CITY OF ROSEVILLE
CONSTRUCTION STANDARDS - CST
January 2023

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ABBREVIATIONS

The following abbreviations are used within these Construction Specifications:

AASHTO:	American Association of State Highway and Transportation Officials
AB:	Aggregate Base
ABS:	Acrylonitrile-Butadiene-Styrene
AC:	Asphalt Concrete and Alternating Current
ASB:	Aggregate Subbase
ANSI:	American National Standards Institute
ARV:	Air Release Valve
ASTM:	American Society for Testing and Materials
AWG:	American Wire Gauge
AWWA:	American Water Works Association
BCR:	Beginning of Curb Return
BO:	Blow Off
C & G:	Curb and Gutter
C-C:	Center to Center
C.F.:	Cubic Foot
CIP:	Cast-in-place
C/L:	Centerline
C.M.P.:	Corrugated Metal Pipe
Const.:	Construction
CST:	Construction
Ctrs:	Centers
Cu. Ft.:	Cubic Feet
DET:	Detail
Dia.:	Diameter
DIP:	Ductile Iron Pipe
DLC:	Detector Lead-in Cable
DR:	Drainage
Dwg:	Drawing
EUD:	Environmental Utilities Director/Department
EVA:	Emergency Vehicle Channel A
EVB:	Emergency Vehicle Channel B
EVC:	Emergency Vehicle Channel C
EVD:	Emergency Vehicle Channel D
Fdn.:	Foundation
FL:	Flowline

Ga.:	Gauge
Gal.:	Gallon
Galv.:	Galvanized
GR:	Grading
HDPE:	High Density Polyethylene
Horz.:	Horizontal
Hz:	Hertz
IBOC:	Internal Battery Operated Clock
ID:	Inside Diameter
LED:	Lighted Electronic Display
LS:	Landscaping
LMA:	Luminaire Mast Arm
MAS:	Mast-Arm Side mount
MAT:	Mast-Arm Top mount
Max.:	Maximum
Mil.:	Millimeter
Min.:	Minimum
M.P.	Metal Plate
No.:	Number
O.C.:	On Center
OD.:	Outside Diameter
OSHA:	Occupational Safety & Health Administration
P.C.C.:	Portland Cement Concrete
PEU:	Photoelectric Unit
P.O.C.	Point of Connection
PPB:	Pedestrian Push Button
PPM:	Parts Per Million
PRD:	Parks and Recreation Director/Department
PSI:	Pounds Per Square Inch
PVC:	Polyvinyl Chloride
RCP:	Reinforced Concrete Pipe
RCV:	Remote Control Valve
Rwd:	Redwood
R.P.:	Radius Point
R/W:	Right-of-Way

Sch:	Schedule
SDMH:	Storm Drain Manhole
SMA:	Signal Mast Arm
SS:	Sanitary Sewer System
SSMH:	Sanitary Sewer Manhole
ST:	Street
STD:	Standard
TS:	Traffic Signals and Markings
TYP.:	Typical
UBC:	Uniform Building Code
UL:	Underwriters' Laboratory, Inc.
U.S.A.:	Underground Service Alert
VA:	Volts ampere
Var.:	Variable
VCP:	Vitrified Clay Pipe Bell and Spigot
Vert:	Vertical
WWF:	Welded Wire Fabric
WWM:	Welded Wire Mesh

All references to specifications, standards other publications refer to the current issue.

SECTION 11: PURPOSE AND DEFINITIONS

11-1 PURPOSE

The purpose of these Construction Standards is to provide minimum standards to be applied to improvements which are to be dedicated to the public and accepted by the City for maintenance or operation and certain private works, as well as improvements to be installed within existing rights-of-way and easements. This is necessary in order to provide for coordinated development of required facilities to be used by and for the protection of the public. These Construction Standards shall apply to, regulate, and guide construction of streets, highways, alleys, drainage, sewerage, traffic signals, site access, water supply facilities and related public improvements, and shall set guidelines for all private works which involve drainage, grading, and related improvements.

11-2 CONSTRUCTION PRACTICE

Because it is virtually impossible to anticipate all situations that may arise or to prescribe specifications applicable to every situation, any items or situations not included in these Construction Standards shall be constructed in accordance with the latest edition of the State of California Department of Transportation Standard Specifications and Standard Plans, hereinafter referred to as the Caltrans Standards Specification. Caltrans Standard

Specifications shall apply where not superseded by these Construction Standards. The Contractor shall follow all applicable City, County, State and Federal laws and regulations relating to construction of the improvements or as directed by the City Engineer.

Should conflicts arise between documents, specifications in these Construction Standards or the approved improvement plans, they shall take precedence over the State of California Department of Transportation Standard Specifications.
The City Engineer may require additional specifications and/or regulations consistent herewith when deemed necessary to protect the health, safety and welfare of the public.

11-3 DEFINITIONS

Whenever the following terms or titles are used in these specifications, or in any document or instrument where these specification govern, the intent and meaning shall be as herein defined:

A. Applicant: Shall mean the same as the Developer or his/her consulting engineer working on his/her behalf.

B. Approved Plans: Shall mean all plans prepared for construction of improvements, reviewed, approved and signed by the necessary Departments within the City of Roseville.

C. City: Shall mean the City of Roseville and its applicable Departments.

D. City Construction Inspector: Shall mean the Development Services Inspector representing the City Engineer for all infrastructure improvements within City right of way.

E. City Engineer: Shall mean the City Engineer of the City of Roseville, acting either directly or through the staff of the appropriate Divisions of the Development Services Department or their authorized representatives.

F. Construction Standard Details: Shall mean the standard construction drawings as set forth in these Design & Construction Standards and included herein, approved by the City Engineer and as amended.

G. Consulting Engineer: Shall mean any person or persons, firm, partnerships or corporation legally authorized to practice civil, mechanical, geotechnical, electrical engineering, or other engineering discipline in the State of California who prepares or submits improvement plans and specifications to the Development Services Department of the City of Roseville for approval.

H. Contractor: Shall mean any person or persons, firm, partnerships, corporation or combination thereof, licensed to perform the type of work involved, who has entered into a contract with any person, corporation or company, or his/her or their legal representatives, for the construction of any improvements, or portions of any improvements, within the City of Roseville.

I. Development of Services Department: Shall mean the Development Services Department of the City of Roseville.

J. Department of Public Works: Shall mean the Department of Public Works or Public Works Department of the City of Roseville.

K. Developer: Shall mean any persons, firm, partnership, corporation, or combination thereof, financially responsible for the work involved. For City projects, the term Developer shall refer to the Contractor contracted with the City.

L. Development: Shall mean the act or process of any construction on properties as well as subdivision improvements.

M. Electrical Utilities Director: Shall mean the Electrical Utilities director of the City of Roseville, acting either directly or through the staff of the appropriate Divisions of the Electric Utilities Department or their authorized representatives.

N. Environmental Utilities Director: Shall mean the Environmental Utilities Director of the City of Roseville, acting either directly or through the staff of the appropriate Divisions of the Environmental Utilities Department or their authorized representatives.

O. Geotechnical Engineer: Shall mean a professional engineer, licensed by the State of California to practice soils engineering.

P. Improvements: Refers to street work, bridges, sidewalk, curb, gutter, driveways, water mains, sanitary sewer mains, reclaimed water mains, storm drainage, traffic signals, public

utilities, landscaping, irrigation, parks, fences, walls and other facilities to be constructed or installed by the developer within an existing or future public right-of-way or easement and other improvements which the City of Roseville is responsible for inspection and future maintenance.

Q. Laboratory: Shall mean any testing agency or testing firm which has been approved by the Development Services Department.

R. Notice of Completion: Shall mean the acceptance of the constructed improvements by the City Council of the City of Roseville.

S. Parks and Recreation Director: Shall mean the Parks and Recreation Director of the City of Roseville, acting either directly or through the staff of the appropriate Divisions of the Parks and Recreation Department or their authorized representatives.

T. Planning Manager: Shall mean the Planning Manager of the City of Roseville, acting either directly or through the staff of the appropriate Divisions of the Development Services Department or their authorized representatives.

U. Director: Shall mean the Development Services Department Director of the City of Roseville, acting either directly or through the staff of the appropriate Divisions of the Development Services Department or their authorized representatives.

V. Relative Compaction: The result of processing soil and moisture in the most effective manner to obtain the maximum density and stability (or as a minimum, the required percentage compaction). All relative compaction testing shall reference ASTM D1557-12e1 test methods.

W. Soils Report: Shall mean a report as prepared by any person or persons, firm, partnership, or corporation legally licensed to prepare "Soils Reports" in the State of California.

X. State: As used in State Specifications shall mean the City of Roseville.

Y. State Highway Design Manual: Shall mean the "Standard Plans" of the State of California, Department of Transportation, (the latest edition which specifies U.S. Customary Units of ounces and inches, currently 2015) and as specified by the City Engineer.

Z. State Standard Specifications: Shall mean the "Standard Specification" of the State of California, Department of Transportation, latest edition, including amendments.

AA. State Traffic Manual: Shall mean the "California Manual of Uniform Traffic Control Devises".

BB. Subdivision Ordinance: Shall mean the "Subdivision Ordinance" of the City Code as adopted by the City Council of the City of Roseville.

1. **Substantial Completion**: Shall mean when the approved and permitted project has been constructed in accordance with Section 21-5 MINIMUM REQUIREMENT FOR PRODUCTION HOME BUILDING PERMITS, Items A-K.

2. **Technology Fee**: This fee is to fund the City's permitting system and make the technology improvements needed to support the Development Services Department in the processing of building plans, fire permits, improvement plans, maps and entitlements.

CC. Zoning Ordinance: Shall mean the "Zoning Ordinance" of the City Code as adopted by the City Council of the City of Roseville.

SECTION 12: CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

12-1.01 Description - Construction area traffic control shall be installed in accordance with the City accepted project specific traffic control plan, the approved improvement plans and specifications, these Construction Standards, the City Improvement Standards, The California Manual on Uniform Traffic Control Devices (CMUTCD), The State of California Standard Plans, and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the Cal Trans Standard Specs and as follows:

1. At least one lane in each direction shall remain open to traffic unless otherwise approved by the Engineer.

2. Turning movement restrictions require prior approval of the City. A changeable message sign (CMS) shall be posted in the direction of travel affected by the restriction a minimum of 3 days prior to the implementation of the traffic control at the contractor's expense. Wording and placement of the CMS shall be "ACCEPTED" by the Public Works Department, "Traffic Engineering Section" prior to installation.

3. Traffic control hours and lane restrictions are subject to limitation by the City.

4. Lane closures that affect traffic flow may require night work, changeable message signs, and/or certified flaggers at the contractor's expense. The contractor should consider traffic control included in their cost of work and may contract the City's Traffic Section for requirements prior to bidding a job.

5. Approved road closures require 96 hour advance notification to the City, the public and emergency services. Changeable message signs (CMS's) shall be posted in the directions of travel affected by the closure a minimum of 1 week prior to the implementation of the traffic control at the contractor's expense. Wording and placement of the CMS's shall be "ACCEPTED" by the City's Traffic Section prior to installation.

6. A Red Flash Request form must be submitted 48 hours prior to the time the red flash is needed. Allowable hours of flashing operation will be set by the City's Traffic Section and will require early morning, evening, or night work unless otherwise approved in writing by the City's Traffic Section. The Red Flash Request form is on Detail TS-21.

7. Special holiday traffic control restrictions are in place from 1 week prior to the Thanksgiving holiday through January 3rd each year for various roads throughout the City (Detail TS-23).

8. Traffic Control (whether on private property or in the public right of way) that impacts traffic within the public right-of-way (including pedestrian and bicyclist pathways) shall require an encroachment permit. Traffic control shall not impact traffic flow and/or operations in the public right-of-way unless traffic control is setup per approved traffic control plan.

Traffic Control Plans:

All traffic control plans (including signage) to be per the most current CMUTCD (California Manual on Uniform Traffic Control Devices).

The City Construction Inspector or Engineer shall determine the necessity of a formal traffic control plan (TCP) submittal based upon the following guidelines:

A TCP submittal will be required if the TCP is any one of the following:

1. Complicated (to be determined by the City Construction Inspector)
2. Involves a signalized intersection
3. Longer than 12 hours
4. Not detailed in the CMUTCD
5. Involves road closures or detours

Traffic Control Plans require responsible party contract information, hours of operation (which may be restricted by the City), and duration of work.

TCP submittals require the following minimum review times per submittal:

Type of TCP	Min. Review Time
Lane closure	5 days
Intersection Signal Flash	5 days
One-way traffic control	5 days
Detour/Road Closure	3-4 weeks

Note that complicated TCP's may require more review time. Traffic control review time should be included in the contractor's work schedule.

The Contractor must have a copy of the "ACCEPTED" TCP on site during the entire time the TCP is in place.

Any deviation from the "ACCEPTED" TCP shall be approved by the inspector and may require re-submittal of the TCP for City review. Failure to maintain the TCP may result in shutdown of the project, suspension of inspection services, correction by the City at the Contractors expense, or any combination of the before mentioned.

SECTION 21: CONTRACTOR'S AND DEVELOPER'S RESPONSIBILITIES

21-1 GENERAL

All improvements within City of Roseville rights-of-way, and easements, and onsite private drainage improvements shall be installed in accordance with the approval improvement plans and specifications, the City of Roseville Design and Construction Standards, the Stormwater Quality Design Manual for the Sacramento and South Placer Regions, the City of Roseville Stormwater Quality BMP Guidance Manual for Construction, and the State of California Department of Transportation Standard Specifications, hereinafter referred to as the Caltrans Standard Specifications. The latest Caltrans edition which specifies U.S. Customary Units of ounces and inches shall apply to these Construction Standards with the exception of Traffic Sections 56, 82, 84, 85 and 86, which will conform to the latest edition of the Caltrans Standard Specifications. The public roadway infrastructure improvements shall be designed and constructed in accordance with these Design and Construction Standards and the latest edition of the City's American Disabilities Act (ADA) Transitions Plan. Should there be any discrepancy between these Standards and the ADA Transition Plan with respect to accessibility, the ADA Transition Plan shall have precedence. Caltrans Standard Specifications shall apply where not superseded by these Construction Standards. The Contractor shall follow all applicable City, County, State and Federal laws and regulations relating to construction on the improvements.

21-2 CONTRACTIOR'S RESPONSIBILITY

It shall be the Contractor's responsibility for:

A. Plans: Perform construction per plans signed and approved by all required City of Roseville Departments. Any additions, deletions or changes to the approved plans shall be submitted to Said departments for review and approval prior to construction.

B. Notification: The Contractor shall schedule a preconstruction meeting with the Development Services Department (DSD), the Environmental Utilities Departments (EUD) and any other departments reviewing and inspecting the improvements. The meeting shall take place a minimum of two (2) working days prior to the start of construction. The preconstruction meeting shall not be scheduled prior to the City departments' receipt of approved plans.

Minimum advance notice to the City's Construction Inspector for inspection shall be two (2) working days. The City's Construction Inspector shall have the opportunity to inspect all underground/subsurface improvements prior to backfill or cover. The scope of various inspection parameters and participation of contracted special inspection duties shall be identified at this time.

The developer/contractor is responsible for completing the project per the approved plans and specifications. Once deemed complete at the discretion of the City Inspector, it shall be the developer's responsibility to notify the City Inspector to commence City procedures to establish a project punch list prior to City acceptance.

C. U.S.A. Markings: White paint shall be used to indicate areas to be marked by Underground Service Alert (U.S.A.). Any areas not marked shall not be included in the U.S.A. and the Contractor shall not excavate in these areas. The Contractor will be responsible for any damage resulting from excavation in unmarked areas. The Contractor or Applicant who requested the USA markings shall be responsible for the removal of the USA markings upon completion of the work, at the discretion of the City Engineer.

The location of storm drain lines is not included within the USA markings. The Contractor shall take routine precautions to ascertain the location of storm drain pipes prior to excavating around them. Contractor shall notify the City's Construction Inspector when the storm drain system is affected.

D. Testing: Constructed utilities shall be tested in accordance with these Construction Standards.

E. Cultural Resources: The Contractor shall stop construction if cultural resources are discovered during excavation operations. It is possible that previous activities have obscured surface evidence of cultural resources.

If signs of an archeological site, such as any unusual amounts of stone, bone, or shell are uncovered during grading or other construction activities, work shall be halted within 100 feet of the find and the Roseville Community Development Department shall be notified immediately. A qualified archaeologist shall be consulted for an on-site evaluation. Additional mitigation may be required by the archaeologist.

F. Hazardous or Toxic Materials and Contaminated Soils: Should the Contractor encounter hazardous or toxic materials, or contaminated soils, or materials which the Contractor believes may be hazardous waste during any and all excavation or grading operations, as defined in Section 25117 of the Health and Safety Code, which require them to be moved to a Class I, Class II or Class III disposal site in accordance with provisions of existing law, the City of Roseville Fire Department shall be contacted immediately. The area which contains the hazardous or toxic materials or contaminated soils shall be marked off until an investigation by a member of the Fire Department is conducted. The cost for remediation and/or removal of soil shall be bourn solely by the Contractor/Property owner. The parties intend that this provision be broadly construed.

G. Working Hours: In accordance with the City of Roseville's noise ordinance, the hours of project construction shall be limited to the following:

7:00 a.m. to 7:00 p.m., Monday through Friday
8:00 a.m. to 8:00 p.m., Saturday, Sunday, and Holidays

There may be additional limitations placed on working hours specified in the project's approved plans, conditions of approval, special provisions, or encroachment permit.

H. Emergency Contact person: Prior to the commencement of project construction, the City's Construction Inspector shall be furnished with the name and telephone number of a contact person who can be reached 24 hours per day regarding problems or emergencies at the site.

I. Traffic Control: A traffic control plan (TCP) shall be submitted and approved, whenever required by the City's Construction Inspector or when the activities (whether on public or private property) impacts traffic within the public right-of-way (including pedestrian and bicyclist pathways).

Traffic control plans may not be required, when in the opinion of the City's Construction Inspector, the situation is adequately covered by the State of California Manual on Uniform Traffic Control Devices (latest edition). When the City's Construction Inspector has determined a TCP is required, the Contractor shall submit the plan to the City for acceptance. The plan shall include: The project title, the encroachment permit number if applicable, the requested traffic alteration specifics and the requested working hours., The TCP shall be available at the site at all times during the work. The Contractor shall assure that the traffic control equipment is erected prior to the work beginning and that it is removed immediately when appropriate.

Temporary signals require design submittal from a registered PE or TE.

If significant detours, lanes closures, and/or signal modifications (including but not limited to loop disruption, the need for a temporary signal, etc.) are needed, a separate Traffic Handling Plan from that of the Traffic Control Plan may be required. The Traffic Handling Plan will require review and approval by Traffic Engineering and will require additional review time for submittals.

1. **Start of Construction**: Construction within City right-of–ways shall not start until all equipment required by the California MUTCD Part 6 has been erected, all required permits from other agencies have been obtained and the Contractor has obtained approval from the City's Construction Inspector. Parties not obtaining prior approval shall be subject to a stop-work order from the City. The TCP shall be the primary governing traffic document. All residences and businesses shall be notified by the Contractor 48 hours prior to site access being affected.

2. **Lane Changes and Closures and Street Closures**: Lanes shall be closed or transitioned conforming to the California MUTCD, or the approved TCP. See Detail ST-40 for the standard lane closure. Lane closures shall not be allowed when the visibility is less than ¼ mile due to fog, dust or rain.

   A lighted arrow board may be employed as an additional lane change measure and shall always be used for lane changes and closures ½ hour after sunset to ½ hour before sunrise.

Traffic control devices/equipment setup/placement shall be accomplished in a manner which renders the safest condition for drivers, pedestrians and workers. As examples, warning signs should be erected prior to erection of cones or delineators. When pedestrian routes are impacted, the approved traffic control plan should include an access plan to accommodate pedestrians and bicycles.

The worker who places the cones or delineators should be accompanied by a helper to watch on-coming traffic. The reverse should apply upon removal of the equipment.

Street closures shall be subject to the approval of the Traffic Engineering Section. Appropriate traffic control and detour plans shall be submitted to the Traffic Section via the City's Construction Inspector 96 hours prior to the proposed closure. The closure shall not be scheduled until plan approval is received. Notification of all concerned agencies including City Public Information, Fire, Police, Refuse, school and public bus systems and ambulance services shall be the responsibility of the Contractor, a minimum of 48 hours in advance of the closure.

3. **Flag Persons**: Flag persons shall be equipped as required in the governing manual with bright colored or fluorescent vests or clothing, flags and/or stop/slow paddles and other equipment as needed. During darkness, clothing shall be reflectorized and shall be visible for one thousand feet and the flag person shall be equipped with a flashlight with an orange or lime green cone. During darkness, flaggers' stations shall be illuminated per the California MUTCD.

4. **Adjacent Roadway Excavation**: Where excavation adjacent to an existing roadway results in an elevation difference of greater than 0.16 foot, the excavated area shall be filled with compacted aggregate base (3/4 inch minus), flush with the adjacent roadway at a slope not to exceed 4:1 (horizontal to vertical) prior to the end of each workday. Native fill may be used with the approval of the City's Construction Inspector. Delineators shall be placed 2 feet off the edge of pavement. The spacing (in feet) of the delineators shall correspond to the speed limit.

   Where concrete forms are placed within 3 feet of the existing pavement edge, the preceding requirement may be exempted overnight upon the placement of appropriate delineation and the approval of the City's Construction Inspector. Unless construction is prohibited by rain, the Contractor shall be aggressive in completing work in the City right of way following excavation and/or removal of existing improvements for same and in opening the thoroughfare up to the public as soon as is practically possible.

5. **Steel plates**: Every effort shall be made to assure the excavation in existing street is backfilled, compacted and cut-backed at the end of each work day. Plates shall be pinned at the discretion of the City's Construction Inspector.

Steel plates shall not be used over trench areas without the approval of the City's Construction Inspector. Steel plates shall have an ante-skid surface.

All excavations covered by steel plates shall be shored. Adequate temporary pavement (cut-back) shall be used to secure the plate and as a traffic transition. Grade differences between the plate and the existing pavement may require notching of pavement for acceptable transitions.

A W-33 (Rough Road") or W-37 ("Bump") sign shall be installed 200 feet ahead of the steel plate. The sign may be mounted to an operable, lighted barricade for a maximum of 24 hours. The sign shall be mounted to a 4"x4" post for a period exceeding 24 hours.

6. **Sidewalk Removal**: Barricades are required where construction requires the removal of sidewalk or curb and gutter. Wooden lathe with flagging or cones shall not be allowed. Signs indicating "Sidewalk Closed" shall be installed at the ends of construction areas, or where required by the City's Construction Inspector.

7. **Barricades**: Barricades shall be Type II per Caltrans Specifications. Barricades shall only be used where collision with an object would be more severe than collision with the barricade and as approved by the City's Construction Inspector. Barricades placed in an excavated street section adjacent to a traffic lane shall be placed at a maximum 50 feet interval.

8. **Temporary Fencing**: Any excavation exceeding 2 feet in depth, left unattended outside project work hours, within a close proximity to or within a City right-of-way or easement shall be enclosed with a 6 foot high temporary fence.

   Where temporary fencing is placed along the street in the gutter-pan or at the back of City sidewalk, a delineator or cone shall be placed at a maximum 50 foot interval along the outside of the fence.

9. **Warning Signs**: All traffic warning signs shall be a minimum 36 inches square; shall be mounted on a metal flag tree assembly and shall include 2 flags each, fully exposed above the sign. The sign shall only be metal, fabric or as approved by the City's Construction Inspector. The top of the sign shall be a minimum 6 feet high. No sign shall be placed on a barricade unless specifically allowed by the City's Construction Inspector or specified by the Traffic control Plan.

   Upon the approval of the City's Construction Inspector, signs may be placed on a 4x4 wooden post for long durations. Clearance shall be 7 feet from finish grade to bottom of sign.

   Signs which are prefabricated to be site specific which may specify detour routing and street names shall be steel or aluminum, 0.080 gauge.

Minimum 6 inch black letters shall be employed on a clean, traffic orange background. The signs shall be approved by the Traffic Engineering Section prior to erection.

10. **Cones and Delineators**: Cones shall be a minimum 28 inches in height and delineators a minimum 36 inches high by 3 inches in diameter. Delineators shall include white or yellow reflective stripe(s). Cones shall include a white or yellow reflective sleeve after dark. Yellow reflective material shall be used between opposing traffic and white at the side of the roadway. Only cones, delineators, k-rail, temporary striping or temporary tape shall be used to temporarily channelize traffic.

J. Preservation of Property: The Contractor shall take extreme care to protect existing site and adjacent improvements from damage.

The Contractor shall be responsible for any damage resulting from the construction and shall be responsible for repair or replacement conforming to the latest standards.

K. Personnel: Only personnel competent in the particular trade undertaken shall be employed for the construction work.

L. Weather: Construction work shall not commence or progress when the weather jeopardizes a safe working environment or the quality of the project in any manner.

Construction activities within or adjacent to the public right of way during inclement weather may be prohibited where the activity constitutes an unsafe condition for the public and/or the workers. This applies to the traveled way and any work area adjacent to the traveled way.

M. Trenching Safety: Prior to excavation of trenches 5 feet or deeper, the Contractor shall submit the following to the City's Construction Inspector:

1. A copy of the company's annual CALOSHA T-1 trenching permit.

2. A copy of the company's letter informing CALOSHA of the time the trenching is commencing and the location of the work prior to trenching within any City street right-of-way or easement, an encroachment permit shall be obtained from the Development Services Department, Engineering Division.

In unimproved areas, the maximum length of open trench (5 feet in depth or more) shall be that which can be trenched and backfilled in one day. Any trench left open overnight and the method of protection thereof shall be approved by the City's Construction Inspector.

In existing streets, following trenching and pipe laying, backfill shall be accomplished immediately unless approved otherwise by the City's Construction Inspector. No excavation which is larger than necessary to leave the end of the pipe exposed for the next work day shall remain open at the end of the day. The excavation shall be plated and/or fenced, subject to the

approval of the City's Construction Inspector and in accordance with the City's Trench Cut Ordinance.

N. Trailer and Material Storage: Dumpsters, construction materials or equipment shall not be placed in the City of Roseville right-of-way without first obtaining an Encroachment Permit from the DSD. As a minimum, 2 operable, Type II, lighted barricades shall be place at each end of the obstacle. The Encroachment Permit conditions may indicate additional reflectorization requirements.

Use of the City right of way should not be requested if there is adequate storage space on-site. Construction offices or material trailers shall not be placed within the City right-of-way with one exception. A trailer with a current California license may be parked along the edge of the street within a subdivision for a period of 72 hours, provided the travel ways are unobstructed and 2 operable, lighted barricades are placed at each end of the trailer.

O. Street Cleaning: Where dirt, mud, rock, sand or other foreign material are tracked onto public street pavement, the Contractor shall clean the streets daily, or as directed by the City's Construction Inspector. If the Contractor fails to keep the streets clean, the City may clean the areas and bill the Contractor. Streets shall be cleaned with a power broom or hand brooms and shall not be washed with water without the approval of the City's Construction Inspector. Any mud displaced into the City storm drain system by the Contractor shall be removed at the discretion of the City's Construction Inspector.

P. Interruption of Parking Areas: Where parking needs to be interrupted by construction work, the Contractor shall place Type II barricades with "No Parking" notices behind the curb, adjacent to the respective parking area, a minimum of 24 hours prior to the start of construction. For more information on street cleaning, see Roseville's Stormwater BMP Guidance Manual for construction.

Information on the notice shall include the date and times that parking is prohibited and shall be legible from a distance of 25 feet. Barricades/notices shall be placed at a minimum interval of 1 per parking space.

Q. Contractor Employee Vehicle Parking: The Contractor's employee parking shall be limited to designated areas on-site, and shall not encroach into designated wetland areas, tree protected zones or any other areas protected by jurisdictional boundaries, Conditions of Approval or City ordinances.

R. Construction Safety: Construction safety within the City of Roseville shall be governed by the Construction Safety Orders of the Occupational Safety and Health Standards of Title 8 of the California Code of Regulations.

S. Blasting and Explosive Requirements: The contractor shall have a valid California State Blasting License issued from the State of California Department of industrial Relations,

Occupational Safety and Health Administration, and a City of Roseville Business License. Additionally, the Contractor shall obtain a City of Roseville "Explosives Application/Permit" from the City's Fire Department prior to any and all blasting within the limits of the City of Roseville. The Contractor shall have on file, and keep current, the required insurance documents established by the Risk Manager's Office. The Contractor shall notify the following City Departments 72 hours in advance of blasting. (If the blasting event involves a street closure or public safety concern, the City reserves the right to require more notification time.):

Police Dispatch:	916-774-5117
Public Information Office	916-774-5201
Development Services Engineering:	916-774-5339

T. Pavement Milling Requirements: All Milled edges perpendicular and diagonal to the travel way shall be temporarily transitioned at 30:1 slope with temporary pavement (cut-back). A W8-8 ("Rough Road") or W8-1 ("Bump") sign shall be installed 200 feet ahead of the pavement milled location. The sign may be mounted to a metal flag tree stand for a maximum of 24 hours. The sign shall be mounted to a wooden 4" X 4" post for a period exceeding 24 hours.

U. Discharge Fluid from Boring Operations: Utilizing the City's drainage system for residual discharge from boring equipment without the required measures is prohibited. This discharge is a violation of the Clean Water Act. Discharging into an open area without the approval is also not allowed.
All street boring shall include adequate measures to mitigate muddy water discharge. An acceptable measure is pumping the discharge fluid into a tanker and hauling it away. Other measures suggested by the Contractor will be considered by the City. For more information concerning discharge fluid from boring operations, see Roseville's Stormwater BMP Guidance Manual for construction.

V. Concrete Truck Washout Areas: The Contractor shall use precautions and or devices for the protection of storm drain inlets, wetlands, vernal pools and sensitive open space areas which may border the respective project. The washout area shall be confined to respective site. For more information concerning concrete truck washout areas, see Roseville's Stormwater BMP Guidance Manual for Construction at:

https://www.roseville.ca.us/UserFiles/Servers/Server_7964838/File/Government/Departments/Development%20Services/Engineering/Stormwater%20Design%20Inspection/Stormwater%20Quality%20Maintenance%20Program/Stormwater%20Quality%20BMP%20Guidance%20Manual%20for%20Construction.pdf

21-3 DEVELOPER'S RESPONSIBILITY

It shall be the Developer's responsibility for:

A. Record Drawings: PDF electronic, two sets of blue line prints (1 set of 24"x36" and 1 set of 11"x17") and one (1) georeferenced electronic ArcGIS or AutoCAD file containing pre- and post-project delineated floodplain boundaries as prescribed in project conditions shall be submitted to City's Construction Inspector as a condition of the Certificate of Completion. ArcGIS files containing pre- and post- project delineated floodplain boundaries shall include the following metadata, as applicable:

- Thumbnail
- Tags
- Summary
- Description
- Credits
- Use Limitations
- Metadata Contacts (consulting firm or project owner)

21-4 MINIMUM REQUIREMENTS FOR MODEL HOME BUILDING PERMITS

Model home building permits will be issued upon the City's satisfaction of all requirements specified in the "Model Home Complex application and building permit submittal and development department inspection checklist, issued by the Permit Center. This includes the following Development Services Department requirements:

A. The pad grades for the model home lots have been certified for compaction by a geotechnical engineer and for conformance to the grading plan elevations by a registered Civil Engineer. Original stamped certifications are required prior to formal City acceptance per Section 21-5.E.

B. All property corners for each of the model home lots shall be staked with permanent markers to the satisfaction of the City Engineer. If curb, gutter and sidewalk has been placed at the time for which model home permits are applied, the front property corners shall be marked per Section 71-4 F. of the Standards.

C. All utilities, utility crossings and utility extensions to each model home lot, located within the roadway, and Public Utility Easement (PUE) shall be installed and tested. All utility water valves and manholes shall be raised and paved.

Utilities include, but are not limited to: natural gas, electric, cable, telephone, water, sewer and storm drain.

D. Access to the model homes from future streets within the subdivision or from approved alternative access does not cross the alignment of any future utility to be installed with the Subdivision Improvements, as determined by the City Engineer.

E. Fire hydrants must be located within 500 feet of all combustible materials and be capable of delivering adequate fire flows to the satisfaction of the Fire Marshall.

For every issuance of model permits access to the model homes must be paved and connected to a maintained public street to the satisfaction of the City Engineer.

If the sub divider intends to obtain an alternative access to the model homes from an adjacent maintained public street, the sub divider shall obtain approval from the City Engineer and Fire Marshal.

The City Engineer may require all work and construction on the model homes to cease at any time until all or additional portions of the subdivision improvements are finished in order to protect the health, safety or welfare of the public and workers.

21-5 MINIMUM REQUIREMENT FOR PRODUCTION HOME BUILDING PERMITS

Production home building permits may be issued once the subdivision improvements are substantially complete.
The subdivision shall be deemed substantially complete by the Development Services Inspector when the following items are completed or verified:

A. All surface street improvements (sidewalks, curbs, gutters, ramps, driveways and street paving) are installed.

B. Raise and pave all manholes, water valves, including survey monuments.

All water, sewer and storm drainage components shall be tested, approved and operational. This includes conformance to the City of Roseville Fire Department's minimum flows for all fire hydrants.

C. Ball and flush all sewers.

D. Install all underground gas, electric, telephone and TV cable facilities and backfill trenches.

E. Submit lot pad certifications for grade and compaction. Electronic signature pad certification submittal with original wet signature pad certification follow up prior to City acceptance is authorized. Original stamped certifications required prior to formal City acceptance.

In the case where a significant lapse in time has occurred between the original pad certification date and City acceptance date, at the discretion of the City Engineer, the City will honor past dated pad certifications provided the Developer's geotechnical engineer re-submits a current wet stamped letter acknowledging the previous certifications are still valid despite the lapse of time.

F. Mark lot corners in City sidewalk or curb and gutter and at the back of lots.

G. Install erosion and sediment control measures, including storm water outfalls as shown on the approved plans and fully implement Stormwater Pollution Protection Plan, (SWPPP).

H. Install street name and traffic signs and striping.

I. Construct all common lot retaining walls per the improvement plans.

J. Assure final subdivision map is recorded.

K. Completion of sound walls, open space and post & cable fencing shall be a condition of building permit issuance, only where the sound wall, open space and post & cable fencing backs up to existing, adjacent residences, or open spaces.

21-6 MINIMUM REQUIREMENT FOR CONSTRUCTION WITHIN THE FLOODPLAIN

Refer to the City of Roseville, CA Flood Damage Prevention Ordinance Section 9.80.160 – **Standards of Construction** – through section 9.80.190 for special construction standards for development within the City's Regulated Floodplain.

Building permits will be issued for construction within the floodplain upon the City's satisfaction of all requirements specified in the "Existing Buildings in Special Flood Hazard Areas/Regulatory Floodplain Substantial Improvement/Substantial Damage Worksheets" application and building permit submittal, issued by the Permit Center. This includes the following Development Services Department and Floodplain Management Section submittal requirements:

A. Current photographs of the exterior (front, rear, sides)

B. If your building has been damaged, include photographs of the interior and exterior; provide pre-damage photos of the exterior, if available

C. Detailed description of the proposed improvement (rehabilitation, remodeling, addition, etc.) or repairs

D. Cost estimate of the proposed improvement or the cost estimate to repair the damaged building to its before-damage condition

E. Elevation certificate or elevation survey

F. You may submit a market value appraisal prepared by a licensed professional appraiser or we will use the tax assessment value of the building

G. Owner's affidavit (signed and dated)

H. Contractor's affidavit (signed and dated)

The construction within the floodplain shall be deemed substantially complete by the City Floodplain Manager when the following items are completed and verified:

A. Post-construction (FEMA-compliant) Elevation Certificate, wet-signed

B. Floodproofing documentation, as required

C. A deed restriction that limits use of the part of the structure that is below the base flood elevation, as required

21-7 REQUIREMENTS FOR SUBDIVISION NOTICE OF COMPLETION (N.O.C)

Prior to acceptance of public improvements by the Roseville City Council, the following items must be completed and provided to the City's Construction Inspector:

The Contractor or Developer shall request a final inspection and punch list for the constructed improvements from the City Development Services Engineering Division, upon the completion of the improvements as shown on the approved plans. As each department approves the completion of punch list items and appropriate conditions of approval, and acknowledges department acceptance in the City's electronic database system. Upon receipt of all applicable approvals, Engineering will consolidate the N.O.C. package and forward it to City Council for approval.

A. PDF Electronic version on portable device (eg. CD or USB thumb drive), 2 sets of blue line prints (1 set of 24"x36" and 1 set of 11"x17").

B. Lot pad elevation and compaction certifications, (original stamped documents).

C. Payment of all outstanding plan check and inspection fees.

D. Maintenance Bond to cover one year construction maintenance warranty period.

E. Written certification from the applicating Contractor that anti-graffiti coat has been placed on all sound and retaining walls conforming to the Roseville Construction Standards and manufacturer's recommendations.

F. Per Roseville Municipal Code, Section 19.64.050 P., where model home complex trap fencing is used, it shall be placed behind the City sidewalk.

G. Annual Stormwater Maintenance Agreement.

Completion of the public infrastructure improvements as specified in Section 21-5, including the street lighting system.

21-8 RESIDENTIAL OCCUPANCIES DURING RESIDENTIAL BUILDING

Upon the occupancy of 1 or more homes in public or private subdivisions, the occupant (s) shall have a safe, clean, un-obstructed travel way, including sidewalks, in accessing and exiting the area of their home, applying to newly constructed streets within the subdivision extending to the closest existing street. The following minimum standards are to be met:

A. Streets shall be thoroughly cleaned, back of walk to back of walk at the end of each work day.

B. No building materials, portable toilets or construction equipment shall be stored within the street right-of-way. Portable toilets shall be a minimum of 50 feet from drain inlets.

C. A trailer with a valid California license may be parked along edges of the street within a subdivision for a period of 72 hours, provided the travel ways are unobstructed and each outside corner of the trailer has lighted barricades.

D. Erosion control materials at drain inlets such as straw bales and gravel bags shall be removed. Silt bags which are in drain inlets fronting homes with completed landscaping shall be removed.

E. Landscaping related materials (such as cobbles, bark or gravel) may be staged in the streets for immediate removal. If stored overnight, a lighted barricade shall be placed on each side of the pile, toward traffic. The pile shall not extend into the street from the curb further than the width of a parked car.

F. Unoccupied cul-de-sacs or other section of streets for which there is no public access necessary shall be barricaded. Barricades shall be Type III (or fencing as approved by the City Fire Department), subject to the approval of the City Engineer.

G. Completion of the street lighting system shall be a condition of Noticeof Completion (N.O.C) and not a condition of building permit issuance, temporary occupancy of model complexes, and/or subdivision occupancies.

H. All other requirements within the Subdivision Ordinance and Building Division regulations for approval of occupancy shall apply.

21-9 GUARANTEE AND WARRANTY

The Contractor shall guarantee and warrant all materials supplied as being fit for the purposes intended. The Contractor shall guarantee and warrant all work performed as having been accomplished in a proper and workman-like manner.

Should any failure of work occur within the warranty period, the Contractor shall promptly make the needed repairs at the Contractor's own expense. Should such failure of work result in excessive maintenance by the City, or in the opinion of the City, the failure is best left unrepaired, the Contractor shall incur the additional maintenance cost.

The cost shall be equal to the annual maintenance cost divided by the current prime rate. Should the Contractor not make or undertake the

Necessary repairs within 30 days of having received written notification from the City Engineer, the City may make the repairs and the Contractor shall pay the entire cost thereof.

In emergency cases, where in the opinion of the City Engineer (provided a reasonable attempt has been made to notify the Contractor) delay would cause serious loss or damages, or a serious hazard to the public, the repairs may be made without prior notice to the Contractor, and the Contractor shall pay the entire cost thereof.

The procedures for review, repair and release of guarantee and warranty obligations shall be as follows:

A. Subdivision Improvements: The guarantee and warranty shall continue for a period of one year after Notice of Completion for all public improvement work installed under any Subdivision Agreement. The Subdivision Agreement shall be binding in its entirety.

The following procedures shall be followed for completion of the guarantee and warranty for subdivision improvement:

1. All necessary City departments shall complete their guarantee and warranty inspections during approximately the tenth month following the Notice of Completion and prepare and deliver a final punch list to the Contractor by approximately the end of the tenth month.

2. Within 30 days of receipt of the final punch list (during the eleventh month), the Contractor shall repair or address all items indicated. All City departments issuing a punch list shall then be notified for re-inspection of repairs.

3. Within 30 days of notifying the Contractor (by the end of the eleventh month), the City departments shall re-inspect the repaired improvements.

Upon the City's approval of the repairs, the maintenance bond will be allowed to expire, at the conclusion of one year following the Certificate of Completion. If the Contractor does not complete the required work by the end of the eleventh month, the list of repairs will be referred to the City Attorney's office for further management.

Any subdivision improvement work subject to the 1 year warranty shall require the issuance of an encroachment permit.

B. Encroachment Permit Improvements: The guarantee and warranty shall continue for a period of 180 days after approval from all City departments affected, for all work installed and completed under an Encroachment Permit for projects valued less than $25,000.00. For projects valued greater than $25,000.00, as determined by the Director, the warranty period shall be 365 days. Upon the permittee's request, the performance security shall be replaced with a warranty security equal to 10 percent of the project costs. Upon final inspection following the warranty period all securities will be released. The Encroachment Permit Shall be binding in its entirety. The following procedures shall be followed for completion of the guarantee and warranty for encroachment permit improvements:

1. All necessary City departments shall complete their guarantee and warranty inspections during the last two weeks of the fifth month following the date of the City's acceptance of the work.

2. The Contractor shall be issued a punchlist upon the conclusion of the two week inspection period.

3. The Contractor shall complete the required repair work by the end of the sixth month following the initial approval of the work.

4. Within 30 days of notification, the City departments shall re-inspect repaired improvements, and upon approval of the repaired improvements, shall notify the City Clerk's office for release of the Encroachment Bond.

C. Underground Warranty Work within City Street Right-of-Way: All underground work done as a result of the one-year warranty inspection shall comply with the following:

1. All backfill in City streets shall be two sack, slurry cement.

2. The pavements patch shall conform to Construction Standard Details TB-1, TB-1A, TB-3. Or TB3A and the Trench Cut Ordinance. Determination of Detail TB-1 or TB-3 shall be at the developer's discretion.

3. Depending upon the extent of pavement patching necessary on asphalt concrete roadways and at the discretion of the City's Construction Inspector, a CalTrans Type II slurry seal or one inch asphalt concrete overlay of the entire street width in the area of the patches may be required.

4. Pavement cracking: Depending upon the extent of cracking and at the discretion of the City's Construction Inspector, cracks in AC roadways shall be sealed per Section 71-4 D (Asphalt Concrete Paving) or Section 71-D (Portland Concrete Paving) of these Standards.

Crack sealing on AC roadways shall be followed with a slurry seal or one inch asphalt concrete overlay which shall be applied to the entire street width in the area of the cracks as required by the City's Construction Inspector.

D. EUD's Policy on Warrant Repairs on Sewer Stub and Services

1. Sewer Services to residential and commercial subdivision lots under warranty: Where a project inspection identifies defects in a sewer service and the sewer main is still within the warrant period, the responsibility to repair the service rests solely on the developer who installed the sewer main.

2. Sewer services to residential and commercial subdivisions outside of warranty: Where a project inspection identifies defects in a sewer service and the sewer main is no longer under warranty, the responsibility to repair the defects shall rest on both the developer and the City as follows:

a. The developer shall be responsible to repair defects found in any sewer service from the first joint downstream of the sewer cleanout to the commercial or residential building (that portion of the sewer services that is considered "private").

b. The City shall be responsible to repair defects found in any sewer service from the first joint downstream of the sewer cleanout to the sewer mainline (that portion of the sewer service that is considered "public").

3. Sewer stubs to residential and commercial subdivisions: Where sewer stubs have been constructed on sewer mains, these sewer stubs become an integral part of the sewer system of the proposed residential or commercial subdivision they were designed and built to serve. The developer of the subdivisions shall be required to test and repair these stubs, if found damaged, prior to tie-ins. A note to this effect shall be placed on all Building and improvement plans to ensure the developer is aware of this requirement prior to initiating construction.

21-10 MATERIALS

A. Approved Equal: The words "approved equal" shall mean any public works material deemed by the EUD or DSD to be acceptable for use within the City rights-of-way or property as compared to products of specified manufacturers. Contactors proposing to use materials which are not specifically named shall submit all necessary documentation to allow use of said material as an approved equal.

The submittal shall include a letter with:

1. Product: A description of the product and the appropriate materials specification section number.

2. Contact: The name and telephone number of the contact person for the proposed product.

3. Reference: A list of other agencies that are using the proposed product including names and telephone numbers.

For water, sewer, reclaimed water, surface improvements and storm drain related materials, address the letter to:

The City of Roseville
Development Services - Construction Management Section
ATTN: Senior Engineer DSD
311 Vernon Street
Roseville, CA 95678

The Contractor shall allow 8 to 10 weeks review time by the City staff.

B. Unapproved Materials
Materials not approved for use on the project shall be removed from the site within 24 hours if requested by the DSD Inspector.

