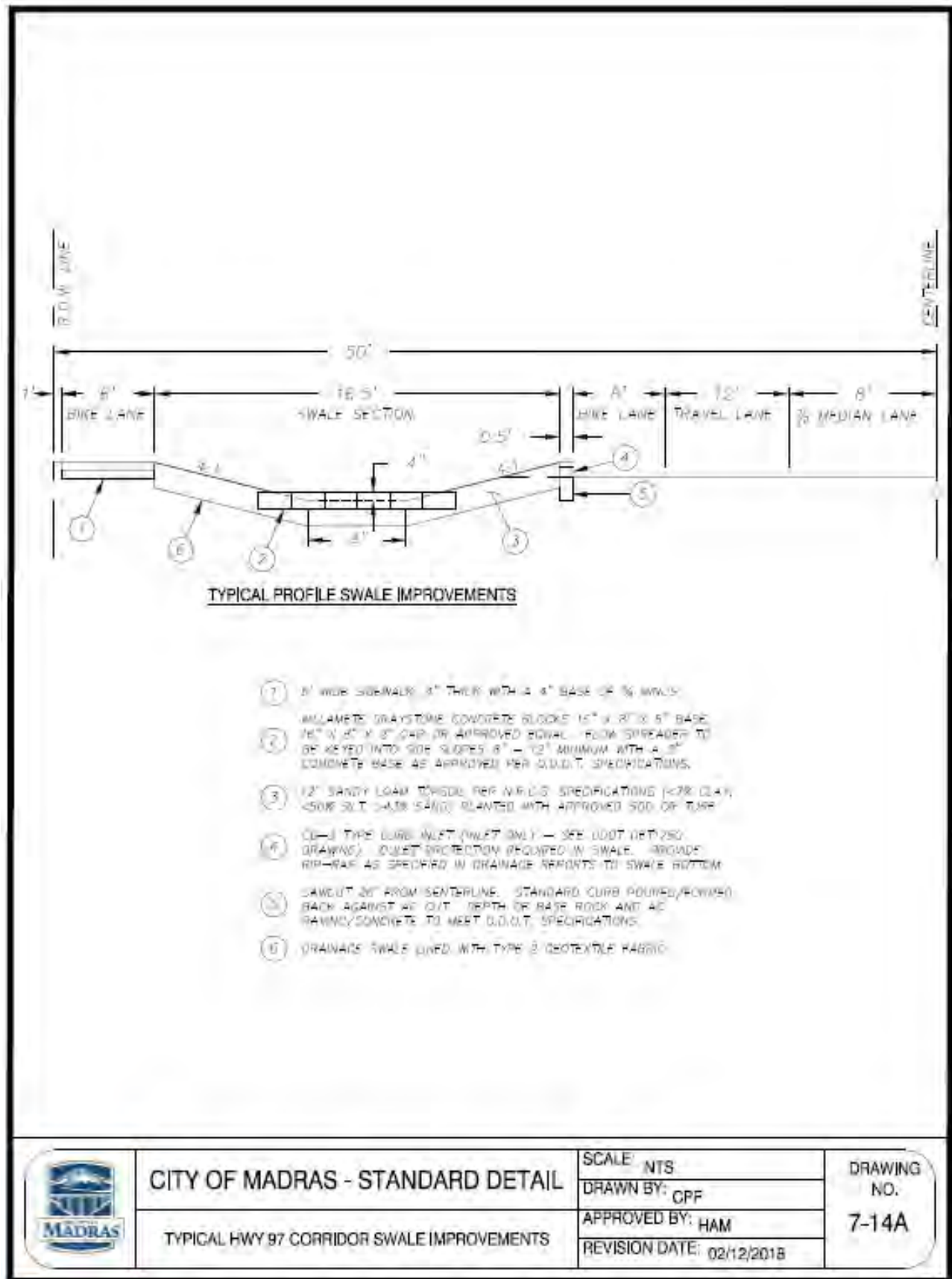


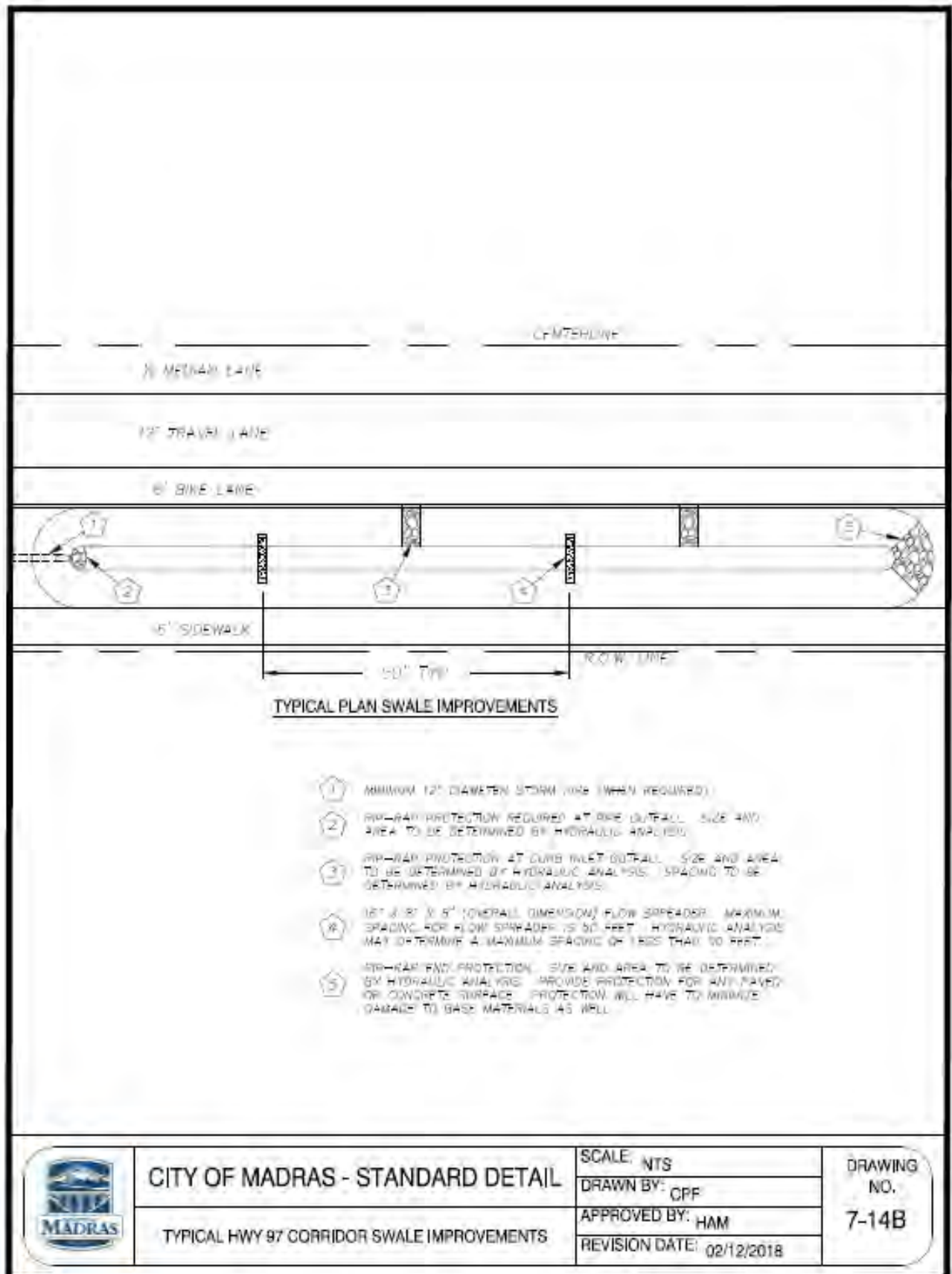
CITY OF MADRAS - STANDARD DETAIL

TYPICAL CROSS-SECTION

SCALE: NTS
DRAWN BY: CPF
APPROVED BY: HAM
REVISION DATE: 4/7/20

DRAWING NO.
7-13



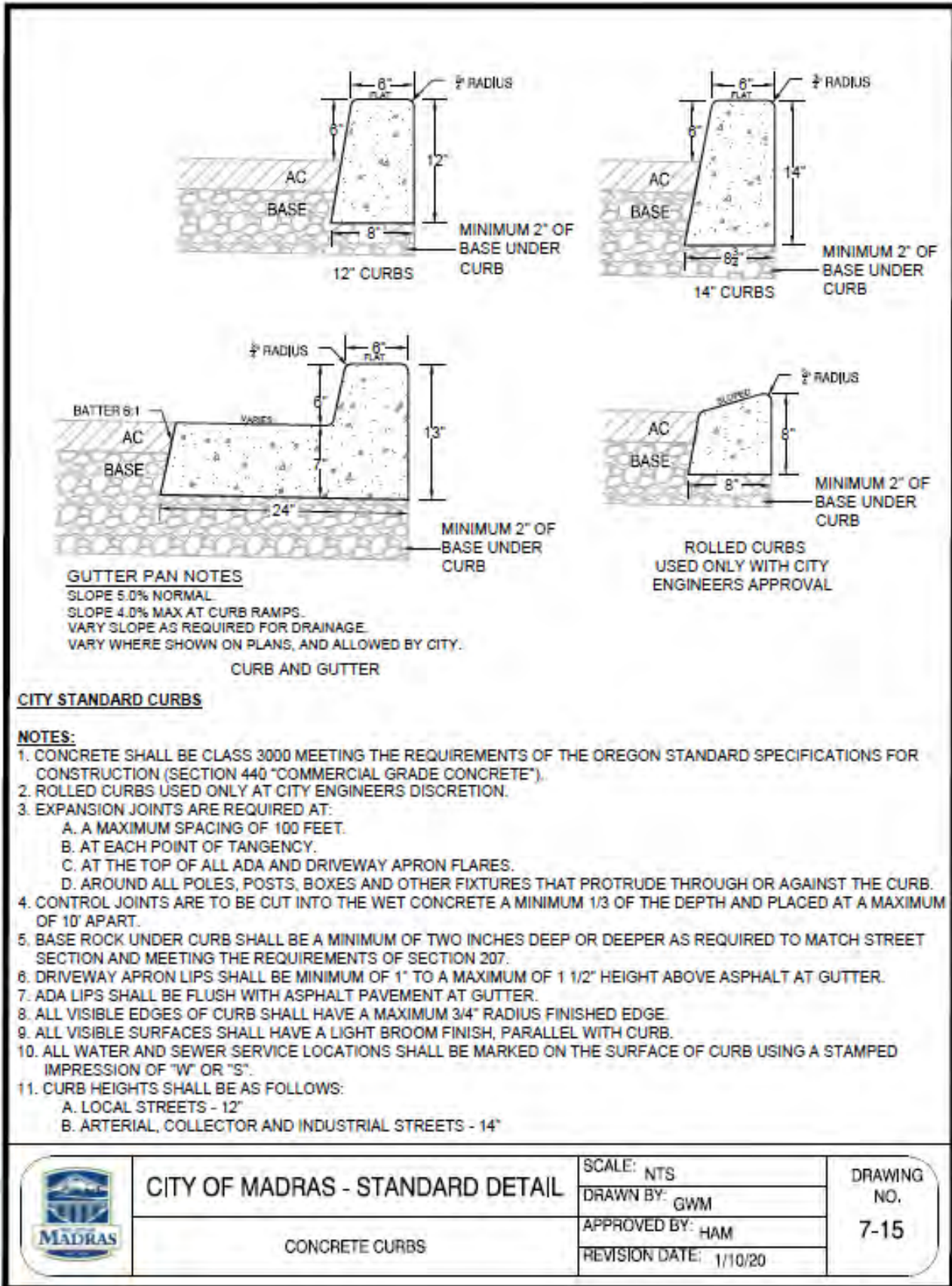


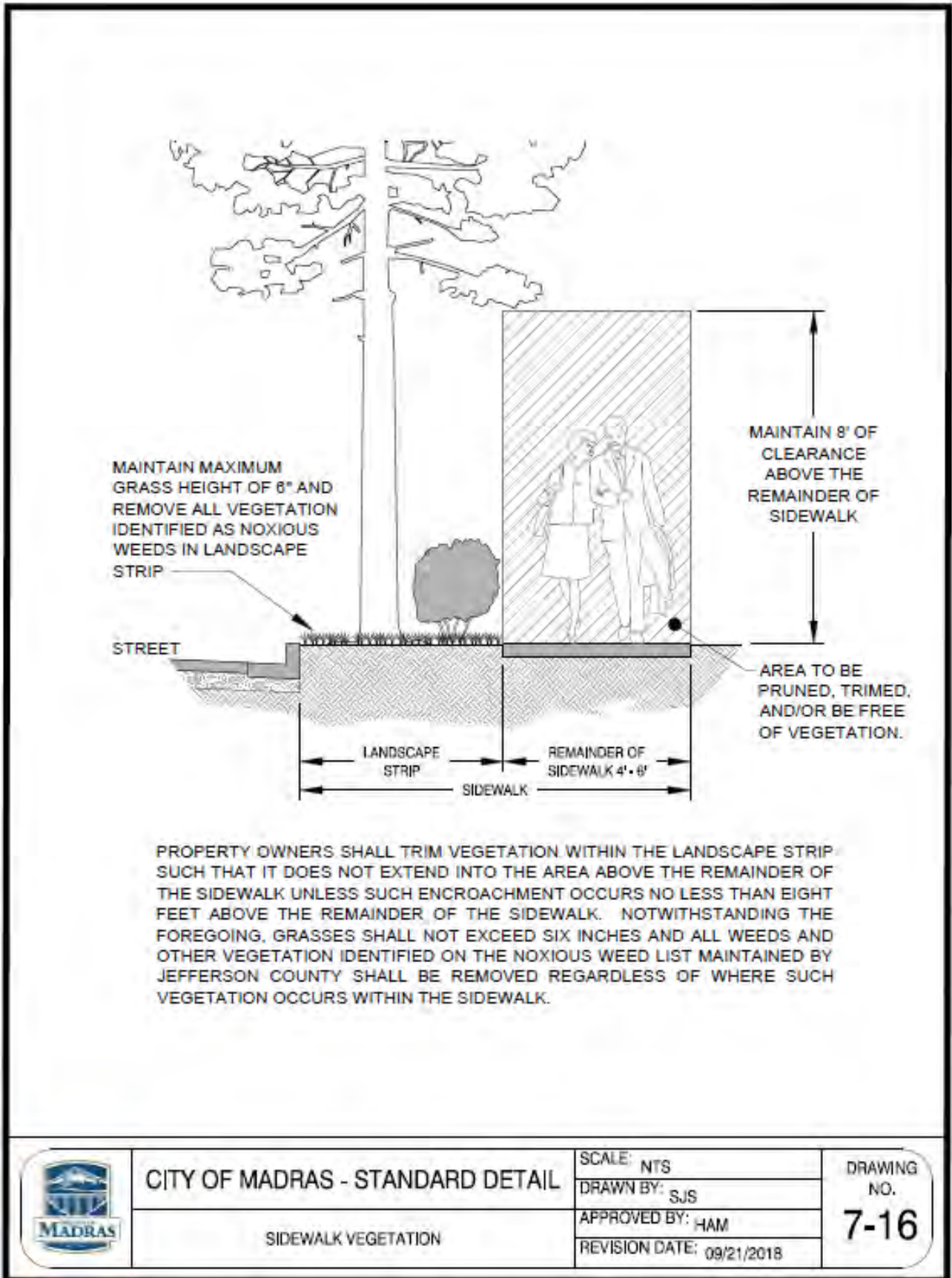
CITY OF MADRAS - STANDARD DETAIL

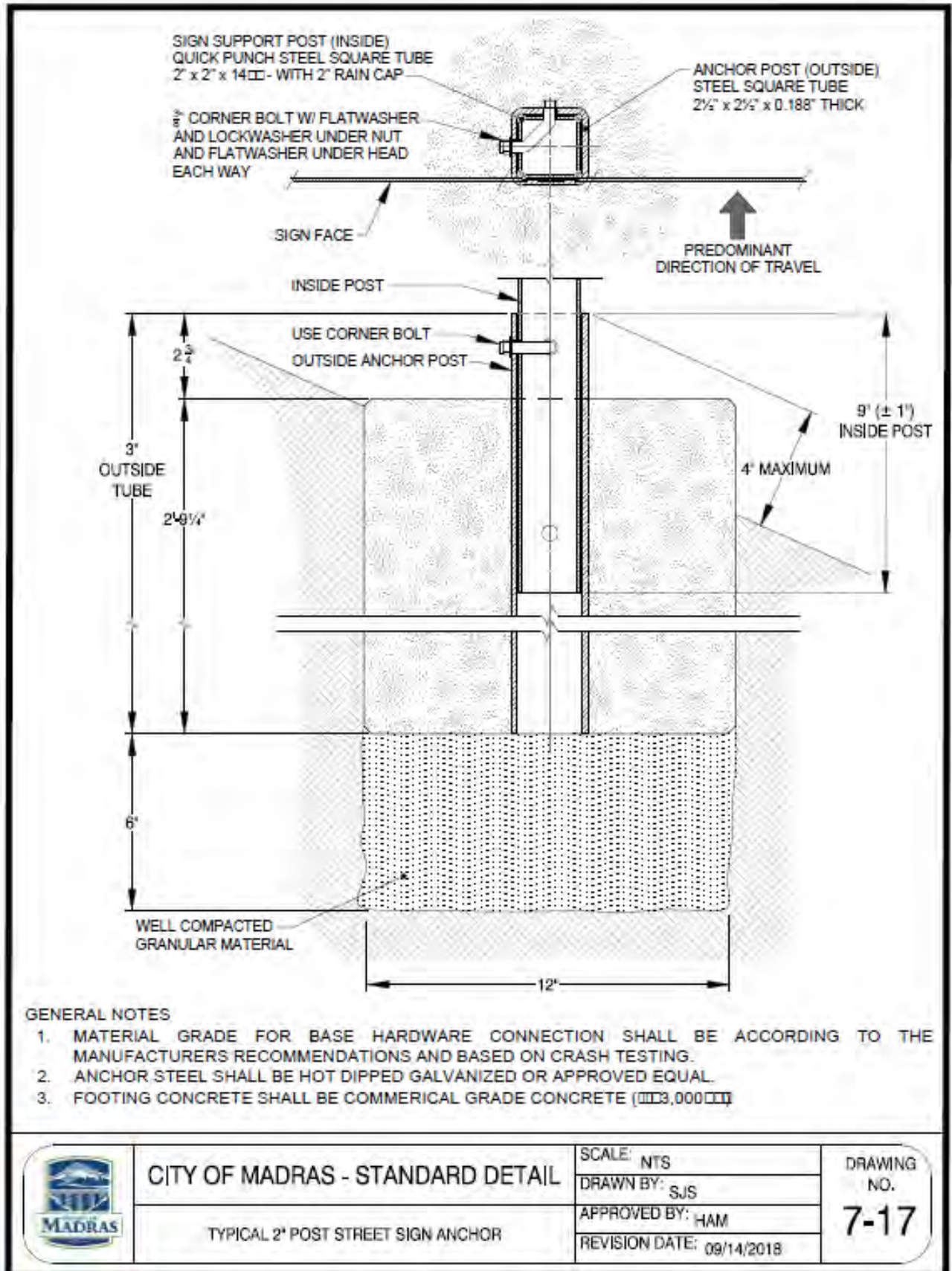
TYPICAL HWY 97 CORRIDOR SWALE IMPROVEMENTS

SCALE: NTS
 DRAWN BY: CPF
 APPROVED BY: HAM
 REVISION DATE: 02/12/2018

DRAWING NO.
7-14B







Specifications

POST DESCRIPTION