SECTION 31: TRENCH BACKFILL

31-1 GENERAL

All trench backfill shall be mechanically compacted native soil, mechanically compacted imported fill, mechanically compacted aggregate base or slurry material, as required on the Construction Standard Details. All trenching within City Streets shall conform to the City's Trench Cut Ordinance Numbers 3524 and 3602. These ordinances represent a comprehensive pavement protection program incorporating a trench cut cost recovery fee. The trench cut fee provides funds to repair the actual accelerated street damage caused by trenching and is an incentive to promote better trench cut coordination among utility companies.

31-2 TRENCH BACKFILL

Trench backfill within the City of Roseville street right-of-ways shall conform to Construction Standard Details TB-1, TB-2, TB-3, TB-3aTB-4 and TB-5. Moisture content shall be controlled to obtain the optimum density for the native soil type encountered. All compaction testing shall conform to ASTM D1557-78 test methods. Trench backfill compaction shall be tested and certified by a licensed geotechnical engineer at the Developer's expense. Certification shall be provided to the City Engineer prior to the construction of surface improvements.

Backfill for joint utility trench shall be sand compacted 85% relative compaction (TYP), above the 4 utilities occupying the joint trench. Then backfill with native material free of all deleterious materials, rocks or boulders compacted to 90% within 1 foot of final grade and 95% the last foot. Sand Shading material to be, screened free, No. 4 sieve, 4mm maximum particle size, free of sharp edges, and approved by each utility trench Inspector. (DG will not be approved).

Following paving operations and where water utility valve clusters are present, standard mechanical compaction efforts and equipment may have limited access to achieve adequate compaction per these Standards. In these cases, it is authorized that 2-sack flowable concrete slurry backfill material (Per Section 71-5.K) may be used within the water valve excavation area to just below the required concrete collar height. Once cured, placement of concrete collar and/or HMA paving operations may progress.

A. Existing Streets: Trench backfill in existing asphalt concrete streets shall conform to Construction Standard Detail TB-1, TB-2, TB-3, TB-4 and TB-5 and the City's Trench Cut Ordinance. Longitudinal trenches for dry utilities (CATV, telephone, gas, electric, traffic signal and signal interconnect cable) shall be excavated 6 inches clear from the gutter lip, conforming to Details TB-1 or TB-3. (For Detail TB-3, the 18 inch key nearest the gutter for the asphalt concrete patch shall be modified to 6 inches.) Following the patching of the trench with asphalt concrete, the street surface shall be slurry sealed from the gutter lip to the edge of the bike lane stripe (usually 4 feet wide). If the bike lane stripe is obliterated in any manner by the construction process, it shall be replaced with thermoplastic per these Construction Standards.

Trench backfill in existing Portland cement concrete streets shall conform to Construction Standard Detail TB-1, TB-2, TB-3a, TB-4, TB-5, and ST-54 and the City's Trench Cut Ordinance. Longitudinal trenches for dry utilities (CATV, telephone, gas, electric, traffic signal

and signal interconnect cable) shall be excavated 6 inches clear from the gutter lip, conforming to Details TB-1 or TB-3. (For Detail TB-3a, the 18 inch key nearest the gutter for the concrete patch shall be extended to the nearest concrete joint.) Following the patching of the trench with Portland cement concrete, the street surface shall be finished in a manner similar to the surrounding pavement, i.e. diamond ground, troweled, or natural. If the bike lane stripe is obliterated in any manner by the construction process, it shall be replaced per these Construction Standards.

B. Jetting: Compaction of trench backfill by jetting methods is NOT allowed in City of Roseville right-of-way areas or over dedicated reclaimed water, storm, sewer or water easements or mains. Jetting of joint utility trenches behind the right-of-way and within public Utility easements may be allowed under specific conditions and upon the written approval of the City's Construction Inspector and the Geotechnical Engineer.

C. Material: Material for backfilled trenches shall contain no organic material and no rocks or soil lumps exceeding 4 inches in diameter with the following qualifications:

1. Cobbles in the initial backfill (the first 1 foot above the pipe bedding covering the pipe) shall be 3 inch maximum diameter.

2. An exception to the 4 inch maximum diameter cobble is where cobbles exceed 4 inches in diameter and are predominant (as determined by the City's Construction Inspector and Geotechnical Engineer). In this condition, 8 inches in diameter is the maximum size cobble allowed.

3. The maximum cobble size shall not be greater than that of the depth of the maximum compaction lift, for the type of equipment used.

Slurry cement backfill, controlled low-strength material or dry mix "Popcorn" may be used on a case by case basis. The Contractor shall submit a proposed design mix to the City Construction Inspector for review and approval prior to placement.) See Section 71-5.K.

Native soil shall not be used for bedding for utility conduits or chases within the City right-of-way, but only select bedding materials such as sand, pea gravel, and ½ inch (minus) crushed rock or 2-sack cement slurry.

D. Placement of Material: Equipment shall be a size and type satisfactory to the on-site geotechnical engineer or City's Construction Inspector. Impact-type pavement breakers or compactors (hydro-hammers) shall not be used within 5 feet of the top of any type pipe. Material for mechanically compacted backfill shall be placed in horizontal lifts which, prior to compaction, shall not exceed the depths specified below for the type of equipment employed. Actual maximum lift depth will vary with soil conditions and compaction equipment. The Contractor shall consult with a geotechnical engineer to determine the appropriate maximum depths.

The Contractor shall be responsible for verifying compaction requirements for each lift.

E. Typical Compaction Equipment and Maximum Lift Depths Achieved by Proper Compaction

Maximum lift depth of 4 inches, equipment type:

- Portable, engine driven pneumatic type (wacker)
- Portable vibratory plate

Maximum lift depth of 12 inches, equipment type:

- Backhoe mounted sheep-foot
- Vibratory smooth wheeled roller
- Vibratory smooth wheel roller with pneumatic tires

Maximum lift depth of 18 inches, equipment type:

- Impact, free-fall or stomping equipment (hydro-hammer)

F. Pipe Bedding References:

- See W-1 and SS-1 for water and sewer pipe bedding requirements.
- See TB-2 for non-rigid storm drain pipe bedding.

SECTION 56: SIGNS

56.1.01 GENERAL

Signs shall be constructed/installed in accordance with the approved improvement plans and specifications, these Construction Standards, the City Design Standards, The California Manual on Uniform Traffic Control Devices (CMUTCD), and the Standard Highway Signs manual.

All sign materials shall be produced by same manufacturer to eliminate incompatibility issues associated with indifferent materials, (i.e. 3M high intensity prismatic sheeting and 3M electronic cut-films shall be similar material). Prior to City acceptance of new sign improvements, Contractor shall submit to City Construction Inspector either letter of authenticity by manufacturer or certification from 3M or approved equal, indicating like materials were used.

As a minimum, all signs shall be the common size as shown in the Standard Highway Signs manual. On collector and arterial streets, the minimum size of type R1 stop signs and R1-2 yield (measured on outside edge) shall be 36 inches. Type R1 stop signs and R1-2 yield signs on other streets shall be 30 inches. If the intersection has more than three lanes (including turn lanes) in each direction, a supplemental 24" STOP sign is required in the median. Retro reflective red tape is also required for both unistruts. If the median is too narrow for supplemental signage, a 36" LED flashing STOP sign is required from the approved City equipment list. Type R1 stop signs installed on bike trails may be either 24 inches or 18 inches as approved by the Engineer. Type R1 stop signs and R1-2 yield signs installed on alleys may be 24 inches as approved.

All signs shall be fabricated using HIP sheeting, except, Fluorescent Yellow Green (FYG) background colored signs shall be diamond grade sheeting and installed for the following sign types: S1-1, S3-1, S4-3, W11-1, W11-2, and W16-7p and W16-9p when used with one of the previously listed signs.

Advance D3 Guide signs shall have a 1 inch white reflective border around the perimeter of the sign as shown in Detail 17-B of these standards.

All Overhead Signs (Signal Mounted) and advance D3 Guide signs shall have a 1-1/4 inch white reflective border around the perimeter of the sign as shown in Code 67-1 of the CalTrans Sign Specifications.

All sign panels, except as otherwise directed in these standards, shall be fabricated using reflective high intensity prismatic (HIP) sheeting or equivalent. Message and sheeting shall be on one side of the panel only. No mixing of diamond, high intensity, or engineering grade sheeting on the same panel shall be allowed.

Overhead Signs (Signal Mounted) shall be fabricated using high intensity sheeting. All Fluorescent Yellow Green (FYG) background colored signs shall be fabricated using diamond grade sheeting. All type D3 (street name and advance street name) signs along arterials and collectors shall be high intensity grading meeting FHWA MUTCD Table 2A-3.

Where crossing the street is restricted at signalized intersections, R9-3 and R9-3bP signs shall be installed on the signal pole in the place of the pedestrian signal indication.

U-turns shall be restricted where less than 44 feet exists between the right lane line of the left turn lane and the face of curb for the opposing direction of travel for single left turn lanes, where less than 36 feet exists between the left edge of the inside left turn lane to the face of curb for the opposing direction of travel for dual turn lanes, or as required by the Engineer (TS-15).

W3-3 Signal Ahead signs shall be installed on all approaches to a signalized intersection on the day of signal activation. The signs shall be installed prior to the left or right turn pocket bay tapers at a minimum and shall be mounted on street light poles when possible. Please see Detail TS-16 for additional placement information. Immediately prior to the activation of a new traffic signal, the contractor shall install 2 orange flags on the "Signal Ahead" signs. The flags shall remain in place for 2 weeks prior to removal by the contractor.

A bicycle signal actuation sign, R10-22, shall be installed in conjunction with bicycle detection. The sign shall be place adjacent to the bicycle loop on the nearest signal pole or on a sign post per City standards as directed by the Engineer.

A. Subdivision Signage Requirements:

1. Subdivision Entrances

a. At all entrances to a subdivision off a collector or arterial, install a type R2-1 "25 mph Speed Limit" sign.

b. At the first 4-way intersection entering a subdivision, coming off a collector or arterial with a separation of less than 200 feet, install type R1-1 "Stop" signs, bars and legends on the residential minor streets.

c. At the first Tee intersection entering a subdivision, coming off a collector or arterial, install type R1-2 "Yield" sign on the stem of the intersection.

d. Install type Install type R26 (CA) "No Parking Anytime" signs at the entrance to subdivision that have a small median/island just off an arterial or collector.

2. Courts

a. Install a type W14-2 "NO OUTLET" sign at the entrance to all Courts or Cul-de-Sac's when you cannot see the end of the roadway from the last intersection. Place the sign on the nearest street light pole when possible (left or right side of roadway acceptable).

3. Intersections within Subdivisions

a. All four-way intersections shall have right-of-way controls established on the minor street. Install type R1-1 "Stop" signs, bars and legends.

All existing traffic signs, which are in conflict with the proposed work as shown on the plans, shall be removed by the Contractor and returned to the City. The Engineer shall make the final decision if a question arises as to what represents said conflict.

OVERHEAD SIGN STRUCTURES (Signal Mounted)

56.1.02 MATERIAL

D3 and G-8 (CA) street sign lettering shall be white high intensity prismatic (HIP) or equivalent Series C, with 8 inch upper case and 6 inch lower case lettering. When the text is too long for a single line, lettering other than Series C, but not smaller than Series B, may be used with the approval of the Engineer.

D-3 and G-8 (CA) Signs with 1 line of text shall be 24 inches tall. Signs with 2 lines of text shall be 36 inches tall.

All white symbols and arrows on G-8 (CA) signs shall be reflectorized.

Internally Illuminated Street Name Signs (IISNS) shall require a City approved layout proof matching existing City LED IISNI's prior to ordering. Only products with prior approval from the City shall be allowed.

56.1.06 SIGN PANELS & FASTENING HARDWARE

Overhead sign Structures shall be attached to signal mast arms per CalTrans Standard Detail ES-7N, or as directed by the Engineer.

All D3 street name signs mounted on signal mast arms shall not be the swinging arm type. One end of each street name sign shall be attached to the signal pole in at least 2 places, and the other end shall be attached to the signal mast arm. Fastener shall pass through both sign panels and stiffening braces, unless otherwise noted.

All signal mast arm mounted signs shall have back stiffening braces attached to the sign panel.

ROADSIDE SIGNS

56.2.02 MATERIAL

D3-2 and G-8 (CA) Signs with 1 line of text shall be 18 inches tall. Signs with 2 lines of text shall be 24 inches tall. At non-signalized intersections, street name signs shall be provided, and shall conform to Detail TS-17A in the City of Roseville Construction Standards.

56.2.02A METAL POLE

All roadside signs shall be installed on metal poles as specified in these standards. Wood posts shall not be allowed. See TS-17 for additional details.

Metal pole, square tube, shall conform to the standard specifications for cold rolled carbon sheet steel, commercial quality, ASTM A-446 or hot rolled carbon steel sheet, structural quality, ASTM

A-570-90 and ASTM A-653-94 structural grade 50.

Square tubes shall be installed into a sleeve of same material with 2 holes showing above **"finished"** grade. All holes below grade shall be taped closed. The sleeve shall be embedded in concrete, per S-1. No concrete shall be allowed to enter the sleeve.

Corner weld shall be carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii. Corner weld shall be zinc coated after scarfing operation.

The cross section of the post shall be square tube formed of 12 gauge (.105" USS gauge) steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii.

Posts shall be 1-3/4" x 1-3/4", have a squareness tolerance of plus or minus 0.010", be made of 12 gauge U.S.S., weigh 2.06 pounds per foot, and twist no more than 0.062" over 3 foot in length. Typical length of pole 10', 12', 14' (MAX) or as approved per section 56-2.04

The square tubes shall have holes that are 7-1/16" plus or minus 1/64" diameter on 1 inch centers, on all four sides for the entire length of the pole. The holes shall be on the centerline of each side in true alignment and opposite to each other directly and diagonally. All posts shall be cut in such a manner to ensure hole alignment between anchors and sleeves when installed.

The length of each post shall be per plan, as required for the project, or as designated per these specifications.

The finished posts shall be straight and shall have a smooth uniform finish. All holes and ends shall be free from burrs and ends shall be cut square.

Supports shall be of sufficient size to support the sign panel. Signs on single supports shall resist the effect of eccentric wind force. A support member 10 feet long shall not rotate more than 2 degrees when test loaded with 50 foot-pounds (600 inch-pounds) torque on one end while the other end is firmly held against rotation.

Permissible variation in the straightness is 1/16" in 3 feet.

Standard outside corner radius shall be 5/32" plus or minus 1/64"

Welding flash on the inside corner of the welded square tubes shall be controlled to permit a 9/64" radius gauge to be place in the corner.

Square tubes shall be manufactured from hot dipped galvanized steel with 1.40 ounces of zinc coating per square foot, conforming to ASTM A-653, also referred to as G-140.

Square tubes shall be produced utilizing a Polyester TGIC Powder Coating in a white high-gloss finish.

Corner weld should be zinc coated after scarfing operation. Interior and exterior walls of the tubing shall be galvanized, or tubing shall be given a triple coated protection by an in-line application of hot-dipped zinc (galvanization) per AASHTO M-120 followed by a chromate conversion coating and a clear organic exterior coating. The inside surface shall be given corrosion protection by double in-line application of a full zinc base organic coating.

56-2.02 DESIGN PANEL FASTENING HARDWARE

All signs with a surface area greater than 9 square feet shall have back bracing attached from the post support to the sign panel. Sign panels 9 square feet or larger shall have adequate bracing to prevent panel flexing.

56-2.04 SIGN PANEL INSTALLATION

Efforts shall be made to ensure that all signs in the center median or shoulder areas are not installed next to landscaping or other objects which may impair visibility of the sign.

The bottom of roadside signs shall be mounted at a minimum height of 7 feet above the grade of the sidewalk (or traveled way if there is no sidewalk), with the following exceptions:

1. The bottom of type R4-7, W1-6, and W1-7 signs shall be mounted at a minimum height of 5 feet.

2. The bottom of type R6-1 signs located in the median shall be mounted at a minimum height of 18 inches.

3. The bottom of type W1-8 signs located outside of sidewalk areas shall be mounted at a minimum height of 3feet.

4. At intersections in residential areas, the bottom of street name signs shall be mounted at a minimum height of 8 feet.

SECTION 71: STREETS

71-1 GENERAL

Street surface improvements shall include: barricades, bikeways, bridges, bollards, curb, curb & gutter, driveways, pavement, curb ramps, sidewalk, survey monuments and tunnels. These improvements shall be installed in accordance with the approved improvement plans, these Construction Standards and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the Caltrans Standard Specifications latest edition and as specified by the City Engineer. No Street shall be cut, nor any public improvement disturbed until the Developer/Contractor has obtained an encroachment permit from, and/or entered into a subdivision agreement with the City.

71-2 CONNECTION TO EXISTING IMPROVEMENTS

Connection to existing surface improvements require that the following conditions be met:

A. Existing Stub Street Connection: The Developer shall be responsible for removing and reconstructing a portion of the existing roadway to make a satisfactory connection, as required by the City Engineer.

B. Street Widening: When widening to complete a partial street along a development project, the Developer shall be responsible for saw cutting and removing a narrow strip along the outside portion of the pavement to provide a clean and stable pavement section for constructing against. The width from centerline shall be shown on the approved plans or as determined in the field, and verified by the City Engineer. PCC pavement may be placed against the existing pavement if the City's Construction Inspector determines the pavement edge is flawless. Joints for PCC pavement shall be placed along a lane line or in the center of a lane. Following construction of the adjacent curb and gutter, paving shall not commence until the City's Construction Inspector is satisfied that the cross grade between the existing pavement edge and the new gutter lip conforms to or approaches the City's required 2% cross grade. 3% is the maximum cross grade allowed on this AC pavement section unless shown on the approved plans.

C. Sawcutting: When sawcutting within an asphalt concrete street for trenching or other purposes, Contractor shall grind 1-1/2 inches of pavement between the lane lines (from lane stripe to lane stripe). Upon completion of the sawcutting and/or trenching work, where the sawcutting occurs between the curb and gutter and nearest lane stripe (including bike lanes), the same 1-1/2 grind shall be required. Contractor shall place a Petromat fabric or approved equal by the City and overlay from lane stripe to lane stripe, or curb to lane stripe and restripe or replace any delineators removed during the grind.

When sawcutting within a PCC street for trenching or other purposes, the work shall conform to Construction Standard Detail ST-54.

71-3 CONSTRUCTION STAKING

Construction staking shall be provided by the Developer for all surface improvements. Such staking shall provide the station and offset, as well as the cut to the nearest hundredth (0.01) of a

foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections and every 25 feet in curved sections. Monuments shall have straddle ties placed.
Cut sheets for the appropriate phase of work shall be on-site and shall be furnished to the City's Construction Inspector upon request.

The engineer's surveyor shall stake the grades and location for the top and bottom of slope for all curb ramps.

71-4 INSTALLATION

A. Subgrade: Note: The geotechnical engineer shall closely monitor and test subgrade fills to assure the material meets soil R-Values identified in the street design portion of the project soils report. If R-Values differ from the soils report, structural sections shall be adjusted (including plan revisions) by the design engineer and approved by the City Engineer. Where mehrten (mehrten mudflow breccia and /or mehrten conglomerate), lava cap material, cobbles or other stable native subgrade materials are encountered upon commencement of street grading, the respective material may be substituted for processed subgrade, and/or aggregate subbase and /or aggregate base. This is conditional upon confirmation by the geotechnical and design engineers (and approval of the City Engineer) that the existing subgrade/subbase/base section thicknesses and composition will meet or exceed traffic index and R-Value requirements for the respective street. A minimum of 3 inches of Class II aggregate base shall be required on such substituted material on which to pave.

Soils testing for relative compaction shall reference ASTM D1557-78 test methods.

1. **Subgrade for Sidewalk and Curb Ramps, Curb and Gutter, Driveways and Pavement -** Subgrade shall be processed to 95% relative compaction, minimum 6 inches plus, and shall be tested and certified by a geotechnical engineer, licensed in California. Written certification shall be provided to the City's Construction Inspector prior to the placement of minor concrete (and aggregate base or aggregate subbase for pavements). For meandering sidewalks, Class II aggregate base may be substituted for native subgrade at the Contractor's discretion and shall be processed to 95 % relative compaction.

   Additionally, subgrade stability for curb, gutter and sidewalk and pavement shall be load tested by proof rolling with a loaded, minimum 3,000 gallon water truck (or equipment of equivalent weight as approved by the City's Construction Inspector) in the presence of the City's Construction Inspector, the Geotechnical Engineer and the Contractor. The proof roll test shall be repeated following corrective measures. Prior to placement of aggregate base, deflection in the subgrade shall be eliminated. Placement of aggregate base shall not commence without the approval of the City's Construction Inspector.

   Where mehrten (mehrten mudflow breccia and/or mehrten conglomerate), lava cap material, cobbles or other native subgrade material not conducive to the operation of the concrete extruding machine are encountered, that material shall be removed to a depth of 6 inches below top of subgrade, and shall be replaced with native or imported soil (acceptable to the City's Construction Inspector and the geotechnical engineer) compacted as specified above.

Aggregate base is not included in the structural section for monolithic sidewalk and Type 1 or Type 2 curb and gutter. Aggregate base may be used for meandering or otherwise detached sidewalk.

Sidewalk subgrade exposed upon removal of existing sidewalk shall remain intact unless it is determined by the City's Construction Inspector to be unstable. In this event, it shall be processed per the preceding paragraphs.

Deflecting, unstable areas shall be corrected per the recommendation of the Geotechnical Engineer and upon the approval of the City's Construction Inspector prior to placement of aggregate base, or concrete curb, gutter and sidewalk.

ORDER OF WORK: Street subgrade preparation, minor concrete placement and placement of any aggregate base or subbase for pavement within the City right-of-way shall conform to the following sequence of operations, notwithstanding Section B. below. Prior to placement of aggregate base in the City right-of-way, the contractor shall:

a. Complete underground work outlined in Section B, below.

b. Process and compact subgrade for curb, gutter, sidewalk and pavement, back of sidewalk to back of sidewalk.

c. Complete construction of curb, gutter and sidewalk after approval of the subgrade by the City's Construction Inspector.

d. In addition to Section 90-8 Protecting Concrete, the Contractor shall protect newly placed concrete finish from rainy conditions, graffiti, and weather related damage. In addition, all Contractor wheeled equipment shall not travel within 1 foot of the lip of gutter in the first 24 hours following concrete placement. Contractor's vibratory compaction equipment shall not operate within 72 hours and until all adjacent sidewalk, curb and gutter concrete has reached a minimum of 1400 psi compressive strength.

e. Complete finish grading of subgrade for pavement, conduct proof rolling test and begin placement of aggregate subbase and/or aggregate base after approval of the finished subgrade by the City's Construction Inspector.

B. Aggregate Base and Subbase: Roadway aggregate base and subbase, lime/cement treated base and sidewalk, curb and gutter shall not be placed until the following items of construction within the City street right-of-way and Public Utility Easement (PUE) are completed:

1. Installation of underground sewer and water systems and testing or televising, and approval of same by the Development Services Construction Inspector.

Completion of testing for the presence of bacteria and the water system tie-in shall not be requirements for the approval of commencement of surface improvement construction. However, the water main tie-in shall be completed prior to paving. The Contractor shall

schedule operations such that the curb, gutter and sidewalk pour shall not be conducted on the same day as the water tie-in.

2. Installation and mandrelling of the non-rigid underground storm drain pipe and approval of same by the City's Construction Inspector.

Installation of electric, natural gas, telephone, traffic signal (including interconnect) and cable TV, including mandrelling and testing of all conduits, installation of 4x4 markers a minimum of 2 feet high, painted red, buried at the crossing ends (if conduit ends do not extend up from finish grade). This includes all dry utility crossing and longitudinal trenches.

3. Backfill and compaction testing of all trenches related to the above and approval of same by the City's Construction Inspector.

All aggregate base and subbase (AB and ASB) shall be installed per provisions in Sections 25 and 26 of the Caltrans Standard Specifications. AB and ASB shall be compacted to 95% relative compaction. An oil seal is not required on the AB surface. If required by the City's Construction Inspector, AB and ASB shall be tested for compaction and approved by geotechnical engineer, licensed in California. It shall be proof rolled as specified in Section 71-4,A.1 above if requested by the City's Construction Inspector. Written certification of compliance to these requirements shall be provided to the City's Construction Inspector.

Aggregate base shall be installed as a base for pavement where specified on the approved plans including over lime and fly ash or cement treatment is used to stabilize the ASB.

Aggregate base in any thickness determined by the contractor may be used for meandering sidewalk wherever that sidewalk is not connected to the back of curb, or as a base for A-7 driveways outside the sidewalk at the curb returns. All aggregate base shall be compacted to 95%.

Where lone valley gutters are placed within the City pavement as in an alley, the aggregate base section for the gutter shall extend to the same depth as the aggregate base section for the adjacent asphalt concrete pavement.

Prior to paving, deflection in the compacted AB shall be eliminated. Paving shall not commence without the approval of the City's Construction Inspector.

Lime/fly ash or other stabilizers may be permitted for subbase stabilization as recommended by the geotechnical engineer and shall not be used as a substitute for structural section components. The City, following addition and processing of lime/fly ash or cement shall require mandrelling of all non-rigid and shallow rigid underground utilities at the discretion of the Development Services Construction Inspector. All utility systems shall be cleaned as appropriate. In the event a dig up and repair is required following lime/cement treatment of ASB; the entire excavation shall be backfilled with either 2-sack cement slurry to finish subgrade, or dry native material compacted and conforming to the Construction Standards to within two feet of finished subgrade and top of two feet of excavation shall be two-sack cement

slurry. Subgrade stability for roadway and/or concrete curb, gutter & sidewalk shall be reload tested by proof rolling with a loaded 3,000 gallon water truck and approved by the City Construction Inspector prior to the placement of aggregate base.

C. Minor Concrete: All concrete curbs, curb & gutters, sidewalks, curb ramps, driveways, bus stop pads and turnouts shall be installed per provisions in Section 73 of the Caltrans Standard Specifications, and the Construction Standard Details ST-17 through ST-30 and ST-35 and ST-37 including the following provisions:

1. Thickness: All residential and commercial sidewalks shall be either 6" thick, or 4" thick with 4" of compacted aggregate base.

All commercial driveways, round-a-bout centers and bus turnouts shall be 8" thick, with number 4, grade 60 rebar, on 18-inch centers each way. Rebar shall be set on 3 inch concrete dobies/rebar supports at three foot maximum spacing each way. The dobies shall include wire ties. See the Construction Standard Details.

Base for commercial driveways may be processed native subgrade or 3/4–inch aggregate base compacted to 95% relative compaction.

2. Finishing: Concrete shall not be placed or finished in the rain. It shall be the Contractor's responsibility to schedule construction operations accordingly.

All gutters shall be flow tested with water during the pour to assure proper drainage. Following concrete finishing, no water shall pond in the gutter pan.

All concrete surfaces shall be completed with a medium broom finish unless otherwise specified. A heavy broom finish is not allowed. A concrete finish not conforming to the Caltrans Standard Specifications with regard to blemishes and alignment tolerances shall be cause for rejection of the work.

No stamps advertising construction companies or other private concerns shall be placed in the concrete.

A detectable warning (truncated dome) panel shall be placed at the back of curb line, immediately behind the curb and gutter, centered in the opening to the street (regardless of slope) at every curb ramp (And shall not be sized as shown on the Case C ramp on Caltrans Revised Standard Plan RSP A88A). At minimum, the panel shall consist of a one piece, 4 foot by 3 foot panel but shall be sized according to the path of travel dimension (e.g., 5 foot by 3 foot in the case of an A-7 Driveway (ST-22)). The long dimensions of the panel shall be along the face of curb. The top, flat, dome panel surface (excluding the domes) shall be placed flush with the adjacent top of concrete surface.

Any runoff water standing behind the curb, on the panel, or concrete voids under the panel, shall be cause for replacement of the panel. See Section 71-5 (Materials).

3. **Tool joints and score marks**: Tool joints and score marks shall be placed through the sidewalk, curb and gutter section at the following intervals for the sidewalk widths indicated. All tool joints shall be a minimum 2 inches. There shall be no expansion joint material used in the City right-of-way.

   The purpose of the tool joint is to separate the aggregate and control cracking. During concrete finishing, after placement of a minimum 2 inch deep tool joint, the joint shall be redressed/finished with a 3/8 inch joint tool, per Detail ST-17.

Sidewalk Width (feet)	Deep Tool Spacing (feet)	Score Mark Spacing (feet)
4	12	4
5	10	5
6	12	6
8	12	6
10	10	n/a

   A score mark shall be placed at the back of the curb for the total length of all monolithic curb, gutter and sidewalk including through curb ramps and driveways. The above intervals for perpendicular score marks in sidewalk shall also apply through curb ramps and driveways.

   All barrier curb and valley gutters shall include deep tool joints at 12 foot intervals maximum.

   The use of sawcutting in lieu of deep tool joints is not acceptable.

4. **Grades**: All sidewalks (including portions through driveways and curb ramps) shall be constructed with a minimum cross grade of 1% and a maximum of 2%. Parallel to the street, the grade of the curb ramp landing shall conform to the longitudinal grade of the street.

   The cross-slope of curb ramps shall be 2.0% maximum. At pedestrian street crossing without yield or stop controls and at midblock pedestrian street crossings, the cross slope shall be permitted to equal the street or highway grade. However, the designer should strive to hold the 2.0% cross slope before deciding to match the street or highway grade. In most cases, the 2.0% can be held and a detail would be needed to show the transition and the pavement/sidewalk conformance. To accomplish this, the gutter pan must be warped before additional slope, beyond the 2%, is introduced outside of the curb ramp itself (on the pavement and sidewalk). The cross slope of the curb ramp should also not exceed that of the crosswalk regardless of the roadway profile grade.
   For all curb ramps the maximum of 8.33%.

For the ramp to the lower side of the landing, (where the ramp must be shortened to achieve the minimum 7% grade), 4 feet shall be the minimum length transition allowed.

For meandering sidewalks, the maximum grade in the direction of travel shall be 5% if the street grade allows. If the longitudinal street grade exceeds 5%, the curb side of the meandering sidewalk shall parallel the grade of the back of curb, maintaining a grade of 2% from the edge of sidewalk to the back of curb. For all meandering sidewalks, a minimum cross grade of 2.0% shall be maintained from the edge of sidewalk, across the planter to the back of curb. Where curb ramp landings adjoin the back of curb, the top of curb shall be sloped up from the gutter flow line 1.0% to 2.0% to the back of landing for Type 1 and Type 2, curb and gutter (Detail ST-22).

Gutter slope from lip to flowline shall be as shown on Detail ST-17. The maximum grade shall not be greater than 5%. The minimum shall not be less than 4% for both the Type 1 or 2 curb and gutter.

The preceding slope specification conform to ADA, California Division of the State Architect, and Caltrans Standard Specification requirements. Any finished concrete not conforming to theses slope specification shall be removed and replaced by and at the expense of the contractor.

5. **Monolithic sidewalk, curb and gutter**: All adjoining sidewalk, curb and gutter shall be poured monolithically.

6. **Curb and gutter installation in an existing street**: In an existing asphalt concrete street, a minimum width of 24 inches of existing asphalt concrete paving shall be removed outside the proposed gutter lip and the lip poured against a form board.

   In an existing PCC street, if the City Inspector determines the pavement edge is flawless the curb and gutter may be poured against the existing pavement. For streets with bike lanes the existing pavement shall be removed to the bike lane strip and the lip poured against a form board. For streets without bike lanes a minimum width of one-half of the exiting joint spacing of existing pavement shall be removed outside the proposed gutter lip and the lip poured against the form board.

   The resulting patch on all streets between the gutter lip and the existing pavement shall be 6 inches thick minimum, or the thickness of the existing pavement, whichever is greater. The pavement patch shall be placed within 2 weeks of the conclusion of the concrete curb and gutter pour.

7. **Curb Ramps, General**: See Details ST-22, ST-26, and ST-27. Other ramp configurations in the Caltrans Standard Plans may be used upon the pre-approval of the City Engineer only if site conditions prohibit use of Roseville's standard ramps.

All grade changes at the back of walk for curb ramps shall be staked by a licensed surveyor, conforming to these Construction Standards.

Specifications for curb ramps in the Construction Standards take precedence over the Caltrans Standard Plans and Specifications. Where there are discrepancies between details shown on the approval plan sheets and the Construction Standards, the plans shall be revised to conform to the Construction Standards unless specifically approved by the City Engineer.

8. **Epoxy Work**: Epoxy shall be liberally applied to a minimum of 95% of all existing surfaces to be connected. Epoxy shall be two-part and conform to ASTM C 881/ AASHTO M 235, see Section 71-5 (Materials).

9. **No Sidewalk at Back of Retaining Curb**: At any curb ramp, no pedestrian surface (i.e., concrete, asphalt concrete, paving stones, etc.) adjacent to the back of sidewalk, shall be constructed within 3 feet behind the retaining curb. This area shall be finished with landscaping, cobbles or other non-pedestrian surface only. If the occasion arises wherein the City Engineer determines that placing concrete behind the retaining curb is justified, the top and face of the retaining curb shall be painted yellow.

10. **Curb, Gutter and Sidewalk Patching**: Patch material shall conform to Section 71-5 (Materials). A professional concrete mason shall apply the patch. The patch shall be flush with the existing concrete and a similar finish shall be maintained. The City's Construction Inspector shall determine if the damage to the concrete warrants patching. Generally, any conspicuous damage shall be patched.

11. **Dowelling New Concrete to Existing**: When pouring combinations of sidewalk or curb and gutter contiguous to existing, the existing concrete vertical face shall be doweled 3 feet on center with 16 inch long, grade 60, #4 rebar penetrating 4 inches into the existing curb, 4 inches below top of curb. The dowel hole shall be 5/8-inch diameter at a slight angle horizontally. The penetrating portion of the dowel and the entire cleaned vertical surface of the adjoining existing concrete shall be 95% coated with two-part epoxy. All abutting sidewalk shall be doweled mid-section with 2 dowels for 4 through 6 foot wide sidewalk and 3 dowels for wider sidewalk. Abutting curb and gutter ends shall 2 dowels installed, 18 inches apart, centered on the curb and gutter section. See Section 71-5 (Materials) for epoxy.

    Where the street side of the meandering sidewalk meets the back of curb at less than a 90 degree angle, the return to the back of curb shall be a minimum 18 inch radius or 18 inch space shall be provided between the front face of sidewalk and the back of curb.

    Replaced sections shall be removed back to score marks, expansion joints or deep tool joints; or at the discretion of the City's Construction Inspector.

    If the existing edge is damaged during removal, the concrete shall be sawcut again at the City's Construction Inspector's discretion.

12. **Sidewalk, curb and Gutter Replacement**: Where sidewalk and/or curb and gutter is being replaced, the maximum length of sidewalk that may be replaced non-monolithically (without the attached curb and gutter) is 20 feet. If more than 20 feet is damaged continuous, the total sidewalk, curb and gutter section shall be removed and replaced monolithically. Where sidewalk, curb and gutter or curb ramps and driveways with sidewalk, curb and gutter as portions thereof are replaced, all replacement shall conform to the latest Construction Standards. In the case where concrete sidewalk replacement is necessary where either the brass disc or property line score mark is removed, the developer shall be responsible to re-establishment of the surveyor's permanent marker in kind as identified on the Final Map.

13. **Median Islands**: All new roadway median infill areas shall have basket weave pattern stamped concrete with brick red #1117 per Detail ST-37.

    Existing cobble medians in retrofit areas effected by utility cuts or damage will be replaced per the following:

    Cobbles set in 4 inches of pea gravel concrete. The top surface of the concrete shall be flush with the top of curb. Where cobble demolition within a median amounts to 50% of the area or more, all existing cobbles to be removed and replaced with "Ashler Slate" per Detail ST-37, and at the applicant's expense.

    Cobbles shall be 4 to 6 inches in size, with 1/3 exposed above the top of curb, per Caltrans Specifications. Base for concrete may be native soil compacted to 95% or Class II, ¾ inch aggregate base. On existing pavement, the two acceptable alternatives for base are ¾ inch aggregate base or total depth concrete. The surface of all embedment concrete shall be above the top of curb and graded/finished to drain.

    Existing Grey stamped medians in retrofit areas effected by Utility cuts will be replaced per the following: Gray stamped concrete retrofit areas effected as described above shall be replaced in-kind with, 4 inches thick " Ashler Slate" and standard color shall be basalt gray (QC Release Power Colors).

14. **Damaged Gutter Lip**: Gutter lip damaged during the grading and rocking operation shall be patched or replaced. Any spall extending more than 1 inch into the gutter pan from the vertical face of the gutter lip shall be patched at a minimum. See Section 71-5,G.3 (Materials).

15. **Concrete and Asphalt Concrete Saw Cutting – Sawcutting of concrete pavements shall conform to Detail ST-54.** Residual from sawcutting shall be removed by vacuum method and disposed of conforming to local environmental and State Stormwater Pollution Prevention Plan requirements. The downstream drain inlet shall be protected. In no case shall the residual be allowed to enter the storm drain system. The above-specified cleanup shall be the responsibility of the contractor.

16. **Concrete Cure**: All newly placed concrete shall be cured in accordance with the provisions in Section 90-1.03B(3)(b) of the State Standard Specifications and these Construction Standards. See Section 71-5,I. (Materials) of these Standards for curing compound. Exposed surfaces of all concrete sidewalk, curb and gutter, driveways, but turnouts and curb ramps shall be coated with a pigmented curing compound immediately following surface finishing, prior to the moisture sheen disappearing from the surface. Curing compound shall be applied at a rate of 1 gallon per 150 square feet, or per the manufacturer's recommendations, whichever is greater, unless otherwise specified.

D. Asphalt Concrete Paving: All asphalt concrete (AC) shall be installed per provisions in Section 39 of the Caltrans Standard Specifications, except as amended by Section 71 (Streets), of these Construction and Design Standards.

No paving shall occur until all underground work is completed, tested, and subgrade and/or aggregate base and/or lime and fly ash or cement treated base have been accepted by the City's Construction Inspector.

1. **Mix Design**: The Contractor shall provide the asphalt concrete mix design to the Director of Development Services at least 10 working days prior to the start of the work on the project for review and approval. The mix design must be approved prior to commencement of work.

   The asphalt concrete mix design shall indicate the following:

   a. Complete aggregate grading with the percentage of aggregate passing each sieve size per AASHTO T 27.

   b. Percent air voids for each percentage of asphalt binder used in the mix design determination per AASHTO T 269a.

   c. Stability - Per MS-2 Asphalt Mix Design Methods per Sections 3 & 8. Mix design requires Hamburg Wheel (AASHTO T 324) and Moisture Susceptibility (AASHTO T 283) once per project or every 10K tons.

   d. Maximum theoretical density for each percentage of asphalt binder used in the mix design determination per AASHTO T 209, Method A.

   e. Compacted unit weight for each percentage of asphalt binder used in the mix design determination.

   f. Percent asphalt binder recommended. (Optimum bitumen content, OBC), per AASHTO T 308, Method A.

   The actual asphalt cement content may vary up to 0.5% plus/minus from the target optimum bitumen content (OBC). For Job Mix Formula, -0.3 to +0.5%.

2. **Spreading and Compaction Equipment**: Per CalTrans Standards 2015 Section 39-2.01C(2) page 466, Paving equipment for spreading must be:

   a. Self-propelled

   b. Mechanical

   c. Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane

   d. Equipped with a full-width compacting device

   e. Equipped with automatic screed controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope

   Asphalt concrete placed in layers of 0.15-foot and greater in compacted thickness or widths of 5 feet and greater shall be spread and compacted with the equipment and by the methods specified in Section 39, except as amended as follows:

   Per the 2015 CalTrans Standards: 39-2.01C(2)(c) Method Compaction Equipment For method compaction, each paver spreading HMA must be followed by 3 rollers:

   a. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.

   b. One oscillating-type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.

   c. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons. Each roller must have a separate operator. Rollers must be self-propelled and reversible.

3. **Compacting**: The entire contents of the Caltrans Standard Specifications, “Compacting” is replaced to read:

   (See page 481 in CalTrans 2015 Standards.) Asphalt concrete shall be spread at a temperature of not less than 260 degrees F.

   A pass shall be one movement of a roller in either direction. Coverage shall be as many passes as are necessary to cover the entire width being paved. Overlap between passes during any coverage, made to ensure compaction without displacement of material, and shall be considered to be part of the coverage being made and not part of a subsequent coverage. Each coverage shall be completed before subsequent coverage is started.

Rolling shall commence at the lower edge and shall progress toward the highest portion, except that when compacting layers which exceed 0.25-foot in compacted thickness, and if directed by the Inspector, rolling shall commence at the center and shall progress outwards.

Rolling shall be performed so that tearing, cracking, shoving, or displacement does not occur. Rolling must leave the completed surface compacted and smooth.

When placing asphalt concrete, large aggregate that migrated to the surface during any handwork shall be returned to the pave box, rather than scattered over the surface of the mat.

Finish rolling or final compaction shall be completed while the temperature of the mixture is at or above 150° F. A vibratory roller may be used as the finish roller provided it is operated with the vibratory unit turned off.

Upon completion of rolling operations, if ordered by the City Construction Inspector, the asphalt concrete shall be cooled by applying water.

Asphalt concrete shall be compacted to not less than 92 percent or more than 96 percent of the theoretical maximum density as determined by AASHTO T 209 Method A and shall be finished to the lines, grades, and cross section shown on the Project Plans.

The City Inspector reserves the right to gather samples for material testing at random for the hot mix asphalt (HMA) material from behind the paving machine in accordance with CTM 125 to determine the maximum theoretical density of the HMA mixture in accordance with AASHTO T 209, Method A. The theoretical maximum density results derived from the samples shall be used to determine the relative density achieved for the same 750 ton lot.

The pavement will be accepted for density on a lot basis. A lot will consist of 750 tons or portions thereof. Cores for determining the density of the compacted pavement will be taken on a lot basis. A minimum of three (3) cores shall be taken per lot. The density of each core shall be determined in accordance with AASHTO T 275. In order for a lot to be accepted for density, all core density results shall be between 92 and 96 percent. Averaging core results is not permitted.

The Contractor shall provide daily laboratory results of ASHTOO T 275 and AASHTO T 209, Method A to the City's Construction Inspector.

In-place pavement density will be determined by comparing the density of cores taken from the compacted pavement to the theoretical maximum density as determined by AASHTO T 209, Method A, and as stated in these City Standard Specifications. Pavement cores shall be collected using a 4 to 6 inch diameter core barrel when the pavement has cooled sufficiently to minimize disturbance to the cores at the discretion of the City's Construction Inspector. Cores shall be taken by either the developer's geotechnical

engineer, as proposed at the start of construction, or the City's geotechnical consultant. No third party geotechnical engineer vendor hired by a contractor for quality control purposes shall be considered. For major backbone roadway infrastructure projects funded by community facility districts, (CFD funds), the City's quality assurance geotechnical engineering firm's laboratory testing results shall be utilized in determining acceptance.

Finish, compacted pavement height shall be ¼-inch above and over the gutter lip, except for 6 feet at the curb ramp opening, where it shall be flush with the top surface of the gutter lip. Corrective operations for recently placed pavement more than ¼-inch above the gutter lip may include reheat, knead and re-compact with pneumatic tired rollers, in order to bring the improvements into compliance.

The horizontal surface of AC paved against an existing AC surface shall be flush with the existing surface.

The completed surfacing shall be thoroughly compacted, smooth and free from ruts, humps, depressions or irregularities. Any ridges, indentations or other objectionable marks left in the surface of the asphalt concrete by blading or other equipment shall be eliminated by rolling or other means approved by the Inspector. The use of any equipment that leaves ridges, indentions or other objectionable marks in the asphalt concrete shall be discontinued, and the Contractor shall furnish acceptable equipment.

Asphalt concrete placed in layers less than 0.15-foot in compacted thickness or widths of less than 5 feet shall be spread and compacted with equipment and by the methods specified in Section 39 of the CALTRANS Standard Specifications.

4. **Miscellaneous Paving Requirements**: When a straightedge 12 feet long is laid on the finished surface and parallel with the centerline, the surface shall not vary more than 0.01-feet from the lower edge of the straightedge. The transverse slope of the finished surface shall be uniform to a degree such that no depressions greater than 0.02-feet are present when tested with a straightedge 12 feet long laid in a direction transverse to the center line and extending from edge to edge of a 12 foot traffic lane.

   If the finished surface of the asphalt concrete does not meet required surface tolerances, as specified above, the Contractor shall, at its own expense, bring pavement surface within tolerance by the following method:

   a. Cold plane asphalt pavement to a minimum depth of 0.15 feet from specified finish surface; (lateral limits shall be from edge of asphalt concrete to edge of asphalt concrete; longitudinal limits shall extend a minimum of 50 feet, starting from the outer edge of tolerance area and extending outward, and as directed by the Inspector). All grindings shall be removed and disposed of in accordance with Caltrans Standard Specifications.

   b. The Contractor shall apply tack coat and place an overlay of asphalt concrete in accordance with the requirements of the City Standard Specifications.

c. The area to which asphalt emulsion has been applied shall be closed to public traffic. Care shall be taken to avoid tracking binder material onto existing pavement surfaces beyond the limits of construction.

Pavement within 50 feet of an approach to a bridge structure or approach slab shall conform to the smoothness tolerances specified in Section 51-1.01D(3)(b)(ii), "Surface Smoothness", of the CALTRANS Standard Specifications."

The surface edges that abut the proposed asphalt concrete shall be clean and free of dirt and dust prior to placing a tack coat. Asphalt emulsion shall be used as a tack coat and/or paint binder on new pavement that is to receive a second lift that has been exposed to traffic or other sources of contaminants or on existing pavements that are to receive an asphalt concrete overlay and also along exposed edges of abutting pavement and concrete curbs and gutters. A tack coat may also be required between subsequent layers of asphalt concrete placed by the contractor when ordered by the City's Construction Inspector. Asphalt emulsion shall conform to Section 92, "Asphalt Binders", of the Caltrans Standard Specifications.

Prior to City acceptance of the improvements (Certificate of Completion), and following the 12 foot straightedge test, and any remove and replace areas with new overlay pavement, streets may be flooded to check for standing water. This procedure may be repeated prior to the expiration of the warranty period. This may be accomplished with a water truck or with rainwater. All low areas in the asphalt concrete pavement holding 0.01-feet for longitudinal and 0.02-feet for transverse depressions or more of water shall be marked by the City's Construction Inspector and milled 0.15-feet and replaced with similar material. A second water test may be necessary at the discretion of the inspector.

A micropave surface treatment or Caltrans slurry seal may be required at the City's Construction Inspector's discretion following cold planing as described above if it is determined the paving surface is sufficiently irregular, boney, discolored, or unsealed to warrant it.

The Contractor shall schedule paving operations such that at the end of each work shift, each layer of asphalt concrete is placed on all contiguous lanes and shoulders of a traveled way to be opened to public traffic

At the end of each work shift, the distance between the ends of the layers of asphalt concrete on adjacent lanes shall not be greater than 10 feet nor less than 5 feet. A drop-off of more than 0.15-foot will not be allowed at any time between adjacent lanes open to public traffic.

Additional asphalt concrete shall be placed along the transverse edge at the end of each lane and along the exposed longitudinal edges between adjacent lanes, hand raked, and compacted to form temporary conforms. Kraft paper, or other approved bond breaker, may be placed under the conform tapers to facilitate the removal of the taper when paving operations resume.

Additional asphalt concrete surfacing material shall be place along the edge of the surfacing at private drives, hand raked, if necessary, and compacted to form smooth tapered conforms.

Longitudinal joints in successive pavement lifts shall be offset from lift to lift a minimum of 1 foot. The surface pass seam shall be located on the lane line. Where extruded concrete curb is removed for pavement widening, Contractor shall grind 1-1/2" of pavement between the nearest lane line and the existing curb and gutter line (including bike lanes). Following placement of the asphalt concrete base lift within the widening section, and 1-1/2" below the new gutter lip, Contractor to replace Petromat fabric or approved equal in grounded area, place asphalt concrete overlay, and restripe and/or replace any delineators removed during the grind.

Prior to permanent patching in a pavement removal area, fresh cut-back (temporary pavement) in a minimum thickness of 2 inches shall be placed as a driving surface.

Whether the surface material is fog sealed or cutback or slurry, the Contractor shall be tenacious in maintaining the surface in a condition and to a grade comparable to the permanent patch. No other materials are allowed as temporary pavement. Placement of steel plates over fresh slurry may be employed per Section 21-2, I. 5 of these Standards.

The temporary surface shall be flush with the surrounding pavement and shall accommodate a smooth drive across it.

Sand and dirt shall not be allowed to accumulate on the slurry surface and adjacent street. It shall be swept daily if necessary.

Utility boxes in asphalt concrete or off-street paths shall include a 12 inch x 12 inch concrete collar of Type II minor concrete as defined in Section 71-5 and W-16 Details of these standards. The top of the collar shall either be 3 inches below the surrounding pavement or flush with the finished surface with medium broom finish. The area shall be patch-paved with asphalt concrete as with manholes, water valves and monuments in the street way.

If a bucket or tank or diesel fuel is carried on the paver for the purpose of cleaning rakes and shovels, a container of grease sweep or equivalent absorbent material shall also be carried on the paver. All diesel spills shall be promptly cleaned up.

Where multiple and grouped HMA cores have been taken from new HMA roadways for the purpose of either additional testing and/or subsurface investigation, permanent patching shall consist of: "Squaring-Up" area to 6 inches beyond outside edge of cores, mill pavement to 0.15 feet deep, place full depth HMA into core holes, then place paving fabric into milled surface, and repave these Standards. Patching limits shall be at the discretion of the City's Construction Inspector.

5. EXISTING PAVEMENT

a. Cut lines made on existing pavement, both longitudinally and transversely, for the placing of new structural section shall be straight and smooth.

b. Edge grinding (Cold Planning) shall be required where existing asphalt is to be overlaid. The edge grind shall match the depth of the asphalt concrete overlay along the length of the gutter lip and abutting pavement where the asphalt concrete pavement is proposed to conform to the existing pavement.

c. Existing pavements to be overlaid with asphalt concrete shall include the installation of pavement reinforcing fabric in accordance with CalTrans 2015 Standards section 96-1.02J , Materials of the Caltrans Standard Specifications at the discretion of the City's Construction Inspector.

d. Existing AC surfaces to remain shall be cut in a straight line parallel to the street centerline, and the exposed edge shall be tracked with SS1H emulsion or equivalent prior to paving. For moratorium defined streets, CRAFCO Pavement Adhesive, "Qwik Seal" or approved equal shall be used per manufacturer recommendations. The exposed base material shall be graded and re-compacted per these Construction Standards prior to paving. Graded and re-compacted areas shall be approved by the City's Construction Inspector prior to paving.

e. Where crack sealing is required: Cracks less than ¼ inch in width shall be sealed with SS1-H asphalt emulsion and 30 grit sand. Cracks from ¼ inch to ¾ inch shall be sealed with CRAFCO hot melt rubber sealant or approved equal. Excess sealant shall not extend more than 1 inch outside the crack onto the pavement surface or above the finished surface of the street. Where cracks larger than ¾ inch (or pavement alligator cracks) occur, asphaltic concrete patching may be required at the discretion of the City's Construction Inspector.

f. Where an excavation in the public right of way is backfilled with 2 sack cement slurry per these Construction Standards, the slurry may be brought to the top of the trench until permanent patching. Where rock-saw utility trenching is necessary in the bottom lift of asphalt concrete and prior to placement of top lift of asphalt concrete, the rock saw trench shall be covered with Glasgrid product (8512, with 100X200 KN tensile strength) or approved equal, at the manufacturers recommendations prior to the placement of top lift of asphalt.

g. If the width of existing pavement between the gutter lip and excavated patch/pave area is 3 feet or less, all existing pavement between the patch/pave area and the gutter lip shall be removed or milled 0.15 feet in depth, and patched conforming to the adjacent patch/pave area requirements.

h. Pothole restoration shall be per Detail TB-5 of these Construction Standards. At the discretion of the Development Services Construction Inspector, the top 6 to 8 inches of asphalt may be replaced with concrete colored throughout with lamp black. In the event that an excessive number of potholes are in close proximity to one another, the

Development Services Construction Inspector may require a grind and overlay to reestablish continuity and ride ability to the roadway surface.

E. Portland Cement Concrete Paving: All Portland Cement Concrete (PCC) pavement shall be installed per provisions in Section 40 of the Caltrans Standard Specifications, except as amended by these Construction and Design Standards.

No paving shall occur until all underground work is completed, tested, and subgrade and/or aggregate base and/or lime and fly ash or cement treated base have been accepted by the City.

Raveling shall be defined as: Progressive disintegration of the concrete pavement surface resulting in dislodged aggregate.

1. Mix Design: The Contractor shall provide a concrete mix design to the City at least 10 working days prior to the start of work on the project for review and approval. The City can provide past examples of mix designs as a template. The mix design must be approved prior to commencement of work.

The PCC pavement mix design shall indicate the following:

a. Mix design shall include proportions including all material weights, volumes, density (unit weight), water-cement ratio, and void content. The mix design shall specify an average compressive or flexural strength that meets or exceeds the acceptance criteria for the specified strength.

b. For streets and parking lot pavement the minimum allowable average strength of the concrete per ASTM C 78, or California Test Method 523, is 550 psi at 28 days age. The average must be calculated using at least three replicate specimens.

c. Rapid set concrete pavement shall be tested per California Test Method 524, and sampled per California Test Method 539. The rapid strength concrete must not have an opening modulus of rupture of less than 400 psi and a 3-day modulus of rupture of not less than 500 psi.

d. A correlation curve between flexural strength and compressive strength using the same mix design.

e. Certification that the mix design will meet the requirements for strength, schedule, and road opening.

2. Pre-paving Meeting: The Contractor shall schedule a pre-paving meeting prior to the submission of the Quality Management Plan to discuss the Quality Management Plan and methods of performing each item of the work. Attendees to include:

- Contractor's Project superintendent
- Concrete paving foreman
- Foremen responsible for earthwork and pavement base

- Representatives from subcontractors for adjacent and related work
- Engineer of Record
- City Project Manager
- Testing Laboratory
- Testing staff

3. **Quality Control Plan**: The Contractor shall provide a Quality Control (QC) plan for concrete paving to the City for review at least 10 working days prior to the start of work on the project for review and approval. If the pavement is at least 2,000 cubic yards the contractor shall supply a Quality Control manager. The QC plan shall address the elements affecting concrete pavement quality. The QC plan shall include action and suspension limits and details of corrective actions to be taken if any process if outside those limits

4. **Submittals**: Contractor shall also submit the following to the City at least 10 working days prior to start of work on the project for review and approval:

   a. Construction schedule for all PCC related operations.

   b. PCC production procedures, description of batching or batching and mixing plant used, and also PCC delivery methods. List of all equipment proposed for the use to perform the placement of PCC including paving equipment and compaction equipment.

   The paver and mixing equipment used must match that listed on the submittal, unless a substitution is made, which meets these specifications and is approved by the Engineer.

   c. Outline of procedures for calibrating the mixing plant, if a mobile plant is used, and monitoring materials during construction shall also be submitted.

   d. Complete paving procedures including, but not limited to, line and grade control, direction of paving operations, paving widths, jointing plan for planned longitudinal and transverse construction joints, and curing method.

      1. Spacing between joints shall not exceed 15 feet unless approved by City.

      2. Larger horizontal dimension of each slab panel shall not exceed 150 percent of smaller horizontal dimension, unless approved by the City.

      3. Contraction joint depth shall be 1/3 pavement thickness.

      4. Concrete pavement joints need to mesh with the traffic control plan and final pavement delineation. Joints shall be either coincidental with or bifurcate the final traffic lane lines.

   e. Certification of aggregate source.

f. Certification of Portland cement and supplementary cementing materials.

g. Certification of mixing water for PCC.

h. Certification of chemical admixtures for PCC.

i. Certification of curing compound.

j. Contingency plan, including but not limited to backup paving equipment and backup batching facility.

k. Methods of handling, storing, delivering and mixing of materials.

l. Operating procedures for corrective action(s) necessary to assure a tight, smooth surface on the PCC pavement, free of tears larger than 1/4" width and 1/4" depth and other surface imperfections, including surface pitting.

5. **Construction Equipment**: PCC pavement shall be placed with approved paver or other equipment.

   a. Concrete pavement shall be spread, screeded, shaped, slip formed, and/or consolidated by one or more self-propelled machines. These machines shall perform in a manner so that the completed pavement will conform to the required cross section with a minimum amount of handwork. Consolidate the concrete with internal vibrators or other authorized method.

   b. The equipment shall operate in a manner that will prevent segregation and produce a smooth continuous surface without tearing, pulling or shoving. The spread of the PCC shall be limited to a length that can be placed and finished within the appropriate time limit under the prevailing air temperature, wind, and climatic conditions.

   c. The equipment shall proceed in a steady, continuous manner. Equipment speed during placement operations shall not exceed the speed necessary to ensure that minimum density requirements are met and surface distress is minimized.

6. **Weather Limitations**: Do not place PCC pavement when the ambient temperature is below 45°F, or is expected to fall below 32°F within 48 hours of placement, unless otherwise permitted in writing by the City.

   Do not place PCC pavement when the ambient temperature is above 95°F unless otherwise permitted in writing by the City.

   If you plan to place PCC pavement in the above conditions, submit a plan to the City outlining procedures and methods for curing and weather protection.

   Do not place PCC pavement when the wind, heat or humidity do not allow enough time to place, properly joint, compact, edge, finish and cure before the surface dries.

7. **Condition of the Subgrade/Subbase**: Prior to PCC pavement placement, the surface of the subgrade/subbase shall be clean and free of foreign material, ponded water and frost prior to the placement of the PCC pavement mixture. The subgrade/subbase must be uniformly moist at the time of PCC placement. If sprinkling of water is required to remoisten certain areas, the method of sprinkling shall not be such that it forms mud or pools of free-standing water. Prior to placement of PCC, the subgrade/subbase shall be checked for proper density and soft or yielding areas and these areas shall be corrected per these specifications.

8. **Joints**: The jointing plan shall be consistent with the recommendations and requirements in ACI 325.12R – "Guide for Design of Jointed Concrete Pavements for Streets and Local Roads" in addition to the requirements of these Construction and Design Standards. Prior to placement of the PCC pavement, joint locations shall be marked by the contractor in the field to insure cold joints will align with the jointing plan. Following PCC placement, and before sawcutting the joints, the jointing plan shall be marked on the PCC by the contractor with a temporary marking material to demonstrate to the engineer that the sawcuts are being placed per the plan.

   New joints in plastic concrete or recently hardened concrete shall align with joints in older concrete. Joints abutting curbs and other fixed concrete shall be installed within 10 degrees of perpendicular to the older concrete.

   If joints are to be sealed they shall be clean and dry before joints are sealed. The Contractor shall not place joint sealant or fillers prior to 72-hours after the joint was sawcut. The Contractor shall remove all loose debris from the joints immediately prior to placing joint sealant or filler.

   Expansion Joints shall be placed at intersections of concrete pavement streets.

   Formation of Joints

   a. **Cold Vertical Joints**: Any planned or unplanned construction joints that do not qualify as fresh joints shall be considered cold joints and shall be treated as follows:

      1. Longitudinal and Transverse Cold Joints. Cold joints cut after two hours of placement shall be saw-cut to 1/3 depth of the PCC pavement with the rest removed by hand or mechanical equipment. Any modification or substitution of the saw cutting procedure must be demonstrated to and accepted by the Engineer. All excess material from the joint cutting shall be removed.

      2. Prior to placing fresh PCC mixture against a cold vertical joint, the joint shall be thoroughly cleaned of any loose or foreign material. The vertical joint face shall be wetted and in a moist condition immediately prior to placement of the adjacent lane.

      3. Uneven surfaces or slopes greater than as determined for "Cold Joint Edges" shall be

cut vertically for the full depth of the PCC.

4. The top layer shall be placed so that longitudinal joints in that layer will coincide with joints in the lower layers of the pavement. Transverse joints in the top layer shall coincide with transverse joints in the lower layers of the pavement.

b. Horizontal Cold Lift Joints: For horizontal cold joints the surface of the lift shall be kept continuously moist and cleaned of all loose material prior to placement of the subsequent lift. The use of a cement slurry or mortar grout between lifts is required. If supplementary bonding materials are used, they shall be applied immediately prior to placement of the subsequent lift.

c. PCC Pavement Joints at Structures: The joints between PCC pavement and concrete structures shall be treated as isolation vertical joints.

d. Control Joints: Control joints shall be constructed in the PCC pavement to induce cracking at pre-selected locations. Early entry saws shall be utilized as soon as possible behind the rolling operation and set to manufacturer's recommendations. Saw crack control joints to the interval specified on the plans. The depth of the crack control joints shall be equal to 1/3 of the thickness of PCC pavement. The width of the crack control joints shall be 1/8" maximum. Extend all crack control joints the entire width of paving. When sawing crack control joints, begin as soon as the PCC cuts without excessive raveling along the saw cut and finish before conditions induce uncontrolled cracking, regardless of the time or weather. Control joints shall be sprayed with curing compound immediately.

e. Isolation Joints: Line the perimeter of fixed structures such as manholes, valves, trench drains, and with strips of fiberboard or other approved isolation joint material, as noted in the plan details, prior to paving. Joint filler for isolation joints must be preformed expansion joint filler for concrete (bituminous type) in compliance with ASTM D 994.

f. Expansion Joints: Install expansion joints to the details, dimensions and locations shown on the jointing plan Include width, filler, sealing material, location and/or spacing recommendations in the expansion joint plan, considering thermal effects, regional climatic conditions, PCC coefficient of thermal expansion and expected daily temperature ranges at the time of placement.

9. Curing

a. General: Immediately after final rolling, compaction testing, and finishing use an approved curing method outlined below. Water cure or curing compound shall be applied vertically from above the pavement. Application shall not be allowed from the side of the pavement. During this work the Contractor shall control the work such that it does not result in visible water or curing compound particulate migration. Reapply curing compound to sawcuts and disturbed areas

b. Curing Compound: A clear with sacrificial red dye membrane forming curing compound conforming to ASTM C 309 Type ID Class B shall be applied at a rate of 150 sf / gallon no later than one hour after completion of finishing operations on the surface and edges of RCC. This application must ensure a uniform continuous (free of uncured areas) membrane across the entire RCC pavement. If the application rate is found to be insufficient, the Contractor, with approval of the Engineer, can increase the application rate to a level which achieves a void-free surface without ponding. In case the minimum rate of application is specified otherwise by manufacturer's recommendations, the highest application rate shall govern. After the first coat dries, apply a second coat per the above specifications.

c. Sheet Materials: Curing paper, plastic and other sheet materials for curing RCC shall conform to ASTM C 171. The coverings shall be held securely in place and weighted to maintain a close contact with the RCC surface throughout the entire curing period. The edges of adjoining sheets shall be overlapped and held in place with sand bags, planking, pressure adhesive tape, or other City-approved method. Sheet material shall be provided and kept readily available to cover pavement less than 12 hours old if rainfall occurs.

10. Concrete Pavement Smoothness

The City accepts pavement surfaces for smoothness based on compliance with the smoothness specifications for the type of pavement surface and roadway classification specified.

For areas that require pavement smoothness determined using a 12-foot straightedge, the pavement surface must not vary from the lower edge of the straightedge by more than:

- 0.01 foot when the straightedge is laid parallel with the centerline
- 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
- 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

The Engineer may order you to recalibrate your inertial profiler equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your inertial profiler operator.

The smoothness criteria are shown in Table 7-X.

Table 7-X: Concrete Pavement Roughness Acceptance Criteria

Roadway Classification	Localized Roughness (International Roughness Index)	Mean Roughness Index (per 0.1 mile section)
Alley-way	≤ 190 in/mi	≤ 95 in/mi
Minor Residential	≤ 190 in/mi	≤ 90 in/mi
Primary Residential	≤ 190 in/mi	≤ 90 in/mi

Collector Non-Residential Collector	≤ 160 in/mi	≤ 75 in/mi
Industrial	≤ 190 in/mi	≤ 90 in/mi
Minor Arterial	≤ 160 in/mi	≤ 75 in/mi
Major Arterial	≤ 160 in/mi	≤ 75 in/mi

11. Additional PCC Paving Requirements

a. Lift Thickness: Place PCC in lifts between 4 inches and 9 inches thick. Multiple lifts are not allowed for pavements less than 9 inches thick.

b. Segregation: If segregation occurs in the PCC during paving, operations shall cease until the cause is determined and corrected.

c. Placement: PCC placement shall be done in a pattern so that the curing water from the previous placements will not pose a runoff problem on the fresh RCC surface or on the subbase layer.

d. Restoration After Quality Assurance Testing: The Contractor shall fill the core holes with Portland cement concrete as directed by the Engineer. Concrete shall meet the requirements of Section 25, "Portland Cement Concrete Pavement" of the Standard Construction Specifications. Core holes are to be filled to be flush with surrounding pavement surface.

Thickness requirement shall occur after the required, if any, diamond grinding of the PCC pavement.

Removal of temporary traffic stripes shall not result in difference in pavement surface difference. If difference is visible to City Inspector, the Contractor shall treat the surface to remove the difference.

F. Roller Compacted Concrete Paving: All Roller Compacted Concrete (RCC) pavement shall be installed per provisions for PCC paving in these Construction Standards and in Section 40 of the Caltrans Standard Specifications, except as amended by these Construction and Design Standards. Attention is directed to ACI 327R-14 – "Guide to Roller Compacted Concrete Pavements" for recommendations and best practices for RCC.

1. Proposed mix design(s) shall meet the following minimum strength requirements based on test results of cylinders prepared according to ASTM C1435.

RCC shall have minimum compressive strength of 4,000 psi at 28-days or 5,000 psi at 42-days. In addition, the RCC shall have a minimum compressive strength of 3,000 psi at 3-days.

Consistency and formability of RCC shall be adequate to the methods of its production, delivery, placement and consolidation. The objective consists of proportioning RCC that

contains sufficient volume of paste to coat the aggregates and fill voids between them, is able to produce the required strength and durability, constructs roads that can be open to traffic within 3 days or sooner should the RCC reach the required strength before 3 days, and makes it easy to achieve the maximum density. Contractor submits to the Engineer along with the statement of the proposed mix design data justifying the selected consistency and formability of the mix and method of its control.

2. An independent testing laboratory shall proportion RCC to meet the specified requirements for strength and Contractors requirements for consistency and formability. The laboratory shall demonstrate its compliance with the requirements of ASTM C1077. The mix design backup information shall show the moisture-density curve with associated maximum dry density, wet density and optimum moisture content, details of cementitious materials, 3-day, 7-day and 28-day, or 42-day compressive strengths, including strength gain curve for the proposed mix. The mix design shall identify the quantity and gradation of aggregates, the optimum moisture content, and the amount of Portland cement, other cementitious material(s) and the total cementitious materials required per cubic yard of the concrete. The mix design shall specify the proportions of each material (aggregate, cement, water, and admixtures) in the mix in terms of pounds per cubic yard based on saturated surface dry weights. Any changes to the mix design shall be approved by the Engineer. Should a change in material source be proposed, the Engineer must approve a new mix design.

3. Proportioning of RCC shall be performed in general compliance and in the sequence recommended by ACI 327R-16, Chapter 6 “Mixture Proportioning.”

4. Batching, Mixing and, Transportation of RCC:

The City shall approve the mixing plant before the Contractor begins producing RCC. The mixing plant shall follow ACI 327R-14.

The plant shall be capable of producing an RCC mixture in the proportions defined by the final approved mix design and within the specified tolerances. The capacity of the plant shall be sufficient to produce a uniform mixture at a rate compatible with the placement equipment. The minimum homogeneous production rate of any acceptable plant shall be 300 tons per hour. For batch mixers, the volume of RCC material in the mixing chamber shall not be more than the rated capacity for dry concrete mixtures. Multiple plants shall not be used to supply RCC material to the paver. The Engineer can halt operations if the plant is unable to produce the RCC mixture sufficiently in quality or quantity, until a plant meeting all requirements is obtained.

A pugmill plant is required, it shall be a central plant with a twin shaft pugmill mixer, capable of batch or continuous mixing, equipped with synchronized metering devices and feeders to maintain the correct proportions of aggregate, cement, mineral admixture, and water.

Other types of batching and mixing equipment and configurations other than twin shaft

pugmill mixers may not be used. This includes but is not limited to dry batch plants, central mix tilt drum plants, ready mix truck mixers, volumetric concrete trucks and trailers.

The mixing time shall be pre-established by uniformity studies conducted, as provided in ACI 327R-14, Section 8.2 "Roller-compacted concrete mixing plants."

Locate the mixing plant within 30 minutes hauling time from the construction site. The supplier may request a longer hauling time not exceeding 60 minutes, provided the documentation is submitted evidencing that properties of fresh RCC are suitable and allow for convenient and proper placement and consolidation.

For RCC produced with a mobile pugmill, prior to commencement of RCC production, the Contractor shall carry out a complete and comprehensive calibration of the plant in accordance with the manufacturer's recommended practice. The strength requirements per these specifications or as directed by the Engineer. The new concrete shall be doweled into the existing RCC layer using dowel bars. Please refer to Caltrans Standard Plan P10.

5. Surface Requirements

a. Surface Texture: The final surface texture after rolling and curing shall be smooth and uniform over the entire area of pavement and will reasonably match the surface condition of the test strip. The surface area shall be free of rips, bird baths, areas of loose aggregate, surface pitting, voids or indentations, pockmarks, surface tears greater than 1/4" depth and 1/4" width, check cracking, segregation or rock pockets, pumped areas, aggregate drag marks, and areas where fines have been washed away during the curing process.

b. Defective area Correction for Surface Texture: Correct surface texture deficiencies using an approved grinding device, or removal and replacement.

c. Areas with excessive smoothness and texture issues, as determined by the City when compared to the approved test section, shall be removed and replaced from joint to joint.

6. Density Requirements

a. In-place Wet Mat Density Determination. Determine the In-place Wet Mat Density on pavement that is at least 24 inches from any joint in accordance with ASTM C1040 Direct Transmission mode at 75% of total RCC pavement depth for each lot of RCC pavement per Table 7-X. For pavement placement units consisting of less than one lot of RCC pavement, include the pavement with the previous or next placement unit.

b. In-place Wet Joint Density Determination. Determine the In-place Wet Joint Density on joints at distance 12 inches or greater for free edge and 6 inches or greater for a confined edge accordance with ASTM C1040 Direct Transmission mode for each lot of RCC pavement per Table 7-X. For pavement placement units consisting of less than one lot of RCC pavement, include the pavement with the previous or next placement unit.

c. Defective Area Correction for Density. For In-place Wet Mat Density and In-place Wet Joint Density, full payment will be made for pavement based on the acceptance criteria in Table 7-X. Pavement lots that have density that is less than the required density are subject to further evaluation. Take an additional test within a 5 to 8 foot radius, of the original test (within the same placement unit). If this test is below the acceptance criteria in Table 7-X, additional roller passes shall be made across the full lane width between the last testing location that produced an acceptable reading and the paver. If the additional roller passes does not correct the problem, or causes the density to decrease, the paving operation shall be discontinued until corrections can be made to assure that the specified density can be achieved.

7. Opening to Traffic

Traffic may be allowed on the concrete pavement once the concrete has attained 3,500 psi compressive strength. The Contractor may request early traffic opening for residential light-duty vehicles when the concrete has attained a compressive strength of 2,500 psi with approval by the City. This early opening must not damage the concrete pavement.

8. Pavement Test Section

a. Construct a 150-foot long test section prior to starting construction. Construct the test section using the proposed mixture design, the staff that will be completing the work, and the materials and equipment that are listed in the pavement construction plan and approved by the Engineer. If the pavement placement requires more than one pass of the paver, construct the test section a minimum of two paver widths wide. If the pavement placement requires more than one lift, construct the test section to the required number of lifts. If the pavement placement requires more than one day of paving or longitudinal cold joints, construct the test section over two days and begin paving from a longitudinal cold joint on the second day. Place the test section in a location approved by the City. The test section may be incorporated into the final project pending acceptance by the City.

The City shall evaluate the following criteria from the test section:

- Adequacy of the production method and equipment to meet productivity requirements and produce uniform PCC pavement.
- Maximum density directly behind the paver prior to compaction.
- Suitability of the proposed lift thickness.
- Sequence of primary/secondary roller passes (with and without vibration).
- Maximum density following roller compaction.
- Texture and surface finish acceptability.

- Integrity of both fresh and cold joints (vertical and horizontal).
- Compressive strength of PCC based on molded cylinders and extracted cores tested at 3-days, 7-days, and 28-days.
- Procedures for troweling and finishing PCC surface to meet specification
- Process for applying curing compound at appropriate rate and coverage
- Process for installing saw cuts in pavement

b. Construction (Cold) Joint Edges. The Contractor shall establish the maximum angle for edges to be used in joint faces of construction (cold) joints.

c. If the test area does not meet acceptance requirements, the Contractor shall remove and reconstruct a new test section with corrected procedures. The contractor will be required to provide new test sections, until an acceptable, reproducible test section is achieved.

9. Joints

Formation of Joints

a. Fresh Vertical Joints: Fresh longitudinal joints will only be allowed under special circumstances under the approval of the Engineer. A vertical joint shall be considered a fresh joint when an adjacent RCC lane is placed within 30 minutes of the batch time of the previous lane. This time may be reduced depending on ambient conditions, as well additional precautions may be necessary to avoid excessive moisture loss at the joint such as the use of evaporation retarders, fogging, and curing mats.

1. Fresh longitudinal joints shall be constructed prior to placement of an adjacent lane by leaving the outer 24 inches of the freshly placed lane uncompacted during rolling. Then both edges of the two lanes shall be rolled together within the allowable time.
2. Adjacent lanes shall be placed such that the new lane abuts tightly against the incomplete edge of the prior lane.
3. The joint formed by both lanes shall be compacted by centering the roller drum over the joint and compacting both edges simultaneously.
4. Extra passes of the roller may be required at the joint to achieve the required density.

b. Cold Vertical Joints: Any planned or unplanned construction joints that do not qualify as fresh joints shall be considered cold joints and shall be treated as follows:

1. Longitudinal and Transverse Cold Joints: Formed joints that do not meet

the minimum density requirements and all unformed joints shall be cut vertically for the full depth or produced using an edging shoe. The vertical cut shall be at least 6 inches from the exposed edge and located on a joint identified on the jointing plan. Do not perform this operation any sooner than 2 hours after final compaction. Demonstrate to the Engineer that saw cutting will not cause significant edge raveling and remove all slurry and excess material from the cutting operation.

If the Contractor can demonstrate that he can construct a cold vertical joint that can meet the minimum joint density requirements using an "edge shoe," then the use of the edge shoe in lieu of cutting a cold vertical joint is allowed. The edge shoe should be as close to vertical as possible with the maximum allowable positive edge angle being of 10 degrees from vertical.

c. Fresh Horizontal Joints. For multi-layer construction, a horizontal joint shall be considered a fresh joint when a subsequent PCC lift is placed within 30 minutes of the batch time of the previous lift. This time may be adjusted at the discretion of the City depending on use of retarders or ambient weather conditions. Fresh joints do not require special treatment other than cleaning the surface of all loose material and moistening the surface prior to placement of the subsequent lift.

10. Additional RCC Paving Requirements: Adjacent Lane Placement. All longitudinal joints must be considered a cold joint and shall be prepared in accordance with "Cold Vertical Joints" section found elsewhere in these specifications. Fresh joints will only be allowed under special circumstances at the Engineer's discretion. In that case, the adjacent paving lane shall be placed within 30 minutes and additional precautions may be necessary to avoid excessive moisture loss at the joint such as the use of set retarding admixtures, water misting, and blankets.

G. Groove and Grind Pavement: All grinding of PCC pavements shall be completed in compliance with the provisions in Section 42 of the Caltrans Standard Specifications, except as amended by these Construction and Design Standards.

Prior to diamond grinding, the pavement shall be profiled to ensure the smoothness requirements have been met. The profilograph created shall highlight areas of localized roughness. All grinding to bring the pavement into compliance with the smoothness requirements shall be completed prior to the finish diamond grinding as shown on the plans.

Holidays are areas of unintentional gaps in the grind pattern. All grinding shall result in a consistent surface finishing with no holidays in the grind pattern.

The ground surface will be tested with a 12-foot ±2-1/2 inches long straightedge laid on the pavement parallel with the centerline with its midpoint at the joint or crack. The surface shall not vary by more than 0.01-foot from the lower edge of the straightedge.

Cross-slope uniformity and positive drainage shall be maintained across the entire traveled way and shoulder. The cross-slope shall be uniform so that when tested with a 12-foot ±2-1/2 inches long straightedge placed perpendicular to the centerline, the ground pavement surface shall not vary more than 1/4 inch from the lower edge of the straightedge.

After grinding has been completed, the pavement surface shall be profiled to verify smoothness requirements have been met. Two profiles shall be obtained in each lane approximately 3 feet from the lane lines. The average profile index shall be determined by averaging the two profiles in each lane. Additional grinding shall be performed, where necessary, to bring the ground pavement surface within the Profile Index requirements specified in Section 40-1.03, "Quality Control and Assurance," of the Standard Specifications.

H. Sound and Retaining Walls: Construction of sound and retaining walls shall conform to the approved plans. Either the Developer's geotechnical engineer or the City Construction Inspector shall inspect all sound and retaining walls shown on the approved subdivision grading or improvement plans. Inspection coverage and observation responsibility preference shall be determined at the preconstruction meeting and determined by the Developer. An anti-graffiti coating per Section 71-5 (Materials) and per the manufacturer's recommendations shall be applied to the City side of all sound and retaining walls bounding the City right-of-way or to the side/surface of sound or retaining walls facing public-owned wetlands, open spaces, or parks, at the discretion of the City's Construction Inspector.

The City's Construction Inspector shall be furnished a letter from the applicating contractor certifying that the coating has been applied per the Manufacturer's recommendations, prior to the Certificate of Completion.

The top course of loose block retaining wall such as "Keystone" type shall be epoxied on. The adhesive shall conform to Section 71-5 (Materials) below.

I. Survey Monuments: All survey monuments shall be installed per Detail ST-36.

Survey monument caps shall be peened and stamped and rebar shall be set at the back of lot prior to the Certificate of Completion.

All rear lot property corners shall be marked with a ½" rebar, 12" long, and the top flush with finish grade. All lot corners at the street shall be marked with a 1" brass marker wet set or drilled and epoxied into the back of sidewalk 6" from edge, at the back of the City sidewalk or (absent of sidewalk) back of curb, whichever applies, or as indicated on the recorded parcel or final map.

J. Street Barricades: All street and sidewalk barricades shall conform to Construction Standard Details ST-31, ST-32, ST-33, and ST-34, respectively. Sidewalk barricades are required at the termination of all new sidewalk improvements.

K. Pavement Removal: Upon demolition of concrete and asphalt concrete pavement, rubble shall be immediately removed or hauled from, and not piled in the City right-of-way. Disposal

of such materials shall conform to all local ordinances and regulations of the City of Roseville and the County of Placer relation to land grading, flood plains, drainage facilities and disposal of surplus materials.

L. Utility Boxes: Boxes for dry utilities shall not be placed in roadway pavement, the gutter pan, in driveways or in the lower half of the ramped portion of curb ramps. Utility boxes may be placed in City sidewalk only upon the approval of the City's Construction Inspector.

M. Slurry Seal Follow-Up: (For surfacing over asphalt concrete pavement) Upon completion of any slurry seal, all loose, residual material shall be swept up and removed as soon as the slurried area is adequately cured to do so. The surface shall be maintained in a clean condition until such a time as raveling has stopped.

N. Detector Loop Related Paving: The minimum total thickness of paving within the area of detector loops is 5". The first lift shall be a minimum 3", and the second lift (covering the loops) shall be a minimum 2".

71-5 MATERIALS

A. Aggregate Base and Subbase: All aggregate base and subbase (AB and ASB) materials shall be Class II as specified on the approved improvement plans and shall conform to provisions in Section 26 of the Caltrans Standard Specifications.

Recycled asphalt concrete material may be used as AB or ASB provided the Contractor supplies the City written documentation and certification that the material meets the State's Class II specifications prior to placement.

B. Minor Concrete: All Concrete curbs, gutters, driveways, island paving, sidewalks, curb ramps, driveways, island and colored concrete, shall be constructed of minor concrete conforming to the provisions in Section 73-1.02A "Concrete Curbs and Sidewalks" of the Caltrans Standard Specifications. The cementitious material content of concrete must be a least 463 lb. /cu yd. for constructing minor concrete as listed above. The aggregate size may range from 3/8" to 1". However, if 3/8" maximum size aggregate is used, cementitious material content must be a least 505 lb. /cu yd.

All other minor concrete for extruded or slip-form curb construction, retaining wall footings, outfall structures and headwalls, utility box collars, rock wheel backfill, trash enclosure slabs and approaches, and miscellaneous footings, shall be constructed of minor concrete conforming to the provisions in Section 90-2 "Minor Concrete", of the Caltrans Standard Specifications . Cementitious material content must be a least 505 lb. /cu yd.

For stamped median concrete color, the standard color shall be Davis Style Tile Red #1117, or Scofield Systems, Chromix C-32 Quarry Red, or as approved equal. Apply 60 pounds per 80 square feet in two hand broadcast applications. Contractor may elect to incorporate approved color into concrete mix at 30 pounds of color (integrated into the mix), per cubic yard.

C. Asphalt Concrete: Shall comply with the provisions of Section 39 of the Caltrans Standard Specifications and as modified herewith. The requirements provided within these provisions shall supersede State Specifications where conflicts or other disparities exist.

Asphalt binder shall be performance grade 64-10 or 64-16 paving asphalt conforming to Section 92, "Asphalt Binders," of the Caltrans Standard Specifications.

Asphalt concrete for alley's residential and collector roadways shall be Type A, ½" Maximum Medium Gradation, conforming to the requirements of Section 39-202A "Type A Hot Mix Asphalt" of the Caltrans Standard Specifications.

Reclaimed Asphalt Pavement (RAP) up to 25% of aggregate blend may be substituted as part of the virgin aggregate for hot mixed asphalt and shall meet the State's quality specifications. RAP not permitted in OGFC or RHMA-G.

RHMA –G (Gap graded RHMA) shall be used for the 2" top lift structural section within Arterial roadways. For rubberized hot mix asphalt, reference the 2015 Caltrans Standard Specifications (Section 39-2.03). A PG64-16 oil shall be used as recommended within the Highway Design Manual Table 632.1 based on location in California.

Asphalt concrete shall be hot plant mixed and shall be furnished from the plant at a temperature not to exceed 325 degrees F.

D. Portland Cement Concrete Pavement: Shall comply with the provisions of Section 40 of the Caltrans Standard Specifications and as modified herewith. The requirements provided within these provisions shall supersede State Specifications where conflicts or other disparities exist.

1. **Cementitious Materials**: The pavement shall contain at least 450 pounds of total cementitious material per cubic yard of concrete. The actual content of cementitious material shall be established by preconstruction mix design studies. Cement shall be Portland cement Type II, Type III, or V conforming to ASTM C150 or portland cement Type IP, IL, or IS conforming to ASTM C595.

   PCC pavement may contain supplementary cementitious materials as shown in Table 7-Y.

Table 7-Y: Allowable Supplementary Cementitious Materials:

Supplementary Cementitious Material	Test Requirement	Allowable Percentage Range
Fly Ash	ASTM C618 / AASHTO M 295, Class F	15% - 35%. (ACI 232.2R)
Ground Granulated Blast-Furnace Slag (GGBFS)	ASTM C989 / AASHTO M 302, Grade 100 or 120	25% - 70%. (ACI 233R)
Metakaolin	AASHTO M 295, Class N	5% - 15%. (ACI 232.1R)
Raw or calcined natural pozzolans	AASHTO M 295, Class N	5% - 15%. (ACI 232.1R)
Silica Fume	ASTM C1240 / AASHTO M 307	5% - 12%. (ACI 234R)

2. **Aggregates for Roller Compacted Concrete Pavement**: The quality of aggregates shall conform to ASTM C33. The aggregate portion passing the No. 40 sieve shall have a liquid limit of not more than 20, and the plasticity index of the aggregate shall not exceed five. Fines shall be non-plastic. Fines shall not be manmade sand. Coarse aggregates must be washed, prior to delivery to the job site, to remove silt and fines. Aggregates may be obtained from a single source or borrow pit, however the coarse and fine aggregate may not be blended prior to entering mixing plant. The combined aggregate shall be well-graded without gaps and conform to the following gradations as per Table 7-Z.

Table 7-Z: Sieve Size Percent passing by weight

Sieve Size	Lower & Upper Specification Limits ½ in Maximum	Lower & Upper Specification Limits ¾ in Maximum
1”		100
3/4”	100	93-100
½”	81-100	70-95
3/8”	71-91	60-85
No. 4	49-70	40-60
No. 8	33-54	30-50
No. 16	24-40	20-40
No. 30	15-30	15-30
No. 50	10-25	10-25
No. 100	2-16	2-16
No. 200	0-8	0-8

Aggregates shall be innocuous, not causing deleterious expansion of RCC. Test individual concrete aggregates in accordance with ASTM C1260. Maximum expansion after 14 days of exposure to the solution of NaOH shall not exceed 0.10%.

If any of individual concrete aggregates do not meet the limit specified in the above paragraph, the aggregates can be tested with the production cementing material (Portland cement and supplementary cementing material proportioned according to the mix design) per ASTM C1567. The Contractor is allowed to test either individual aggregates or their blended proportioned according to the mix design. In either case the expansion in 14 days of exposure to the solution of NaOH shall not exceed 0.10%

3. **Chemical Admixtures for Roller Compacted Concrete**: Chemical admixtures shall conform to ASTM C 494. The contractor is allowed to use proprietary chemical admixtures improving the formability of RCC, provided the record of the previous experience certifying the beneficial use of admixtures is included with the submittal.

For moisture control in RCC, one of the following admixtures, or an approved equal, is allowed, but not required by the City. Please refer to the manufacturer’s recommendations

for dosage rates.

- ACEiT Plus Manufactured by ACEiT Industries
- V-MAR VSC500 Manufactured by Grace Concrete Products

For troweling, the following admixture, or approved equal, is allowed by the City. Please refer to the manufacture's recommendations for dosage rates.

- ACEiT Blue Manufactured by ACEiT Industries

4. **Curing Compound**: Concrete curing compounds shall conform to ASTM C 309 Type ID.

5. **Joint Sealants and Fillers**: Joint filler materials for isolation joints shall be pre-formed expansion joint filler for concrete (bituminous type) in compliance with ASTM D994.

6. **Water**: Water used in the concrete shall conform to the requirements of ASTM C1602. It shall be clean, clear and free of acids, salts, alkalis or organic materials that may be detrimental to the quality of the concrete. Non-potable water may be considered as a source for part or all of the water, providing the mix design indicates proof that the use of such water will not have any deleterious effect on the strength and durability properties of the concrete.

7. **Forms**: Forms shall be of steel or wood capable of resisting deformation during edge compaction and to maintain grade. Wood forms shall have a minimum nominal thickness of 2-inches. Forms shall be clean and free of warp, debris, rust, and hardened concrete. Forms shall be treated with a bond breaker prior to use.

E. Lime/Fly Ash or Cement Treated Subbase: On a case-by-case basis, lime/fly ash or cement treated subbase may be an acceptable substitute for placement of compacted aggregate base material permitted use in subbase stabilization only. Prior to plan approval, the Developer shall submit to the City Engineer for review and approval, a proposal for lime/fly ash or cement treatment sections and compaction procedures, accompanied by recommendations from a California licensed, geotechnical engineer. In no case shall asphalt concrete be placed directly on lime/fly or cement treated bases or shall the recommended structural section be less than the City standard structural section from Table 7-2 in Section 7 "Streets".

F. Truncated Domes: Truncated dome panels shall be of vitrified polymer composite construction, embedded type, or (surface applied for retrofit applications) manufactured by Armor Tile Tactile Systems, Buffalo, New York, ADA Solutions, N. Billerica, MA, or approved equal. The dimensions and interval of the truncated domes within the panel shall conform to Caltrans Standard Plan RNSP A88A and Division of the State Architect Accessibility Reference Manual, Figure No. 31-23A. The orientation of the dome pattern for all panels shall be parallel with the panel edges.

G. Graffiti Coating: Blok Guard® (Prosoco), Acryli-Master (Graffiti Master), GCP 1000 (Genesis Coatings Inc.), Prmakote, by Visual Pollution Technologies or approved equal, non-sacrificial type only.

H. Epoxies, Patching Material: Following are products specified for the indicated applications.

1. **Bonding extruded curb to asphalt concrete pavement; bonding concrete to existing during pour; bonding the top course of loose block, sound/retaining wall:** Rezi-Weld 1000, (Supplier: Spec-West), Sealtight Rezi-Weld ER-43 Type I, (Supplier: Spec-West) or Pro-Poxy 200 (available at whitecap) should be added as it meets C881/AASHTO M-235 for old to new concrete.

2. **Anchor Bolts:** Seal Tight Rezi-Weld Gel Paste Unitized Cartridge Epoxy (Supplier: Spec West), Covert Operations CIA Gel 7000 (Supplier: White Cap) or Rebar SETXP (Supplier: White Cap, Home Depot), SpecPoxy 2000 by SpecChem or approved equal. Apply appropriate epoxy product to concrete and/or asphalt as recommended by manufacturer.

3. **Patching:** Patchcrete (Supplier: Spec-West), Emaco R350CI Repair Mortar (Supplier: White Cap), Ardex CP (Supplier: Spec-West) or approved equal.

I. Reinforcement Bar: Rebar shall be grade 60 steel, deformed type. Smooth bar shall not be allowed. All rebar shall be #4 unless otherwise specified on the plans.

J. Concrete Curing Compound: Curing compound shall conform to ASTM C-309. Type 1-D and Class B, resin base, clear with fugitive red dye. Approved products include Burke Aqua Resin Cure (with dye), W.R. Meadows 1100- Clear Series (with dye) or approved equal.

K. Slurry Seal: Slurry seal shall conform to Caltrans Standard Specifications, Section 37-2, "Seal Coats" and Type II Aggregate Type. A design mix shall be submitted to the Development Section for approval prior to commencing work.

L. Slurry Cement Backfill: The backfill must contain at least 188 pounds of cement per cubic yard and enough water to produce a fluid workable mix that flows and can be pumped without segregation during placement.

When authorized by the City Construction Inspector, controlled low-strength material (CLSM), per Caltrans Standard Specifications Section 19-3.02G or dry mix "popcorn" backfill may be used with pre-approval. 94 pounds of cement content to the CLSM cement backfill shall be required. A design mix shall be submitted to the City Construction Inspector for approval prior to commencing work. CLSM requires mechanical equipment effort to achieve proper consolidation. Whenever CLSM is placed within the travelled way or covered by paving or embankment materials, the CLSM must achieve a maximum indentation diameter of 3 inches when tested under ASTM D6024 before covering and opening to traffic.