The lighting post shall be all aluminum construction consisting of a pole top adapter plate, painted Stainless steel shaft and a decorative fluted cast aluminum base.

MATERIALS
The base shall be heavy wall, cast aluminum produced from certified ASTM 355.1 Ingot per ASTM B-179-05a or ASTM B29-05. The shaft shall be extruded from aluminum, ASTM 6061 alloy. All hardware shall be temper resistant stainless steel. Anchor bolts to be completely hot dip galvanized.

DESIGN NOTES
The post shall be 14'-0\"/>

INSTALLATION
The post shall be provided with four, hot dip galvanized L-type anchor bolts to be installed on a 12\"/>

FINISH
The pole shall be standard Holograph Black Finish.

LEADERSHIP

- Lilly Washington LED
- 80 Watt 5000 DCT
- Auto-Sensing 120-277V
- Asymmetric Type III, Spike Finial
- HEMA Teletouch Photocell Receptacle
- 20' Prewired Leads
- DTL Teletouch Photocell For Solid-State Lighting

Anchorage Detail

DO NOT USE TO SET ANCHOR BOLTS
CONTACT CUSTOMER SERVICE FOR TEMPLATE

Order #: _____

Customer Signature: _____ **Date:** _____



City of Madras
Oregon

ORDER #: 2170-12-10218	TYPE: 1	DRAWING #:
REVISION:	REVISION DATE:	TSG 007330
DRAWN: KRW	ORIGIN DATE: 11/28/12	PAGE: 1 of 1

THIS DRAWING, WHEN APPROVED, WILL BECOME THE CONTRACT DOCUMENT FOR CONSTRUCTION TO BE PERFORMED BY HOLOPHANE. OTHER THAN AS SHOWN ABOVE, A LIST OF SUPPLIERS SHALL BE OBTAINED BY THE CONTRACTOR BY VISITING HOLOPHANE'S WEBSITE OR BY CONTACTING HOLOPHANE'S CUSTOMER SERVICE DEPARTMENT. HOLOPHANE SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO OBTAIN THE NECESSARY PERMITS AND APPROVALS FROM THE LOCAL, STATE AND FEDERAL AUTHORITIES. HOLOPHANE SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO OBTAIN THE NECESSARY PERMITS AND APPROVALS FROM THE LOCAL, STATE AND FEDERAL AUTHORITIES. HOLOPHANE SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO OBTAIN THE NECESSARY PERMITS AND APPROVALS FROM THE LOCAL, STATE AND FEDERAL AUTHORITIES.