M. Clean Crushed Rock: Shall consists of gravel, crushed gravel, crushed rock, reclaimed aggregate, or a combination of these. All gravel characteristics shall comply with CTM 211 and 227. The percentage composition by weight of clean crushed rock shall conform to the following gradations for the Type specified.

	Type A	**Type B**	**Type C**
	3/8" Crushed (Pea Gravel)	½" Crushed	¾" Crushed
1-1/2"	-	-	-
¾"	-	100	90-100
½"	100	90-100	30-60
3/8"	50-85	20-60	0-20
No. 4	20-60	0-15	0-5
No. 200	0-2	0-2	0-2

SECTION 81: DOMESTIC WATER SUPPLY SYSTEM CONSTRUCTION

81-1 GENERAL

All potable water pipe, fittings, gate valves, fire hydrants, blow-offs and other appurtenances shall be installed in accordance with the requirements of the American Water Works Association (AWWA), these Construction Standards, and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times.

81-2 CONNECTION TO EXISTING FACILITIES

Connection to existing City water facilities may be made upon approval from the Environmental Utilities Department.

A. The Environmental Utilities Department has the option of making a system tap as required on the plans. Should the Environmental Utilities Department elect to perform the tap, the Contractor shall pay for such work on a time and materials reimbursement basis. The Contractor shall be responsible for the following tasks associated with the tap as determined by the Environmental Utilities Department:

1. Coordinating the work requested with the Water Division and the Development Services Construction Inspector. This shall include discussions on provisions for materials and equipment required to complete the work.

2. Traffic control per the City's Public Works Department requirements.

3. Excavating the work area, as agreed upon by the Development Services Construction Inspector.

4. Sheeting, shoring, and bracing as required.

5. Lighting as required if the tap is to be performed at night.

6. Backfilling, compacting, and pavement restoration of the excavation(s) upon tap completion.

B. The Contractor shall tie-in the new system to an existing stub under the following conditions:

1. With specific approval of the Development Services Construction Inspector.

2. Care shall be taken to provide a clean, sanitary tie-in site.

3. Dewatering of both the new and existing water mains shall take place in a way as to prevent contamination by trench water.

4. All material used in the tie-in shall be clean and swabbed with chlorine to the satisfaction of the Development Services Construction Inspector.

5. All tie-ins shall take place in the presence of the Development Services Construction Inspector.

6. Tie-ins may take place only after the newly constructed water system has successfully passed all required testing procedures as established in these Construction Standards and as determined by the Development Services Construction Inspector.

7. After system tie-in or system pressure loss to less than 5 psi, additional bacteriological samples shall be collected that represent the water quality in the affected portions of the system.

8. Under no circumstances shall anyone other than an Environmental Utilities Water Division representative or Development Services Construction Inspector operate an existing water valve. All water main shutdowns and valve turning operations on existing facilities shall be approved by Environmental Utilities Water Division. All existing water mains returned to service and valve turning operations after tie-ins shall be performed by an Environmental Utilities Water Division representative.

9. If tie-in requires the interruption of water service to residences and/or businesses, the Contractor will be responsible for the notification to the residences and/or businesses of the interruption. A minimum of two (2) business days prior to the start of the tie-in will be required. Notification plan must be approved by Environmental Utilities Water Division and Development Services Construction Inspector.

81-3 CONSTRUCTION STAKING

The water main shall be staked prior to excavation. Staking shall provide the station and the offset to the water main, as well as the cut to the nearest 0.1 foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections, every 25 feet in curved sections, and every 10 feet in approved vertical curve sections.

81-4 EARTHWORK

Earthwork required to construct water facilities and appurtenances shall be performed to the lines and grades shown on the approved project plans and as specified below:

A. Excavations: Pipeline excavations shall be open-cut trenches, unless otherwise specified on the approved improvement plans, with vertical sides to the pipe crown as specified on Construction Standard Detail W-1. Excavations shall conform to all applicable Federal and State safety requirements. The contractor shall appoint a designated "competent person" during construction.

B. Trench Width: The trench bottom width to 6 inches above top of pipe shall comply with Construction Standard Detail W-1 or as approved by the Environmental Utilities Department.

C. Compaction: Compaction of the trench shall conform to Construction Standard Detail W-1. Compaction test results shall be supplied to Environmental Utilities Department upon request. Jetting of trenches is not allowed.

D. Weather: During inclement weather, trenches shall be excavated only as far as pipe can be laid and backfilled during the course of the day.

E. Existing Roadways: Trenching in existing roadways shall be limited to the length of pipe that can be laid that day. No open trenches shall be left overnight. Exposed trenches shall be plated and backfilled as approved by the Development Services Construction Inspector and the Public Works Department.

F. Excess Material: Excess material and materials determined unsuitable for backfill by the Development Services Construction Inspector shall be removed from the project site.

81-5 DEWATERING

Dewatering for the installation of structures and pipelines shall commence when groundwater is first encountered and shall be continuous until the excavation is backfilled. Best Management Practices including but not limited to scouring and erosion measures shall be used to eliminate sediment-laden discharges in accordance with the approved SWPPP.

81-6 PIPE BEDDING

Pipe bedding shall conform to Detail W-1 and the following:

A. Bedding shall provide uniform and continuous support along the barrel of the pipe. The minimum depth of bedding material shall be provided under the bell. Blocking of the pipe is not permitted.

B. Loose material shall be removed from the trench bottom and replace with imported material.

C. Where rocky, unyielding, or unsuitable foundation material is encountered, the subgrade shall be excavated a minimum of 12 inches below the pipe and the trench width shall be increased a minimum of 12 inches. The over-excavation shall be replaced with imported material.

D. Where the trench bottom is soft, yielding or unstable, the trench bottom shall be over-excavated. ¾" crushed rock shall be placed in the trench to provide a stable foundation. The rock is in addition to the required pipe bedding used in the pipe zone.

E. Bell holes shall be excavated per manufacturer's recommendations. The minimum depth of bedding material shall be provided under the bell. Care shall be taken to ensure that the bell hole is no larger than necessary to accomplish proper joint assembly.

81-7 CONCRETE CRADLES, ARCHES ENCASEMENTS AND TRENCH DAMS

Concrete cradles, arches and encasements shall conform to Construction Standard Details W-23, W-24, and the following:

A. The pipe shall be placed in proper position on temporary cradles or arches consisting of concrete block or bricks. When necessary, the pipe shall be rigidly anchored or weighted to prevent flotation when the concrete is placed.

B. Cradles and arches shall be constructed with an ability to adjust the pipe to proper grade in order to avoid vertical joint pull. Cradles and arches shall be placed at 1/3 and 1/2 way points along each pipe segment where specified. Concrete placed beneath the pipe shall be sufficiently workable to fill the voids without excessive vibration. The concrete shall be allowed to cure and remain undisturbed for a minimum of 24 hours prior to backfill and compaction of the trench.

C. Restrained pipe within casings, bridges, shall be fully extended or "stretched out" to remove the slack between the joints the entire length of the structure.

D. Water shall not be permitted to enter, seep or run onto the concrete while curing.

E. Trench dams shall be constructed of controlled density fill or clay as shown on the drawings or as directed by the Development Services Construction Inspector. Trench dam excavations shall be made into native earthen materials to the dimensions shown on the drawings or as directed by the Development Services Construction Inspector. Clay materials shall be moisture conditioned to near-optimum moisture content prior to placement in the excavation and compacted to the required relative compaction.

81-8 PIPE ZONE BACKFILL

Pipe zone backfill shall conform to Construction Standard Detail W-1 and the following:

A. Extreme care shall be taken when consolidating the backfill around the pipe zone. For pipe 12 inches in diameter and smaller, no more than 1/2 of the pipe shall be covered prior to shovel slicing the haunches of the pipe. For pipe greater than 12 inches in diameter, no more than the lesser of 6 inches or 1/3 of the pipe shall be covered prior to shovel slicing. Sufficient care shall be taken to prevent movement of the pipe and damage to the polyethylene encasement during shovel slicing. Shovel slicing shall be witnessed by the Development Services Construction Inspector prior to shading the pipe.

B. Compaction equipment shall not make direct contact with the pipe.

81-9 PIPE INSTALLATION:

Water pipe shall be installed in accordance with the following provisions:

A. The contractor shall keep the pipe interior free from foreign materials and in a clean and sanitary condition until acceptance by the City. At times when pipe-laying is not in progress, the open pipe end shall be sealed with a tight cap or plug to prevent foreign matter from entering the pipe. Provisions shall apply to the noon-hour as well as overnight.

1. Trenches shall be in a reasonably dry condition when pipe is laid.

2. Care shall be taken when lowering pipe into the trench to protect the pipe from damage. Chains are not permitted. The pipe shall be laid carefully to the lines and grades shown without grade breaks, unless designed with such, or to minimum depths shown on the approved plans. If field conditions exist such that the pipe may not be laid to the specified grade, the approved plans will require revisions prior to proceeding with construction.

3. Pipe sections shall be closely jointed to form a smooth flowline. Care shall be taken in placing the pipe and making field joints.

4. No facility is to be backfilled without inspection by the Development Services Construction Inspector. Improvements installed without proper inspection shall be exposed and inspected as required by the Development Services Construction Inspector.

5. All installations shall follow manufacturer's recommendations unless otherwise noted on the approved plans. The manufacturer's installation guide shall be on the job site at all times.

6. Pipes shall be mechanically restrained to the length specified in the approved plans, using materials specified herein.

7. Thrust blocks shall only be used where specifically shown on the plan /profile sheets and/or standard detail sheets. All fittings and appurtenances shall maintain a minimum of 18 feet of restrained pipe into the fitting from all directions. Plans should reflect the restraint lengths required for each segment and transition.

8. A continuous number 12 blue insulated tracing wire (81-16,G.36) shall be attached to mains, service lines and appurtenances per the Construction Standard Details and the following:

i. Tracing wire shall be continuous between mainline valve boxes and fire hydrants. It shall be attached to the top of the pipe with 10-mil vinyl tape every 5 feet.

ii. Tracing wires through valve boxes shall be placed outside of riser, but inside the box.

iii. Tracing wire in manholes and vaults shall be attached inside the facility within 1 foot of the rim.

iv. Wire splices shall be located above ground and inside of valve boxes, per Details W-16, W-17, and as follows:

a. Install a copper split bolt connector on the splice.

b. Twist the wire together with a minimum of 5 twists.

c. Solder all connections with electrical solder.

d. Cover the splice with mastic tape and wrap with vinyl tape.

9. A 12 inch wide, blue plastic non-detectable water pipe marking tape, marked "Buried Water Main Below," shall be placed in all main line trenches, 12 to 24 inches from the surface. Where a water main and recycled water main intersect, the plastic marking tape shall also be attached to the top of the pipe with nylon tie-wrap banded around the warning tape and the pipe every 5 feet on center. The warning tape shall extend to the nearest valves located on each side of said intersection.

10. Mains in unpaved areas shall be marked every 150 lineal feet with a blue composite utility marker having a decal stating: "Caution Water Pipeline." Appurtenances (valves, ARV's, test stations, etc.) and angle points shall also be marked. Mains in landscaped areas shall be delineated with a brass marker set in an 8 inch concrete cylinder 4 inches above finished grade. The brass marker shall state "City of Roseville Water Main."

11. All underground metal (ductile iron, valves, fittings, copper, brass, etc.) shall be wrapped in 8 mil minimum thickness polyethylene encasement (81-16,G.26) with ends taped off with vinyl pipe wrap tape (81-16,G.25).

B. Polyvinyl Chloride (PVC) Pressure Pipe Installation: PVC shall be installed in accordance with the AWWA Manual M23 and the manufacturer's recommendations, except as otherwise provided herein:

1. PVC Pipe shall have been manufactured within the 18 month period prior to installation.

2. Pipe and gaskets shall be kept clean and protected against sunlight and heat damage.

3. Pipe showing signs of physical damage or excessive ultraviolet exposure will be rejected and shall be immediately removed from the job site.

4. The pipe shall be installed with the manufacturing label showing on the top.

5. The reference mark or stab line on the spigot end must be flush with the bell end and visible for inspection.

6. The beveled end of the pipe shall be cut off before placement into a mechanical joint.

7. Minimum length of pipe for installation shall be 5 feet.

C. Ductile Iron Pipe (DIP): DIP shall be installed in accordance with the standards for "Installation of Ductile Iron Water Mains and Their Appurtenances" (ANSI/AWWA C-600) and the manufacturer's recommendations, and as provided herein:

1. DIP shall be polyethylene-encased (81-16,G.26) in accordance with these Construction Standards and the standard for "Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids" (ANSI/AWWA C-105/A21.5).

Polyethylene-encased pipe shall be bedded and backfilled with 3/8" pea gravel to 4 inches above the crown of pipe.

2. At the direction of the Environmental Utilities Department Inspector, the Contractor shall repair damages to the polyethylene encasement as described within ANSI/AWWA C-105/A21.5 or shall replace all damaged polyethylene film sections.

3. Metallic lines shall be exothermically welded and electrically continuous on DIP runs exceeding 100 feet or as approved by the Environmental Utilities Department Director. Each joint shall have 2 individually welded wires. Exothermic welds shall be installed per Detail W-20 and as follows:

a. Weld only against bare metal adjacent to both bell and spigot ends of pipe.

b. Care must be taken not to remove excess metal when removing the pipe coating.

c. Correct horizontal molds must be used for pipe diameters from 4 to 24 inches in diameter. Pipes 30 inches and larger may use flat mold.

d. After a solid weld is made, coat the bare metal with an acceptable bituminous coating material and cover with a exothermic weld cap (81-16,G.8.d).

e. DO NOT weld onto valves.

4. Corrosion test stations shall be installed on metallic lines at intervals not to exceed 1,000 lineal feet or as specified on the approved plans.

5. Minimum length of pipe for installation shall be 2 feet.

D. Ductile Iron Pipe Fittings: In addition to requirements set by these standards, fittings shall be constructed per the following requirements. Flanged and mechanical joint fitting bolt threads and nuts shall be coated with an approved bituminous material (81-16,G.24).

1. Transitions between DIP and PVC shall be made as follows:

a. A PVC pipe spigot may be inserted into a DIP bell by cutting off the PVC bevel on the spigot, and leaving no more than a 1/2-inch taper. A Development Services Construction Inspector shall be present to witness this process.

b. Transitions may be made by the use of DIP repair sleeve.

E. Boring: Borings for installation of water lines shall be made per Detail W-22 and as follows:

1. The equipment, method and sequence of operation and casing pipe grades shall be approved by the Environmental Utilities Department. A minimum of 2 business days shall be given prior to the start of work. Excavation for the boring operation shall be the minimum necessary to satisfactorily complete the work. Bracing, sheeting and shoring shall be adequate to protect workers and any adjacent structure or roadbed.

2. **Casing**: Welded steel casing pipe shall have a minimum wall thickness of a ¼ inch for pipe 24 inches in diameter and smaller, and 5/16 inch for pipe 27 inches through 36 inches in diameter. Casing material larger than 36 inches shall be engineered on a case by case basis. The inside diameter of the casing shall be a minimum of 10 inches larger than the outside diameter of the pipe bell or joint, as approved by the Environmental Utilities Department. A minimum of 4 inches clearance shall be required between the conducted pipe and the casing taking the skids into consideration.

3. **Installation of Casing**: The casing shall closely follow the boring operation. The bored hole shall not be more than 0.10 foot larger in diameter than the outside diameter of the casing. Guide rails shall be accurately set to line and grade to insure installation of the casing within allowable limits.

4. **Placing Pipe in Casing**: Pipe shall be fully restrained ductile iron pipe and shall be supported by a minimum of 2 sets of synthetic skids per stick of pipe, or as required by the Environmental Utilities Department. Skids shall be tightly banded to pipe with steel straps. Pipe sections shall be joined outside of the conductor. The skids and casing entrance shall be lubricated prior to sliding the conducted pipe into place. The height of the skids may be adjusted to meet specified grades.

   The space between the conducted pipe and casing shall be completely filled with clean, dry silica sand, blown into place. First, both ends of the casing shall be plugged with non-shrink grout a minimum of 12 inches into the casing. Both ends shall have a pipe of sufficient diameter placed through the mortar plug and parallel with the conducted pipe. One pipe shall be used for blowing the sand into the annular space. The other pipe shall remain open for venting. Prior to starting, the method of placing sand in the void shall be approved by the Environmental Utilities Department.

5. **Backfill of Voids**: When in the opinion of the Developer's design engineer or geotechnical engineer, the nature of the soil indicates the likelihood of ground loss which would result in a greater space between the outer surface of the casing than allowed, the Contractor shall take immediate steps to prevent such occurrences by installing a jacking head extending at least 18 inches from the leading edge of the casing.

   The jacking head shall cover the upper 2/3 of the casing and project not more than ½ inch beyond the casing outer surface. Excavation shall not be made in advance of the jacking head. Voids greater than allowable shall be filled with sand, soil, cement, grout, or as approved by the Environmental Utilities Department. Where voids are suspected, the design or geotechnical engineer may direct the Contractor to drill the casing, to pressure

inject grout to refusal and repair the drilled hole. Grouting pressure shall not exceed 50 pounds per square inch at the nozzle.

6. Utilizing the City's drainage system for residual discharge from boring operations without the required measures is prohibited. This discharge is a violation of the City's Stormwater Ordinance and the Clean Water Act. Discharge fluid shall be recovered, contained and discharged at an appropriate location, or if the situation allows, fluid may be discharged into an open area with the pre-written approval of the property owner and approval from the Regional Water Quality Control Board provided it does not impact sensitive areas such as wetlands, creeks, or other natural water conveyances.

All street borings shall include adequate measures to mitigate sediment laden water discharge. An acceptable measure is pumping the discharge fluid into a tanker and hauling it away. Other measures suggested by the Contractor will be considered by the City.

F. Vertical Elevation Change: Mains designed with a vertical elevation change using angle fittings shall use ductile iron pipe with an approved restraint system between the 2 angle fittings.

1. The Contractor shall follow the City of Roseville design standards and the California Code of Regulations (CCR) Title 22 Section 64572 Water Main Separation Requirements. Refer to the City's Design Standards Section 8-13.C and Standard Detail W-39.

G. Bridges and Casings: Pipe within bridges and casings shall be fully restrained and fully extended prior to closure.

81-10 SERVICE INSTALLATION

Water services shall be installed in accordance with manufacturer's recommendations, the Construction Standard Details and with the following provisions. Refer to the Table 1 or "Meter Application Table" for meter lay lengths.

A. Services shall be continuous from the main line to the service box. Bends in copper tubing shall be made in a manner that does not crimp or flatten the tubing.

B. Taps, service saddles and fittings attached to mains shall be separated from each other by a minimum of 24 inches.

C. Service saddles shall be wrapped and sealed in 8-mil minimum thickness polyethylene and backfilled with sand. Use pipe wrap tape to secure and seal the polyethylene wrap.

D. Service lines shall be encased in 8-mil minimum thickness poly tubing and backfilled with clean washed well graded sand (100% passing #4 sieve and less than 10% passing #100 sieve). Use pipe wrap tape to secure and seal the polyethylene wrap.

E. Service manifolds shall be constructed per the following criteria:

1. Where a service line is extended a distance greater than 40 feet, a construction jumper shall be installed per Construction Standard Detail W-15. The new service line and manifold shall be tested in accordance with these Construction Standards.

   Where a service line is extended a distance less than 40 feet, the extension shall be cleaned, swabbed with chlorine and flushed in the presence of the Development Services Construction Inspector. The new service line and manifold shall be pressure tested in accordance with these Construction Standards.

   In both cases, the installation shall be fully restrained by an approved restraint system, starting at the main and as required by the approved Improvement plans.

2. Service lines and manifolds 3 inches and larger shall be ductile iron.

3. No water shall be drawn through a service prior to installation of the water meter and certification of the backflow prevention assembly.

F. A backflow assembly shall be required for construction and sales trailers having a landscape irrigation system or a septic holding tank.

G. Backflow assemblies shall be covered with a freeze protection insulated bag (81-16,G.10) per these Construction Standards.

H. The curb in front of residential water services shall be stamped with a "W."

I. Service saddles shall be installed with zinc caps (81-16,G.43) on all bolts, per these Construction Standards.

81-11 ABANDONMENT OF SERVICES AND MAINS

All water services up to and including 2", on water mains that are to remain active, annotate to remove the corporation stop and saddle and install a full circle stainless steel clamp on the main under City inspection.. Mainline stubs shall have the valve removed and replaced with a blind flange or as approved by the Environmental Utilities Department. The abandoned piping shall be removed or left in place as approved by Environmental Utilities Director.

81-12 APPURTENANCES INSTALLATION

All appurtenances, including fire protection, blow-offs, sample stations, air release valves and fire hydrants shall be installed in accordance with manufacturer's recommendations, these Construction Standards and the following provisions:

A. All valves, fittings, DIP, copper and underground brass shall be wrapped and sealed in an 8-mil minimum thickness clear polyethylene encasement (81-16,G.26). Use 10 mil pipe wrap tape (81-16,G.25) to secure and seal to the polyethylene encasement. Damaged or scratched surfaces on epoxy coated valves and appurtenances may be repaired with an epoxy kit per manufacturer's recommendations and to the satisfaction of the Development Services Construction Inspector prior to wrapping. Otherwise, the damaged valve shall be replaced with a new valve.

B. Gate valves shall be centered in a one-piece 8" riser stock (81-16,G.31). Riser stock shall be PVC C-900. An operator nut extension shall be installed on valves where the operation nut exceeds 40 inches in depth from final grade. Valve extensions shall be continuous and within 24 inches of finished grade.

C. Buried nuts and bolts shall be coated with a bituminous material (81-16,G.24). This includes exposed bolts found on a manufactured appurtenance (i.e., valve bonnets, etc.) "T" bolt heads do not require coating.

D. Fire hydrants shall be marked with a blue reflector placed 1 foot off of street centerline on the fire hydrant side of the street. Fire hydrants located at intersections shall be marked on both streets.

E. Fire hydrants shall be painted with 1 coat primer and 2 coats safety yellow gloss enamel paint (81-16,G.12). When used as blow-offs, the top 2 inches shall be painted white and marked with an "X" with black gloss enamel paint. Private hydrants shall be painted gloss white.

F. Dead-end lines, permanent and temporary, shall have a Hydrant Assembly constructed per Construction Standard Detail W-4. Temporary Hydrant Assemblies upon inspection and approval of a Development Services Construction Inspector may be re-used in permanent or temporary applications.

G. Insulating kits (81-16,G.11.d) shall be installed at transitions between dissimilar metal pipes per the Construction Details (W-21) and as required by the Environmental Utilities Department.

81-13 TESTING PROCEDURES

Testing of the water system may proceed only after joint utility crossings are completed, the sewer mains and services have passed pressure test and TV inspections, the recycled water system has passed testing and subgrade elevations have been met. Road bases to be lime-treated shall be pressure tested before and after the lime treatment process. Testing prior to subgrade placement may be subject to additional pressure tests at the discretion of the Development Services Construction Inspector. The new system shall be filled with potable water through an approved backflow device.

A. Pressure Test

1. Contractor shall verify with the Development Services Construction Inspector that all system valves are open prior to testing.

2. The Development Services Construction Inspector will be present during the duration of the test.

3. Pressure testing shall be conducted for 2 hours at a minimum of 150 pounds per square inch or at 1 1/2 times the operating pressure, whichever is higher, as measured from the system high point. The test gauge shall be liquid-filled and capable of testing up to 300 psi. Service lines 2" and smaller after the backflow should hold a running pressure test for

minimum one (1) hour, and be flushed per the Development Services inspector's discretion.

B. Topside Improvements: When all water, recycled water and sewer infrastructures have passed air, vacuum, pressure, continuity and CCTV inspection the Development Services Inspector shall notify Water Asset Gathering indicating that the project is ready for road bases and top side improvements. This does not constitute approval for use of the infrastructure.

C. Chlorine Disinfection: Chlorine disinfection shall comply with the American Water Works Association Standard for Disinfection of Water Mains (C651-14) and as specified below:

1. Disinfection inspections shall begin only after passing the pressure test.

2. Prior to chlorination, pre-flush water mains and services. Pre-flushing is not permitted if using the Tablet Method for chlorination.

3. Chlorine shall be drawn through all mains, hydrant runs and services. The Development Services Construction Inspector shall verify that a minimum chlorine residual of 50 parts per million (ppm) has been achieved.

4. After a 24-hour holding period, the Development Services Construction Inspector will verify that a minimum chlorine content of 25 ppm remains in the system.

5. Upon approval by the Development Services Construction Inspector, the water system shall be flushed to remove concentrated chlorine. Flushing shall be continued until the remaining water has a chlorine residual below 1 ppm and a turbidity equal to or less than 1 NTU. Chlorinated water shall be neutralized to 1 ppm chlorine residual or less prior to discharge. Discharge location and neutralization methods shall be documented in the SWPPP and coordination with and approved by the Development Services Construction Inspector.

6. Chlorinated water resulting from flushing newly installed water lines may only be discharged into the City's sewer system with the specific permission of the Environmental Utilities Department.

Prior to discharging into the sewer system, the Contractor shall sign a form authorizing the Environmental Utilities Department to bill for the amount of water discharged into the system. At the end of each flushing exercise, and prior to tying into the City water system, the Development Services Construction Inspector shall prepare a bill for water usage based on the meter reading. This bill must be paid before the project is signed off by EUD.

The discharged chlorinated water shall be classified as "low-strength metered commercial users" under Title 14.16.220 of the City of Roseville Municipal Code. The sewer unit for low-strength metered commercial users shall be one sewer unit per 1,000 cubic feet. The Environmental Utilities Department shall determine the volume of discharge. Chlorinated water shall not be disposed of into environmentally-sensitive areas (i.e., under oak trees,

vernal pools, man-made or natural streams, drainage systems, etc.) during any time of the year.

All discharges into the sewer system shall be governed by the following conditions:

a. Water used for the purpose of flushing shall be metered.

b. Discharge into the sewer system shall be done in such a manner as to avoid surcharging the sewer system.

c. No discharge into the sewer system shall be permitted on rainy days.

d. No discharge shall be permitted upstream of a small lift station.

e. An approved air gap shall be maintained at all times. Air gap distances shall be calculated as 2.5 times the pipe diameter. In no case shall the air gap be less than 12 inches.

D. Water Quality Testing: Water quality samples shall be taken per the following procedure:

1. Once flushing has lowered the chlorine residual below 1 ppm and the turbidity is equal to or less than 1 NTU, the initial set of samples shall be collected by the Development Services Construction Inspector and taken to the City's laboratory. Then the water system shall observe a minimum 24 hour detention time. Water may not be drawn during this time period.

2. After the 24 hour holding period has elapsed, water quality samples shall be collected by the Development Services Construction Inspector for testing by the City's laboratory.

3. The laboratory will require a minimum of 48 hours to complete total coliform and total plate count tests. Actions allowed based on test results are as follows:

Pass Coliform Test		
(Coliform not present?)	**Plate Count Results**	**Action**
Yes	0-1,000	Connect to City
Yes	1,000-1,250	Flush water system and re-test
Yes	1,250+	Flush and re-chlorinate water system and retest
No		Flush and re-chlorinate water System and retest

4. For new mains, sets of samples shall be collected every 1,200 feet (370 meters) of the new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.

If trench water has entered the new main during construction or if, in the option of the City, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 feet (61 meters), and the sampling location shall be

identified (see Sec. 5.1.3 for sampling location details). Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.

E. Tying onto the City System: A tie-in procedure shall be submitted and approved by the Environmental Utilities Department prior to the proposed work. The Contractor shall allow for up to 7 days review of the procedures by the Environmental Utilities Department. The water system shall be tied into the City system within 10 working days upon completing and passing all the testing procedures. Tie-ins shall be conducted a specified in Section 81-2 of these Construction Standards. After the tie-in has been made, the Contractor shall flush the segment tied-in to the approval of the Development Services Construction Inspector.

1. If the new water system cannot be tied into the City system within 10 working days, the new system shall maintain a chlorine residual of 0.5 to 1.0 ppm or be subject to water quality testing and re-chlorination. This shall be discussed with the Development Services Construction Inspector.

2. On-site private systems may connect onto the City System upon passing all testing procedures, backflow tests, and meters have been paid for and installed. A tie-in procedure shall be required per this section.

F. Continuity Testing: The Environmental Utilities Department will test continuity of the tracing wire with City standard locating equipment upon request for testing by the Contractor. Discontinuity in the tracing wire shall be repaired. It is recommended that the Contractor request continuity testing after subgrade is made, but before the pavement is placed. Final continuity testing will take place after the pavement is placed and all valve boxes are raised. Costs for said inspection shall be borne by the Contractor. Preliminary inspections may be performed by outside Contractors, but shall not be accepted by the Environmental Utilities Department as an official record.

G. Corrosion Protection System Testing: At the completion of the pipe installation and prior to curb and gutter, the corrosion engineer shall conduct a test of the corrosion monitoring system in the presence of the Development Services Construction Inspector. A report showing the test results shall be submitted to the Environmental Utilities Department for review and approval. The report shall include test station locations as called out on the approved plans, appurtenance tested, test result and recommendations for future monitoring and maintenance.

81-14 REPAIRING INSTALLED IMPROVEMENTS

All PVC and DIP water mains shall be repaired per the following procedures:

A. Damaged or failed pipe sections shall be removed and replaced with new pipe in the presence of the Development Services Construction Inspector. Replacement can be accomplished by the use of City approved ductile iron mechanical joint repair sleeves. Pipe restraints will be required.

B. After the repair has been completed, the excavation shall be backfilled and compacted to grade as specified. The repairs shall then be retested per these Construction Standards.

C. At the direction of the City, the Contractor shall repair damage to the polyethylene encasement as described within ANSI/AWWA C-105/A21.5 or shall replace all damaged polyethylene film sections.

81-15 PUNCHLIST PROCESS

When the Contractor is satisfied that all improvements are substantially complete, a punchlist of final outstanding items may be requested. With the assistance and presence of the Contractor, the punchlist shall be generated by the Development Services Construction Inspector and Water Distribution Division. The cost of generating the punchlist shall be borne by the Contractor/Developer.

A. Pre-final Requirements
In order for Environmental Utilities Department to install meters to any new residential buildings (model or production homes), the following requirements must be met:

1. The meter box must be set to finished grade. The contractor shall make sure that debris is not entering the meter box.

2. The meter box must be squared to adjacent sidewalk or property line.

3. The meter box must be in a structurally sound condition (no cracks or visible damage).

4. The box shall be cleaned and free of debris.

81-16 MATERIALS

A. Approved Equal: The words "approved equal" shall mean any material deemed by the Environmental Utilities Department to be acceptable for use within the City's water system as compared to products of specified manufacturers. Contractors proposing to use materials which are not specifically named shall submit all necessary documentation to allow review of said material for use as an approved equal. The submittal shall include a letter with:

1. Product: A description of the product and the appropriate materials specification section number. A sample of the product may be required for review and testing.

2. Contact: The name and telephone number of the contact person for the proposed product.

3. Reference: A list of a minimum of 3 agencies that are using the proposed product (include names and telephone numbers).

4. Performance: Information and reference for 3 locations with a performance record of 3 years in operation of the installation.

5. Address the letter to the Environmental Utilities Department Engineering Division at 2005 Hilltop Circle, Roseville, CA 95747 Attn: EUD, Chairman of METAC. City staff may request a sample of the product for review.

6. The contractor shall submit all material for review 35 days prior to contract award. All submittals shall include documentation verifying contract award date. Contractors shall allow 2 to 4 weeks review time by the Environmental Utilities Department.

B. Conditionally Approved Material: Materials or products that have met the reference and performance requirements shall be conditionally approved for a minimum trial period of 2 years. Upon completion of the 2 year period, the product may be approved, the evaluation period may be extended, or the product may be denied approval as determined by the Environmental Utilities Director. A list of conditionally approved products may be obtained from the Environmental Utilities Department.

C. Material Defects and Failures: Defective material and failures shall be reported immediately. The date of sale, manufacturing dates, lot numbers, and all other identifications shall be provided to the Environmental Utilities Department.

D. Unapproved Materials: Materials not approved for use on the project shall be removed from the site within 24 hours as requested by the Development Services Construction Inspector.

E. Water Main: Unless noted on the approved plans, all water mains shall be either Polyvinyl Chloride Pressure Pipe (PVC) or Ductile Iron Pipe (DIP).

1. PVC Pressure Pipe: PVC Pressure Pipe shall be manufactured to a minimum Class 150 rating and shall conform to the "Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 6 inches through 12 inches, for Water" (AWWA C-900), and shall also include the following:

a. PVC Pressure Pipe shall be blue or white in color and shall have been manufactured within 18 months of installation. The pipe shall be manufacturer date coded and the City provided the manufacturer's coding for translation. Sun damaged pipe may be rejected at the Development Services Construction Inspector's discretion.

b. Rubber rings shall conform to the "Standard Specifications for Elastomeric Seals (Gaskets) for Joining Plastic Pipe" (ASTM F-477).

c. Approved PVC Pressure Pipe manufacturers include: Aquaspring C900 Certa-Lok, Diamond Plastics Corporation, J-M Manufacturing, Pacific Western Pipe, Vinyl Tech-White Knight, Pressure-Flex Pipe, PW-Eagle, North American Pipe Corporation, or approved equal.

2. Ductile Iron Pipe: DIP shall be manufactured to conform to the standards ANSI/AWWA C-150/21.50 thickness design of ductile iron pipe and to "Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water and Other Liquids" (ANSI/AWWA C-151/A21.51) and shall also include the following:

a. DIP shall be cement-mortar lined in accordance with the standard for "Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water" (ANSI/AWWA C-104/A21.4).

b. Approved DIP manufacturers include: McWane, Tyler, US Pipes, Griffin, American, Electrosteel USA, or approved equal.

3. Concrete Cylinder Pipe- CCP shall be manufactured to conform to the standards AWWA C-303:

a. Approved CCP manufacturers include: Ameron or approved equal.

F. Services

1. Brass Material: In compliance with California State Assembly Bill 1953 and any amendments thereto, all brass components and pipe in contact with potable water intended to convey or dispense water for human consumption through drinking or cooking shall contain a maximum of 0.25% lead by weight. Compliant brass product shall be marked indicating the product is manufactured from a low-lead alloy. Non-compliant product shall be immediately removed from the construction site.

a. Brass pipe: Brass pipe shall conform to ASTM B-43 standards. A listing of approved pipe include: Hallstead ¾" through 2" Red Brass, Cambridge-Lee, Federal WW—351, Wolverine, or approved equal.

b. Brass fittings: Brass fittings shall conform to ANSI Standard B16.15, B16.24, B2.1, T-94-1 and be a minimum of Class 125. A listing of approved manufacturers include: Lee Brass, Merritt Brass, New England Union Co. or approved equal.

c. Brass fittings for Copper Tubing: An approved listing for brass fittings for copper tube includes: Jones, Mueller, Ford or approved equal. Parts reference numbers are shown below:

1. Jones (¾through 2):
- Jones Super Grip CTS x CTS E-2609SG
- Jones Super Grip CTS x MIP E-2605SG
- Jones Super Grip CTS x GIP E-2607SG
- (2 Compression x Compression)

2. Mueller (¾through 2):
- Mueller-110-CTS H-15403N
- Mueller-110-CTS H-15428N
- Mueller-110-CTS H-15451N

3. Ford (¾ inch through 2 inch):
- ¾ inch"- - Ford Quick Joint CTS x CTS C44-33-Q-NL
- 1– Ford Quick Joint CTS x MIP C84-44-Q-NL

- 2– Ford Quick Joint CTS x FIP C14-77-Q-NL
- (2 Compression x Compression)

2. **Copper Tubing**: Copper tubing shall be seamless, annealed copper tube and shall conform to ASTM B88 "Standard Specification for Seamless Copper Water Tube" and shall be Type K. Copper shall be grade UNS-C12200. For diameters ranging from ¾ to 1" inch, use Type K Roll Soft Copper. For diameters ranging from 1 ¼ to 2" inch, use Type K Soft 20Sticks. Approved tubing includes: Cambridge Lee, Mueller Streamline, Aqua Shield or approved equal.

3. **Corporation Stops**: Corporation Stops shall be male, iron pipe thread by compression and full throat ball valve design. A corporation stop shall be installed at the water main for all service laterals 2 inches and smaller. Approved manufacturers of corporation stops include: Jones, Mueller, Ford, or approved equal. Part reference numbers are as shown below:

   - Jones:
     - Part #E-1935SG (¾ inch to 2 inch)
   - Mueller:
     - Part #B-25028-MIPTXCTS-110N (Compression ¾ inch to 2 inch)
     - Part #N-35028-MIPTXCTS-110N (Compression ¾ inch to 1 inch)
   - Ford:
     - Part # FB1100-x-Q-NL (¾ inch to 2 inch)
   - AY McDonalds Mfg. Co. Brass 74704BQ 1 inch corp stop

4. **Curb Stops**: Approved curb stop manufacturers include: Jones Mueller, Ford, or approved equal. Part reference numbers are shown below:

   - Jones: Part #E1921WSG (¾ inch to 2 inches)
   - Mueller: Part #B-25172-FIPTXCTS-110N (Compression ¾ inch to 2 inches)
   - Ford: Part # B41-xxx-Q-NL (¾ inch to 2 inches)
   - AY McDonalds Mfg. Co. Brass 76102Q 1 inch curb stop

5. **Dielectric Tape**: Approved manufacturers for dielectric tape include Polyken #932 Hi-Tack joint wrap tape or approved equivalent flexible dielectric tape.

6. **Service Saddles**

   a. PVC Pressure Pipe Service Saddles manufacturers include Jones, Mueller, Ford, or approved equal. Part reference numbers are as indicated below:

   - Jones: 4 inch through 12 inch saddles with ¾ inch through 2 inch tap, Part #J-996

   - Mueller:

Saddle Size	Part#
4 inch	H-13490

6 inch	H-13491
8 inch	H-13492
10 inch	H-13493
12 inch	H-13494

- Ford:

Saddle Size	Part#
1 inch	S912

b. DIP Service Saddles manufacturers include: Jones, Mueller, or approved equal. Part reference numbers are as indicated below:

- Jones: 4 inch through 12 inch saddles with ¾ inch through 2 inch taps: Part # J-979

- Mueller: ¾ inch through 2 inch taps:

Saddle Size	Part#
4 inch	BR2B0474Ip*
6 inch	BR2B0684IP*
8 inch	BR2B0899Ip*
10 inch	BR2B1104IP*
12 inch	BR2B1314IP*
16 inch	BR2B1732IP*

*the last three numbers denote tap sizes (0.75"=075, 1"=100, 1.50"=150, 2"=200)

G. Appurtenances: In compliance with California State Assembly Bill 1953 and any amendments thereto, all brass components and pipe in contact with potable water intended to convey or dispense water for human consumption through drinking or cooking shall contain a maximum of 0.25% lead by weight. Compliant brass product shall be marked indicating the product is manufactured from a low-lead alloy. Non-compliant product shall be immediately removed from the construction site.

1. Air Release Valves: Air release valves shall be epoxy coated vacuum break type. A listing of approved manufacturers includes: Crispin, Valvematic, or approved equal. Part reference numbers are as shown below:

Crispin	Part#	Valvematic	Part #
1 inch	UL10	1 inch	201C
2 inch	UL20	2 inch	202C
3 inch	UL31	3 inch	203C
4 inch	UL41	4 inch	204C
6 inch	UL61	6 inch	206C
8 inch	Ul81	8 inch	208C

2. Backflow Assembly – A listing of approved manufacturers and products include:

For domestic and Irrigation services ¾"-2" "Lead Free" Reduced Pressure Principle BPA:

- Watts LF009 and LF909 series
- Wilkins 975 Series

For domestic and Irrigation services 3"-10" Reduced Pressure Principle BPA:

- Wilkins 375AST and 375 ASTR

For Commercial Fire Service Connections

- Ames 3000SS DCDA Stainless Steel Series (OS&Y)
- Wilkins 350 ASTDAR (OS&Y)
- Wilkins 350 ASTDA(vertical and horizontal installation)(OS&Y)

3. **Backflow Assembly Support Stands**: Placer Waterworks series PW/PS or approved equal.

4. **Backflow Assembly Support Stand Saddles**: Placer Waterworks series PW/SDL or approved equal.

5. **Backflow Assembly Color**: All brass/copper Backflow Preventer Assemblies, including the bypass meter and backflow on a commercial fire backflow, shall be painted a "Forest Green" color to provide a deterrent to theft with the proper outreach to recyclers. The paint color code shall be RAL6004 blue green.

6. **Blocking for Boxes**: A listing of approved materials includes: Slump Block- 4 inch x 4 inch x 15 ½ inch, or approved equal.

7. **Cadwelds**: A listing of approved materials includes:
   - #4 jumper cable, CP cable, 18 inches long with 1 inch bare end
   - #4 cadweld copper sleeve
   - #4 cadweld shot with thermite mastic weld cap-t-cap
   - Exothermic weld caps:
     - Ci thermOcap with thermOprime adhesive
     - Ci thermOcap PC
     - Royston Handy Cap with Roybond 747 Primer
     - Royston Handy Cap IP

9. **Fittings**

   a. PVC: Unless otherwise specified or shown on the approved plans, all fittings to be used with PVC Pressure Pipe shall conform to the standard for "Ductile Iron Compact Fittings for Water and Other Liquids" (ANSI/AWWA C-153/A21.53 for MJ compact

fittings; C110 for flange fittings). Approved fitting manufacturers include Sigma, Star, Tyler, Union and US Pipe.

1. All ductile iron fittings shall be mortar lined in accordance with the standard for "Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water" (ANSI/AWWA C-104/A21.4).

2. All fittings shall be wrapped and sealed in accordance with these Construction Standards.

3. The Contractor may use a ductile iron mechanical joint flange adapter designed for AWWA C-900 pipe with connecting PVC Pressure Pipe to flanged fittings or flanged valves. Pipe ends must be cut smooth and square with no bevel. The joint shall be restrained to the PVC pipe using an approved restraint method.

b. Ductile Iron Pipe: Unless otherwise specified or shown on the approved plans, all fittings to be used with DIP shall employ either mechanical joints or restrained joints conforming to the standard for "Ductile Iron Compact Fittings for Water and Other Liquids" (ANSI/AWWA C-153/A21.53). Approved fitting manufacturers include Sigma, Star, Tyler, Union, and US Pipe.

1. All ductile iron fittings shall be mortar lined in accordance with the standard for "Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water" (ANSI/AWWA C-104/A21.4 – Double thickness mortar).

2. All fittings shall be wrapped and sealed in clear polyethylene encasement in accordance with these Construction Standards (81-16,G.26).

10. **Freeze Protection for Backflow Assemblies**: The backflow assembly freeze protection materials shall be comprised of the following:

a. Laminated forest green fabric conforming to Herculite #10 by Herculite Products (fabric shall be a minimum of 10.6 oz/sq. yd.), or approved equal.

b. Brass Rolled Rim Grommet and spur washer by Astrup, or approved equal.

c. Polyester thread with a minimum strength of 14.2 pounds, Coats American's Star Ultra product line, or approved equal.

d. Fiberglass insulation R-19 rated, 6 inch minimum thickness.

e. inch minimum width Velcro, or approved equal.

f. Nylon zip ties.

11. **Gaskets**: Gaskets shall conform to the following specifications:

a. Flange Gaskets: Flange gaskets shall be neoprene rubber, red rubber, US Pipe, Flange Tite, or approved equal.

b. Push On Gaskets: Manufacturers recommendations.

c. MJ Gaskets: Manufacturers recommendation.

d. Insulting Flange Gaskets: Insulating flange gaskets shall be USSO Standard B.16.21 insulation flange kits, Type E Full Face Gasket with 2 sided insulation as manufactured by Calpico, or approved equal as per detail W-21.

12. Hydrants: Hydrants shall be wet barrel type bronze – lead free. Exterior shall be painted with 1 coat primer and 2 coats "safety yellow" gloss oil based enamel paint (e.g. Rust-Oleum HP 7543). Caps shall be cast iron. Approved hydrants (with 6" x 2-1/2" x 2-1/2" x 4-1/2)include: James Jones (Bronze) Part # J3762-Z13, Clow (Bronze) 2060, or approved equal. The Part Number shall contain the letter "NL" to indicate the hydrant is lead free. Example: Part # Jxxx-ZxxNL.

i. All new hydrants to be installed with breakoff check valves. Approved valve: Clow LP619 Hydrant Breakoff Check Valve or equal.

13. Hydrant Bury: Hydrant buries shall be ductile iron mechanical jointed cross flange, cement-mortal lined per AWWA C104. A list of approved hydrant buries include: South Bay Foundry MJ x Size, Clow MJ x Size or approved equal.

14. Hydrant Bury Extensions: Hydrant bury extensions shall be grooved and cement-mortar lined per AWWA C104. A list of approved hydrant bury extensions include: South Bay Foundry, Clow Part # CW-EXT-BO (6 inch x 6 inch through 6 inch x 36 inch), Tyler (6 inch x 6 inch through 6 inch x 32 inch), or approved equal.

15. Location Stakes: A list of approved off-site location stakes include: Carsonite-# CUM375, 4 inch x 5 feet with anchor barb kit, Caution stickers attached-# CW-112 and organization decal # P101, City of Roseville-Call Before Digging-(916) 774-5750, or approved equal.

16. Main Line Valve Lock-Out: A list of approved manufacturers and part reference numbers include: SW Services PC800, DC600, or approved equal.

17. Manhole Frame and Cover: A listing of approved manufacturer and part reference number includes: South Bay Foundry (SBF1957-W), GMI Composite Frame and Cover 2600 and 3800 series, or approved equal. Manholes constructed outside of paved area shall use a GMI composite lid and frame.

18. Meters: All meters shall be purchased through the Environmental Utilities Department, Water Division. Call (916) 774-5750 for information.

19. Meter Idlers: A listing of approved meter idler manufacturers include: Ford, Jones, Spears, or approved equal. Part reference numbers are shown below:

Ford	Part #

¾ inch	IDLER #3-NL
1 inch	IDLER #4-NL
¾ inch x 9 inch	884-090-NL
1 ½ inch	IDLER #6-NL

Jones	Part #
5/8 inch x ¾ inch	E-2208
1 inch to 2 inch	E-2208

Spears (no lead/low lead)	Part #
¾ inch x 7 ½ inch	884-075
1 inch x 10 ¾ inch	885-107

20. Meter Setters: A listing of approved meter setter manufacturers include: AY McDonald, Ford, Jones, Mueller, or approved equal. Part reference numbers are shown below:

Ford 40 Series	Part #
¾ inch	VBHH43-12WH-NL-FP
1 inch	VBHC44-15W-NL-FP
1 ½ inch	VBB76-18HB-11-66-NL-FP
2 inch	VBB77-18HB-11-77-NL-FP

Jones	Part #
¾ inch to 1 inch	E03-B-(C)-MT X MT-BV-SC-12
1 ½ inch	E02E-FIP-FIP-BV-SC-12AS
2 inch	E02F-FIP-FIP-BV-SC-12AS

AY McDonald	Part #
1 inch	718 412JC

Mueller	Part #
¾ inch to 1 inch	B-24118-2N
1 inch	390 B-24118-6A
1 ½ inch to 2 inch	B-2423-99000N

21. Meter Spud Couplers: A listing of approved meter spud couplers manufacturers include: Ford, Jones, Mueller, or approved equal. Part reference numbers are shown below:

Ford	Part #
¾ inch	C38-33-NL (4" and 8-1/2" Spud)
1 ½ inch	CF31-66-NL
2 inch	CF31-77-NL

Jones	Part #

1 ½ to 2 inch	E-129
¾ inch to 12 inch	E-130 (3/4" or 1" use 4" and 8-1/2" Spud)

AY McDonalds	Part #
1 inch	718412JC

Mueller	Part #
1 inch	H-10890N
Size 10	H90-99029N (4 inch and 8 ½ inch Spud)

22. Nuts and Bolts

a. Flange bolts and nuts shall conform to a minimum ASTM #A307. Bolts less than ¾ inches in diameter shall be a minimum Grade B (heavy hex). Bolts ¾ inches and larger in diameter shall be a minimum Grade A (standard hex).

b. Hydrant Bolts: Hydrant bolts to be Hollow Break Away, 5/8 inch x 3 inch, conforming to ASTM-A307 Grade A & B Low Carbon Steel. Insulating flange bolts, nuts, and washers shall be stainless steel Grade 316.

c. Meter Bolts are to be stainless steel, Grade 316 with brass nuts.

d. Tee Bolt: Steel bolts are to be ¾ inch high strength, low alloy steel with a heavy nut, conforming to AWWA Standard C-111-90.

23. Nylon Bushings: Nylon bushings shall be 76-76R, 2 ½ inch MIPT x 2 inch FIPT.

24. Patching Material: A listing of approved manufacturers and part reference numbers for patching of Dip include: Cop-Coat Carboline Company (Bitumastic No. 50, Coal Tar), Coppers Coat 50, or approved equal.

25. Pipe Wrap Tape: 10 mil vinyl tape manufactured by Calpico Inc. (Calpico VI-10) or approved equal.

26. Polyethylene Encasement: "Clear" non-colored polyethylene film shall be used. The polyethylene film shall have a minimum thickness of 8 mils. The thickness shall not be less than 10 percent of the nominal thickness. The polyethylene shall be in either tubular or in sheet form. Polyethylene film shall be manufactured from a Type 1, Class A raw polyethylene material conforming to "Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids" (ANSI/AWWA C-105/A21.5). Approved manufacturers include: Fee Spec's-LP378D Northtown, Fulton Enterprise Inc., Global Polymer Tech, Unisource, or approved equal.

27. Pressure Regulators: A listing of approved all brass pressure regulator systems include: Watts (¾ inch through 2 inch, UB5-series), Wilkens (¾ inch through 2 inch 600 series, 2 ½ inch through 3 inch 500YSBR), or approved equal.

28. Reinforcement Bar: Rebar shall be grade 60 steel, deformed type. Smooth bar shall not be allowed. All rebar shall be number four (4) unless otherwise specified on the plans.

29. Restraints

a. PVC: Approved restraint systems for PVC Pressure Pipe include: Aquaspring C900 Certa Lock (for straight runs only), ROMAC Alpha Restrained Joint, ROMAC Grip Rings, EBAA Iron Series 2000 PV, Sigma One Lok Series "SLC", DR18 JM Eagle Loc, eagle lock, PVC Star Grip 4000 series, (See section 81-16,H for additional conditionally approved options) or approved equal.

b. DIP: Approved restraint systems for DIP include: Field Lock Gaskets (3 inch through 12 inch diameter only), Mega Lug 1100 Series, TR Flex, sigma One Lok Series "SLD", Star Grip 3000 series, American Fastite Joint Assembly or approved equal.

30. Riser Aligners: A listing of approved products include: Davis & Associated Riser Aligners 8 inch, or approved equal.

31. Riser Stock For Curb Stops: Riser stock schedule 40 PVC. The riser shall be 4 inch diameter inside meter boxes, and 6 inch diameter for curb stop type valves in valve boxes.

32. Riser Stock for Main Line Valves: Riser stock shall be 8 inch diameter PVC C-900 for all main line valves.

Riser insert/main line valve lock out shall be used where the valve is located in the gutter pan. See section 81-16.G.16

33. Sampling Stations: MX Fusion or approved equal. Model MX3000-H FBE (Wht)

34. Service Boxes and Lids: All box lids are to be permanently marked with the appropriate label (i.e., Water, ARV, Blow-Off, CPT, etc.). Lids shall have a 1 7/8 inch hole offset at upper 1/3 portion of lid measured along the long axis. In commercial project, meter lids shall be stenciled with the number address it serves. The numbers shall be painted using white enamel paint and 2 inch stenciling. A list of approved box manufacturers include: Christy, BES, Armorcast, CDR, Placer Water Works, or approved equal. Part reference numbers are shown below:

Christy	Part #
¾ inch and 1 inch services	N-16 Box (10k load)
	N-30 box (10k load)
	B-16-61DP Cover (10k load)
	B-16CP Cover (10k load)
	FL16P001 (10k load)
	FL 30 cover (10k load)
	Placer Water Works PWW-F16 (20k load)

	(w/ 1 7/8 inch hole, off-set at upper 1/3 portion of lid, measured along the long axis) B-16-12 Box Extension
1 ½ inch to 2 inch services	B-40 Box B-40-61D CoverB-40-61D Cover (w/1 7/8 inch hole, off-set at upper 1/3 portion of lid, measured along the long axis) B-40-10Box Extension
3 inch meter box	B-40 Box
4 inch meter box	B-48 Box B-48-62DP P48-10 Extension
6 inch to 10 inch meter boxes	B-48 Box P48-10 Extension R-17P24 PIT R-17-52DP Lid R-17-24 Extension
6 inch to 8 inch compound meter Box and Extension	R37-54H Lid

Armorcast	Part #
¾ inch to 1 inch	A6000492 Box (20k load) P000492 Box (20k load) A6000489-T-H5 (20k load) A6000489-H5 (10k load) A-6000 489-TI Non Traffic Lid with 2 inch probe hole and metal detection device. Label “RSVL WATER
1 ½ inch to 2 inch services	A-6001 643-TI Non Traffic Lid with 2” probe hole and metal detection device. Label “RSVL WATER”

CDR	Part #
¾ inch to 1 inch services	WB03-1121-12 Box WC00-1121-02RR Lid (10k load)
1 inch services	(For Tiers 15 & 22)*
Quazite Lid	(For Tiers 15 & 22)*

*Tiers 15 & 22: Driveways, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic.

Placer Waterworks	Part #
All sizes	All standard lids listed above (10k and 20k load)

Hubble Meter Box	Part #
1 inch meter	CDR 15 inch X 27 inch straight wall style (stackable assembly) CDR 17 inch X 30 inch straight wall style (stackable assembly)

35. Traffic Boxes: A list of approved traffic box manufacturers include: BES, Christy, or approved equal. Parts reference numbers are shown below:

a. BES
- C-17 inch x 30 inch Box-Full Traffic Concrete
- G-5 Box

b. Christy
- V-64 Box
- V-64 Box x 12 inch Extension
- V-64 Cover Traffic Load
- G-5 Box with D & L Lid # K6004
- G-5C Lid

c. Placer Water Works
- PW/G5 Lid

37. Tracing Wire: Tracing wire shall be light blue in color and minimum 12 gauge solid copper with UF rated plastic insulation.

38. Tracing Wire Connectors: Tracing wire connectors shall be copper split-bolt type connectors. A listing of approved products include: Perminate Seal-Wire Connectors-Part #97811, Christy's (S-X), or approved equal.

39. Tracing Wire Mastic Tape Seal: Tracing wire mastic tape shall be 3M Mastic Tape #2229 or approved equal.

40. Valves

a. Butterfly Valves: Butterfly valves to be used on pipe diameters ranging from 16 inch to 72 inch. A list of approved valves include: Standard Pratt Ground Hog, with MDT Traveling Nut Actuator, Mueller Lineseal III, Dezurik butterfly valve with square nut actuator, (LA series) , or approved equal. NOTE: All valves shall be Holiday free epoxy, interior lining and standard black asphalt varnish exterior. Certification shall be

provided by the valve manufacturer stating the epoxy lining is holiday free. The epoxy coating shall be spark tested and approved for installation by the Environmental Utilities Department inspector.

b. Gate Valves: Gate valves used on diameters ranging from 3 inch to 12 inch shall be grey cast iron or approved equal. A list of approved valves includes: M & H 4067 RW Gate Valve, Mueller-A-2361 RS Gate Valve, Clow, AFC or approved equal.

c. 2-part epoxy repair kit shall be provided by valve manufacturer.

41. Valve Boxes: All valve boxes in street and other traffic areas shall be designed to H-20 loading conditions. A list of approved manufacturers and part reference numbers include: Christy (Type G5, Type B 17 by 30 H-20), BES, D&L (#K-6004), or approved equal.

42. Valve Extensions: Placer Waterworks extensions model PW/VE or approved equal.

43. Water Pipe Marking Tape-Approved manufacturers and materials include: Cal Pico Inc. (Tracer Tape-non-Detectable 12 inch width), Reef Industries Inc., Terra Tape Extra Stretch 450 Material, or approved equal.

44. Zinc Caps: A listing of approved manufacturers include: Mars, or approved equal. Part reference numbers are shown below:

Mars:

- 7/16 inch to ½ inch— 2.5 ounce weight
- 5/8 inch to 1 inch— 6.0 ounce weight

H. CONDITIONALLY APPROVED

The following products are conditionally approved in the City for a period of 2 years conditional acceptance period, the product may be granted approved equal status and be added to the list of approved products in the City of Roseville Standards.

1. Old Castle Precast (Formerly U.S. Concrete Precast)
    a. Sewer Manholes and Appurtenances
    b. Grease Interceptors

2. SIP Industries DIP
    a. C153 Compact MJ Ductile Iron Fittings
    b. C110 Full Body Flanged Joint Ductile Iron Fittings
    c. Ductile Iron MJ Restraints for Ductile Iron and PVC Pipes

3. Diamond Plastics Lok 21 Restraint Gasket

4. American Flow Control – Series 2500 Gate Valve (Sizes 2” – 12”) with a single stainless steel fastener

5. Clow LP619 Hydrant Break Check

METER APPLICATION TABLE 1

METER APPLICATION TABLE 1

Size	Class	Meter Type	Meter Length	Meter Box [2]	Top of pipe finish grade	Residential Dom	Commercial Dom	Commercial Irrig	Meter Lid [1]
3/4"	PD	SRII TRC	7 1/2"	NA	Fire bypass				Fire backflow bypass
3/4"	PD	SRII or iPerl	9"	N-16	9"	x	x	x	CI incert/Fibrelyte
1"	PD	SRII or iPerl	11"	N-30	9"	x	x	x	CI incert/Fibrelyte
1 1/2"	C [2]	Sensus omni-Compound	13"	B-40 w/ext	8" - 12"		x		Checker plate
1 1/2"	T [2]	Sensus omni-Turbo	13"	B-40 w/ext	8" - 12"			x	Checker plate
2"	C [2]	Sensus omni-Compound	17"	B-40 w/ext	8" - 12"		x		Checker plate
2"	T [2]	Sensus omni-Turbo	17"	B-40 w/ext	8" - 12"			x	Checker plate
3"	C [2]	Sensus omni-Compound	19"	B-40 w/ext [3]	8" - 12"		x		Checker plate
3"	T [2]	Sensus omni-Turbo	19"	B-40 w/ext [3]	8" - 12"			x	Checker plate
4"	C [2]	Sensus omni-Compound	23"	B-40 w/ext [3]	8" - 12"		x		Checker plate
4"	T [2]	Sensus omni-Turbo	23"	B-40 w/ext [3]	8" - 12"			x	Checker plate
6"	C [2]	Sensus omni-Compound	27 1/8"	B-48 w/ext	8" - 12"		x		Checker plate/Split-lid
6"	T [2]	Sensus omni-Turbo	27 1/8"	B-48 w/ext	8" - 12"			x	Checker plate/Split-lid
8"	C [2]	Sensus omni-Compound	30 1/8"	B-48 w/ext	8" - 12"		x		Checker plate/Split-lid
8"	T [2]	Sensus omni-Turbo	30 1/8"	B-48 w/ext	8" - 12"			x	Checker plate/Split-lid
10"	C [2]	Sensus omni-Compound	41 1/8"	B-48 w/ext	8" - 12"		x		Checker plate/Split-lid
10"	T [2]	Sensus omni-Turbo	41 1/8"	B-48 w/ext	8" - 12"			x	Checker plate/Split-lid

Notes:
[1] Lid shall have probe hole for Ert
[2] Standard meter box for City of Roseville
[3] Recycled meters 3" and larger use B-48

* All meters are ordered in turbo length

SECTION 82: MARKERS AND DELINEATORS

82-1.01 DESCRIPTION

Markers and delineators shall be installed in accordance with the approved improvement plans and specifications, these Construction Standards, the City Design Standards, The California Manual on Uniform Traffic Control Devices (CMUTCD), the State of California Department of Transportation Standard Plans, and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the CalTrans Standard Specs.

82-1.02F REFLECTORS

Type K-4 (Type Q in the CalTrans Standard Plans) markers (aka: Superducks) shall be 36 inches tall and have 3 bands of reflective sheeting per Section A73A of the CalTrans Standard Plans.

Type K-4 markers mounted between two lanes of opposing traffic shall be yellow with yellow reflectorized sheeting. Type K-4 markers mounted between two lanes of traffic traveling in the same direction shall be white with white reflectorized sheeting.

At median curb noses, a yellow Type K-4 marker shall be mounted on top of the curb. A white Type K-4 marker shall be mounted at the nose for a Right turn “pork chop” island.

Medians within and at the entrances to subdivisions shall have 3 yellow reflective markers (Type H) installed on top of the median curb with one at the beginning, center, and end of the median nose radius. The markers should be placed so that they face approaching traffic parallel to the centerline of the median. K-4 markers should not be used unless required by the Engineer.

SECTION 84: TRAFFIC STRIPES & PAVEMENT MARKINGS

84-1.01 DESCRIPTION

Traffic stripes and pavement markings shall be installed in accordance with the approved improvement plans and specifications, these Construction Standards, the City Design Standards, The California Manual on Uniform Traffic Control Devices (CAMUTCD), The State of California Standard Plans, and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the CalTrans Standard Specs.

Sandblasting of traffic stripes shall not be permitted. Removal of traffic stripes shall be by grinding, or by other methods approved in writing by the Engineer. Drain inlets adjacent to areas to be ground shall be protected from grindings entering the storm drain system. For removal of pavement markings, a rectangular area shall be ground to prevent ghosting of the original marking and be covered with rectangular area of Type II slurry. Conflicting striping shall be removed completely. Type II slurry of conflicting striping is required when it crosses the new traveled lane. When this occurs, the entire lane shall be slurried from lane line to lane line over the entire length of the conflicting striping. This requirement will not apply to ceramic markers unless specified on the plans.

All striping or pavement markings damaged during construction shall be repaired/replaced at the contractor's expense. Repairs shall consist of complete replacement of markings or legends, replacement of sections of thermoplastic striping, and replacement of damaged or missing markers as directed by the Construction Inspector.

All pavement markings and 4 inch to 8 inch pavement stripes on concrete surfaces (unless otherwise noted) shall be 3M tape or equivalent in place of thermoplastic material and shall require 1 inch black borders when located on concrete pavement. The 1 inch black borders shall be in addition to required width of the stripe.

84-1.03 TOLERANCES & APPEARANCES

The following clarifications or modifications shall be applied when installing traffic stripes and pavement markings:

1. In addition to locations as shown on the plans, bike lane signs and pavement markings shall be installed at no more than 1/2 mile intervals and following every break in the bike lane striping. The BIKE LANE legend shall be centered in the lane to ensure the legend does not run into the lane striping.

2. A bicycle detector pavement marking shall be installed in conjunction with each bicycle detector loop at signalized intersections per CAMUTCD Figure 9C-7 and shall be placed starting 6 inches back of the crosswalk/stop bar.

3. Unless otherwise specified on the plans, crosswalks shall be 11 feet wide, measured from the centerline of the stripe.

4. Traffic stripes and pavement markings shall not be placed over utility covers including, but not limited to, manhole covers, utility boxes, hand holes, or water valve covers.

5. STOP and YIELD legend pavement markings and limit lines are required with corresponding signs. The yield limit line shall be per the CAMUTCD with CS (24" by 36" triangles).

6. Pavement arrows shall be one of the following types unless otherwise directed by the Engineer: Type II (L, R or B), Type III (L, R, or B), Type VI or Bike Lane Arrow.

7. At signalized intersections with left turn lanes longer than 150 feet, an additional Type II, or Type III arrow shall be placed 20 feet behind the limit line. Where there are dual left turn lanes with staggered limit lines, the arrows in the number 1 left turn lane (closest to the median) shall be placed 15 feet behind the limit line, and the arrow in the number 2 left turn lane shall be placed 20 feet behind the limit line. The intent is to have the 2 arrows line up side by side, even though the limit lines are staggered.

8. All turn lanes shall have a Type II or Type III arrow at the beginning of the turn lane such that the tail of the arrow lines up with the beginning of the Detail 38 striping. All turn lanes 150 feet or longer shall have a minimum of 2 Type II or Type III arrows (one arrow for every 150 feet of turn lane).

9. All traffic lane striping shall be discontinued through any 4 way public intersection from crosswalk to crosswalk, marked or unmarked. Striping shall be continuous through private intersections unless there is a striped left turn lane and/or traffic signal. For non-signalized public "T" intersections, the through and bike lane striping shall be continuous for the non-intersection direction, i.e. "across the top of the T". However, there shall be no striping within the limits of the crosswalk.

10. At locations where bike lane striping is used to channelize traffic, right turn acceleration/deceleration lanes and bus turnouts, both strips shall be detail 38. Reflective pavement markers shall be placed to the vehicle travel lane side of both stripes.

11. Bike lane striping shall be continuous except at right turn bay tapers, intersections with City streets, and driveways where the centerline/median is broken. See TS-18 for examples.

12. Lanes designated by the Engineer as auxiliary shall be striped as directed by the Engineer. Examples of typical auxiliary lane striping can be seen on TS-19. Bike lane striping along auxiliary lanes shall be a modified Detail 38 with 4 foot stripes at 10 feet on center.

13. Left turn arrows shall not be placed in 2 Way Left Turn Lanes unless otherwise directed by the Engineer.

14. Stop bars and yield triangles shall be 7 feet back from the center of the pedestrian access ramp unless directed otherwise by the Engineer. Where the stop sign is installed with a yellow school crosswalk, a supplemental white stop bar shall be installed 4 feet back from the crosswalk line.

15. Lane line extensions for dual turning lanes (right and left) shall be placed on a continuous arc as appropriate for a turning 40 foot bus. Triple turning lanes shall be placed to accommodate the turning of a 65 foot total length (California legal) tractor truck-semitrailer (TS-20).

84-2.03 THERMOPLASTIC TRAFFIC STRIPES & PAVEMENT MARKINGS

The thermoplastic material shall conform to State Specification PTH-02ALKYD:

Thermoplastic Traffic Striping Material, Alkyd Binder, White and Yellow. All thermoplastic must be applied per section 84-2.03C(2)(b)(2015 CalTrans) Extruded Thermoplastic Traffic Stripes and Pavement Markings.

A. APPLICATION

The Contractor shall apply an adhesive primer base coat prior to the application of any thermoplastic material on treated pavement, stamped pavement, colored pavement, concrete surfaces, or pavement older than 30 days.

As shown on the plans, the following permanent traffic lane striping shall be thermoplastic, and placed as one of the following types: Detail 25, 27B, 38, 39, 39A and Detail 40. Pavement Markers are also required for placement of Detail 25 and 38.

SECTION 85: PAVEMENT MARKERS

85-1.01 DESCRIPTION

Pavement markers shall be installed in accordance with the approved improvement plans and specifications, these Construction Standards, the City Design Standards, The California Manual on Uniform Traffic Control Devices (CAMUTCD), The State of California Standard Plans, and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the Cal Trans Standard Specs.

85-1.04 NON-REFLECTIVE PAVEMENT MARKERS

All non-reflective pavement markers shall be ceramic.

85-1.05 RETROREFLECTIVE PAVEMENT MARKERS

All lane line pavement markers of 2 and 3 lane arterials shall be Type C Red-Clear retroreflective markers and shall be placed between through lanes.

85-1.06 PLACEMENT

As shown on the plans, the following permanent traffic lane striping shall be raised pavement markings and placed as one of the following types: Detail 4, 7, 10, 13, 17, 20, 23, 25, 26, 30, 33, 37C, or Detail 38. Thermoplastic striping is also required for placement of Detail 25 and 38.

Detail 26 markers shall be placed 2 inches from the face of the median curb.

At all fire hydrant locations, a blue reflective pavement marker (Type BB) shall be installed 1 foot off paved centerline or median on the hydrant side of the roadway.

All traffic lane striping shall be discontinued through any 4 way public intersection from crosswalk to crosswalk, marked or unmarked. Striping shall be continuous through private intersections unless there is a striped left turn lane and/or traffic signal. For non-signalized public "T" intersections, the through and bike lane striping shall be continuous for the non-intersection direction, i.e. "across the top of the T". However, there shall be no striping within the limits of the crosswalk.

At locations where bike lane striping is used to channelize traffic, right turn acceleration/deceleration lanes and bus turnouts, both stripes shall be detail 38 (A20D). Reflective pavement markers shall be placed to the outside of the bike lane along both stripes

See Section 84 of these Construction Standards for additional striping requirements.

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

86-1.01 GENERAL

Signals, lighting, electrical systems shall be constructed/installed in accordance with the following standards listed in priority - the approved improvement plans and specifications, these Construction Standards and the City Design Standards, The California Manual on Uniform Traffic Control Devices (CAMUTCD), The State of California Standard Plans, and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the CalTrans Standard Specs. Note that the more recent of either the City of Roseville Construction or Design Standards shall govern the older of the two.

Signal phasing shall start with phase 2 northbound and proceed in a clockwise direction unless directed otherwise due to coordinated corridor restrictions.

A copy of the Traffic Signal Inspection Check List is included on TS-22 as a reference of required inspections during construction.

Temporary signals require design submittal from a resisted PE or TE.

86-1.04.1 EQUIPMENT LIST AND DRAWINGS

The City shall provide, as discussed in these Standards, the following traffic signal equipment and materials listed below unless otherwise specified in the plans. (For signals being installed as a developer obligation, the City shall supply equipment as outlined in the City Standards at the developer's cost. Full payment is required prior to the release of the equipment. The Contractor shall identify the cost of the City furnished equipment as a bid item):

Upon 10 calendar day notice to the City's Construction Inspector, the equipment and materials to be provided by the City will be available for pick-up by the Contractor at the City's Corporation Yard located at 2005 Hilltop Circle, Roseville. The Contractor shall provide all labor and equipment necessary to load, transport, and install the City-provided equipment and materials.

Traffic signal standards, posts, and mast arms shall be of the types listed in Table 6-1.

Table 6-1: Traffic Signal Standards, Posts and Mast Arms

STANDARD/POST	MAST ARM	LUMINAIRE ARM
Ped. Push Button	none	none
7 to 15 foot 1-B	none	none
Type 15	none	6-15 foot
Type 15TS (7.2' foundation)	none	6-15 foot
16-3-100	15-20 foot	none
17-3-100	15-20 foot	6-15 foot
18-4-100	25-30 foot	none
19-4-100	25-30 foot	6-15 foot
23-4-100	35 foot	none
24-4-100	35 foot	6-15 foot
26-4-100	40-45 foot	6-15 foot
27-4-100	40-45 foot	none
28-5-100	50-55 foot	none
29-5-100	50-55 foot	6-15 foot
60-5-100	60-65 foot	none
61-5-100	60-65 foot	6-15 foot

The typical luminaire arm length used is 15 feet. Signal mast arms and luminaire mast arms shall be within 2 degrees of perpendicular to the centerline of the roadway. The Type 15TS pole above shall be used in conjunction with IISNS installations.

1B poles for 4 section and 5 section heads shall be 13 feet and 14 feet tall respectively.

Poles (except 1B's) shall be permanently labeled with the pole size, manufacturer, and serial number below or above the handhole. Signal pole and arm welding shall be performed by individuals certified by the pole manufacturer and shall not limit the original manufacturer warranty.

86-1.06 MAINTAINING EXISTING & TEMPORARY ELECTRICAL SYSTEMS

Roadway closures requiring restrictions of turning movements and/or signal red flash operations shall be in accordance with Section 12 of these Construction Standards.

86-2.03 FOUNDATIONS

Placement (location) of all foundations shall be verified by the Traffic Engineer, Development Services Inspector and Signal Tech prior to installation (TS-22).

There shall be a minimum 6 inch high curb around the signal controller/service pad, excluding the sidewalk/roadway side of the pad. The minimum curb height shall increase as necessary to ensure no steeper than a 2:1 slope of the native material around the pad. Masonry blocks (not gravity type blocks) may be utilized to achieve the required 2:1 slope. The Contractor shall be responsible for acquiring engineering for retaining walls if the wall is greater than 4 feet from base of footing to top of wall. Refer to TS-4 through TS-8 for further details.

Signal pole anchor bolts shall be aligned to ensure a maximum mast arm offset of 2 degrees from perpendicular to the roadway and shall be verified by the Traffic Engineer, Development Services Inspector and Signal Tech prior to concrete (TS-22).

Unless otherwise directed by the Inspector or Engineer, the Contractor is not required to place Inspection tubes in the foundations per Caltrans Standard Plan ES-7N.

86-2.04 STANDARD, STEEL PEDESTAL AND POST

Any 1B standard having a signal head display, 4 sections or larger, shall be installed under the following criteria:

1. 4 section displays will be side (SV-1-T or SV-2-T) mounted. The 1B standard shall be 13 feet in height. A PVC cap shall be provided as a pole cap. Special mounting instructions as described in these Standards shall apply. (See Section 86-4.06).

2. 5 section display shall be side (SV-1-T or SV-2-T) mounted. The 1B standard shall be 14 feet in height. A PVC cap shall be provided as a pole cap. Special mounting instructions as described in these Standards shall apply. (See Section 86-4.06).

3. Individuals certified by the pole manufacturer shall perform signal standard welding. The contractor shall give 7 days advance notification prior to any welding on existing poles installed in the public right-of-way. The contractor shall certify that any welding of signal standards will not degrade the integrity of the standards. Upon completion of welding on a signal mast arm, the contractor shall replace any existing electrical wires in the arm.

4. All future tenons shall be covered with a plastic cap and a pull wire shall be installed from the tenon to the side vehicle termination.

Internally Illuminated Street Name Sign (IISNS) Mast Arms shall be per TS-11 and TS-12. The loading of the mast arms and the signal pole to which the sign mast arm is attached shall be approved in writing by the manufacturer or a licensed Structural Engineer.

86-2.05A CONDUIT MATERIAL

All conduits shall be gray PVC, minimum Schedule 40. When directional boring has been approved, the use of Schedule 80 HDPE conduit that complies with the UL65IA listing may be used.

86-2.05B CONDUIT USE

All conduits shall be 2 inch to 3 inch in diameter except the run to the pedestrian push button posts shall be 1 inch.

86-2.05C CONDUIT INSTALLATION

All trenches in existing streets shall be constructed per Section 31-2 of these Standards and as required in this section. See TS-13 for trench details.

All new conduit placed in existing roadways shall be buried at a minimum depth of 18 inches below finished grade. All new conduit placed in new roadways shall be installed prior to any paving operations and be buried at a minimum of 18 inches below finished subgrade with the

exception of conduit between detector handholes and the first pull box which shall be buried a minimum of 18 inches below finished grade. New conduit installed outside of the roadway and sidewalk shall be installed at a minimum depth of 36 inches below finished grade.

Unless otherwise specified, all signal interconnect (SIC) conduit shall be: 2 inch to 3 inch schedule 40 gray PVC conduit with 3 foot radius 90 degree sweeps into each number 6 pull box.

All traffic signal and SIC conduit shall have a DLC taped with a 5 inch green band labeled "LOCATE" in each pull box or approved equivalent pull tape installed along with the conductors/fibers.

End bells shall be installed on the pull box end of each 90 degree sweep conduit into all pull boxes prior to pulling the wire.

After conductors have been installed, the ends of conduits terminating in pull boxes and controller cabinets shall be sealed with a duct seal type of sealing compound.

If delay to motorists will not exceed 10 minutes, conduit may be installed as allowed by "Trenching In Pavement Method" as provided in Section 86-2.05C of the CalTrans Standard Specifications and these requirements:

1. The trench shall be maximum 6 inches wide and 2 inches wider than the outside diameter of the conduit to be installed. There shall be 1 inch minimum clearance between the conduit and the trench wall. The trench shall be crumbed clean prior to placement of conduit.

2. Aggregate material in concrete shall be pea gravel. Concrete shall be thoroughly consolidated around the conduit filling all voids.

3. Rock wheel trenching shall not be allowed in Portland cement concrete roadways. Rock wheel trenching per detail TS-13 and conduit installation in new and existing AC roadways shall be located along the centerline of the bike lane stripe or stop bar/crosswalk striping whenever possible. The trench cut will be hidden by the thermoplastic stripe where applicable. Pre-existing improvements requiring deviation from the centerline of the stripe shall be accomplished within 20 feet from the beginning to the end of deviation. Deviations along bike lane lines shall be to the curb side of the stripe unless directed otherwise by the City. Deviations greater than 20 feet shall require pavement repair per Item 4 below:

4. Rock wheel trenching parallel to the roadway centerline across acceleration, deceleration, or bus turn out openings that cannot be completed per TS-13 upon the same day shall be filled with concrete to the top of the trench and the Contractor shall return to complete per Detail TB-3.

5. Saw cutting in the street other than rock wheel trenching will require pavement repair per TB-1 or TB-3 and/or grinding between lane lines per City Standards (71-2,C).

6. Should the contractor fail to install the conduits in new asphalt concrete roadways prior to the bottom lift of asphalt concrete, the City will require the installation of Tensar GlasGrid 8502 or

equivalent matt prior to the final lift of pavement.

7. Should the contractor fail to install the conduits in new Portland cement concrete roadways prior to the placement of concrete, the City will require the conduits be installed by horizontal direction drilling or the contractor shall place the conduit per TB-1 or TB-3a.[A1]

The contractor is solely responsible to provide all labor and equipment necessary to locate existing underground facilities beyond the information provided by the U.S.A. markings including, but not limited to, metal detectors, wire locating equipment, and potholing.

86-2.06 PULL BOXES

Pull boxes shall not be placed within the area of an access ramp or driveway unless directed by the Engineer. Pull boxes should be installed a minimum offset of 1 foot from back of walk when within the sidewalk and from any score or deep tool joint. The bottoms of pull boxes shall be bedded in 6 inches of clean crushed rock. Grout in the bottom of pull boxes is not required. The pull box rim and lid shall be flush with surrounding surface. In planter areas, the pull box rim and lid shall be 1 inch above the finish grade. Pull boxes located outside of the sidewalk or planter area behind a sidewalk shall be of the Caltrans traffic rated pull box design.

Conduit termination in the pull box shall be a minimum of 2 inches from the sides of the pull box, 2 inches above the crushed rock, and at least 8 inches below the bottom of the pull box cover. Conduits shall enter and exit pull box quadrants relative to the direction of the run.

All pull boxes and lids shall be Fiberlyte FL36 unless otherwise directed by the Engineer.

All pull boxes shall be No. 6 except as modified by the plans or the provisions below:

1. Advance loop pull boxes shall be No. 6 and shall have a minimum of 20 feet of detector lead-in cable (DLC) and 20 feet of extra loop cable spooled in the pull box.

2. The “Home Run” and “Communication Home Run” pull boxes (typically adjacent to the controller) shall be No 6, Fiberlyte FL36 24 inch deep vaults (02006110). Detector loop splicing is not allowed in the “Home Run” pull boxes.

3. Fiberlyte FL36 24 inch deep vaults shall be installed at the fiber hub locations as designated by the City and at every fiber optic cable splice point.

All pull boxes to be abandoned shall have conductors removed from the pull boxes and conduits and the pull box shall be removed. The remaining hole shall be backfilled and compacted with similar material as the surrounding material. If within a sidewalk, the entire square of sidewalk shall be removed and replaced.

86-2.06B COVER MARKING

Pull box covers shall read "TRAFFIC SIGNAL" (02006400), except covers for pull boxes used solely for traffic signal interconnect. Should the signal interconnect pull box or vault contain any communication cable, the cover shall read "TRAFFIC SIGNAL FIBER OPTICS" instead.

86-2.08 CONDUCTORS

Conductor installation in new conduits shall be limited to 26 percent fill of the conduit maximum. Conductors installed in existing conduits shall be limited to 40 percent fill of the conduit maximum.

A DLC taped with a 5 inch green band and labeled with "LOCATE" in each pull box or approved equivalent pull tape shall be installed in all conduits.

Equipment grounding conductors shall be #6 stranded copper with insulation.

At new and remodeled traffic signals, a 3 inch, two cell "MAX CELL" or equivalent product shall be provided in all street crossing traffic signal conduits and from #1 Home run box to controller cabinet and must be installed using swivels.
Three (3) category 6E cables (from the City approved equipment list), or City approved equivalent, and one (1) power cable (IMSA 14-3/20-1-STR 600V, Belden part number 601195) or City approved equivalent to top of designated pole with 10 feet of slack for each cable at the top of the pole and 40 feet of slack in the pull box adjacent to the pole and 60 feet of slack in the pull box adjacent to the pole.

In order to reduce strain on the Cat6 cabling, all cables shall be adequately supported by feeding them through a Kellems grip which is attached to and suspended from the pole cap. The hole drilled for the cabling shall be drilled on the back side of the pole 3 feet from the top in order to minimize the camera view obstructed by the cable and shall be threaded for a straight ¾ inch strain relief cord connector. At least 4 feet of cable shall be pulled through and secured by the strain relief cord connector. The cables shall be looped together, adequately secured to the pole to prevent movement, and sealed on the ends to prevent moisture exposure.

The contractor shall install new wire and/or cable in conformance with guidelines below. It is assumed that all existing conductors and cables are undamaged unless inspected, documented, and reported to the Construction Inspector prior to the contractor starting that section of the work. Otherwise, any damage to City facilities shall be repaired by the contractor at the contractor's cost in conformance with City standards.

New traffic signal and SIC conductors shall be installed per the following guidelines:

1. New wire may be pulled through existing conduits without removing conductors if based on common conditions:

   a. There are a maximum number of 4, 90 degree by 24 inch radius bends in 1 conduit run between pull boxes or termination points, and

b. Conductors, conduit, number of bends and length of the pull are within reasonable limits (under 175 feet for signal wiring and under 400 feet for signal interconnect wiring), and

c. Ratio of the conduit (inside diameter) to the combined diameter of both the new and existing conductors or cables (outside diameter), otherwise known as conduit fill, does not exceed 40 percent.

2. All existing conductors shall be removed from conduits, the conduit proven, existing wires inspected, and the new wires added and re-pulled along with the wires previously removed if:

a. Items 1a and 1b above are met but the ratio of the conduit (inside diameter) to the combined diameter of both the new and existing conductors or cables (outside diameter), otherwise known as conduit fill, is greater than 40 percent but less than or equal to 60 percent, or

b. Items 1a through 1c above are met but jamming occurs.

3. New conduit shall be installed per City of Roseville Construction Standards if more than 4, 90 degree radii exist, the length of the pull exceeds Item #1b above, or the ratio of the conduit (inside diameter) to the combined diameter of both the new and existing conductors or cables (outside diameter), otherwise known as conduit fill, exceeds 60 percent.

4. The new wire shall be pulled as follows:

a. Conductors shall be pulled into conduits by hand or by approved mechanical pulling methods such as a pulley with adjustable clutch.

b. Only Polymer Based pulling compounds such as Aqua-Gel by Ideal or equivalent shall be used.

c. Lubricants shall be forcefully injected into the conduit system.

d. Only fiberglass fish tape or polyester measure tape may be used.

e. All wiring shall be formed and bundled with tie-wraps and directed to the field wire termination area of the cabinet in the workman like manner. This work shall be approved by the Traffic Signal Technician before the field wiring termination work begins. All wire terminations shall be crimped and soldered.

86-2.08A CONDUCTOR IDENTIFICATION

Each multiple conductor cable shall have 2 distinct identification markings at the signal cabinet and at each pull box as follows:

1. A distinct colored tape marking.

2. An identification tag tie-wrap to identify which signal/pedestrian pole(s) the cable services within the intersection.

All individual conductors, including those within a multiple circuit conductor cable, shall be bundled together by vehicle and pedestrian phases and banded with plastic tie-wrap labels in the signal

cabinet, in every pull box (for individual conductors not within a cable), and at their field termination point(s).

Cat5 cables being installed shall be identified with electrical tape at both ends with orange for video and blue for the wireless access point.

86-2.08B MULTIPLE CIRCUIT CONDUCTORS

All new and replacement traffic signal phase wiring shall be compromised of multiple circuit conductors per Section 86.08D of the Caltrans Standard Specifications. A separate 3-conductor cable shall be provided for pedestrian pushbutton wiring. Multiple circuit conductor cable used for vehicle displays shall not be used for any part, hot or common, of the pedestrian pushbutton circuit. Unique color coding shall be provided for each wire within the cable. The number of wires per cable shall be the next common size up from that required to provide the necessary wires as specified on the plans. Phases shall be labeled as described in Section 86-2.08A.

The handling of multiple circuit conductors shall be to the best industry standard practice and as follows:

1. Razor blade knives shall not be used to strip back the outer jacket of insulation. A round cable stripper (example: Clifford #6-670-114-0 or equivalent) shall be the only means of stripping back the outer cable insulation.

2. The outer insulation jacket shall not protrude past the top of the signal cabinet entrance conduits.

86-2.08E SIGNAL INTERCONNECT CABLE

Traffic signal interconnect shall be provided for new signal installations, and for modification of existing signals which currently do not have interconnect. The interconnect cable shall have its own conduit and shall not share conduit with service conductors, signal conductors, or lead-in cables.

The interconnect shall connect the subject signal with at least 1 existing traffic signal. If the subject signal is between 2 existing signals, the interconnect shall connect all 3 signals.

If a City Parcel is adjacent to a new fiber run, a fiber stub shall be provided.

Signal interconnect cable (SIC) shall be a 9/125um wavelength, 72 to 216 strand, single mode, indoor/outdoor, loose tube, all-dielectric fiber optic cable as specified on the plans.

A Type 1 splice (refer to TS-26) shall be used at traffic signal locations where 2 point to point fiber cables will be spliced along with a tactical cable to service the local cabinet.

A Type 2 splice (refer to TS-27) shall be used at traffic signal locations where 2 point to point fiber cables will be spliced along with a tactical cable to service the local cabinet and a fiber cable from an outside facility (UE, IT, etc.) is also being spliced.

A Type 3 slice (refer to TS-28) shall be used at traffic signal locations where 2 point to point fiber cables forming a network ring path and 1 fiber cable from a non-ring path will be spliced along with 2 tactical cables to service the local cabinet.

A Type 4 splice (refer to TS-29) shall be used at traffic signal locations where 2 point to point fiber cables forming a network ring path will be spliced along with a tactical cable to service the local cabinet and 2 point to point fiber cables forming a second network ring path with be spliced along with a tactical cable to service the local cabinet.

SIC shall have footage markings every 4 feet. This marking may be on the outside of the cover or on the inside insulation jacket.

The signal interconnect cable shall not be placed in any conduit runs or pull boxes containing live conductors, unless otherwise directed by the Engineer.

Unless specified otherwise on the plans, 6 feet of copper and/or 15 feet of fiber optic cable slack shall be provided in each pull box. 50 feet of copper and/or 100 feet of fiber optic cable slack for each signal interconnect cable run shall be provided in the dedicated communications Home Run pull box in front of each signal controller or the last pull box before the controller if a dedicated communications Home Run pull box is not available.

An industry standard 4 inch orange or yellow label marked "CAUTION FIBER OPTIC CABLE" in black font shall be attached to each fiber optic cable in each pull box.

At the discretion of the City Engineer existing SIC may be disconnected by the City and moved out of the work area by the contractor during construction. However, the SIC must be reinstalled by the contractor within 7 days of its disconnection. Otherwise, all SIC must remain operational.

Existing copper SIC damaged during construction shall be replaced at the contractor's cost from controller cabinet to controller cabinet on either end of the damage. Splicing of copper SIC is not allowed. Damaged copper SIC shall be replaced with fiber optic SIC, conforming to current City standards including cable, conduit, splices, terminations, patch panels, and pull boxes. The contractor shall also be responsible, at the contractor's cost, to make any additional repairs needed to install the new cable from controller to controller.

Existing fiber optic SIC damaged during construction shall be repaired.

Damage

1. Fiber Optic Cable and related facilities damaged during construction shall be replaced/repaired to current City standards and as specified below at the contractor's cost. This work shall include fiber optic cable, conduit, pull boxes/vaults, trenches, concrete, asphalt, traffic control, pull tape, splices, splice enclosures, terminations, labor, etc., as required.

2. Damage is described as a breach in the fiber optic cable jacket, a kink, a break of the cable, or any other condition that causes a reduction in the capacity of the cable.

3. Should fiber optic cable facilities be damaged during construction without visible damage to the cable, the cable shall be tested by a certified fiber optic technician provided by the

contractor at the contractor's cost to ensure that there is no internal damage. Should the test show internal damage, the cable shall be replaced as specified below. Otherwise, the cable shall be protected and the facilities repaired to current City standards.

Repair

1. Fiber optic cable running between and terminating at adjacent traffic signals or devices shall be replaced from:

a. Termination to termination. All new cable and terminations shall be acceptance tested as required elsewhere in the City standards.

b. If the new cable must be pulled through conduits that contain traffic signal phase wiring, then a "MAX CELL" or equivalent sleeve, per City standards, shall be installed in the conduit prior to the installation of the new fiber optic cable.

i. Pull box adjacent to the damage to controller cabinet.

a) No more than 5 feet of slack may be used out of any one pull box.

b) Pull boxes where new splices shall occur will be replaced with Fiberlyte FL36 24 inch deep vaults as specified in these construction standards (86-2.06)(02006110).

c) At least 50 feet of slack must be provided in the new splice vault.

d) The slack shall be provided in even amounts on either side of the splice enclosure.

e) Only fusion splicing meeting City standards by a certified fiber optic technician will be allowed.

f) All new cable, splices, and terminations shall be acceptance tested as required elsewhere in the City standards.

g) The average optical loss of each splice shall not exceed 0.10 dB. The average is determined by measuring the splice loss in both directions with an OTDR, adding the 2 readings, and dividing by 2. Testing should be performed for both the 1310 and 1550 nm wavelengths.

h) Splicing will not be allowed in pull boxes or vaults shared with non-signal interconnect cables.

i) If the new cable must be pulled through conduits that contain traffic signal phase wiring, then a "MAX CELL" or equivalent sleeve, per City standards, shall be installed in the conduit prior to the installation of the new fiber optic cable.