CP3B "ML" Series

Main Load Center Series

1Ø/3 wire 120/240 or 208Y/120 volt

Typical applications: Remote site service for multiple loads

The Milbank Main Load Center Commercial Pedestals are designed to handle the vast majority of all requirements in a standard, stocked configuration.

- No waiting or extra charge
- Units all feature a load center with a plug on, back-fed main breaker.
- Load center has 16 positions for the 100 amp pedestals and 24 circuits for the 200 amp pedestals.
- Both sizes include sub-feed lugs to allow feeding an external panel

If your application requires turning loads on based on "dusk-to-dawn" requirements, be sure to see the Milbank Switched Load Center Commercial Pedestal products on the following page.



Features:

These units include everything required for remote site service:

- ↳ NEMA 3R construction
- ↳ Expandable—Load centers allow for future expansion without costly modifications.
- ↳ All units feature 200 amp meter socket with optional field-installable fifth terminal kit available
- ↳ 22K ampere interrupting capacity (AIC) standard
- ↳ Optional mounting base can be embedded in concrete for fast, easy installation
- ↳ Separate sealable and lockable utility termination section
- ↳ Separate sealable and lockable metering section with the option of:
 - EITHER**
 - Milbank ring-type socket with test / bypass blocks (conforms to EUSERC 308)
 - OR**
 - Milbank heavy duty ringless socket with lever bypass
- ↳ A separate sealable and lockable customer section with a load center for "always on" loads that includes:
 - Main circuit breaker
 - Twenty (200 or 125 amp model) or fourteen (100 amp model) blank breaker spaces
 - A circuit directory to document configuration

ML SERIES-MAIN LOAD CENTER

STOCKED PEDESTALS*	OPTIONAL FIFTH TERMINAL KIT	MAIN CB AMPS	LOAD CENTER SPACES	AIC	METER SOCKET TYPE	
CP3B11116A22	105J	100	1,2	16	22K	Ring-type with test / bypass blocks
CP3B11115A22	105J	100	1,2	16	42K	Ring-type with test / bypass blocks
CP3B12119A22	105J	200	1,2,3,4	24	22K	Ring-type with test / bypass blocks
CP3B51115A22	K3885	100	1,2	16	22K	Ringless socket with lever bypass
CP3B52119A22	K3885	200	1,2,3,4	24	22K	Ringless socket with lever bypass

*NOTE: Chart shows standard, stocked items. Other options and features are available. Contact factory for options details and availability.

Utility requirements for this equipment may vary. Always consult the serving utility before ordering or installing equipment in this catalog.



ACCESSORIES



CP-PE-TYP5-3POS
Photodetecto cell kit with HOA switch for field installation



CP-TC7D 7-day time clock kit

CP-TC24H 24-hour time clock kit

CP-TCWIRE Male four-pin connector and wiring harness for use with time clocks other than above

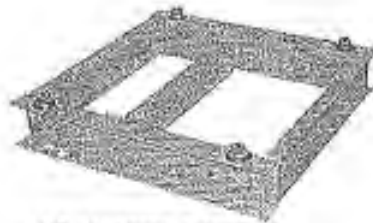
105J
Fiberglass terminal kit for use with ring-type meter sockets



K3065
Fiberglass terminal kit for use with ringless meter sockets



CP-16FPAD
Fiberglass pedestal mounting base for 16" pedestal (direct buried)



CP-16PDMNT-CALT
Pedestal mounting base (includes mounting hardware)



CP-ABK5/8
Anchor bolt kit (includes four 5/8 - 13 x 16" anchor bolts)

AVAILABLE FINISHES



Mint Green (Standard)

Black



Desert Tan

Dark Green

Pine Green



White

Gray

Summerland Gray



Pre-grained Stainless

Anodized Aluminum

Untreated Aluminum

Painted steel and aluminum models feature polyurethane industrial grade powder coating. Other finishes available by special order – consult factory.



SECTION 12 APPENDICES A & B

APPENDIX A:

1	Permits.....	194
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1-3	Water Connection and Inspection Permit.....	198
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APPENDIX B:

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Public Improvement Design & Construction Standards

CITY OF MADRAS

RIGHT-OF-WAY CONSTRUCTION & USE PERMIT

125 SW "E" Street, Madras, Oregon 97741 Telephone (541)475-2622 – Fax (541) 475-1038

Permit type (may include multiple types, please provide detail in the description field below).

Utilities	New Improvement	Repairs/Replacement
<input type="checkbox"/> Waterline*	<input type="checkbox"/> Sidewalk	<input type="checkbox"/> Sidewalk
<input type="checkbox"/> Sewerline*	<input type="checkbox"/> Curb	<input type="checkbox"/> Curb
<input type="checkbox"/> Storm	<input type="checkbox"/> Handicap Access	<input type="checkbox"/> Handicap Access
<input type="checkbox"/> Fire Line	<input type="checkbox"/> Driveway Access	<input type="checkbox"/> Driveway Access
<input type="checkbox"/> Franchise Utility		

May require additional permitting (i.e. sewer permit, water permit) call 541-475-2622 to verify

1. All forms shall be inspected prior to pour, please call for inspection 48 hrs. before 541-475-2622
2. Curb shall be poured separate from the sidewalk and/or driveway apron NO MONOLITHIC POURS
3. Non-Remonstrance Agreement for Sidewalks only
4. Contact Oregon Utility Notification Center (1-800-332-2344 or 811) before you dig
5. Contact Oregon Department of Transportation when working within State ROW