2. Fiber optic cable running continuously past multiple traffic signal devices may be repaired by splicing at adjacent pull box locations.

a. A single splice location may be appropriate if the damage is close enough to the adjacent pull box that the repair may be accomplished by using some of the slack in the existing cable.

i. No more than 5 feet of slack may be used out of any 1 pull box.

ii. Pull boxes where new splices shall occur will be replaced with Fiberlyte FL36 24 inch deep vaults as specified in these construction standards (86-2.06)(02006110).

iii. At least 50 feet of slack must be provided in the new splice vault.

iv. The slack shall be provided in even amounts on either side of the splice enclosure.

v. Only fusion splicing meeting City standards by a certified fiber optic technician will be allowed.

vi. All new cable, splices, and terminations shall be acceptance tested as required elsewhere in the City standards.

vii. The average optical loss of each splice shall not exceed 0.10 dB. The average is determined by measuring the splice loss in both directions with an OTDR, adding the 2 readings, and dividing by 2. Testing should be performed for both the 1310 and 1550 nm wavelengths.

viii. Splicing will not be allowed in pull boxes or vaults shared with non-signal interconnect cables.

b. 2 splices may be necessary if the damage is not near an existing pull box. In this case, a splice shall be provided on either side of the damage and a new length of cable meeting City standards shall be installed between the splices.

i. Pull boxes where new splices shall occur will be replaced with Fiberlyte FL36 24 inch deep vaults as specified in these construction standards (86-2.06)(02006110).

ii. At least 100 feet of slack must be provided in each vault.

iii. The slack shall be provided in even amounts on either side of the splice enclosure.

iv. Only fusion splicing meeting City standards by a certified fiber optic technician will be allowed.

v. All new cable, splices, and terminations shall be acceptance tested as required elsewhere in the City standards.

vi. The average optical loss of each splice shall not exceed 0.10 dB. The average is determined by measuring the splice loss in both directions with an OTDR, adding the 2 readings, and dividing by 2. Testing should be performed for both the 1310 and 1550 nm wavelengths.

vii. Splicing will not be allowed in pull boxes or vaults shared with non-signal interconnect cables.

viii. If the new cable must be pulled through conduits that contain traffic signal phase wiring, then a "MAX CELL" or equivalent sleeve, per City standards, shall be installed in the conduit prior to the installation of the new fiber optic cable.

3. Repair work must **begin within 24 hours** and be **completed within 48 hours** of the damage occurring irrespective of weekends and holidays.

4. Should the contractor be unable to make the repairs within this time frame, the City will complete temporary repairs and bill the contractor for their time and materials at the City's billable rate. The temporary repair shall be treated with the same restrictions, requirements, and care as the original cable. The contractor will still be required to make the permanent repairs prior to completion of the project.

Temporary copper SIC repairs must be **made within 48 hours** of the damage and provide sufficient bandwidth and reliability for the intended purpose of the copper SIC. Permanent repairs shall be **completed within 30 days** of the damage. The City may make the repairs and bill the contractor for the work should the contractor be unwilling or unable to meet these requirements.

Should the copper SIC installation be required by the City, the contractor shall test all copper SIC prior to installation as follows:

1. For continuity of each wire pair. Resistance shall be consistent.

2. For high resistance (meggar) testing (250v setting):

a. Each wire pair to ground

b. Each wire pair to the cable shielding

c. Each wire pair to wire pair

3. The test may be in the field or shop

4. A city technician does not need to be present

5. The contractor shall be liable for all inspection costs related to the removal and re-installation of new cable should untested cable found to be faulty after installation

Fiber optic cable shall be acceptance tested, every strand, both before and after installation at both 1310 and 1550 nm wavelengths. All testing shall be documented on OTDR Acceptance Test and Splice Loss Record forms. Losses shall not exceed 1.85 dB per mile of cable including patch panels and splices.

86-2.09 WIRING

All wiring shall meet or exceed the current CalTrans Standards and National Electrical Code Standards.

86-2.09B WIRING INSTALLATION
Ends of spare conductors or conductors terminated in pull boxes shall be taped and water sealed with ScotchKote or approved equivalent.

86-2.09C CONNECTORS AND TERMINALS
Field conductor wiring shall not be doubled up on any single wire connector. For conductor sizes larger than number 10, connections shall be spliced by the use of "C" shaped compression connectors as shown in the CalTrans Standard Plans.
All field wiring connections shall be soldered after crimping the wire connector.

All crimp connectors shall be sized to accommodate the proper wire gauge.

86-2.09D SPLICING
Grounding conductor splicing shall be water sealed with Scotch Kote sealant or an approved equivalent. 2 applications are required.

86-2.09E SPLICE INSULATION
All splices shall be Method B. Heat-shrink tubing may be used with prior approval by the Engineer.

86-2.09F FUSED SPLICE CONNECTORS
Field fuses shall be installed in the hand hole of the standard.

All ungrounded conductors shall be fused.

86-2.10 BONDING AND GROUNDING
Grounding jumper shall be attached by 3/8 inch or larger galvanized bolt in the signal standard or controller pedestal and shall be run to the conduit, ground rod or bonding wire in adjacent pull box. Grounding jumper shall be visible after cap has been placed on foundation. All ground connections shall be water tight.

Grounding electrodes shall be of copper clad steel rod, not less than 5/8 of an inch in diameter x 10 feet in length.

A grounding electrode shall be installed in all electrical services and controller foundations. They shall be spaced a minimum of 20 feet apart. See NEC 2011 Part III 250.53(A)(3).

The grounding electrode rod in the pull box shall be greater than 20 feet from the service and shall be paralleled with the grounding electrode rod in the Service. This connection shall consist of a continuous stranded #6 green insulated copper conductor. The ground connection shall be on the line side of the electrical entrance terminal block.

A continuous stranded #6 green insulated copper conductor shall connect the ground bus in the electrical service, grounding electrode in service, grounding electrode in the pull box. See Detail TS-25.

The equipment-bonding conductor for all 1B standards shall be visible and accessible after completion of work.

In the event that ground resistance testing failed, the contractor shall install an additional 8 foot ground rod in the signal "Home Run" pull box. This additional ground rod shall be paralleled with the grounding electrode in the controller pad and service pad with a continuous stranded #6 green insulated copper conductor. The ground wire for this additional ground rod shall be permanently fused to the rod using a "CADWELD PLUS ONE SHOT" connection (See Detail TS-25).

86-2.11 SERVICE

The City shall supply an electrical service consisting of Type III AF, low body configuration, or Type 27-22 service with battery backup system.

The Contractor shall provide an address tag for the service as described in the Roseville Electric Department Specifications for Commercial Construction, Section 6, and "Panel Marking Policy".

The service pedestal shall be installed a minimum of 5 feet from the controller cabinet.

A City of Roseville Encroachment Permit is required for every traffic signal installation and/or modification. The project address for the permit shall be the service pedestal address. This address should be noted on the plans but is obtainable from the City in its absence. Minor modifications by City forces not involving the service pedestal are exempt from the encroachment permit requirement. Should a traffic signal be a part of a larger project, there may be an encroachment permit for the entire larger project and 1 or more permits for each and every signal installation/modification.

There shall be a 1 inch grouted section between the service and the foundation. A ¼ inch weep drain hole shall be installed in this grout section.

86-2.14 TESTING

The contractor shall contact the Construction Inspector at least 5 working days prior to installation of a tested controller assembly and/or electrical service.

86.2.14B (2) GROUND

Before electrical power can be connected, then grounding electrode shall be tested for earth ground resistance. The City Traffic Signal Technician shall perform this ground resistance testing and said test shall be performed after the service and controller pad foundation have cured. The earth ground resistance shall be a maximum of 5 ohms. If the ground resistance testing results are greater than 5 ohms maximum limit, refer to Section 86-2.10 and drawing TS-25 for corrective action requirements.

86-2.14C FUNCTIONAL TESTING

Functional testing shall be performed for 5 working days prior to signal activation. All systems shall be in place before functional testing can begin.

A shutdown of the electrical system resulting from damage caused by public traffic or from a power interruption shall not constitute discontinuity of the functional test.

During interconnect cable installation, the Contractor shall, in the presence of the City Traffic Signal Technician, perform a high resistance to ground test, DC resistance test and a dB attenuation loss test. The Contractor shall supply factory specifications prior to the test. The Contractor shall notify the Engineer at least 48 hour prior to interconnect cable installation.

86-2.15 SIGNAL ACTIVATION

On the day of signal activation, the contractor shall be required to have in his possession at the job site all tools, equipment and parts necessary to repair a signal malfunction. These items shall include, but not be limited to, a bucket truck, replacement LED's, wire, etc.

Immediately prior to the activation of a **NEW** traffic signal, the contractor shall install 2 orange flags on the "Signal Ahead" signs. Flags shall remain in place for 2 weeks.

Prior to activation of a **NEW** traffic signal, the contractor shall provide a minimum of 2 flaggers per intersection to control traffic. The number of flaggers may be increased at the request of the City's Construction Inspector for large intersections at no additional cost to the City. Each flagger shall wear appropriate safety gear and carry a stop paddle for controlling traffic. The flaggers shall completely stop traffic prior to the signal changing from red flash to full operation.

86-3.01 CONTROLLER CABINET ASSEMBLY

The City shall supply the controller cabinet assembly.

Wire connections and/or termination shall comply with section 86-2.08.

The traffic signal controller cabinet shall have a 1 inch bead of clear silicone sealant applied between the foundation and the controller cabinet bottom immediately before installation. The bead shall be centered 2 inches in from the outer edge of the controller cabinet around the entire perimeter. All excess silicone on the outer edges shall be cleaned off.

The sealant shall be 35 year rated 100% silicone. There shall be no substitution for the silicone sealant.

On 332 cabinets, the field wire entrance section of the controller shall face the intersection or as directed by the Engineer.

No access to the controller shall be permitted without supervision of a City of Roseville Traffic Signal Technician, unless otherwise directed by the Engineer.

86-3.08 EMERGENCY VEHICLE PREEMPTION EQUIPMENT

The City shall supply emergency vehicle preemption equipment, with the exception of the required cabling from the optical detector to the discriminator in the Controller Cabinet Assembly.

Where existing signals are being modified, and said signals are already equipped with emergency vehicle preemption equipment, the Contractor shall perform any necessary remodel and reinstallation of said equipment as required by the plans or as directed by the City Engineer.

Preemption cables shall be labeled in the following manner:

- Phase 2&5 single gray band
- Phase 4&7 double gray band
- Phase 1&6 triple gray band
- Phase 3&8 quadruple gray band

Labels shall consist of banded colored tape visible at the preemption detector, signal standard Handhole, adjacent pull box and the Controller Cabinet. Cables in the Controller Cabinet shall have tie wrap labels with appropriate phasing descriptions.

86-4.01 VEHICLE SIGNAL FACES

All signal faces shall be aluminum. All mountings for shall be bronze metal.

Signal faces shall have 12 inch LED displays, unless otherwise specified.

Vehicle signals and pedestrian signals shall be of the following types:

- MAT (3 section only)
- MAS
- MAS-4B
- SV-1-T
- SV-2-TB
- SV-3-TB
- TV-1-T
- TV-2-T
- TV-3-T
- SP-1-CS

The MAT mounting shall only be used for 3 section vehicle signals for protected left turn movements. All other mast arm mounted vehicle signals shall be MAS mounted.

All signal sections shall have full circle visors unless directed otherwise on the plans.

The following vehicle signal alignments are typical. Variations may be required on a case by case basis.

1. For single left turn lanes with protected left turn movement, the left turn signal shall line up with the center of the left turn lane as close as possible.

2. For dual left turn lanes (which shall have a protected movement), the left turn signal shall line up with the line between the 2 left turn lanes as close as possible.

3. Through movement signal indications shall align as follows:

- 1 travel lane – the center of the lane.
- 2 travel lanes – the lane line in-between the 2 lanes
- 3 or more travel lanes – 1 signal indication shall be provided on each lane line between through lanes.

4. For one through lane with permissive left turn, the MAS signal shall line up as close as possible with the center of the through lane. Far left permissive signal indications shall not be used.

5. When a 4 section MAS (MAS-4C) signal is used, it shall line up with:

- The lane line between the through and the left turn, or
- The lane line between dual left turn lanes at a "T" intersection, or
- The center of a single left turn lane at a "T" intersection, or
- The center of a split phase shared through/left turn lane at a "T" intersection.

Typical indications are as follows:

1. For protected left turn movements: one 3-section all arrow MAT and one 3-section all arrow far left side pole-mounted signal.

2. For through movements (with protected left turns): one 3-section MAS, one 3-section far right side pole-mounted signal, and one 3-section near right side or top pole-mounted signal.

3. For through movements (with permissive left turns): one 3-section MAS, one 3-section far right side pole-mounted signal, and one 3-section near right side pole-mounted signal. Far left permissive signal indications shall not be used.

4. For split phased situations: one 4-section MAS (MAS-4C w/GA), one 3-section far left side pole-mounted signal (all Arrow), one 3-section far right side pole-mounted signal, and one 3-section near right side pole-mounted signal.

5. For right turn arrow overlap situations: same as above except the far right side and near right side pole-mounted signals shall be 5-section with green and yellow arrows. Right turn arrow

overlaps shall not be provided without prior approval of the City Engineer. Where right turn arrow overlaps are provided, the conflicting U-turn shall be prohibited via signage.

86-4.01B SIGNAL SECTIONS
All signal sections shall be 12 inch mold-cast aluminum.

86-4.02 LIGHT EMITTING DIODE SIGNAL AND PEDESTRIAN MODULE
All vehicle and pedestrian displays shall be supplied with LED countdown signal lamps. Manufacture date of installed LED's must be newer than one (1) year old. Contact the City Traffic Section for an approved list of vendors and model numbers.

86-4.04 BACKPLATES
All vehicle signal sections shall include aluminum backplates with perforated louvers.

86-4.05 PROGRAMMED VISIBILITY VEHICLE SIGNAL FACES (PV DISPLAY)
All programming of the optic display shall be done in accordance with the manufacturer and the City Engineers' specifications. Programmed visibility heads shall not be used without prior approval from the Engineer and shall be LED type.

86-4.05B FRONT SCREEN
The front screen shall be plastic.

86-4.06 PEDESTRIAN SIGNAL FACES
Pedestrian signals shall be aluminum Type "A" with international symbols.

Pedestrian heads shall be mounted on the intersection side of the signal pole unless otherwise directed by the Engineer.

Pedestrian head indications shall be 9 inch LED countdown type. Contact the City for approved vendors and models.

86-4.08 SIGNAL MOUNTING ASSEMBLIES
Terminal compartments (TV & SV), mast arm slip fitters (MAS & MAT), and pedestrian clam shell mounts shall be bronze.

Signal mast arm mounted 4-section displays shall be type MAS-4C.

Extra support shall be incorporated whenever the following conditions arise:

1. The use of a SV-3-TA or SV-3-TB display.

2. If any display on a side mount is larger than a 3-section 12 inch display.

The extra support method shall consist of a 1 inch standoff w/ ¼ X 20 threaded hole. The stand-off shall be banded to the signal standard, 3 inch below the bottom of the top slip fitting of the displays' 1½ inch riser. A ¼ inch hole shall be drilled in the center of the 1½ inch riser to match the position of the thread hole on the stand-off. The riser shall be attached to the standoff with a ¼ X 20 bolt, which shall include a lock washer and flat washer.

All signal display mounting assembly top members shall be watertight. The watertight sealing method shall be a ½ inch thick layer of clear silicone around the top jointing member of all displays. Additional sealant shall be installed in the same manner on all plugs installed in the top of any signal display. Rubber washers used for water-sealing the top assembly shall not be permitted on any display framework or MAT mounting even if supplied by the manufacturer.

All MAT mounted signal displays shall have only 1 serrated washer Installed between the lock nut and the display.

All MAT and MAS mounts shall be sealed with approved clear silicone around the tenon attachment area, including the through bolt and tenon openings.

The sealant shall be 35 year rated. There shall be no substitution for the silicone sealant.

Where no vehicle or pedestrian displays are to be installed on the side of a signal pole, a terminal compartment only shall be installed on the signal pole at the vehicle display position. All signal display wiring from the signal mast arm shall terminate at this location.

Pedestrian head mounts shall be clam shell type with bronze mounting hardware. Mounting shall include 1 Allen head screw for opening and all wiring shall be quick connect type (plug in).

86-5.01A(4) VEHICLE DETECTORS CONSTRUCTION MATERIALS

The first front call loops shall be Type D or a "Quadra Circle". All other vehicle loops shall be type A. Refer to detail's TS-9 and TS-10 for further information. The loops nearest the stop bar shall be placed 1 foot from the stop bar. Where a loop is designated to have counting ability as discussed above, the loop shall not share an input with any other loop. Loop wire shall terminate in the nearest pull box and not the handhole.

Vehicle loop wire shall be Caltrans Type 1 or Type 2.

All loops placed in concrete shall be City approved performed loops (See City approved equipment list).

Bicycle detection loops shall be Type D modified as follows:

- The loop size shall be decreased such that it is 1 foot narrower than the bike lane. A 6 foot bike lane shall have a 5 x 5 foot loop, a 5 foot bike lane shall have a 4 x 4 foot loop, etc.

- The loop shall be centered in the lane.
- The front of the loop shall be 6 inches back of the stop bar.
- Each bicycle loop shall have its own detector lead-in cable and shall be spliced in the pull box not the handhole.
- Each loop shall consist of 5 turns of 14 AWG with XLLP insulation.

Lead-in cable shall be Caltrans Type B. Lead-in cable shall not be spliced between the termination point (pull box adjacent to the detector loop) and the controller cabinet terminals. A spare DLC shall be pulled to each advance loop pull box with 20 feet of slack. For intersections that have a fourth crossing conduit, an additional spare DLC must be pulled through the long side and terminated in the advanced pull box. All spare DLC's must be un-spliced and marked in each pull box with a 5 inch green band labeled "LOCATE".

At grade detector hand holes shall be G5 w/ lockable lids (unless otherwise noted). Below grade detector hand holes shall use Type B (unless otherwise noted). Hand holes shall be placed so they line up with roadway stripes to minimize the frequency of vehicle tires driving over the handhole covers. A sufficient number of handholes shall be placed so that detector loop saw cuts shall not cross adjacent lanes of travel.

Traffic signal detectors must remain operational at all times unless approved by the City Engineer. Damaged detectors must be **replaced within 24 hours**. The contractor may use temporary detection including temporary loops, tape down loops, video detection, and microwave detection should the signal loop replacement need to be delayed more than 24 hours.

86-5.01A (5) VEHICLE DETECTORS INSTALLATION DETAILS

The Engineer, prior to saw cutting, shall verify all loop locations. The contractor shall give 48 hour notice prior to loop verification. Debris from saw-cutting operations shall be recovered immediately and disposed of properly. At no time can debris from saw-cutting operations enter the storm drain system.

Signal loops installed in new asphalt concrete (AC) shall be placed in the lift of AC immediately below the final lift. The new bottom lift of AC shall be a minimum of 3 inches thick (5 feet back of advance loop) where the traffic signal loops will be installed. New loops that will be buried under AC shall be installed with a saw cut depth as required to maintain a minimum of 1/2" coverage of loop sealant. Loops installed in the top lift will be saw cut to a depth required to maintain 1" of sealant coverage. Loops installed in existing pavement where existing loops are surface cut on that same approach may also be surface cut per the State of California Standard Plans unless otherwise directed by the Engineer. Vehicle loops shall have four (4) turns of wire in the slot. Bicycle loops shall have five (5) turns.

Signal loops installed in new concrete pavement shall be placed immediately below the concrete per Section 6-2 of the Design Standards.

Signal loops shall be protected from damage before and during pavement placement.

Existing buried loops damaged by construction shall be reinstalled as if in new pavement per the above paragraph. The contractor shall grind a minimum of 1 ½ inches of asphalt concrete from lane line to lane line and at least 1 foot outside the limits of work required to install the entire loop wire. The loops shall then be covered by an asphalt concrete overlay per City Standards. Should the AC thickness be insufficient to install the loops as specified above, the contractor shall complete any additional grinding, excavating, or paving necessary to install the loops. For concrete pavement, the entire panel, from joint line to joint line, shall be removed and replaced as specified elsewhere in the City Design Standards with the loops installed as described above.

New loops installed in existing pavement with a Pavement Quality Index (PQI) of 85 or greater shall be installed as if in new pavement per the above paragraphs unless the roadway was recently resurfaced.

New loops installed in existing pavement with a Pavement Quality Index of 85 or greater and resurfaced within the past three years, shall be surface cut per the State of California Standard Plans. In addition, the pavement shall be resurfaced with the resurfacing material used in the previous resurfacing project or as otherwise approved by the City Engineer.

Loop wires shall be labeled in the following manner:

- lane 1-black
- lane 2-red
- lane 3-blue
- lane 4-white
- lane 5 –yellow
- right turn lane – orange
- bike lane – brown

Labels shall consist of banded colored tape visible in the pull boxes, where the loop wire is spliced to the detector lead-in cable.

Loop detectors shall be clearly marked to reference their location in relation to the limit line and lane. The loop closest to the crosswalk in the left most lane shall be labeled as loop number 1-1. The second loop in the same lane shall be labeled 1-2, and so on. Refer to details TS-9 and TS-10 for further information.

The start and end leads of a loop detector shall be clearly marked by a means of plastic tie wrap labels.

Loop Home Run slots shall be double cut to accommodate the twisted pair (3-turns/foot), or as directed by the Engineer. Sealant for filling slots shall be Hot Melt Rubberized Asphaltic Sealant or equivalent as approved by the Engineer. All excess sealant shall be squeegeed off after application if under the top lift. If surface cut lift, must be neatly applied (not squeegeed).

During loop installation, the Contractor shall in the presence of Signal Technician, perform a high resistance test and an inductive reactance test. The Contractor shall notify the Engineer at least 48 hour prior to loop installation.

All wires for each detector loop shall terminate in the nearest pull box, not the hand hole.

Lead-in cables shall not be spliced between the termination point (the pull box adjacent to loop detectors) and the controller cabinet terminals.

Where the approved plans call for preformed detector loops, the following shall apply:

1. The conduit shall be sealed to prevent the entrance of water and the movement of wires within the conduit.

2. The loop wires from the preformed loop to the adjacent pull box or hand hole shall be twisted together into a pair (at least three (3) turns per foot) and encased in Schedule 40 or Schedule 80 PVC or polypropylene conduit (3/8 inches minimum diameter). The lead-in conduit shall be sealed to prevent the entrance of water at the pull box and handhole end.

3. The preformed loop and lead-in conduits shall be placed prior to placing final concrete. In new roadways, the top of the conduit shall be placed flush with the top of the base course. For other roadways, the top of the conduit shall be between 2 and 3 inches below top of finished surface. Where the concrete is steel reinforced, the preformed loops may rest on the steel.

4. All detector loop shields shall be left 6” inches in length and wrapped around the DLC and secured.

Typical vehicle detector layout and inputs shall be as follows (see details TS-9 and TS-10):

1. For permissive or protected left turn situations, the left turn lane shall have four loops with the first and second loops spaced 8 feet apart, the second and third loops spaced 9 feet apart, and the third and fourth loops spaced 10 feet apart. The fourth loop shall have counting ability. The other three loops can share one input.

2. Each through lane shall have two call loops spaced 8 feet apart with one count loop spaced 9 feet behind the second call loop and 1 advanced loop placed per the CAMUTCD.

3. Each right turn only lane shall have one loop placed 30 feet behind the stop bar in line with the through lane count loops. The loop shall be used for counting and may be used for detection following a 10 second minimum delay.

4. For the stem of a "tee" intersection, each left turn lane shall have four loops with the first and second loops spaced 8 feet apart, the second and third loops spaced 9 feet apart, and the third and fourth loops spaced 10 feet apart. The fourth loop shall have counting ability. The other three loops can share one input. No intermediate or advanced loops will be required on “tee” stems.

5. For split phase signals with a shared through/left turn lane, the shared lane shall have four loops with the first and second loops spaced 8 feet apart, the second and third loops spaced 9 feet apart, and the third and fourth loops spaced 10 feet apart. The fourth loop shall have counting ability. There shall also be one advanced loop placed per the CMUTCD.

6. All loops shall have 4 wraps.

86-5.01E DETECTOR LOOP CIRCUITRY

All loops shall be wound in a clockwise rotation. Adjacent loops on the same sensor unit channel shall be sliced to the DLC in an alternating pattern so that the electrical loops will alternate in a clockwise, counterclockwise pattern. The loop at the limit line, closest to the center median (lane 1), shall be spliced in a clockwise direction. The next loop back in the same lane shall be spliced in a counter-clockwise direction and so on. The loop detector in lane 2 closest to the limit line, shall be spliced in a counterclockwise direction.

86-5.02 PEDESTRIAN PUSH BUTTON ASSEMBLIES

Pedestrian push buttons shall be aluminum Type “B” with metal international symbol signs. Push buttons shall meet all Americans with Disabilities Act guidelines and be placed 36 inches above the grade of the closest edge of sidewalk and meet reach requirements per section 308.3 Side Reach of the 2010 ADA Standards for Accessible Design (https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf). Buttons shall be solid state, 2 tone audible, momentary LED type. Contact the City for approved vendors and models. The Contractor shall provide a City approved wave file.

Pedestrian push buttons shall be within 5 feet from the edge of the access ramp pan (CAMUTCD Figure 4E-2).

86-6.01 HIGH PRESSURE SODIUM LUMINAIRES

All traffic signal luminaires shall be 400 watt equivalent LED unless directed otherwise by the City. See the City’s website for a list of approved equipment. 2 separate 120 volt circuits shall be provided to equally split the powerload.

86-6.065 INTERNALLY ILLUMINATED STREET NAME SIGNS

Internally illuminated street name signs shall be slim profile, LED with City logo. Contact the City for approved vendors and models. Sign proofs must be approved by the City prior to ordering equipment.

Internally Illuminated Street Name Signs (IISNS) shall require a City Traffic Engineering accepted stamp for all layout proof matching existing City LED IISNS’s prior to ordering. Only

products with prior approval from the City shall be allowed.

1. Refer to City of Roseville Construction Standards Section 56 "Signs".

2. Internally Illuminated Street Name Signs (IISNS)

a. All proof require a City approved layout matching existing City LED IISNS's prior to ordering.

b. IISNS name panels shall be manufactured as follows:

i. Sign panel material shall be clear (not opaque) poly. Thickness of the panel shall be 3.5 mm/6.0 mm maximum.

ii. Sign panels background sheeting shall be: 3M DG3 (Diamond Grade) series 4090. Color (White).

iii. Etched sheeting (Street name and City of Roseville logo) shall be 3M EC 1177c material. Color (Green).

iv. Manufacture shall warranty, no chemical reaction, shall be exhibited between the background sheeting and etched sheeting components.

v. The IISNS shall be double sided with street names on both sides.

86-6.07 PHOTOELECTRIC CONTROLS

Photoelectric controls shall be Type II and pole top mounted.

The Contractor shall supply all equipment, supplies, and material required for mounting the photoelectric cell.

86-6.07B (4) WIRING

Wiring from the photoelectric cell assembly to the electrical service shall be # 14. Wire color for the PEU shall be as follows: black for ungrounded conductor, red for ungrounded switch-leg conductor, and white for grounded conductor.

86-7.01 REMOVING ELECTRICAL EQUIPMENT

All existing traffic control devices, lighting devices, signs, and equipment to be removed and not reused in the work shall be salvaged, unless otherwise specified or directed by the City Engineer. Salvageable equipment shall remain the property of the City. Equipment determined to be unsalvageable by the City Engineer shall become the property of the Contractor. The Contractor shall deliver salvaged equipment to the City's Corporation Yard located at 2005 Hilltop Circle, Roseville, following at least 48 hours advance notice of delivery.

Damaged conduits deemed to not be reusable shall be removed from existing pull boxes and ends plugged solid with grout. Existing conductors shall be removed from said conduits prior to plugging. Contractor shall dispose of said conductors.

Abandoned conduits deemed reusable shall have the line blown out, existing conductors shall be removed, a number 10 green locate wire shall be installed, and the ends of the conduits shall be sealed.

SECTION 91: SANITARY SEWER SYSTEM CONSTRUCTION

91-1 GENERAL

Sewer pipe and fittings shall be installed in accordance with the requirements of these Construction Standards and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times.

91-2 CONNECTION TO EXISTING FACILITIES

Connection to existing City sewer facilities may be made upon approval of the Environmental Utilities Department.

A. The Environmental Utilities Department has the option of making any system tap as required on the plans. Should the Environmental Utilities Department elect to perform the tap, the Contractor shall pay for such work on a time and materials reimbursement basis. The Contractor shall be responsible for the following task associated with the tap, and as determined by the Environmental Utilities Department:

1. Coordinating the work requested with the Sewer Division and the Development Services Inspector. This shall include discussions on provisions for materials and equipment required to complete the work.

2. Providing traffic control per the City's Public Works Department requirements.

3. Excavating the work area, as agreed upon by the Environmental Utilities Department.

4. Providing sheeting, shoring, and bracing as required.

5. Providing lighting as required if the tap is to be performed at night.

6. Backfilling, compacting, and pavement restoration of the excavation(s) upon tap completion.

B. **Existing Sewer Stubs**: The contractor shall excavate and connect to an existing sewer stub in the presence of the Development Services Inspector. Existing stubs shall be air tested by contractor and CCTV'd by Environmental Utilities before connecting. If an existing stub is found damaged or otherwise exceeding tolerances, the contractor shall remove and replace prior to connecting. Contractor shall incur all expenses. A note to this effect shall be placed on the improvement plans.

C. **Sewer System Outfalls**: Sewer system outfalls shall be mechanically plugged and grouted. The plug shall remain in place until final acceptance by the Environmental Utilities Department.

91-3 CONSTRUCTION STAKING

The sewer main shall be staked prior to installation. Such staking shall provide the station and offset to the sewer main, as well as the cut to the nearest 0.10 foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections and every 25 feet in curved sections, and every 10 feet in approved vertical curve sections.

91-4 EARTHWORK

Earthwork required to construct sewer facilities and appurtenances shall be performed to the lines and grades shown on the approved project plans and as specified in the following:

A. Excavations: Pipeline excavations shall be open-cut trenches, unless otherwise specified on the approved improvement plans, with vertical sides to the pipe crown as specified on Construction Standard Detail SS-1. Excavations shall conform to all applicable Federal and State safety requirements. The contractor shall appoint a designated "competent person" to be present during construction.

B. Trench Width: The trench bottom width to 6 inches above top of pipe shall comply with Construction Standard Detail SS-1 or as approved by the Environmental Utilities Department.

C. Compaction: Compaction of the trench shall conform to Construction Standard Detail SS-1. Compaction test results shall be supplied to the Development Services Inspector/ Environmental Utilities Department upon request. Jetting of trenches is not allowed.

D. Weather: During inclement weather, trenches shall be excavated only as far as pipe can be laid and backfilled during the course of the day.

E. Existing Roadways: Trenching in existing roadways shall be limited to the length of pipe that can be laid that day. No open trenches shall be left overnight. Exposed trenches shall be plated or backfilled as approved by the Development Services Inspector/Development Services Department.

F. Excess Material: Excess material and materials determined unsuitable for backfill by the Development Services Inspector shall be removed from the project site.

91-5 DEWATERING

Dewatering for the installation of structure and pipelines shall commence when groundwater is first encountered and shall be continuous until the excavation is backfilled. Best Management Practices, including but not limited to scouring and erosion measures, shall be used to eliminate sediment-laden discharges in accordance with the approved SWPP.

91-6 PIPE BEDDING

Conform to Construction Standard Detail SS-1 and the following:

A. Bedding shall provide uniform and continuous support along the barrel of the pipe. The minimum depth of bedding material shall be provided under the bell. Blocking of the pipe is not permitted.

B. Loose material shall be removed from the trench bottom and replaced with imported material.

C. Where rocky, unyielding or unsuitable foundation material is encountered, the subgrade shall be over-excavated a minimum of 4 inches and replaced with imported bedding material.

D. Where the trench bottom is soft, yielding or unstable, the trench bottom shall be over-excavated and ¾-inch crushed rock shall be placed in the trench to provide a stable foundation, to the satisfaction of the Development Services Inspector. The rock is in addition to the required pipe bedding used in the pipe zone.

E. Where a saturated trench condition is encountered, the trench wall and pipe shall be lined with a geotextile fabric as shown on Construction Standard Detail SS-1, and to the satisfaction of the Development Services Inspector.

F. Bell holes shall be excavated per the manufacturer's recommendations. The minimum depth of bedding material shall be provided under the bell. Care shall be taken to ensure that the bell hole is no larger than necessary to accomplish proper joint assembly.

91-7 CONCRETE CRADLES, ARCHES & ENCASEMENTS AND TRENCH DAMS

Concrete cradles, arches and encasements and trench dams shall conform to the Construction Standard Details W-23, W-24, and the following:

A. Concrete shall conform to the requirements of the construction standards.

B. The pipe shall be placed in proper position on temporary cradles or arches consisting of concrete block or bricks. When necessary, the pipe shall be rigidly anchored or weighted to prevent flotation when the concrete is placed.

C. Cradles and arches shall be constructed with an ability to adjust the pipe to proper grade in order to avoid vertical joint pull. Cradles and arches shall be placed at 1/3 and ½ way points along each pipe segment where specified. Concrete placed beneath the pipe shall be sufficiently workable to fill the voids without excessive vibration. The concrete shall be allowed to cure and remain undisturbed for a minimum of 24 hours prior to backfill and compaction of the trench.

D. Restrained pipe within casings, bridges, shall be fully extended or "stretched out" to remove the slack between the joints the entire length of the structure.

E. Water shall not be permitted to enter, seep, or run onto the concrete while curing.

F. Trench dams shall be constructed of controlled density fill or clay as shown on the drawings or as directed by the Development Services Inspector. Trench dam excavations shall be made into native earthen materials to the dimensions shown on the drawings or as directed by the Development Services Inspector. Clay materials shall be moisture conditioned to near-optimum moisture content prior to placement in the excavation and compacted to the required relative compaction.

91-8 PIPE ZONE BACKFILL

Pipe zone backfill shall conform to Construction Standard Detail SS-1 and the following:

A. Extreme care shall be taken when consolidating the backfill around the pipe zone. For pipe 12 inches in diameter and smaller, no more than ½ of the pipe shall be covered prior to shovel slicing the haunches of the pipe. For pipe greater than 12 inches in diameter, no more than 6 inches shall be covered prior to shovel slicing. Shovel slicing shall be witnessed by the Development Services Inspector prior to shading the pipe.

B. Compaction equipment shall not make direct contact with the pipe.

C. Where the pipe is to be installed below historic groundwater levels or where the trench is subject to inundation, crushed rock material shall be placed to the crown of the pipe. Additionally, woven geotextile fabric Mirafi® 600x or approved equal shall be installed per Construction Standard Detail SS-1.

91-9 PIPE INSTALLATION

The sewer system outfall(s) shall be mechanically plugged and grouted, and shall remain plugged until final acceptance. Sewer pipe (gravity and pressure) shall be installed in accordance with the following provisions:

A. The Contractor shall keep the pipe interior free from foreign materials and in a clean and sanitary condition until acceptance by the City. At times when pipe-laying is not in progress, the open pipe end shall be sealed with a tight cap or plug to prevent foreign matter from entering the pipe. Provisions shall apply to the break times as well as overnight.

1. Trenches shall be in a reasonably dry condition when pipe is laid.

2. Care shall be taken, when lowering pipe into the trench, to protect the pipe from damage. Chains are not permitted. The pipe shall be laid carefully to the lines and grades shown without grade breaks, unless designed with such, or to minimum depths shown on the approved plans. If field conditions exist such that the pipe may not be laid to the specified grade, the approved plans will require revisions prior to proceeding with construction.

3. Pipe sections shall be closely jointed to form a smooth flowline. Care shall be taken in placing the pipe and making field joints.

4. Improvements installed without proper inspection shall be exposed and inspected as required by the Development Services Inspector.

5. All installations shall follow manufacturer's recommendations unless otherwise noted on the approved plans. The manufacturer's installation guide shall be on the job site at all times.

6. A 12 inch wide metallic backfill tape with the warning "BURIED SEWER MAIN" shall be placed in the trench lines of all mains and services, within 12 to 24 inches of the subgrade or finish grade (outside of aggregate base).

7. Mains in unpaved areas shall be marked every 125 lineal feet with a green composite utility marker having a decal stating "CAUTION BURIED SEWER PIPELINE". Appurtenances (such as manholes, valves, ARV's, test stations, etc.) and angle points shall also be marked. Mains in landscaped areas shall be delineated with a brass marker set in an 8 inch diameter concrete cylinder.

B. Vitrified Clay Pipe (VCP) Installation: Pipe-laying shall proceed upgrade with the bell end of the pipe placed upstream, and shall follow manufacturer's guidelines for installation.

C. Gravity Ductile Iron Pipe (DIP) Installation: DIP for gravity sewer applications shall have an interior coating with "Permashield 431" (or approved equal) unless otherwise specified on the approved plans. The pipe bedding and shading shall be ½ inch or ¾ inch crushed rock. DIP sewer systems shall be constructed per the manufacture's recommendations and the following:

1. Gravity Installations: Transitions from DIP to VCP pipes shall be in accordance with Section 91-9.K of these specifications.

2. Force Main Installations: The force main shall be constructed and tested in accordance with the water pressure pipe standards established in Section 81, Domestic Water Supply System Construction, of these Construction Standards, with the following deviations:

a) The force main will not require disinfecting or water quality testing. The main shall be pre-flushed again with a properly sized "pig" after the pressure test. Flushing shall occur in the presence of a Development Services Inspector.

b) Backfill tape shall be 12 inch wide green plastic stating "BURIED FORCE SEWER MAIN".

c) Exothermic welds shall be made on the bell of the pipe as near to the edge as possible and on the weld pads provided on the spigot end of the pipe. Exothermic welds shall

conform to Section 81, Domestic Water Supply System Construction, of these Construction Standards.

d) When it is necessary to cut a "Permashield 431" treated pipe, the City's Wastewater Division shall make all repairs prior to installation. Coordinate through the Development Services Inspector.

e) All DIP fittings for wastewater use shall have an interior coating with "Permashield-431" Or approved equal.

f) Tracing wire shall be installed per Section 81, Domestic Water Supply System Construction, of these Standards. Above ground access to the tracing wire shall not exceed 500 linear feet along the main. Access shall be provided by raising and securing the tracing wire through a conduit into a valve box. This location shall be 2 feet minimum from back of walk and marked per standards.

D. Transitions between VCP and DIP: When specified on the approved Improvements Plans, transitions between VCP and DIP shall be made using one of the following two methods:

1. Manufactured "speed-seal" gasketed DIP spigot. The transition fitting shall be manufactured by Gladding McBean. The Contractor shall incur all expenses.

2. At a manhole, if a pre-cast manhole is to be used, a manufactured transition shall be used. If a cast-in-place manhole is used, a flex joint is not required.

E. Boring: Borings for installation of sewer lines shall be made per Detail W-22 and as follows:

1. The equipment, method and sequence of operation and casing pipe grades shall be approved by the Environmental Utilities Department. A minimum of 48 hours notice shall be given prior to the start of work. Excavation for the boring operation shall be the minimum necessary to satisfactorily complete the work. Bracing and shoring shall be adequate to protect workers and any adjacent structure or roadbed.

2. Casing: Welded steel casing pipe shall have a minimum wall thickness of a ¼ inch for pipe 24 inches in diameter and smaller and 5/16 inch for pipe 27 inches through 36 inches in diameter. Casing material larger than 36 inches shall be engineered on a case by case basis.

3. Installation of Casing: The casing shall closely follow the boring operation. The bored hole shall not be more than 0.10 of a foot larger in diameter than the outside diameter of the conductor. Guide rails shall be accurately set to line and grade to insure installation of the casing within allowable limits. The casing diameter shall be sufficient to allow

adjustment of line and grade of the conducted pipe to meet allowable tolerances and to allow sand to be placed between the conductor and the conducted pipe.

The inside diameter of the casing shall be a minimum of 10 inches larger than the outside diameter of the conducted pipe bell or joint, as approved by the Environmental Utilities Department. A minimum of 4 inches clearance shall be required between the conducted pipe and the casing, taking the skids into consideration.

4. **Placing Pipe in Casing**: Conducted pipe shall be fully restrained ductile iron with Permashield 431 interior coating, supported by a minimum of 3 sets of Calpico or equal synthetic skids per stick of pipe, or as required by the Environmental Utilities Department. Pipe sections shall be joined outside of the casing. The skids and casing entrance shall be lubricated prior to sliding the conducted pipe into place. The height of the skids may be adjusted to meet specified grades.

   The space between the conducted pipe and casing shall be completely filled with clean, dry silica sand, blown into place. Both ends of the casing shall be plugged with non-shrink grout a minimum of 12 inches into the casing. Both ends shall have a pipe of sufficient diameter placed through the mortar plug and parallel with the conducted pipe. 1 pipe shall be used for blowing the sand into the annular space. The other pipe shall remain open for venting. Prior to starting, the method of placing sand in the void shall be approved by the Environmental Utilities Department.

5. **Backfill of Voids**: When, in the opinion of the Developer's design engineer or geotechnical engineer, the nature of the soil indicated the likelihood of ground loss which would result in a greater space between the outer surface of the casing than allowed, the Contractor shall take immediate steps to prevent such occurrences by installing a jacking head extending at least 18 inches from the leading edge of the casing.

   The jacking head shall cover the upper 2/3 of the casing and project not more than ½ inch beyond the casing outer surface. Excavation shall not be made in advance of the jacking head. Voids greater than allowable shall be filled with sand, soil cement, grout, or as approved by the Environmental Utilities Department. Where voids are suspected, the Developer's design or geotechnical engineer may direct the Contractor to drill the casing, to pressure inject grout to refusal and repair the drilled hole. Grouting pressure shall not exceed 50 pounds per square inch at the nozzle.

6. Utilizing the City's drainage system for residual discharge from boring operations without the required measures is prohibited. This discharge is a violation of the City's Stormwater Ordinance and the Clean Water Act. Discharge fluid shall be recovered, contained and discharges at an appropriate location, or if the situation allows, fluid may be discarded into an open area with the pre-written approval of the property owner and approval from the Regional Water Quality Control Board (RWQCB) provided it meets RWQCB requirements and does not impact sensitive areas such as wetlands, creeks or other natural water conveyances.

All street boring shall include adequate measures to mitigate sediment-laden water discharge. An acceptable measure is pumping the discharge fluid into a tanker and hauling it away. Other measures suggested by the Contractor will be considered by the City. The City stormwater or Development Services Inspector shall inspect and monitor the discharge recovery, containment, and restoration process.

91-10 MANHOLE INSTALLATION

Manholes shall be installed in accordance with the Construction Standard Details and as specified herein:

A. Manholes shall be set flush with finish grade, unless otherwise noted on the approved plans.

B. Manholes placed in off-site, unimproved areas shall be constructed with the top of the casting cover a minimum of 1 foot above the final surrounding grade. A minimum 12 inch wide concrete collar with a #4 rebar ring shall be constructed around the casting and centered in collar.

C. Manholes placed in landscape areas adjacent to City improvements shall be constructed with the top of the casting cover a minimum of 6 inches above the final surrounding grade. A minimum 12 inch wide concrete collar with a #4 rebar ring shall be constructed around the casting and 6 inches below finish grade.

D. VCP pipe entering a sewer manhole shall have a flex joint at the manhole base. A flex joint consists of a bell and spigot joint at the manhole with only bell ends cast into the manhole base, and a second bell and spigot joint located 12 to 24 inches outside of the manhole. Service "Y's" shall not be installed directly onto a manhole.

E. Manhole lids and castings for 48 inch diameter barrels shall be 24 inch diameter. Manhole lids and castings for 60 inch barrels shall be 36 inch diameter. Lid shall be bolt-down type with 2 cast-in-place bars and a gas detector probe hole, and have no poke holes. Lids shall be bolted when a manhole is constructed outside a paved area, as specified on the approved plans, or as directed by the Development Services Inspector. Manholes constructed outside of paved area shall use a GMI composite lid and frame. All manhole openings 36 inches or larger shall use a GMI composite lid and frame.

F. Sewer mains or services entering an existing manhole shall be core drilled, without exception. The space between the pipe and the manhole shall be filled with non-shrink grout.

G. Any work on an existing sewer manhole shall require the manhole to pass a vacuum test as described in section 91-13 of these Construction Standards. The work completed shall remain exposed until the vacuum test has been accepted by the Development Services Inspector.

H. Concrete manhole bases may be either pre-cast or cast-in-place. Pre-cast bases shall conform to section 91-16 of these Construction Standards.

This section covers all the work necessary to complete the installation of a cast in place manhole base, comprising cast-in-place concrete manhole base slab and wall.

1. Concrete
   Cement shall be ASTM C-150, Type V Portland cement with proportioning and mix design as follows:

   1. Specified 28-day Compressive Strength: 4000 psi minimum.
   2. Air content: 2% ± 1%.
   3. Slump, after addition of superplasticizer: 8" maximum

Coarse Aggregate Size	Cementitious Content-Pounds Per Cubic Yard	Water-Cement Ratio by Weight
¾"	625 min, 800 max	0.375
1"	600 min, 800 max	0.385
1 ½"	590 min, 800 max	0.400

2. Reinforcing

   a. Bars shall be ASTM A615, Grade 40 for all non-welded bars.
   b. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement. Locate and support reinforcing by chairs, spacers and hangers, as required. Arrange, space, and securely tie bars with16-gage wire to hold reinforcement accurately in position during concrete placement operations.
   c. Place reinforcement to obtain the minimum concrete cover as shown in detail SS-2A.
   d. Reinforcement with bends, kinks or reduced cross section due to excessive rusting or other causes will not be permitted.
   e. Reinforcement around pipe openings shall be in accordance with detail SS-2A.
   f. Provide reinforcement lap splices as noted in detail SS-2A, by placing bars in contact and tying tightly with wire.
   g. Do not place concrete until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.

3. Concrete Placement

   I. General
      a. Place concrete continuously so that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing.

b. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
c. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
d. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
e. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.
f. The forms shall be limited in height to allow visual observation of the concrete and the vibrator operators shall be required to see the concrete being consolidated to ensure good quality workmanship.
g. Unless otherwise approved, place concrete only when ENGINEER is present.