Miscellaneous

Roadway or Pedestrian Encroachment (Closure and/or Reroute)

Other: _____

Description and location of work being performed:

If project is to serve a new development, provide development name: _____

Proposed work start date: _____ Proposed completion date: _____

Will work require a lane closure? Yes No

Field Contact Name: _____ (must be available at all times)

Cell Number: _____ Email: _____

Closure Times: _____ AM PM to _____ AM PM

Approved Times are 7:00 AM – 6:00 PM

Applicant Name: _____ Phone: _____

Address: _____

Contractor: _____ Phone: _____

Address: _____

Application Date: _____ Name of person picking up permit: _____

Public Improvement Design & Construction Standards

INSURANCE REQUIREMENTS:

Contractor/Franchisees shall provide and maintain, the following minimum levels of insurance: (a) general liability insurance for all losses or claims arising out of or related to Contractor's performance of its obligations under this Agreement (including, without limitation, damages as a result of death or injury to any person or destruction or damage to any property) with limits of not less than \$1,000,000 per occurrence, \$2,000,000 in the aggregate; (b) comprehensive automobile liability insurance for all owned, non-owned, and hired vehicles that are or may be used by Contractor in connection with Contractor's performance of the Services with limits of not less than \$1,000,000 per occurrence, \$2,000,000 in the aggregate; (c) errors and omissions insurance with limits of not less than \$1,000,000 per occurrence, \$2,000,000 in the aggregate; and (d) workers' compensation insurance in form and amount sufficient to satisfy the requirements of applicable Oregon law.

As evidence of the insurance coverage required by this permit, the Permittee shall furnish a certificate of insurance to the City prior to issuance of the Right-of-Way Construction and Use Permit. The City of Madras, its officers, agents, and employees shall be named as an additional insured on such certificate. The certificate of insurance shall be accompanied by a copy of the additional insured endorsement.

Franchisees that have a current Certificate of Insurance on file at the Madras City Hall will not be required to provide proof of insurance with each permit application.

BUSINESS LICENSE REQUIREMENT:

Except as otherwise exempted under section 4 of Ordinance No. 849, no person may establish, maintain, operate, engage, conduct, and/or carry on any business within the City of Madras without first applying for and obtaining a business license.

NOTE: NO WORK SHALL COMMENCE UNTIL APPLICANT HAS RECEIVED A VALID SIGNED PERMIT.

Notify Public Works Department at 541-475-2622 and Oregon Utility Notification Center at 1-800-322-2344 or 811 before commencing work

This approval is requested pursuant to City Ordinance No. 477. Neither party to this permit is relieved of the responsibility or liability for injury or damage by its intentional conduct. Applicant will hold harmless and will indemnify the City, its agents, officers, and employees against any and all claims, demands, loss, injury, damage actions, or costs of actions whatsoever which they or any of them may sustain by reason of the acts, omissions or other negligence of applicant, its agents, or employees in connection with the construction, maintenance, repair, operations, or use of said facility.

Specifications for, and placement of, all facilities shall be to City of Madras standards and shall conform to any specifications attached to and made a part of this permit.

Permittee/Applicant hereby acknowledges that they have read and understand these requirements.

_____/_____
Signature of Applicant Permittee / Date

OFFICE USE ONLY

Comments: _____

Fee Received YES Franchise YES NO

Approved: _____ Date: _____

Submittal Requirements for Work in the Public Right-of-Way

- ✓ Complete Right-of-way Construction and Use Permit Application.
 - ✓ Vicinity map showing nearest cross street(s)
 - ✓ Site plan showing proposed work – legible, accurate, and drawn to scale (1" = 20') which shall include the following:
 - ✓ North arrow
 - ✓ Location of property lines abutting the area of proposed work
 - ✓ Location and name of streets, alleys and walkways in the area of and adjacent to the proposed work
 - ✓ Location of all driveways on the subject property and nearest driveway on adjacent properties
 - ✓ Location of on street parking spaces, accessible parking spaces must be marked as such
 - ✓ Location of known utilities and drainage facilities in the work area
 - ✓ Dimensions from known utilities identified through current locate to property lines and area of work
 - ✓ Dimensions of proposed work, distance between driveways and property lines, property line for curb
 - ✓ Location and type of all traffic control devices and street lights adjacent to the proposed work
-

Additional submittal requirements for traffic closures

- ✓ Show proposed traffic control devices including; sign types/legends and device types/spacing within delineated work area
 - ✓ Traffic control plan in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) or utilize ODOT Standard Detail Drawings where applicable.
 - ✓ Show limits of work zone, existing lane configuration, distance to all intersections within 500 linear feet and existing traffic control devices.
 - ✓ Show proposed traffic control devices including, sign types/legends and device types/spacing
-

Additional submittal requirements for walkway and bike lane closures

- ✓ Pedestrians should be provided with a safe, convenient travel path that replicates as nearly as possible the most desirable characteristics of sidewalks, footpaths or bike lanes.
- ✓ Plan, Drawing or declaration depicting how pedestrian and bicyclist movement through or around the work site will be managed. Refer to Manual on Uniform Traffic Control Devices (MUTCD) or utilize ODOT Standard Detail Drawings where applicable.
- ✓ If a pedestrian walkway structure is to be constructed, provide detailed drawings to scale with dimensions, including:
 - ✓ Elevation
 - ✓ Cross-section
 - ✓ Walkway slope elevations
 - ✓ Bracing and framing details



THE CITY OF
MADRAS

SEWER CONNECTION AND INSPECTION PERMIT

DATE: _____ ACCOUNT # _____

PERMIT FEE: \$175.00 RECEIPT #: _____ NUMBER OF EDU'S _____

SINGLE FAMILY RESIDENCE DUPLEX TRIPLEX APARTMENT BLDG. COMMERCIAL

APPLICANT: _____ PHONE #: _____

ADDRESS: _____

City State Zip

OWNER'S NAME: _____ PHONE #: _____

ADDRESS: _____

City State Zip

MAP #: _____ TAX LOT #: _____

SERVICE LOCATION/ADDRESS: _____

ESTIMATED TURN ON DATE: _____ (All new sewer connections are plugged until customer notifies the City to begin services)

By signing this application, I fully understand that I am responsible for payment of services to this address. If my sewer service is utilized without billing in place I will be liable for back dated charges or measured usage.