II. Cold Weather Placing:
a. Do not place base slab on frozen soil.
b. Protect all concrete from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
c. When the air temperature has fallen to or may be expected to fall below 40°F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50°F and 70°F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
d. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55°F and not more than 85°F at point of placement.
e. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost and ice before placing concrete.
f. When temperatures are expected to be below 32°F the night before the concrete is placed, then all reinforcing steel, forms and the ground shall be preheated, for a minimum of 12 hours, under a minimum temperature of 50°F.
g. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.

III. Hot Weather Placing:
h. Cool ingredients before mixing to maintain concrete temperature at time of placement below 85°F. No concrete shall be placed if its temperature exceeds 90°F. Mixing water may be chilled or chopped ice may be used. The addition of ice shall not increase the specified water to cement ratio.

i. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
j. Thoroughly wet forms before placing concrete. Forms shall be free of standing water when concrete is placed.
k. Do not use set-control admixtures, unless approved by ENGINEER in mix designs.
l. Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic shrinkage cracking.
m. Obtain ENGINEER'S approval of other methods and materials proposed for use.

4. Execution

a. Construct manhole base slab and stem per dimensions shown in detail SS-2A. Concrete may be poured monolithically or in 2 separate pours with slab and wall with prior approval from City Engineer.
b. The poured manhole base must not be moved until adequate hydration has occurred. The concrete on cast-in-place bases shall cure a minimum of 24 hours before stacking the barrel sections.
c. Excavation at manhole location shall be wide enough to provide working room around manhole. Concrete in the cast-in-place portion shall be placed against a stable subgrade. All loose material shall be removed from the excavation prior to installation. The bedding shall consist of a minimum of 4 inches of compacted ½ inch or ¾ inch crushed rock, compacted to 95% relative density.
d. Belled pipes set in the manhole base wall shall be set flush with the exterior of the wall. The “speed-seal” on the spigot end shall be cut off prior to setting.
e. Unless specified on the approved plans, there shall be a 0.10-foot drop constructed across the manhole base. U channel can pour monolithically with the base or hand placed per City's approval. Install PVC or hydrophilic water stop as shown in detail around the base, if slab and stem for base is constructed in separate pours.
f. The top of the base shall be formed to accept the first barrel section. Wet setting is not permitted. Ram neck shall be installed on this first joint after the Environmental Utilities Department inspector has approved the manhole base for stacking.
g. Flow through manholes shall have the pipe laid continuously as a whole pipe with flex joints and a minimum 0.10-foot drop, or as approved. After the initial 24-hour curing period, the top half of the pipe shall be carefully cut off without cracking the bottom. The sides shall be mortared smooth.
h. Backfill shall be placed in layers of not more than 12 loose measure inches and mechanically tamped. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the manhole structure.

5. Final Testing and Approval
    a. Acceptance: Manholes will be accepted with relation to the vacuum test requirements in section 91-12 E of this document.
    b. No repairs shall be allowed for manhole base with cracks, holes or other defective concrete in areas of potential leakage. Any manhole base which fails the initial test will be rejected and must be replaced prior to backfilling.

I. Adjusting Manholes: The manhole neck and frame shall be adjusted to grade. Use of metal grade rings is not permitted. The finished manhole shall conform to Construction Standard Detail SS-2, or as approved by the Environmental Utilities Department.

J. Frame and Lid: The manhole frame and lid shall be sealed with an approved rubber gasket. Manholes constructed in streets shall have the lid bolt holes filled with silicone (91-16,F.10). Manholes constructed outside of the street or paved area shall be bolted down or closed by other locking mechanism.

K. Manholes Coatings: Approved materials include epoxy or calcium aluminate.

Epoxy Coating: Sewer manholes requiring an epoxy coating shall first pass a vacuum test, per Section 91-12,E.4 of these Construction Standards, and shall then be constructed as follows:

1. The exterior of the manhole shall be coated with an asphaltic material and wrapped in 8 mil polyethylene sheeting (81-16,G.26) prior to backfilling. Use to 10 mil vinyl tape (81-16,G.25) to secure and seal the polyethylene per Section 81 of these standards.

2. All voids and imperfections in the interior of the manhole shall be mortared or "sacked" smooth with a cement paste composed of 50 percent Portland cement and 50 percent sand. The mortar mixture shall be manually worked into the dampened surface with sufficient pressure to completely fill voids and imperfections. The surface shall then be finished smooth.

a. This process shall be continued until the entire manhole surface (base, barrel, cone, neck and joints) is smooth and free of imperfections. Note that it is not required to cover the entire interior surface area of the manhole, only where voids or imperfections exist.

b. Upon receiving the Development Services Inspector's approval of the sacking, the outlet channel(s) of the manhole to be epoxied and the first upstream manhole shall be mechanically plugged to prevent water flow. The newly sacked manhole shall cure for a period of 28 days.

3. The epoxy coating and applicator's certification must be submitted to the Environmental Utilities Department for approval. The approved coating may be applied after the 28 day curing period has ended. An accepted method of epoxy application is as follows:

a. Mask off the metal frame.

b. Sandblast the interior concrete surfaces of the sewer manhole.

c. Apply a sealer/primer approved by Development Services Inspector and allow curing per the manufacturer's recommendations. Application may be withheld if, in the opinion of the Development Services Inspector, the walls of the manhole exceed the recommended moisture content. A visqueen test may be performed to determine the absence of moisture.

d. Apply an approved epoxy to obtain a minimum thickness of 80 mils and allow curing per the manufacturer's recommendations.

e. Verify the thickness and adherence of the coating by coring samples, to the satisfaction of the Development Services Inspector.

f. Repair the sampled areas and allow the repairs to cure.

g. "Spark test" the entire epoxy surface area. The electrode shall provide a minimum of 10,000 volts. Areas failing the spark test shall be removed, repaired and retested.

h. After approval from the Development Services Inspector, remove the masking from the metal frame and use "Sikaflex" (or approved equal) sealant to caulk to transition joint between the epoxy coating and the metal frame.

i. Use "Sikaflex" (or approved equal) sealant at the concrete VCP interface and for all epoxy transitions.

j. Remove the plugs.

Calcium aluminate: Calcium aluminate may be used in lieu of epoxy coating. The manhole shall pass a vacuum test, per section 91-12,E.4 of these Construction Standards. Calcium aluminate shall be SewperCoat by Kerneos Aluminate Technologies or approved equal and shall be installed per manufacture specifications. Whenever Calcium Aluminate is used, the contractor shall immediately TV the sewer line to ensure no grout entered the line during application. Use "Sikaflex" (or approved equal) sealant at the concrete VCP interface and for all epoxy transitions.

91-11 SERVICE INSTALLATION

Sewer services shall be installed in accordance with Construction Standard Details SS-4 and SS-5.

A. Sewer services originating from sewer mains 14 feet in depth or greater shall have the crotch on the VCP "Y" fitting filled with concrete.

91-12 TESTING OF INSTALLED IMPROVEMENTS

Sewer mains, services, manholes and appurtenances shall be tested by the following procedures:

A. Sewer Mains and Services: Public and private sewer mains and services shall be air-tested per ASTM C828 by the Contractor and the Environmental Utilities Department shall provide closed circuit TV inspection, after installation of the joint trench utility crossings and subgrade elevations have been met. Additionally, pipeline segments beneath road bases to be lime-treated shall be tested before and after the lime treatment process.

B. Air Pressure Test: Sewer mains and laterals shall be pressure tested in accordance with the National Clay Pipe Institute recommended guidelines with the following amendment:

1. Minimum test time shall be 60 seconds.

2. For mains installed in an area where the water table is higher than the pipe, the test pressure shall be increased 0.5 PSI per foot of water over the pipe.

3. The test gauge shall be liquid-filled, capable of testing up to 15 PSI, and graduated to 1/10 PSI.

C. TV Inspection: TV inspection of sewer mains and services shall be performed by the Environmental Utilities Department, Wastewater Division. Costs for said inspection shall be borne by the Contractor. Preliminary inspections may be performed by outside contractors, but shall not be accepted by the Environmental Utilities Department as an official record.

1. The sewer system shall be completely cleaned by an approved method prior to TV inspection. The sewer system shall be rejected if any of the following conditions exist:

a. For main lines 12 inches and smaller - standing water or sags greater than ½ inch in depth at acceptance or greater than 1 inch at warranty.

b. For main lines exceeding 12 inches - standing water or sags greater than ¾ of an inch in depth at acceptance and greater than 1 ½ inches at warranty.

c. Standing water in services.

d. Offset joints.

e. Joint separations greater than ½ inch wide.

f. Damaged pipe.

D. Inspection Criteria for Coated Ductile Iron Pipe: All ductile iron sewer will have the following additional inspection requirements:

1. The condition of the barrel section of pipe as well as 360◦ at each joint shall be recorded to a DVD or portable drive. Once completed, and the inspection demonstrates the pipe meets the City's construction standards, the contractor may proceed with the backfill of the trench. The Contractor shall provide the DVD and a map of the section inspected, to the Wastewater Collection Division for review prior to the City's acceptance inspection.

2. Upon finding any deficiency in the pipe which does not meet the design and construction standards of the City of Roseville, it is strongly encouraged that the contractor make the necessary corrections at that time. If deficiencies aren't corrected City forces at time of acceptance CCTV will identify these deficiencies and require the contractor to dig and replace the pipe sections; there will be no exceptions.

3. The observation data on the DVD provided to the City shall include the following:

   a. City wide job number.

   b. Encroachment permit number.

   c. Project name.

   d. Location (street name).

   e. Manhole numbers (based on approved plan set or city asset numbers if applicable).

   f. Direction of inspection (upstream or downstream).

   g. Date of inspection.

4. The speed of travel shall be slow enough to inspect each pipe joint, wye connection, coating integrity, and potential sags. Camera speed should travel at a rate of no more than 30 feet per minute. The camera speed shall be steady and slow enough to record features and defects.

E. Manholes: Sewer manholes shall pass a vacuum test consisting of the following criteria and procedures:

1. The test shall be performed after assembly of the manhole and installation of the pipe entering or exiting the manhole, but prior to backfilling. The Contractor shall perform the test and supply all test equipment. The Development Services Inspector shall witness the test results.

2. Lift holes shall be filled with non-shrink grout prior to testing.

3. Pipe entering and exiting the manhole shall be plugged. The plug shall be places on the flex joint outside of the manhole base. Securely brace the plugs to prevent them from being drawn into the manhole. Unused channels shall be permanently plugged with a plastic or clay stopper.

4. A vacuum of 10 inches of mercury shall be drawn to start the test. The amount of time required for the vacuum to drop to 9 inches shall be measured. The manhole will pass the test if the amount of elapsed time is greater than 60 seconds for a 48 inch manhole, 75 seconds for a 60 inch manhole, 90 seconds for a 72 inch manhole and 120 seconds for an 84 inch manhole. A liquid-filled vacuum gauge shall be used for testing. All detectable leaks shall be repaired with non-shrink grout while the vacuum is drawn. No mortar shall be applied to the inside of the manhole until the vacuum test has passed.

5. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until elapsed times are satisfactory.

6. After passing the vacuum test, all joints shall then be mortared, inside and out. Outside mortared joints shall be allowed to dry 24 hours or as approved by the Development Services Inspector before backfilling.

7. If damage to the manhole is evident any time during the construction, the Development Services Inspector may require repairs to be made on the manhole which will require a new vacuum test prior to acceptance.

F. Topside Improvements: When all water, recycled water and sewer infrastructures have passed air, vacuum, pressure and continuity test as well as CCTV inspection the Development Services Inspector will email a notification to internal departments indicating that the project is ready for road bases and top side improvements only. This does not constitute approval for use of the infrastructure.

G. Tying Into the City System: A tie-in procedure shall be submitted and approved by the Environmental Utilities Department prior to the proposed work. The contractor shall allow for up to 7 days for review of the procedures by the Environmental Utilities Department. The sewer system shall be tied into the City system within 10 working days upon completing and passing all the testing procedures. Tie-ins shall be conducted as specified in Section 91-2 of these Construction Standards.

91-13 PUNCHLIST PROCESS

After the sewer manholes have been raised and finished to grade, the sewer system shall have a final ball and flushed in the presence of the Development Services Inspector. The system shall then have a final TV inspection to ensure the entire sewer system is intact for warranty. Final ball and flush can be done by city forces on a time and material basis at the request of the contractor.

When all improvements are complete, the contractor shall provide a written request for a punch list inspection of the improvements. With the assistance and presence of the Contractor, the wastewater facilities punch list shall be generated by the Development Services Inspector and Wastewater Collection Division.

91-14 REPAIRING INSTALLED IMPROVEMENTS

Sewer mains, services, manholes and appurtenances shall be repaired per these Construction Standards and by the following procedures:

A. Repairing Vitrified Clay Pipe

1. Damaged pipe shall be exposed and replaced in-kind by "bridging" the new pipe into place. Coupling devices shall not be used.

2. Sagging or misaligned pipe shall be exposed and corrected in place if possible. If the pipe is defective, then a new pipe shall be bridged in place.

3. After the correction has been completed, the excavation shall be backfilled and compacted to grade as specified. The repairs shall then be retested per section 91-12 of these Construction Standards.

91-15 ABANDONING SEWER STUBS AND SERVICES

In new construction, sewer stubs and services to be abandoned shall be removed to the main or manhole of origination. Abandonment of existing sewer stubs shall be as directed by the Environmental Utilities Director.

91-16 MATERIALS

A. Approved Equal: The words "approved equal" shall mean any material deemed by the Environmental Utilities Department to be acceptable for use within the City's sewer system as compared to products of specified manufacturers. Contractors proposing to use materials which are not specifically named shall submit all necessary documentation to allow review of said material for use as an approved equal.

The submittal shall include a letter with:

1. **Product**: A description of the product and the appropriate materials specification section number. A sample of the product may be required for review and testing.

2. **Contact**: The name and telephone number of the contact person for the proposed product.

3. **Reference**: A list of a minimum of 3 agencies using the proposed product (include names and telephone numbers).

4. **Performance**: Information and reference for 3 locations with a performance record of 3 years in operation of the installation.

5. Address the letter to the Environmental Utilities Department Engineering Division, 2005 Hilltop Circle, Roseville, CA 95747, ATTN: EUD, Chairman of METAC. City staff may request a sample of the product for review.

6. The Contractor shall submit all material for review 35 days prior to contract award. All submittals shall include documentation verifying contract award date. Contractors shall allow 2 to 4 weeks review time by the Environmental Utilities Department.

B. Conditionally Approved Material: Materials or products that have met the reference and performance requirements shall be conditionally approved for a minimum trial period of 2 years. Upon completion of the 2 year period, the product may be approved, the evaluation period may be extended, or the product may be denied approval as determined by the Environmental Utilities Director. A list of conditionally approved products may be obtained from the Environmental Utilities Department.

C. Unapproved Materials: Materials not approved for use on the project shall be removed from the site within 24 hours if requested by the Development Services Inspector.

D. Sewer Main and Services: Unless noted on the approved plans, all gravity pipe shall be Vitrified Clay Pipe Bell and Spigot (VCP), conforming to ASTM C700-C301, C828 Standards manufactured by Gladding McBean or approved equal. The VCP shall be Extra Strength and shall not be dipped in solution or glazed to enhance air pressure tests.

All commercial sewer services shall be VCP up to 5' outside the building footprint.

All force main pressure pipe will be Ductile Iron Pipe (DIP) manufactured by Pacific States Company, US Pipe, Griffin, Electrosteel USA or approved equal. The interior of the DIP shall be coated with Permashield 431, or approved equal, from bell gasket seat to 8 inches of spigot end exterior. The coated DIP shall be manufactured with an exothermic weld (cadweld) plate installed on the spigot end.

E. Manholes: Manholes, frames and covers are to be in accordance with details SS-2 and SS-3. All materials used in cast-in-place concrete or precast concrete shall conform to ASTM C-150 Specifications with Type V cement for sulfate protection.

1. Barrels, Cones, and Lids

a. 48 inch Manhole Material:

- Jensen Precast 36 inch eccentric cone, #CN48E36 or approved equal
- Jensen Precast 30 inch concentric cone, #CN48C30 or approved equal
- Jensen Precast 24 inch concentric cone, #CN48C24 or approved equal
- Jensen Precast 18 inch concentric cone, #CN48C18 or approved equal
- Jensen Precast 12 inch barrel, #BL485812S or approved equal
- Jensen Precast 18 inch barrel, #BL485818 or approved equal
- Jensen Precast 24 inch barrel, #BL485824S or approved equal
- Jensen Precast 36 inch barrel, #BL485836S or approved equal
- Jensen Precast 48 inch barrel, #BL485848S or approved equal
- Armorock

b. 60 inch Manhole Material:

- Jensen Precast 36 inch concentric reducer cone, #CNR603636 or approved equal
- Jensen Precast 48 inch transition slab #TS604812 or approved equal
- Jensen Precast 36 inch barrel, #BL607236 or approved equal
- Jensen Precast flat lid with 24 inch opening, (either eccentric or concentric opening) #FT6024C or #FT6024E ++ or approved equal
- Jensen Precast flat lid with 36 inch opening (either eccentric or concentric opening), #FT6036C or #FT6036E or approved equal
- Armorock

c. 72 inch Manhole Material:

- Jensen Precast 12 inch barrel section, #BL728612 or approved equal
- Jensen Precast 24 inch barrel section, #BL728624 or approved equal
- Jensen Precast 36 inch barrel section, #BL728636 or approved equal
- Jensen Precast flat lid with 24 inch concentrate opening, #FT7224C or approved equal
- Jensen Precast flat lid with 36 inch concentric opening, #FT7236C or approved equal
- Armorock

2. Grade Rings

- Jensen Precast 3 inch grade ring (5 inch walls), #GR243403 or GR304003 or approved equal
- Jensen Precast 6 inch grade ring (5 inch walls), #GR243406 or GR304006 or approved equal
- Jensen Precast 6 inch grade ring (6 inch walls), GR364806 or approved equal
- Jensen Precast 3 inch grade ring (6 inch walls), #GR364803 or approved equal

3. Manhole Frame and Cover

a. For 24 inch Openings: South Bay Foundry, #SBF 1920 RV-S, GMI Composite frame and cover 2600 Series, Saint-Gobian PAM, Rexus – CDRU60EHSEW, D&L Supply - #A-1021 with "sniffer plug" and "O" ring gasket, National Casting Corporation - NC 1021 or approved equal

b. For 36 inch Openings: GMI Composite frame and cover 3800 Series or approved equal due to safety reasons.

4. Precast Bottom

- Jensen Precast 6 inch two way, #MBS4824-2W-6C or approved equal

- Jensen Precast 8 inch two way, #MBS4824-180-8C or approved equal
- Jensen Precast 6 inch 90 degree left, #MBS4824-90L-6C or approved equal
- Jensen Precast 6 inch 90 degree right, #MBS4824-90R-6C or approved equal
- Jensen Precast 8 inch 90 degree left, #MBS4824-90L-8C or approved equal
- Jensen Precast 8 inch 90 degree right, #MBS4824-90R-8C or approved equal
- Jensen Precast 6 inch clay, three way, #MBS4824-3W-6C or approved equal
- Jensen Precast 8 inch clay, three way, #MBS4824-3W-8C or approved equal
- Jensen Precast 6 inch clay, four way, #MBS48245W-4W-6C or approved equal
- Jensen Precast 8 inch clay, four way, #MBS4824-4W-8C or approved equal
- Jensen Precast 6 inch outlet, 4 inch cul-de-sac base, #MBS4824-6W-6CUL or approved equal
- Jensen Precast 8 inch clay outlet, 4 inch cul-de-sac base, #MBS4824-6W8CUL or approved equal
- Jensen Precast 10 inch two way, #MBS4824-2W-10C or approved equal
- Jensen Precast 12 inch two way, #MBS4824-180-12C or approved equal

5. Precast Flat Lid

- Jensen Precast 6 inch lid, 24 inch concentric opening, #FT4824C or approved equal
- Jensen Precast 6 inch lid, 36 inch concentric opening, #FT4836C or approved equal

F. Appurtenances

1. **Air Release Valve**: Crispin UX41 (4”), Crispin UX20 (2”), Crispin Sewer Pressure Air Release Valves Series S or approved equal.

2. **Clay to Concrete Sealant**: SikaFlex or approved equal.

3. **Trench Dam**: Clay or Controlled Density Fill.

4. **Cleanout Caps**: ABS.

5. **Couplings**: For 4 inch lines, use Flex Seal Repair Coupling for ABS cap only, or approved equal. For 4 to 12 inch lines, use Mission Rubber Repair Coupling or approved equal. Couplings may not be used in new construction.

6. **Flange Gaskets**: All flange gaskets to be neoprene rubber or red rubber, USSO Standard B.16.21 insulation flange kits—Calpico Type E full-faced gasket and two-side insulation.

7. **Joint Sealing Compound**: Ram-Nek, Con Seal Compound or approved equal.

8. **Location Stakes**: Carsonite 4 inch x 5 feet CUM 375 with anchor barb kit or approved equal.

   a. Caution stickers attached, #CW-112 and organization identification decal #P101, stating: “CITY OF ROSEVILLE - CALL BEFORE DIGGING (916) 774-5750”.

b. For pressurized sewer mains, use decal #CPS-1977. For gravity sewer mains, use decal # CS-225.

9. **Mortar**: Non-shrink grout during manhole vacuum testing and as specified. Standard mortar mix for all other applications.

10. **Silicone**: 100 percent clear silicone with a 25-year life, or approved equal.

11. **MH Coatings**

- Hydro Pox 204 or approved equal.
- Calcium aluminate

12. **Wastewater Marking Tape**: Terra Tape Extra Stretch 450 Material, detectable, 12 inch wide or approved equal. Non-Detectable for sewer force mains.

13. **Grease Interceptor**: Jensen Precast or approved equal.

14. **Reinforcement Bar**: Rebar shall be grade 60 steel, deformed type. Smooth bar shall not be allowed. All rebar shall be number four (4) unless otherwise specified on the plans.

15. **Eccentric Non-Lubricated AWWA Plug Valves**: Crispin Series 800 or approved equal.

91-17 ILLEGAL USE OF SEWER SYSTEM

If Stormwater enters the sewer system, the Contractor and/or Owner/Developer shall be charged according to Title 14.16.220 of the City of Roseville Municipal Code. Stormwater run-off shall be classified as "low-strength metered commercial users." The sewer unit shall be 1 sewer unit per 1,000 cubic feet discharge. The Environmental Utilities Department shall determine the volume of discharge.

91-18 CONDITIONALLY APPROVED

The following products are conditionally approved in the City for a period of 2 years conditional acceptance period, the product may be granted approved equal status and be added to the list of approved products in the City of Roseville Standards.

A. Old Castle Precast (U.S. Concrete)

1. Sewer Manholes and Appurtenances
2. Grease interceptors

SECTION 101: DRAINAGE

101-1 GENERAL

Drainage improvements are to include: culverts, drop inlets, lined channels, turf reinforcement matting, manholes, Stormwater quality control measures, outlet and inlet structures and storm drain pipe. These improvements shall be installed in accordance with the approved improvement plans, these Construction Standards, the West Placer Storm Water Quality Design Manual, the City of Roseville Stormwater Quality BMP Guidance Manual for Construction and the latest edition of the State of California Department of Transportation Standard Specifications hereinafter referred to as the Caltrans Standard Specifications. These Standards shall apply to the public right of way and easements and private on-site drainage improvements. Several items within this section shall apply to on-site improvements and in conformance to stormwater quality requirements.

The City of Roseville has adopted Stormwater quality design standards to reduce water pollution generated by urban runoff. These design standards are detailed in the West Placer Storm Water Quality Design Manual. This manual is available on the City of Roseville's webpage: https://p1cdn4static.civiclive.com/UserFiles/Servers/Server_7964838/File/Government/Departments/Development%20Services/Engineering/Stormwater%20Design%20Inspection/Post%20Development%20Run-off%20Control/W%20Placer%20SWMP%20Manual%20FINAL%202016-04-01.pdf

Storm Water Pollution Prevention Plans (SWPPP's), as defined by the State, shall not be required for projects smaller than 1 acre in size, provided the project is not part of a larger project. An erosion and sediment plan shall be required as part of the project improvement plan submittal that identifies temporary and permanent Best Management Practices (BMP's).

The Owner of the property or their permit applicant representative may be responsible for Storm Water Inspection services, as required through such time the project is deemed complete.

101-2 CONSTRUCTION STAKING

The Developer for all drainage improvements shall provide Construction staking. Such staking shall provide the station and offset, as well as the cut to the nearest hundredth of a foot, 0.01 foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections and every 25 feet in curved sections. Cut sheets shall be on-site and shall be furnished to the City's Construction Inspector upon request.

101-3 DROP INLET INSTALLATION

Drop inlet installations shall conform to Construction Standard Details DR-1, DR-2 and DR-3 and to provisions in Sections 51 and 52 of the Caltrans Standard Specifications. The interior of the drop inlet shall have a troweled finish; rock pockets shall be grouted and brushed; exposed top surfaces shall have a Class I Surface Finish. Within all City streets and easements and within all commercial sites and private residential subdivisions, a fish stamp conforming to Construction Standard Detail DR-20 shall be placed adjacent to all drop inlets. If the storm drain system is active and open to discharges, then immediately following installation, all storm drain inlets shall

be protected with sediment control protection until construction no longer poses a risk of sediment discharges. Drop Inlets shall conform to ASTM C913. Otherwise, unused knockouts shall be grouted to wall thickness dimension.

101-4 MANHOLE INSTALLATION

A. Bases

1. **Precast**: Precast concrete structures shall be of approved design and sufficient strength to withstand the loads to be imposed upon them. Precast concrete walls for catch basins shall be 6 inch thickness except at knockouts where the minimum thickness shall be 2 inches. Precast bases shall be placed on a foundation of 3/4 inch minus crushed rock, a minimum of 4 inches thick, compacted to 90 percent relative compaction. Elevation differentials of inlets and outlets shall conform to the approved improvement plans. Openings in the base shall align true with all inlet and outlet pipes. Stub out or couplings provided in precast bases shall be of the same material as the pipe to which they connect, unless otherwise approved by the City's Construction Inspector. Precast bases shall be furnished with cutouts or knockouts. Unused knockouts need to be grouted solid to wall thickness dimension if wall is left intact should ASTM C913 certification not be submitted to City Engineer prior to construction. Pipes shall be installed only in factory knockouts unless otherwise approved by the City Engineer. Maximum Knockout or cutout hole-size shall not be greater than the sum of the outer pipe diameter plus the catch basin wall thickness.

2. **Cast-in-Place Base**: The cast-in-place base portion shall not be placed higher than 6 inches above the outside tops of the main incoming and outgoing pipes.

   The wall thicknesses for the top of the cast-in-place base sections shall conform to the following table:

Manhole Diameter	Minimum Wall Thickness
48"	5"
60"	6"
72"	7"
84"	8"
96"	9"

   Inside diameters of cast-in-place base portions shall equal the inside diameter of the manhole specified. Standard precast manhole riser sections and/or cones shall be placed above the cast-in-place section to bring the manhole rim to finish grade. Upon pouring the concrete base, the top surface of the cast in place base barrel shall be stamped with a rigid impression ring in order to match it up with the above, precast barrel section. As an alternate, a maximum 1 foot barrel section may be stacked when it is determined that the concrete for the base is adequately stiff.

   A 24-hour minimum curing time is required before manhole stacking is allowed.

All inlets and outlets with a 30 inch inside diameter or smaller, connecting to existing manholes, shall be core bored.

Concrete in the cast-in-place portion shall be placed against undisturbed earth or upon a base of crushed rock or sand. All loose material shall be removed from the excavation prior to installation.

B. Cones: Cone tops shall be placed within 7 to 18 inches of final street grade. Where depth is insufficient for cones, flat slab tops shall be used. Lifting rings in precast cones shall be plugged with dry packed mortar.

C. Joints: Joints in precast manhole sections shall be made with either mortar or plastic sealing compound.

1. **Mortar Application**: All joint surfaces and the face of the manhole base shall be thoroughly cleaned and wetted before applying mortar. Both the inside and outside of mortared joints shall be plastered with mortar, and the inside surfaces brushed to a smooth finish with a wet brush. Special precautions shall be taken to ensure that the entire joint space is filled with mortar and is water tight.

2. **Plastic Sealing Compound Application**: All joint surfaces and the face of the manhole base shall be thoroughly cleaned before applying plastic sealing compound. The sealing compound shall be protected from dirt during application. Ends of the compound shall be joined end-to-end and not joined by overlapping. Sufficient compound shall be used to cause a visual "squeeze-out" of the compound material when adjacent sections are seated.

   Squeeze-out material on the inside of the manhole shall be neatly trimmed flush with the inside surface.

D. Connections: Pipe connections to drainage manholes shall be made so that the pipe is flush with the inside face of the manhole. These connections shall be finished so that entrances are smooth. Unless the manhole is cast around the pipe, connections shall be made with dry packed cement mortar inside and a 12 inch by 12 inch minor concrete collar outside. Pipe connections shall not be made into the cone section of the manhole unless shown on the approved plans.

E. Grade Rings: Grade adjustments shall be made using precast grade rings. Precast rings shall be a minimum of 3 inches in height. The total height of the grade rings, frame, and cover casting shall not exceed 18 inches.

F. Frames and Covers: The tops of frames and covers shall be set no more than 1/8th inch below finish grade pavement in the street and 6 inches above finish grade in landscape areas and 12 inches in unimproved, isolated areas unless otherwise shown on the approved plans. Per the Construction Standard Details, a 12 inch deep by 12 inch wide concrete collar shall be

placed around the casting, either covered by 3 inches of asphalt concrete paving in a street area, per Detail DR-4, or be placed flush with the finished surface using minor concrete with a medium broom finish with pattern perpendicular to travel direction. The concrete collar shall be in conformance to Section 90-2, "minor concrete". All joints between the frame, grade rings, dome, barrels and base shall be sealed with non-shrink mortar, or an approved plastic sealing material. Inside the manhole, all joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished/wet-brushed.

G. Adjusting Existing Manhole Frames: The frame shall be supported above the grade ring or dome by spacers, or by suspending with timber and wires. After the concrete collar is poured, any space between the frame and grade ring and dome shall be filled with non-shrink mortar, and the inside wall of the riser finished/wet-brushed.

H. Compaction: Compaction around storm drain manholes shall conform to Construction Standard Details TB-1 and TB-3.

101-5 JUNCTION BOXES/VAULTS

Manholes shall not exceed 96 inches in diameter. Where the number of pipes and/or pipe diameters requires a larger structure than a 96 inch diameter manhole, junction boxes or vaults are required. A registered civil engineer shall design vaults. Shops drawings shall be submitted and approved by the City Engineer.

101-6 PIPE INSTALLATION

All drainage improvements shall conform the following requirements:

A. Excavation: Pipeline excavation shall be open-cut trenches, unless otherwise specified on the approved improvement plans. All excavations shall adhere to all applicable Federal and State safety requirements. All work shall be conducted in such a manner as to prevent damage to new and existing facilities or adjoining property.

Wherever the trench bottom is unstable, the area shall be excavated and an adequate amount of ½ or ¾ inch crushed rock shall be compacted in place to provide a stable base for the pipe. Pipe bedding material, per approved plans, will be placed on top of stabilized trench bottom.

B. Trench Width: A minimum clearance of 6 inches shall be maintained between the pipe and the trench wall for reinforced concrete pipe and ductile iron pipe. See Detail TB-2 for trench widths for non-rigid pipe.

C. Pipe Bedding: Pipes shall be placed on a firm bed of imported granular material conforming to Details TB-1, TB-2 and TB-3. Unless unstable pipe bedding subgrade needs to be removed, pipe bedding shall only be placed on native, undisturbed soil. Prior to placing pipe bedding, the trench bottom shall be free of any loose material.

D. Laying Pipe: The pipe shall be laid up-stream with the bell end of the pipe placed up-stream. The interior of the pipe shall be kept clean as the work progresses. There shall not be a change in pipe material between storm drain structures.

1. **Handling, Laying and Backfill of Polyvinyl Chloride (PVC), High Density Polyethylene Pipe (HDPE), Steel Reinforced High Density Polyethylene Pipe (SRHDPE), and Polypropylene Pipe**: The pipe shall be handled in accordance with the manufacturer's published recommendations. Laying and backfill shall conform to Caltrans Standard Specifications, the manufacturer's recommendations, ASTM D-2321 and Construction Standard Detail TB-2, with the following modifications:

   a. Due to the lightweight characteristic of the pipe, extreme care shall be taken to avoid displacing the pipe during the backfilling operation. Following placement of the pipe on the required bedding and to the required grade, the pipe shall be stabilized in place with ballast. At a minimum, this shall be accomplished by loading the pipe down slowly and carefully with small piles of embedment material to a minimum of 1 foot above the pipe on each joint and midway on each length. The pipe shall be kept centered in the trench during this operation. Every precaution shall be taken to avoid flooding the trench prior to placing backfill. The City's Construction Inspector may require dewatering the trench to confirm pipe grade, and to retest the integrity of the pipe following trench flooding.

   b. The trench shall be backfilled with embedment material 6 to 12 inches above the pipe, prior to continuing with the trench backfill.

   c. Pipe material shall not change between manhole structures or between the last structure and the discharge/inlet opening.

   d. The pipe run between the last structure and the discharge/inlet opening shall be reinforced concrete. Pipe stub runs from storm drain mains into commercial sites shall also be reinforced concrete.

   e. No pipe, conduit or any other appurtenance shall be located within any existing or newly constructed storm drainpipe or culvert. Each run of storm drainpipe and culvert shall also be 100% clear and unobstructed the total length.

E. Non Rigid (PVC/HDPE/SRHDPE/Polypropylene) Pipe Testing: A mandrel test shall be conducted following completion of subgrade processing and compaction for curb gutter and sidewalk and pavement. Placement of curb, gutter and sidewalk and pavement (and related aggregate base) shall not occur until the City's Construction Inspector has confirmed the passing of the mandrel test. The City's Construction Inspector shall be present through the duration of the mandrel testing.

The allowable deflection (reduction in vertical inside diameter) for all non-rigid pipes shall be 7.5% maximum. The deflection shall be tested by pulling a mandrel which is 92.5% of the inside pipe diameter through all installed pipe. The mandrel shall be the "go/no-go:" type and shall be pulled per the manufacturer's recommendations without mechanical assistance. Prior to the mandrel test, the pipe shall be thoroughly flushed and cleaned, (See Subsection "J"

below). Obstacles in the pipe shall be removed. At each location in which the mandrel cannot pass, the cause shall be ascertained. If it is found the deflection exceeds 7.5 % or that a gasket has been improperly installed, or that the pipe has been damaged due to construction activities, then the respective section of pipe shall be repaired and retested. Pipe section repair operations may require rebedding pipe, replacing pipe, or both as needed to properly repair pipe section. Watertight repair couplings shall be used in repair. A passing mandrel retest is required.

At the contractor's discretion, any sections of non-rigid pipe not passing the mandrel test may be televised to evaluate the problem.

F. Pipe Laying Tolerances: The pipes shall be laid true to line and grade with allowed tolerances of 0.03 foot above or below the design grade and 0.10 foot left or right of the design alignment.

G. Trench Backfill: Initial backfill material shall be place immediately after pipe joints have been completed inspected and passed by the City's Construction Inspector.

The material shall be carefully placed so as not to disturb or damage the pipe, and shall be brought up evenly on both sides. Trench backfill shall be placed in accordance with Section 111 of these Construction Standards.

H. Cast-in-Place Concrete Pipe: Cast-in-place concrete pipe shall conform to provisions in Section 63 of the May, 2006 Edition of the Caltrans Standard Specifications. Where excavations for other utilities undermine installed cast-in-place pipe, that excavation shall be backfilled to the spring line of the cast-in-place pipe with 2 sack slurry per these Standards.

I. Pavement Cutting and Repaving: When the trench line is in an existing pavement area, the pavement shall be sawed or scored and broken ahead of trenching operations.

The proper tools and equipment shall be used in marking and removal of the pavement such that it is cut accurately to a neat and parallel line on either side of the trench width required, in conformance with the Trench Cut Ordinance. All cuts in Portland cement concrete pavements shall be sawcut with equipment approved by the City's Construction Inspector. See Section 31, Trench Backfill, of these Standards.

J. Cleaning of Storm Drain System: The storm drain system shall be cleaned to the satisfaction of the City's Construction Inspector upon completion. If flushing is utilized, then the discharge shall not be routed into the existing City system. The downstream manhole shall be plugged and the discharge fluid shall be disposed of in a manner satisfactory to the City's Construction Inspector. Flushing shall comply with requirements of Section 21-2 U of these Standards

101-7 CHANNEL LINING INSTALLATIONS

Channel lining installations shall conform to Construction Standards DR-16 and DR-17 and to the following specifications:

A. Surface Preparation: The surfaces of the areas to be lined shall be evenly graded to the lines and grade and sections as indicated on the approved plans. The surfaces shall be moistened thoroughly to prevent moisture from being drawn from the freshly placed lining.

All surfaces on which lining is to be placed shall be free from water, mud and debris and shall be firm enough to prevent contamination of the fresh lining by earth or other foreign material. Prior to placing any lining, the Contractor shall verify line and grade of the excavated channel.

B. Reinforcement: Welded wire fabric shall be embedded in the concrete so that it will be a minimum of 1 inch clear from either face of the concrete, unless otherwise noted.

C. Joints:

1. **Construction Joints**: Shall be square and edged with a ¼ inch radius-edging tool. The edge shall be thoroughly wetted before the next section of lining is placed. Construction joints shall be constructed whenever the operation is halted for a period exceeding 30 minutes. Welded wire fabric reinforcing shall extend through the construction joint.

2. **Deep Tool Joints**: Transverse deep tool joints shall be constructed at 10 foot intervals. The aggregate shall be separated with the joint tool a minimum of 2 inches deep. Immediately following application of the deep tool joint, a ¼ inch grooving tool shall be applied to the surface to seal the joint.

D. Weep Holes: On channels with side lining extending more than 18 inches vertically above the channel toe, weep holes shall be constructed at intervals of 10 feet, midway between contraction joints on each side of the channel. The weep hole elevation shall be 12 inches above the adjacent toe of slope.

The holes shall be backed by a minimum of 1 cubic foot of aggregate material tied in a burlap bag.

The aggregate shall extend at least 6 inches above and below and to each side of the weep hole, and at least 10 inches into the side slope. The side and back of the burlap sack shall be protected from being coated by mortar or concrete during the lining placing operation.

On the day following the lining placement, each weep hole shall be rodded to assure it has not been blocked. The weep hole shall then be cut to fit the channel slope.

E. Cutoff Walls: Cutoff walls shall be constructed around the perimeter at each end of the channel lining and at all locations where the new lining meets structures or existing lining, and at all other locations shown on the approved plans. The cutoff walls shall be a minimum of 6 inches thick and 18 inches in depth, as measured from the surface of the lining. The welded wire fabric shall be bent down into the cutoff walls.

F. Geotextile Linings: Geotextile linings shall follow the manufacture's recommendations for preparation of soil, seed bedding, blanket orientation, anchoring details, and appropriate seed blend and application rates.

101-8 MATERIAL

A. Backfill Material: All Drainpipe backfill material shall conform to Construction Standard Details TB-1, TB-2, TB-3, TB-4 and TB-5.

B. Drop Inlets: All drop inlets shall conform to Construction Standard Details DR-1, DR-2 and DR-3. Concrete shall conform to these standards.

C. Manholes: All precast manhole barrels, risers, cones, flat tops and grade rings shall conform to ASTM Designation C478 and shall conform to dimensions shown on Construction Standard Details DR-4 through DR-8 inclusive.

1. **Bases -** Bases shall be either precast or cast-in-place. Precast bases shall conform to ASTM Designation. Cast-in-place bases shall be of minor concrete with cementitious content of not less than 505 pounds per cubic yard, with a maximum size aggregate not greater than 1 inch or smaller than 3/8 inch, per Section 90 of the Caltrans Standard. Slump shall not exceed 4 inches as determined by the slump cone method of ASTM Designation C143 or an equivalent slump as determined by CTM533.

2. **Barrels**: Manhole barrels shall conform to dimensions of Jensen Precast Products or approved equal, and shall conform to ASTM Designation C478.

3. **Cones**: All cones shall be concentric (unless otherwise shown on the approved improvement plans), Jensen Precast Products and conform to ASTM Designation C478.

4. **Joints/Mortar**: Joints shall be made with either non-shrinking mortar or with a plastic sealing compound conforming to Federal Specification SS-S-002-10. Mortar shall consist of 1 cubic foot of Portland cement to 2 cubic feet of concrete sand.

5. **Manhole Frames and Covers**: All manhole frames and covers shall be of cast iron or ductile iron and conform to ASTM Designation A48, C478 or ASTM A536 for Ductile Iron or Class 30 and shall be the following or approved equal for the indicated size and application: 24 inch frame and slotted cover: D&L Supply #A-1021 (standard 6 5/8 inch high) or South Bay Foundry #D1920; "D" shall be embossed in center.

   a. 36 inch frame and cover: D&L Supply #A-1462 or South Bay Foundry #D1907; "D" shall be embossed in center.

   b. 24 inch frame and slotted cover: D&L Supply #C-2660 (#A-1021 with slotted cover), or South Bay Foundry #1920 (specify slotted cover).

c. Short 24 inch frames and covers: D&L Supply #A-1022 (5 inch) and #A1023 (3 inch); South bay Foundry #1922 (5 inch) and #1923 (3 inch).

d. Rexus Manhole Cover: Saint-Gobain Pam, CDRU60EHDRA, 24 inch round lightweight hinged, ductile iron manhole cover.

Note: Covers for all 24 inch frames are interchangeable.

D. Storm Drain Pipe: Storm drainpipe; shall conform to the following:

1. **Cast-in-Place Concrete Pipe**: Concrete shall be Type II Modified Portland Cement content of the minor concrete shall not be less than 550 pounds per cubic yard with a maximum size aggregate not greater than 1 inch or smaller than 3/8 inch and shall conform to the requirements of Sections 63 (2006 Edition) and 90 of the Caltrans State Specifications.

2. **High Density Polyethylene Pipe (HDPE)**: HDPE shall be type "S", conforming to Section 64 of the Caltrans Standard Specifications. Joint connections shall be water tight, rubber ring gasketed. HDPE shall be Hancor (Sure-Lok F477), ADS, Inc. (N-12 Pro Link Ultra) or approved equal.

3. **Polyvinyl Chloride Pipe (PVC)**: PVC shall conform to the following standards based on pipe diameter:

Pipe Diameter	ASTM Designation
12" through 15"	D3034, SDR 35
18" through 27"	F794, F2241, SDR 51
30" through 48"	F794

All PVC pipe joints shall be integral wall bell and spigot configuration, factory formed. All rubber rings shall conform to ASTM Designation F477.

4. **Precast Reinforced Concrete Pipe (RCP)**: RCP shall conform to ASTM Designation C76 for Class I, II, III, IV or V. The class of pipe shall be based on the designation conforming to the approved plans.

Joints for RCP shall be bell and spigot with rubber gasket. The gasket shall conform to Section 65 of the Caltrans Standard Specifications.

5. **Steel Reinforced High Density Polyethylene Pipe (SRHDPE)**: SRHDPE shall be manufactured in accordance with ASTM F2562 "Standard Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage". SRHDPE shall be manufactured from high density polyethylene stress rated resins conforming to the minimum requirements of cell classification 345464 C per ASTM D3350 "Standard Specification for Polyethylene Plastic Pipes and Fittings Material".

Joints shall be watertight to an internal water pressure of 15 psi when tested in accordance with ASTM D3212 "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals". SRHDPE shall be CONTECH (DuroMaxx) or approved equal.

6. **Polypropylene Pipe**: Pipe 12 inch – 60 inch Diameter shall conform to ASTM F2736 (12-30 inch diameters) and ASTM F2881 (36-60 inch diameters). Joints must be watertight in accordance to ASTM D3212 with gaskets meeting the requirements ASTM F477. Minimum cover shall be 36 inches cover from top of pipe bell to bottom of roadway structural section. Maximum cover exceeding 20 feet and unpaved surfaces will be approved on a case-by-case basis at the discretion of the City Engineer. Polypropylene Pipe shall be ADS N-12 HP Pipe, or Prinsco GOLDPRO Storm Dual Wall HP Pipe, or approved equal.

E. Stormwater Treatment Devices: The use of on-site storm water treatment devices are strictly limited to smaller development projects with limited space where bio-retention facilities are not functional, at the discretion of the City Engineer.

F. Inlet and Outlet Structures: All inlet and outlet structures shall conform to Construction Standard Details DR-1 through DR-14 inclusively.

G. Slurry Cement Backfill: Slurry cement backfill shall conform to the requirements of Section 19 of the Caltrans Standard Specifications containing 188 pounds of cement.

H. Lined Channels: All lined channels shall conform to Construction Standard Details DR-16 and DR-17 and the following materials:

1. **Air Blown Mortar**: Air blown mortar shall conform to provisions in Section 53 "Shotcrete" of the Caltrans Standard Specifications.

2. **Concrete**: Concrete shall be either "Minor Concrete" with Type II cement, sacked concrete, or doweled and sacked concrete. The minimum weight of sacked concrete shall be 94 pounds per sack.

3. **Curing Compound**: Curing Compound shall conform to provisions in Section 90-1.03B(3) of the CalTrans Standard Specifications and Section 71-5,I of these Design and Construction Standards.