Customer Signature

Date

CONTRACTOR PERFORMING INSTALLATION

CONTRACTOR: _____ CCB #: _____ EXP: _____

ADDRESS: _____

City State Zip

CITY OF MADRAS BUSINESS LICENSE NUMBER: _____

OFFICE USE ONLY

APPROVAL IS HEREBY GRANTED TO MAKE CONNECTION TO THE CITY SEWER SYSTEM AND CONNECTION HAS BEEN COMPLETED IN CONFORMANCE WITH THE CITY OF MADRAS STANDARDS AND SPECIFICATIONS.

APPROVED BY: _____ DATE: _____

Utility Dept. Supervisor or Designee

CONNECTION TO CITY SEWER MUST BE SUPERVISED AND INSPECTED BY CITY PERSONNEL. FOR AN INSPECTION, PLEASE CALL 541-475-7259 48 HRS IN ADVANCE TO SCHEDULE AN INSPECTION.

*City of Madras is an Equal Opportunity Provider
Contact Oregon Utility Notification Center (1-800-332-2344 or 811) before you dig*



City of Madras, 125 SWE Street, Madras, OR 97741. Tel. (541) 475-2344 Fax (541) 475-1038

WATER CONNECTION AND INSPECTION PERMIT

DATE: _____ ACCOUNT # _____

PERMIT FEE: \$125.00 RECEIPT #: _____

3/4" SERVICE 1" SERVICE 1 1/2" SERVICE 2" SERVICE _____ SERVICE

APPLICANT: _____ PHONE #: _____

ADDRESS: _____

City State Zip

OWNER'S NAME: _____ PHONE #: _____

City State Zip

ADDRESS: _____

MAP #: _____ TAX LOT #: _____

SERVICE LOCATION ADDRESS: _____

CONTRACTOR PERFORMING INSTALLATION

CONTRACTOR: _____ CCB #: _____ EXP: _____

ADDRESS: _____

City State Zip

CITY OF MADRAS BUSINESS LICENSE NUMBER: _____

OFFICE USE ONLY

APPROVAL IS HEREBY GRANTED TO MAKE CONNECTION TO THE CITY WATER SYSTEM IN CONFORMANCE WITH THE CITY OF MADRAS STANDARDS AND SPECIFICATIONS.

APPROVED BY: _____ DATE: _____

Utility Dept. Supervisor or Designee

CONNECTION HAS BEEN COMPLETED IN CONFORMANCE WITH CITY OF MADRAS REGULATIONS AND STANDARDS.

APPROVED BY: _____ DATE: _____

Utility Dept. Supervisor or Designee

CONNECTION TO CITY WATER MUST BE SUPERVISED AND INSPECTED BY CITY PERSONNEL. FOR AN INSPECTION, PLEASE CALL 541-475-7259 48 HRS IN ADVANCE TO SCHEDULE AN INSPECTION.

*City of Madras is an Equal Opportunity Provider
Contact Oregon Utility Notification Center (1-800-332-2344 or 811) before you dig*

Fact Sheet

Applying for the 1200-C Construction Stormwater Permit



State of Oregon
Department of
Environmental
Quality

Operations Division
811 SW Sixth Avenue
Portland, OR 97204
Phone: 503-229-5696
800-452-4011
Fax: 503-229-5850
Contact: Erich Brandstetter
www.oregon.gov/DEQ

Background

In Dec. 2016, the Water Quality Administrator for DEQ signed the revised National Pollutant Discharge Elimination System Stormwater Construction General Permit No. 1200-C to be effective starting Dec. 15, 2015. The permit regulates stormwater runoff to surface waters from construction activities that disturb one or more acres in Oregon.

What you need to know

Construction sites disturbing one acre or more must be covered under either the NPDES 1200-C or 1200-CN permit. In addition, construction sites disturbing less than one acre and part of a larger common development plan or sale must be covered under either the 1200-C or 1200-CN permit. Examples of a large common development or sale include a subdivision or possibly a business park.

Permit applications

1. Obtain the application and check to see where to send it.

You can obtain permit application forms on DEQ's [website](http://www.oregon.gov/DEQ).

If you have questions about the application or do not have access to the internet, please contact the regional DEQ stormwater representative, agent or local government agency, who can provide assistance on the preparation and submittal of the application.

DEQ Agents:

City of Eugene, City of Hermiston, City of Troutdale, Clean Water Services (serving Washington County), Clackamas County Service District #1 and Rogue Valley Sewer Services.

DEQ Regional Offices for Stormwater:
Eugene, Pendleton, Bend and Portland

1200-CN Local Government Agencies:

City of Albany, City of Corvallis, City of Eugene, City of Milwaukie, City of Springfield, City of West Linn, City of Wilsonville, City of Gresham, City of Troutdale, City of Wood Village, Multnomah County, Clackamas County Service District #1 and Surface Water Management Agency of Clackamas County.

Clean Water Services and Rogue Valley Sewer Services.

2. What you submit with your application

For projects that disturb one or more acres, submit one paper copy and one electronic copy of a completed application form, an approved Land Use Compatibility Statement with Findings, if applicable, and a full sized Erosion and Sediment Control Plan. For projects that disturb less than one acre and are part of a larger common plan, submit one paper copy of a completed application form, and a full sized ESCP. These forms and related guidance documents, including the application and ESCP guidance document are available on [DEQ's website](http://www.oregon.gov/DEQ) or can be obtained at a DEQ regional office or through a DEQ agent.

3. Permit fees

You must submit the appropriate permit fees to DEQ or its Agent at the time you apply for new permit coverage.

Appropriate fees are available on [DEQ's stormwater web pages](http://www.oregon.gov/DEQ). All stormwater permits charge an application fee and an annual fee upon registration. The registrant will also be billed an annual fee for every year the permit coverage is in effect after the first year. Please note: if submitting a dewatering or active treatment Operating and Maintenance Plan to address contaminants beyond sediment, a disposal system plan review fee may be charged as indicated in Table 70H.

If you are submitting your application to a DEQ agent, please contact the Agent for information on the fees.

4. Processing your application

Once you submit the application materials, DEQ or its Agent will review the forms to make sure the application is complete as well as technically and administratively adequate. DEQ or its Agent will return any incomplete application with a list of missing information.

Please note: An incomplete application (incomplete forms, applications submitted without fees, and so on) will be returned to you and will slow the processing of your permit coverage.

Last Updated: 2/11/16
By: Erich Brandstetter

5. Public review for construction sites disturbing five acres or more.

- Projects that have the potential to disturb five acres or more of land will be subject to public review. Applications and Erosion and Sediment Control Plans for these projects will be subject to a 14-calendar day public review and comment period.
- A notice will be posted on [DEQ's website](#) for public notice. The public will have 14-calendar days to review the application materials and submit comments to DEQ about the application and ESCP. The application materials may also be reviewed at the regional DEQ office.
- After the public comment period, DEQ will review the comments and determine if the Erosion and Sediment Control Plan is adequate. DEQ may request that you change the plan based on public comment.
- After accepting the Erosion and Sediment Control Plan, DEQ or its agent will assign the applicant coverage under the 1200-C permit, and will notify all commenters.

For assistance, please contact the DEQ regional stormwater representative in your area.

DEQ regional (stormwater) offices:

Bend: 541-278-4605

Eugene: 541-686-7326

Pendleton: 541-278-4605

Portland: 503-229-5263

Alternative formats

Alternative formats of this document can be made available. For more information call 503-229-5696, Portland, or call toll-free in Oregon at 1-800-452-4011, ext. 5696. Hearing-impaired persons may call 711.

APPENDIX B – ACRONYM LIST AND DEFINITIONS

AASHTO	American Association of State Highway and Transportation Officials
ADA	American Disabilities Act
ANSI	American National Standard Institute
ARC	Atecedent Runoff Condition
ARX	AutoCad Runtime Extension
ASTM	American Standard Test Method
AVC	Air-Vacuum Control
AWG	American Wire Gauge
AWWA	American Water Works Association
BMP	Best Management Practice
CAD	Computer Aided Design
CADD	Computer Aided Design Development
CEC	Central Electric Co-op
CIP	Capital Improvement Program
CLSM	Controlled Low Strength Materials
CMP	Corrugated Metal Pipe
COE	Corps of Engineers
CTP	Color Dependent Plotting
DBH	Diameter at Breast High
DCC	Deschutes County Code
DEQ	Department of Environmental Quality
DI	Ductle Iron
DSL	Oregon Division Of State Lands
DVWD	Deschutes Valley Water District
EDU	Equivilant Dwelling Unit
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GVW	Gross Vehicle Weight
HCM	Highway Capacity Manual
HDPE	High Density Polyethylene

HMAC	Hot Mix Asphalt Concrete
HOA	Hand, off & Auto Positions
IBC	International Building Code
IDF	Intensity- Duration Frequency
IES	Illumination Engineering Society
ISD	Intersection Sight Distance
ITE	The Institute of Traffic Engineers
LOS	Level of Service
NAD	North American Data
NCHRP	National Cooperative Highway Research Program
NEC	National Electrical Code
NPDES	National Pollutant Discharge Elimination
NRCS	Natural Resource Conservation Service
OAR	Oregon Administrative Rule
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
ORS	Oregon Revised Statute
OSHA	Occupational Safety & Health Administration
P&ID	Process and Instrumentation Diagrams
PC	Point of Curvature
PCC	PDX Cement Concrete
PDF	Portable Document Format
PI	Point of Intersection
PLC	Process Loop Control
PP&L	Pacific Power and Light
PRV	Pressure Reducing Valve
PSTALB	Proposed Stationing Label
PT	Point of Tangency
PTR	Part Time Restriction
PUE	Public Utility Easement

Public Improvement Design & Construction Standards

PVC	Polyvinyl Chloride
QA	Quality Assurance
QPL	Qualified Products Lists
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SCSUH	Soil Conservation Service Unit Hydrograph
SD	Short Drain
SDC	System Development Charge
SSD	Stopping Site Distance
STA	Special Transportation Area
TAL	Transportation Analysis Letter
TIA	Traffic Impact Analysis
TIS	Transportation Impact Study
TPR	The Oregon Transportation Planning Rule
TSP	Transportation System Plan
UGB	Urban Growth Boundary
UIC	Underground Injection Control
UPC	Uniform Plumbing Code
UPS	Uninterruptible Power Supply
V/C	Volume-to-Capacity
VFD	Variable Frequency Drives
WPCF	Water Pollution Control Facility