4. **Grouted Cobbles**: Ground cobbles shall be set in 6 inches of "Minor Concrete" with pea gravel concrete. The top surface of the concrete shall be flush with adjacent finish grade. Cobbles shall be 4 to 10 inches in size, with 1/3 exposed above the concrete surface, per Caltrans Specifications. Base for concrete shall be undisturbed native soil. If the soil is disturbed or undercut, it shall be processed to 90% relative compaction.

5. **Weep Holes**: All weep holes shall be 2 inches in diameter and made of: galvanized steel pipe, schedule 40 or greater; PVC pipe, schedule 40 or greater; or ABS pipe, schedule 40 or greater.

6. **Welded Wire Reinforcement**: Welded wire reinforcement to conform to ASTM Designation A185.

I. Metal Storm Drain Marker: "No Dumping" public notices are required at all storm drain inlets within the City limits, public and private storm drain improvements. Where conditions do not warrant as defined in Detail DR-20 "Detail A" of these Design and Construction Standards, metal storm drain markers as shown on Detail DR-20 "Detail B" may be substituted as approved by the City's Construction Inspector. "Detail B" shall be Almetek Industries Marker, stainless steel storm drain marker model SDM-SS, "No Dumping Drains to Creek" with "fish" symbol and blue background. Installation methods shall be installed per manufactures' recommendations and approved by the City's Construction Inspector.

101-8A ABANDONING STORM DRAINS

In newer construction, storm drain stubs and services to be abandoned shall be either removed to the main or manhole of origin or filled solid with concrete slurry, at the discretion of the City Engineer. Abandonment of existing storm drain stubs shall be removed or left in place as directed by the Director and/or as shown on the approved plans.

Temporary storm drain plugs may be used when short term blockage is necessary at either the stub or lateral run to prevent storm water from entering/exiting the stub or lateral run. Material for plugs may be a combination of 6 mil plastic and rigid plywood. For longer term plugs, and at the discretion of the City's Construction Inspector, 6 mil plastic and 1 foot thick of 2 sack concrete is required. In both cases, the plug shall be marked with a 4x4 temporary post.

SECTION 111: GRADING

111-1 GENERAL

Grading improvements shall include: excavation and embankment work for channels, pads and roadways, erosion control measures and retaining walls. These improvements shall be installed in accordance with the approved improvement plans, these Construction Standards, the latest edition of the California Building Code, (CBC), the City of Roseville Grading Ordinance, the SWRCB Construction General Permit No.CAS000002, (WQ ORDER No. 99-08-DWQ), The City of Roseville Stormwater Ordinance, and the latest edition of The State of California Department of Transportation Standard Specifications hereinafter referred to as the Caltrans Standard Specifications.

The City of Roseville has adopted Stormwater Quality Design Standards to reduce water pollution generated by urban runoff. These design standards are detailed in the Stormwater Quality Design Manual for the Sacramento and South Placer Regions. This Manual is available on-line at the Sacramento Stormwater Management Partnership website, https://www.cityofsacramento.org/-/media/Corporate/Files/DOU/Specs-Drawings/SWQ_Design_Manual_FINAL2018.pdf?la=en. The manual can also be purchased at the City's Permit Center located on the first floor of the Civic Center Building at 311 Vernon Street downtown Roseville.

111-2 CONSTRUCTION STAKING

Construction staking shall be provided by the Developer for all grading improvements as indicated below including adjacent to wetlands per 111-3.G: Cut sheets shall be on-site and shall be furnished to the City's Construction Inspector upon request.

A. Channels: Channel staking shall provide the station and offset, as well as the cut to the nearest 0.1 foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections and every 25 feet in curved sections.

B. Erosion Control Measures: Erosion control measures shall be staked per the approved plans. Erosion control requirements shall apply to all construction sites regardless of size, which involve disturbed soil. Sites exceeding 1 acre of disturbed surface area are subject to the Storm Water Pollution Prevention Plan (SWPPP) requirements. Owner's SWPPP must be approved by the City prior to the commencement of grading operations.

C. Pads: Pad staking shall provide the station and offset, as well as the cut to the nearest 0.1 foot. Stakes shall be provided at each property corner, front and rear.

D. Retaining Walls: All retaining wall shall be staked for line and grade to the nearest 0.1 foot.

E. Roadways: Roadway excavation staking shall provided the station and offset, as well as the cut to the nearest 0.1 foot. Minimum staking intervals shall be 50 feet in tangent sections

and 25 feet in curves. Stakes shall also be placed at curve beginnings, ends, points of reverse curvature, points of compound curves, horizontal angle points and at changes of grade.

111-3 INSTALLATION

All grading improvements shall be installed in accordance with provisions in Chapter 33 of the UBC, recommendations of site specific geotechnical reports and geotechnical engineer, provision in Sections 16 through 19 of the Caltrans Standard Specifications, the approved improvement plans and per the following specifications:

A. Channels: All fill areas in channels shall receive suitable fill material to be compacted to a minimum of 90 percent relative compaction. The Developer's geotechnical engineer will determine suitable fill material. Unsuitable materials shall be removed from the channel and replaced with suitable backfill material based on recommendations provided by a State of California licensed geotechnical engineer.

B. Erosion Control Measures: Construction sites shall have required erosion and sediment control measures in place between October 1 and April 30. All projects adjacent to creeks, wetlands, vernal pools, drainage ditches, and Stormwater drain inlets shall have adequate sediment control measures in place prior to ground disturbance regardless of time of year. If construction is in progress, the Contractor shall ensure that the construction site is prepared prior to the onset of any storm. For Stormwater quality compliance information, refer to the City's Storm Water Quality Best Management Practices (BMP) Guidance Manual for Construction Activities, latest edition. Waterways under the jurisdiction of governmental agencies other than the City of Roseville may be subject additional erosion control measures or criteria and is the responsibility of the Developer/Owner. City of Roseville erosion control provisions shall include, but are not limited to:

1. **Broadcast Seed**: Where required, broadcast seed shall be applied as follows:

Brando Brome	12 lbs/acre
Rose Clover	9 lbs/acre

   Areas with sandy, dry soil shall receive:

Zorro Annual Fescue	6 lbs/acre
Rose Clover	9 lbs/acre

   A fertilizer consisting of 16-20-0 shall be applied at a rate of 500 pounds per acre. If hydroseeding/mulching is used, seed quantities shall be increased by 30 percent.

   Seed for creek banks shall conform to the latest requirements of the California Department of Fish and Wildlife.

2. **Drainage Areas**: All bare areas, regardless of slope, within 50 feet of natural drainages and active stormwater collection systems shall be covered with straw, erosion control

blankets, hydromulch, or other types of soil stabilizers suitable for elimination soil migration. A City Stormwater Inspector may require additional control measures be installed if deemed necessary.

No grading or trenching, except as required for erosion or sediment control, shall occur within 35 feet from the centerline of perennial and intermittent drainage swales between October 1 and April 30 unless approved by the Engineering Division, as well as any other governmental agency which may have additional jurisdiction and/or requirements.

3. Dust/Mud Control:

a. Construction Access: Where construction traffic accesses a project, on or off public streets, the contractor shall have in place prior to the start of grading, a construction access conforming the City's Stormwater Quality Best Management Practices Guidance Manual. Alternative tracking control measure will be considered provided they are equally or more effective than specified. Construction access locations shall be maintained during the course of construction.

b. Adjacent Streets: Adjacent street frontages shall be kept clean at all times. When tracking has occurred, the contractor must clean immediately, or as directed by the Development Services Construction Inspector.

c. Construction Vehicles: The Contractor is responsible for cleaning construction vehicles leaving the site on a daily basis to prevent dust, silt, mud and dirt from being released or tracked offsite. See the City of Roseville Stormwater Quality BMP Guidance Manual for information on vehicle and equipment cleaning requirements, and instructions concerning concrete washout areas.

d. Grading Spoils: Dry stock piles of soil shall be watered, covered with tarpaulins, or stabilized suitable to prevent the generation of airborne dust. Trucks transporting dry soil shall be covered with tarpaulins. Stockpiling of spoils during the wet season, (October 1 to April 30), should be avoided. If avoidable, spoil stockpiles shall be covered with plastic, or adequately stabilized by other BMP's, with a perimeter sediment barrier installed at all times. The City Stormwater Inspector may require additional control measure depending on the proximity of the stockpile to any sensitive areas and/or drainage systems.

e. Dust Control: Water shall be sprayed on all exposed earth surfaces during clearing, grading, earth moving and other site preparation activities. The exposed earth shall be watered throughout the day to minimize dust. Care must be taken to ensure that excessive water use doesn't create a sediment-laden discharge. Water from City hydrants is usually available to supply water, however a hydrant permit from the Environmental Utilities Department must be obtained prior to use.

f. Wind Allowances: Grading activities shall be restricted or halted when winds exceed 15 miles per hour as deemed necessary by the City's Development Services Construction Inspector. In addition, Placer County Air Pollution Control District may issue enforcement actions for air-borne migration violations, per their guidelines.

4. **Drain Inlet Protection**: Drain inlet filters must be employed whenever there is risk of sediment-laden water entering the City's storm drain system. This applies to both existing and newly constructed drain inlets. If the storm drain system is active and open to discharges, then immediately following installation, all drop inlets shall be protected with silt and gravel bags until construction no longer poses a risk of sediment laden discharges. Only high flow volume bag type filter, or other devices that have been approved of the Stormwater Inspector shall be used.

5. **Perimeter Protection**: Silt fences, and straw wattles are commonly used as perimeter sediment control BMP's. Proper installation of these is critical for their effectiveness. Refer to the City's Stormwater Quality Best Management Practices Manual, for proper installation procedure for these BMP's and for information on additional BMP's that may be available.

6. **Slope Protection**: Disturbed exposed slopes pose the highest risk of erosion and shall be protected as required. BMP's such as blown or broadcast straw, erosion control blankets, plastic sheeting, soil stabilizers, and linear sediment controls along the toe, face, and grade breaks of exposed slopes shall be employed to minimize or eliminate erosion. Refer to the City's Stormwater Quality Best Management Practices Manual, Temporary Soil Stabilization, for proper installation procedures.

7. **Straw Bales**: Straw bales should strategically stockpiled on site during the "Wet Season" for the purpose if immediate broadcasting prior to storm events. Measures shall be provided to keep straw dry. Refer to the projects' SWPPP or erosion control plan for proper stockpiling of BMP's.

8. **Alternative Control Devices**: Use of alternative sediment control devices will be approved of at the discretion of the City's Stormwater Inspector.

9. **Wildlife Friendly / Non-entrapment Materials**: Areas where permanent erosion and sediment control materials are placed, or locations adjacent to open space or other sensitive areas shall employ wildlife friendly, or non-entrapment products. (Non-entrapment products are those that use specially designed netting, biodegradable netting, or no netting at all for their blanket and waddle products, which are designed to minimize or eliminate animal entrapment). Materials shall be approved prior to placement by Development Services staff.

C. Pads: All pads shall be compacted to a minimum of 90 percent relative compaction. Unsuitable materials shall be removed from the pad areas per the recommendations of the Developer's licensed geotechnical engineer. The Developer shall submit a letter from the

geotechnical engineer stating that the grading was performed in substantial conformance with the geotechnical report (and subsequent updates). Recertification of lot pad compaction/elevation certificates may be necessary due to stockpiling, rutting, sales trailers, temporary parking lots, erosion, and time lapse at the discretion of the City Construction Inspector, refer to section 21-5 E.

D. Retaining Walls:

1. **Concrete/Masonry/Rock Walls**: All concrete, masonry, or rock walls shall be installed per the manufacturer's instructions or design engineer's recommendations.

2. **Wood Retaining Walls**: All wood retaining walls shall be installed in accordance with Construction Standard Detail GR-3.

E. Roadways:

1. **Compaction**: Relative compaction of not less than 95 percent shall be obtained for a minimum depth of 0.5 feet below the subgrade grading plane for the width between the outer edges of shoulder, including curb and gutter areas, whether in excavation, embankment or at original ground level. All other material shall be compacted to a relative compaction of 90 percent.

2. **Grade Control**: When the next layer to be placed on the subgrade is a portland cement concrete pavement, asphalt concrete pavement, asphalt concrete base or asphalt concrete subbase, the subgrade grading plane at any point shall not vary more than 0.05 foot above or below the grade established by the project surveyor.

3. **Stability Testing**: The Contractor shall proof roll the subgrade areas with a full, 3,000 gallon water truck prior to placement of aggregate base or aggregate subbase. The City's Development Services Construction Inspector shall approve the equipment used for proof rolling.

4. **Unsuitable Materials**: Any unsuitable material encountered within 2 feet below subgrade or 2 feet below original ground shall be removed and replaced with a suitable backfill material.

   Suitable backfill materials and methods for placement are to be reviewed and approved by the on-site geotechnical engineer. Other methods for subgrade stability may be used upon review and approval of the Developer's geotechnical engineer.

10. **Tree Grading**: Grading activities within the protected zone of a Native Oak Tree or Landmark Tree shall be conducted under the conditions set forth under the Grading Permit and Tree Permit Conditions. These conditions shall also include:

1. **Fencing**: A minimum 5-foot high chain link fence, or approved equal by the Planning Department, shall be installed at the outermost edge of the protected zone of each protected tree or group of trees. The fence shall not be removed until written authorization is received from the Planning Department.

   Fences must be installed in accordance with the approved fencing plan prior to the start of any grading operations. The Contractor shall call the Planning Department for an inspection of the fencing prior to grading operations.

   Signs must be installed on the fence in four locations, equidistant around the tree. On fencing around a grove of trees, the signs shall be placed at approximately 50-foot intervals. Sign verbiage is indicated in Section 111-4.B.

2. **Grade Changes**: No grade changes are permitted which cause water to drain to within twice the longest radius of the protected zone of any protected tree.

3. **Native Ground Surface Fabric**: Removal of any native ground surface fabric from the protected zone of the tree shall require protection of the tree within 48 hours of removal.

4. **Preservation Devices**: Preservation devices (such as aeration systems, oak trees wells, drains, special paving and cabling systems) shall be installed per approved plans and certified by the Developers arborist.

5. **Retaining Walls**: The Contractor shall provide immediate protection against moisture lost to exposed roots due to construction of a retaining wall within the protected zone of the tree. The retaining wall shall be constructed within 72 hours after completion of grading in the protected zone.

6. **Roots**:

   a. **Minor roots**: Minor roots (less than 1 inch in diameter) may be cut. Damaged roots shall be traced back and cleanly cut behind any split, cracked or damaged area.

   b. **Major roots**: Major roots (over 1 inch in diameter) may not be cut without approval and supervision of the Developer's arborist.

7. **Trenching**: Trenching within the protected zone of a tree, when permitted, may only be conducted with hand tools, in order to avoid root damage. The Contractor shall follow provisions approved in the Utility Trenching Pathway Plan, submitted by the Developer to the Planning Department.

11. **Grading Adjacent to Wetlands**: Grading activities adjacent to sensitive wetland or creek areas shall be conducted under the conditions set forth under the Grading Permit. These conditions shall also include:

1. Prior to construction within any phase of the project, high visibility temporary construction fencing shall be installed along the parcel adjacent to the Preserve or Creek. Fencing shall be maintained daily until permanent fencing is installed, at which time the temporary fencing shall be removed from the project site.

2. With the exception of access required for maintenance and/or emergency vehicles, the project shall be designed to prevent vehicle access into the Preserve. Post and cable fencing or other improvements shall be utilized to meet this requirement.

3. Landscaping adjacent to the Preserve shall be California native, drought-tolerant groundcover, shrubs, plants and trees.

4. The Pre-Construction meeting shall address the presence of the Preserve, the sensitive habitats present and minimization of disturbance to the Preserve. During grading and construction the preserve area shall be avoided and shall not be used for parking, storage, or project staging. The contractor shall remove all trash blown into the preserve from adjacent construction on a daily basis. After construction is complete, the temporary fencing shall be removed from the preserve, along with all temporary erosion control measures.

111-4 MATERIALS

A. Retaining Walls:

1. **Concrete/Masonry/Rock Walls**: All concrete, masonry, or rock walls shall conform to materials and specifications provided by the wall manufacturer or designing engineer.

2. **Wood Retaining Walls**: All wood retaining wall materials are to be in accordance with Construction Standard Detail GR-3.

B. Tree Fencing:

1. **Signs**: The size of each sign shall be a minimum of 2 feet by 2 feet and shall contain the following language.

WARNING
THIS FENCE SHALL NOT BE REMOVED
OR RELOCATED WITHOUT WRITTEN
AUTHORIZATION FROM THE
PLANNING DEPARTMENT

C. Wetland Preserve Fencing:

1. **Signs**: The size of each sign shall be a minimum of 2 feet by 2 feet and shall contain the following language:

WARNING
THIS FENCE SHALL NOT BE REMOVED
OR RELOCATED WITHOUT WRITTEN
AUTHORIZATION FROM THE
COMMUNITY DEVELOPMENT DEPARTMENT

111-5 SOIL TESTING PROCEDURES AND FREQUENCIES

A. Field Testing:

1. **Field Density Testing**: Field density test for earthwork and backfill will be performed by either the owner's Independent Testing Laboratory (ITL), or the City's Geotechnical Engineering Consultant, at the discretion of the City Engineer as follows:

   a. Private property building areas including 10 feet outside the exterior building lines shall be tested by the property owner's Geotechnical Engineer with proper written pad certifications submitted to City Building Official prior to foundation placement.

   b. Public Right-of-Way - All grading operations, which involve revision to existing contours for the purpose of accepting right-of-way improvements, shall require written and stamped certification from a licensed California Geotechnical Engineer.

   c. Test Method-In-place nuclear density, ASTM D2922 (Method B-Direct Transmission) to check conformance to requirements of Geotechnical Report, project plans, specifications, and Section 71 of these Standards. In addition to testing, the field technicians shall observe ALL backfill operations to ensure methods consistent with those that achieved minimum required compaction results are used throughout the backfill process. The field technician shall record these observations in the Daily Field Reports (DFR's). The field technician shall perform additional testing when the operations deviate from proven practices even if testing at the frequencies required below has already been performed. Samples for compaction curves shall be taken at the discretion of the technician or as directed by the City's field representative.

   d. The City expects testing at a higher frequency at the discretion of the field technician or City's Development Services Construction Inspector if there is any reason to doubt the effectiveness of the operations or the precision of the test results, and when a material change is observed in the soil being compacted. These tests shall be recorded in the DFR.

B. Minimum Reporting Requirements:

1. **Daily Field Reports (DRF)**: All testing and observations shall be recorded in a DFR. The DFR shall include all field density testing; test tables and/or plans shall show the field-recorded dry density, moisture content, reference laboratory compaction test used and any moisture offset used based on supplemental laboratory testing. All test results indicating less than minimum compaction shall be recorded in the DFR's along with the observation of corrective operations and retest results. DFR's shall also indicate where observation and soil probing was performed in between nuclear gauge testing.

C. Mass Grading Testing Frequencies:

1. Large Area Density Testing: One test per 1,000 to 2,000 cubic yards. A separate compaction certification report is required for City right-of-way limits.

2. Small Area Density Testing: One test per 500 cubic yards or each 10,000 square feet of fill.

D. Trench Backfill Testing Frequencies:

1. Utility Installations: Observe all bedding, shading, shovel slicing, and filter fabric installation procedures for compliance with City Standards and project plans and specifications. Observations shall be documented in DFR's along with measures taken to correct noncompliant items.

2. Compaction Testing - By Nuclear Gauge Method: Tests shall be taken at a minimum frequency of 1 test per lift per 200 lineal feet of backfill, testing pattern should be staggered such that the location of test varies with each lift of backfill. The maximum loose lift thickness shall conform to the requirements outlined in Section 31-2E, Typical Compaction Equipment and Maximum Lift Depths Achieved by Proper Compaction, of these Standards, or as approved by the City Engineer. The ITL shall submit copies of the field technician's DFR's and testing logs on a weekly basis to the City City's Construction Inspector for review.

3. Performance Specification Observation: (Deep Trenches or Rocky Material), Performance specifications shall be used to verify compaction efforts where vertical cuts or other issues prevent safe entry for nuclear gage density testing. A series of tests will be performed at the beginning of the backfill operations in a protected area of the trench to determine the minimum number of passes, acceptable equipment, moisture conditions, and maximum loose lift thickness. Once the procedure is approved, full-time observation will be performed to check that operations comply with the approved performance specifications. The field technician shall require the contractor to provide access for further testing by the field technician if, in the opinion of the City's Development Services Construction Inspector, conditions change such that observation alone will not suffice to verify compliance or if the material or equipment used to backfill the trench changes such that re-evaluation or compaction procedures is required. Adequate compaction of material containing more than 30 percent rock larger than ¾ inch shall

be verified via performance specifications. The ITL shall develop the performance specification and, if none exists, perform full-time observation of the operations to verify compliance. Field observations shall be recorded in the field technician's DFR's as described above. The DFR shall clearly reference approximate stations and elevations over which the observation of performance specification was performed.

4. Dry Utility Trenches: Installation of Electric Department facilities shall be according to Electric Department designed job print and City of Roseville Electric Department Specifications, Details: Residential 1.2, 1.2.1; Commercial 3.1, 3.2. Frequencies of testing to coincide with these Standards.

5. Manholes: Areas around manholes shall be tested every vertical foot. Testing methods and recordings shall be as described above.

6. Utility Services to Residences: Test at least every other lift on a minimum of 50 percent of the services.

7. Retrofit Utilities: See Section 31 of these Construction Standards.

SECTION 141: RECYCLED WATER SYSTEM CONSTRUCTION

141-1 GENERAL

On-site and public recycled water pipe, fittings, gate valves, fire hydrants, blow-offs and other appurtenances shall concur with the current Environmental Utilities Department list of approved materials, provided herein, and shall be installed in accordance with the requirements of the American Water Works Association (AWWA) Standards, these Construction Standards, and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times.

141-2 CONNECTION TO EXISTING FACILITIES

Connection to existing recycled water facilities may be made upon approval of the Environmental Utilities Department.

A. The Environmental Utilities Department has the option of making a system tap as required on the approved plans. Should the Environmental Utilities Department elect to perform the tap, the Contractor shall pay for such work on a time and materials reimbursement basis. The Contractor shall be responsible for the following tasks associated with the tap, or as determined by the Environmental Utilities Department:

1. Coordinating the work requested with the Environmental Utilities Department and the Development Services Construction Inspector. This shall include discussions on provisions for materials and equipment required to complete the work.

2. Providing traffic control per the City's Public Works Department requirements.

3. Excavating the work area, as agreed upon by the Development Services Construction Inspector.

4. Providing sheeting, shoring, and bracing as required.

5. Providing lighting as required if the tap is to be performed at night.

6. Backfilling, compacting, and pavement restoration of the excavation(s) upon tap completion.

B. The Contractor shall tie-in the new system to an existing stub under the following conditions:

1. With specific approval of the Development Services Construction Inspector.

2. Care shall be taken to provide a clean, sanitary tie-in site.

3. Dewatering of both the new and existing recycled water mains shall take place in a way as to prevent contamination by trench water.

4. All material used in the tie-in shall be clean and swabbed with chlorine.

5. All tie-ins shall take place in the presence of the Development Services Construction Inspector.

6. Tie-ins may take place after the newly constructed recycled water system has successfully passed all required testing procedures as established in Section 141-13 of these Construction Standards and as determined by the Development Services Construction Inspector.

7. Under no circumstances shall anyone other than a representative of the Environmental Utilities Department open or close valves in a City-operated system.

141-3 CONSTRUCTION STAKING

The recycled water shall be staked prior to excavation. Staking shall provide the station and offset to the recycled water main, as well as a cut to the nearest 0.1 foot. Stakes shall be provided at a minimum of every 50 feet in tangent sections and every 25 feet in curved sections and every 10 feet in approved vertical curve sections.

141-4 EARTHWORK

Earthwork required to construct recycled water facilities and appurtenances shall be performed to the lines and grades shown on the approved project plans and as specified below:

A. Excavations: Pipeline excavations shall be open-cut trenches, unless otherwise specified on the approved improvement plans, with vertical sides to the pipe crown as specified on Construction Standard Detail W-1. Excavations shall conform to all applicable Federal and State safety requirements. The contractor shall appoint a designated "competent person" who will be present during construction.

B. Trench Width: The trench bottom width to 6 inches above top of the pipe shall comply with Construction Standard Detail W-1 or as approved by the Environmental Utilities Department.

C. Compaction: Compaction of the trench shall conform to Construction Standard Detail W-1 and Section 31. Compaction test results shall be supplied to the Environmental Utilities Department upon request.

D. Weather: During inclement weather, trenches shall be excavated only as far as pipe can be laid and backfilled during the course of the day.

E. Existing Roadways: Trenching in existing roadways shall be limited to the length of pipe that can be laid that day. No open trenches shall be left overnight. Exposed trenches shall be plated or backfilled as required by the Development Services Construction Inspector and/or the Development Services Department.

F. Excess Material: Excess material and materials determined unsuitable for backfill by the Development Services Construction Inspector shall be removed from the project site.

141-5 DEWATERING

Dewatering for the installation of structures and pipelines shall commence when groundwater is first encountered and shall be continuous until the excavation is backfilled. Best Management Practices including, but not limited to, scouring and erosion measures shall be used to eliminate sediment-laden discharges in accordance with the approved SWPPP.

141-6 PIPE BEDDING

The gradation of allowable backfill material is as shown on the Construction Standard Detail W-1 and Section 31. Pipe bedding shall be installed as follows:

A. Bedding shall provide uniform and continuous support along the barrel of the pipe. The minimum depth of bedding material shall be provided under the bell. Blocking of the pipe is not permitted.

B. Loose material shall be removed from the trench bottom and replaced with imported material.

C. Where rocky unyielding, or unsuitable foundation material is encountered, the subgrade shall be excavated a minimum of 12 inches below the pipe and the trench width shall be increased a minimum of 12 inches. The over-excavation shall be replaced with imported material. DIP may be used as an alternative to the over-excavation requirements.

D. Where the trench bottom is soft, yielding or unstable, the trench bottom shall be over-excavated. 3/4 inch crushed rock shall be placed in the trench to provide a stable foundation. The rock is in addition to the required pipe bedding used in the pipe zone.

E. Bell holes shall be excavated per manufacturer's recommendations. The minimum depth of bedding material shall be provided under the bell. Care shall be taken that the bell hole is no larger than necessary to accomplish proper joint assembly.

141-7 CONCRETE CRADLES, ARCHES & ENCASEMENTS AND TRENCH DAMS

Concrete cradles, arches and encasements shall conform to Construction Standard Details W-23 and 24 and the following:

A. The pipe shall be placed in proper position on temporary cradles or arches consisting of concrete block or bricks. When necessary, the pipe shall be rigidly anchored or weighted to prevent flotation when the concrete is placed.

B. Cradles and arches shall be constructed with an ability to adjust the pipe to proper grade in order to avoid vertical joint pull. Cradles and arches shall be placed at 1/3 and ½ way points along each pipe segment where specified. Concrete placed beneath the pipe shall be sufficiently workable to fill the voids without excessive vibration. The concrete shall be allowed

to cure and remain undisturbed for a minimum of 24 hours prior to backfill and compaction of the trench.

C. Restrained pipe within casings, bridges, shall be fully extended or "stretched out" to remove the slack between the joints the entire length of the structure.

D. Water shall not be permitted to enter, seep or run onto the concrete while curing.

E. Trench dams shall be constructed of controlled density fill or clay as shown on the drawings or as directed by the Development Services Construction inspector. Trench dam excavations shall be made into native earthen materials to the dimensions shown on the drawings or as directed by the Development Services Construction inspector. Clay materials shall be moisture conditioned to near-optimum moisture content prior to placement in the excavation and compacted to the required relative compaction.

141-8 PIPE ZONE BACKFILL

Pipe zone backfill shall conform to Construction Standard Detail W-1 and the following:

A. Extreme care shall be taken when consolidating the backfill around the pipe zone. For pipe 12 inches in diameter and smaller, no more than ½ of the pipe shall be covered prior to shovel slicing the haunches of the pipe. For pipe greater than 12 inches in diameter, no more than the lesser of 6 inches or 1/3 of the pipe diameter shall be covered prior to shovel slicing. Sufficient care shall be taken to prevent movement of the pipe and damage to the polyethylene encasement during shovel slicing. Shovel slicing shall be witnessed by the Development Services Construction Inspector prior to shading the pipe.

B. Compaction equipment shall not make direct contact with the pipe.

C. Where the pipe is to be installed below historic groundwater levels or where the trench is subject to inundation, crushed rock material shall be placed to the crown of the pipe.

141-9 PIPE INSTALLATION

Recycled water pipe shall be installed in accordance with Section 81-9 of these Construction Standards and the following provisions:

A. The Contractor shall keep the pipe interior free from foreign materials and in a clean and sanitary condition until acceptance by the City. At times when pipe-laying is not in progress, the open pipe end shall be sealed with a tight cap or plug to prevent foreign matter from entering the pipe. Provisions shall apply to break time as well as overnight.

1. Trenches shall be in a reasonably dry condition when pipe is laid.

2. Care shall be taken when lowering pipe into the trench to protect the pipe from damage. Chains are not permitted. The pipe shall be laid carefully to the lines and grades shown

without grade breaks, unless designed with such, or to minimum depths shown on the approved plans. If field conditions exist such that the pipe may not be laid to the specified grade, the approved plans will require revisions prior to proceeding with construction.

3. Pipe sections shall be closely jointed to form a smooth flow line. Care shall be taken in placing the pipe and making field joints.

4. No facility is to be backfilled without inspection by the Development Services Construction Inspector. Improvements installed without proper inspection shall be exposed and inspected as required by the Development Services Construction Inspector.

5. All installations shall follow manufacturer's recommendations unless otherwise noted on the approved plans. The manufacturer's installation guide shall be on the job site at all times.

6. Pipes shall be mechanically restrained to the length specified in the approved plans, using materials specified herein. Thrust blocks shall only be used where specifically shown on the plan/profile sheets and/or the standard detail sheets. All fittings and appurtenances shall maintain a minimum of 18 feet of restrained pipe into the fitting from all directions.

7. A continuous number 12 blue insulated tracing wire (81-16,G.36) shall be attached to mains, service lines and appurtenances per the Construction Standard Details and as follows:

a. Tracing wire shall also be continuous between main line valve boxes and fire hydrants. It shall be attached to the top of the pipe with 10-mil vinyl tape every 5 feet.

b. Tracing wires through valve boxes shall be placed outside of riser, but inside the box.

c. Tracing wire in manholes and vaults shall be attached inside the facility within 1 foot of the rim.

d. Wire splices shall be located above ground and inside of valve boxes and conform to Details W-16, W-17, and as follows:

i. Install a copper split bolt connector on the splice

ii. Twist the wire together with a minimum of 5 twists.

iii. Solder all Connections with electrical solder.

iv. Cover the splice with mastic tape and wrap with vinyl tape.

8. A 12 inch wide plastic backfill tape with black printing on a purple field having the words "RECYCLED WATER PIPELINE BELOW" shall be installed above all mains. Tape is to be buried 12 to 24 inches below finished grade.

B. Pipe Identification: All buried recycled water piping shall be purple-colored (Pantone 522) PVC with stenciling identifying it as recycled water in accordance with the AWWA manual, Guidelines for the Distribution of Non-Potable Water. The pipe shall be installed with the manufacturing label on top. Markings shall be as specified in Section 141-16 of these Construction Standards, and as modified herein:

1. Alternate pipe with warning tape, as specified below, will be accepted as an alternative to stenciled purple-colored PVC pipe only on a project-by-project basis, with prior written approval from the Environmental Utilities Department.

2. The plastic warning tape shall be prepared with black printing on a purple field, having the words "CAUTION: RECYCLED WATER PIPELINE." The overall width of the tape shall be 3 inches.

3. The warning tape shall be installed directly on top to the pipe, longitudinally and centered. The warning tape shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic tape banded around the pipe with fasteners no more than 5 feet apart. Taping attached to the section of the pipe before laying in the trench shall have flaps sufficient for continuous coverage. All risers between the main line and control valves shall be installed with warning tape.

4. Mains in unpaved areas shall be marked every 150 lineal feet with a purple composite utility marker, 5 feet 6 inches tall, having a decal stating: "CAUTION: RECYCLED WATER PIPELINE." Appurtenances (valves, ARVs, test stations, etc.) and angle points shall also be marked. Mains in landscaped areas shall be delineated with a brass marker set in an 8 inch diameter concrete cylinder 4 inches above finish grade. The brass marker shall state "City of Roseville Recycled Water Main."

5. All underground metal (ductile iron, valves, fittings, copper, brass, etc.) shall be wrapped in 8 mil minimum thickness polyethylene encasement.

C. Polyvinyl Chloride (PVC) Pressure Pipe Installation: PVC shall be installed in accordance with the AWWA Manual M23 and the manufacturer's recommendations, except as otherwise provided herein:

1. PVC Pipe shall have been manufactured within the 18 month period prior to installation.

2. Pipe and gaskets shall be kept clean and protected against sunlight and heat damage.

3. Pipe showing signs of physical damage or excessive ultraviolet exposure will be rejected, and immediately removed from the job site.

4. The pipe shall be installed with the manufacturing label on top.

5. The reference mark or stab line on the spigot end must be flush with the bell end and visible for inspection.

6. The beveled end of the pipe shall be cut off before placement in a mechanical joint.

7. Minimum length of pipe for installation shall be 5 feet.

D. Concrete Cylinder Pipe: Concrete cylinder pipe shall be installed in accordance with the manufacturer's recommendations, and in accordance with the following provisions:

1. A 3 inch wide plastic warning tape with black printing on a purple field with the words: "CAUTION: RECYCLED WATER PIPELINE" shall be installed longitudinally, and centered directly on top of the pipe. The warning tape shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic tape banded around the pipe with fasteners no more than 5 feet apart. Taping attached to the sections of pipe before laying in the trench shall have flaps sufficient for continuous coverage.

E. Ductile Iron Pipe (DIP): DIP shall be installed in accordance with Section 81-9.M of these Construction Standards. Warning tape shall be applied as specified in Section 141-9.N.1 above.

F. Borings: Borings for installation of recycled water lines shall be in accordance with Section 81-9.P of these Construction Standards. Utilizing the City's drainage system for residual discharge from boring operations without the required measures is prohibited. This discharge is a violation of the City's Stormwater Ordinance and the Clean Water Act. Discharge fluid shall be recovered, contained and discarded at an appropriate location, or if the situation allows, fluid may be discharged into an open area with the pre-written approval of the property owner and approval from the Regional Water Quality Control Board (RWQCB) provided it meets RWQCB requirements and does not impact sensitive areas such as wetlands, creeks or other natural water conveyances.

1. All street boring shall include adequate measures to mitigate sediment-laden water discharge. An acceptable measure is pumping the discharge fluid into a tanker and hauling it away. Other measures suggested by the Contractor will be considered by the City. The City stormwater or Development Services Construction Inspector shall inspect and monitor the discharge recovery, containment, and restoration process.

141-10 SERVICE INSTALLATION

Recycled water services shall be installed in accordance with manufacturer's recommendations, per Section 81-10 of these Construction Standards, per the Construction Standard Details and with the following provisions:

A. Services shall be continuous from the main line to the service box. Bends in copper tubing shall be made in a manner that does not crimp or flatten the tubing.

B. Taps, service saddles and fittings attached to mains shall be separated from each other by a minimum of 24 inches.

C. Service saddles shall be wrapped and sealed in 8 mil minimum thickness polyethylene and backfilled with sand. Use pipe tape to secure and seal the polyethylene wrap.

D. Service lines shall be encased in 8 mil minimum thickness poly tubing and backfilled with sand. Use pipe tape to secure and seal the polyethylene wrap.

E. Recycled water identification shall be installed on service lines as provided for in these Construction Standards.

F. Service manifolds shall be constructed per the following criteria:

1. Where a service line is extended a distance greater than 40 feet, a construction jumper shall be installed per Construction Standard Detail W-14. The new service line and manifold shall be tested in accordance with Section 81-13 of these Construction Standards.

Where a service line is extended a distance less than 40 feet, the extension shall be cleaned, swabbed with chlorine and flushed in the presence of the Development Services Construction Inspector. The new service line and manifold shall be pressure tested in accordance with Section 81-13.A of these Construction Standards.

In both cases, the installation shall be fully restrained by an approved restraint system, starting at the main and as required by the approved Improvement plans.

2. No water shall be drawn through a service prior to installation of the water meter and testing of the backflow assembly.

Meter Installation and Address: When location of meter is absolutely certain, developer/contractor shall verify address with Development Services Inspector. This shall be prior to payment of recycled water meter by developer/contractor.

G. Mow strip shall be used to separate potable and non-potable landscaping.

141-11 APPURTENANCES INSTALLATION

Appurtenances, including blow-offs, sample stations, air release valves, booster pump stations and meters shall be installed in accordance with manufacturer's recommendations, Construction Standard Details and with the following provisions:

A. All valves, fittings, DIP, copper and underground brass shall be wrapped and sealed in 8 mil minimum thickness polyethylene encasement. Use vinyl pipe wrap tape to secure and seal the polyethylene. Damaged or scratched surfaces on epoxy-coated valves and appurtenances may be repaired with an epoxy kit per manufacturer's recommendations and to the satisfaction of the Development Services Construction Inspector prior to wrapping. Otherwise, the damaged valve shall be replaced with a new valve.

B. Gate valves shall be centered in a one piece riser stock. Operator nuts deeper than 40 inches from finished grade shall require a continuous valve nut extension to within 24 inches of finished grade. Extension shall conform to section 81-16.G.41.

C. Buried nuts and bolts shall be coated with a bituminous coating. This includes exposed bolts found on a manufactured appurtenance (i.e., valve bonnets, etc.). "T" bolt heads do not require coating.

D. Dead end lines, permanent and temporary, shall have a blow-off constructed per these Construction Standards.

E. All appurtenances shall be marked with warning tags, signs and/or purple paint as indicated on the approved plans.

F. Insulating kits shall be installed at any transition between dissimilar metal pipes per the Construction Details and as required by the Environmental Utilities Department.

141-12 ON-SITE RECYCLED WATER FACILITIES

Private, on-site recycled water systems shall conform to additional specifications as described herein:

A. Inspections: If the on-site system is installed prior to plan approval and/or inspection, any and all portions of the systems shall be exposed, inspected and corrected as directed by the Development Services Construction Inspector. Failure to comply will result in termination of service. Plan changes or field modifications shall be reviewed and approved by the Environmental Utilities Department prior to installation.

B. Coverage Test for On-site Irrigation Systems: The Owner/Developer shall be responsible for controlling overspray and run-off on new systems or systems requesting conversion. To ensure that overspray or run-off is in accordance with the Department of Health Services regulations, inspection by the Environmental Utilities Department is required. The Environmental Utilities Department is to be contacted at (916) 774-5750 for a

coverage inspection test upon completion of the landscaping improvements involving use of recycled water.

The Owner/Developer or representative shall attend the coverage test and shall have someone attend capable of making minor adjustments to the sprinkling system. All modifications and costs are the responsibility of the Owner/Developer.

The Owner/Developer will be notified in writing of modifications to the system which could not be made during the coverage test. Such modifications shall be made in a timely manner. Failure to make timely modifications will result in termination of service.

C. Controller Charts: Controller charts shall be prepared by the Owner/Developer, approved by the Environmental Utilities Department, and then placed in the controllers prior to start of service. Failure to provide controller charts, or removal of charts from the controller will result in termination of service. Controller charts shall be prepared as set forth herein:

1. Provide 1 controller chart for each automatic controller, showing the area covered by the controller. The chart shall be the maximum size the controller door will physically allow.

2. The chart shall be a reduced size drawing of the actual as-built system. The line weights and lettering on the original controller chart drawing shall be drawn so that the reduced chart is clearly legible.

3. The chart shall be a black line print, with a different color used to show the area of coverage provided by the controller.

4. When completed and approved, the charts shall be hermetically sealed between 2 pieces of plastic, each plastic piece being a minimum of 10 mils thick.

D. Conversion From a Potable System to Recycled Water Supply: The facilities to be converted shall be investigated in detail, including review of any record drawings, preparation of required reports, findings and determinations by the Environmental Utilities Department of measures necessary to bring the system into full compliance with these Construction Standards. The Owner/Developer shall pay all costs associated with converting the system.

E. Conversion From a Recycled Water System to Potable Water Supply: If it becomes necessary to convert from a recycled water system to a potable water system, it shall be the responsibility of the Owner/Developer to pay all costs associated with the conversion, including, but not limited to, the following items:

1. Isolation of the Recycled Water Supply: Service shall be removed and plugged at the main, or abandoned in a manner approved by the Environmental Utilities Department.

2. Installation of approved backflow devices on all meter connections.

3. Removal of recycled water quick couplers and replacement with approved potable water quick couplers.

4. Notification to all personnel involved.

5. Removal of all above ground warning labels.
6. Installation of potable water lines, as necessary. Potable water connection fees shall be paid prior to installation.

7. Any previously paid recycled water connection fees will not be credited toward potable water connection fees.

8. Water quality testing as specified in these standards.

9. Any other provisions necessary to meet City Water System Design and Construction Standards, as deemed necessary by the Environmental Utilities Department Director.

10. Preparation of required reports.

F. On-site Pipe Identification: All buried on-site recycled water piping shall be purple-colored (Pantone 522) PVC with stenciling identifying it as recycled water in accordance with the AWWA manual, Guidelines for the Distribution of Non-Potable Water. The pipe shall be installed with the manufacturing label on top. Markings shall be as specified in Section 141-9 of these Construction Standards, and as modified herein:

1. Alternate pipe with warning tape, as specified below, will be accepted as an alternative to stenciled purple-colored PVC pipe only on a project-by-project basis, with prior written approval from the Environmental Utilities Department.

2. The plastic warning tape shall be prepared with black printing on a purple field, having the words "CAUTION: RECYCLED WATER PIPELINE." The overall width of the tape shall be 3 inches.

   The warning tape shall be installed directly on top of the pipe, longitudinally and centered. The warning tape shall be installed continuous for the entire length of the pipe and shall be fastened to each pipe length by plastic tape banded around the pipe with fasteners no more than 5 feet apart. Taping attached to the sections of the pipe before laying in the trench shall have flaps sufficient for continuous coverage. All risers between the main line and control valves shall be installed with warning tape.

G. Quick Coupling Valves: Quick coupling valves shall conform to the following:

1. **Recycled Water**: Quick coupling valves used for recycled water systems shall be constructed of brass with a purple rubber or vinyl cover and shall have a ¾ inch or 1 inch inlet.

   a. The cover shall be of a locking type and shall have a warning label, permanently stamped or molded into the cover, stating:

   "RECYCLED WATER"
   "DO NOT DRINK" in English and "NO BEBER" in Spanish

2. **Potable Water**: Quick coupling valves used in potable water systems shall have a cover made of brass, metal or yellow rubber or vinyl. Quick coupling valves intended for recycled water use shall not be used on potable water systems.

H. Sprinklers: All sprinklers used for on-site recycled water systems shall have an exposed surface colored purple. The exposed surface shall be colored purple through the use of dyed plastic. The exposed surface shall also display either a molded or hot stamped warning, stating "DO NOT DRINK" in English and Spanish along with an international warning symbol cautioning against drinking the water emitted through the sprinkler or an identification tag conforming to these Construction Standards.

Sprinkler risers and swing joints shall be identified with purple adhesive 3 inch x 3 inch labels. Each label shall state "Recycled Water – Do Not Drink" in English and "NO BEBER" in Spanish.

I. Warning Labels: Controller panels, wash down or blow-off fire hydrants on water trucks and temporary construction services may require installation of warning labels, as directed by the Environmental Utilities Department Director. The labels shall state "Recycled Water – Do Not Drink" in English and Spanish.

J. Valve Boxes and Tags:

1. **Valve Boxes**: Valve boxes shall meet the following requirement:

   a. All gate valves, manual control valves, electrical control valves, and pressures relief valves for on-site recycled water systems shall be installed below grade in a purple valve box with a lid identifying use of recycled water.

   b. Electrical and manual control valve boxes shall have a warning label permanently molded into or affixed onto the lid with stainless steel rivets or bolts. Warning labels shall be constructed of a purple weatherproof material with the warning permanently stamped or molded into the label. The warning shall contain the following information:

"RECYCLED WATER"

"DO NOT DRINK" in English and "NO BEBER" in Spanish

2. **Valve Tags**: All recycled water sprinkler control valves shall be tagged with identification tags conforming to the following:

   a. Tags shall be weatherproof plastic, 3 inch x 4 inch, purple background with permanent black lettering, stating "RECYCLED WATER – DO NOT DRINK" imprinted on one side and "AGUA RECICLADA – NO BEBER" on the other side.

   b. One tag shall be attached to each valve as follows:

   - Attach to valve stem directly or with plastic tie wrap, or;
   - Attach to solenoid wire directly or with plastic tie wrap, or;
   - Attach to valve cover with existing valve cover bolt.

K. Strainers: Strainers shall be installed as follows:

1. Sprinkler irrigation systems shall have a "Y" or basket strainer located upstream of the meter. The strainer shall have a 30 mesh or finer screen. Strainers that have automatic backwash features will not be normally allowed unless it can be demonstrated to the Environmental Utilities Department that the backwash water will not cause run-off and is disposed of in a manner approved by the Environmental Utilities Department. The strainer drain valve shall operate with a recessed key slot.

2. All strainers shall be installed below grade in a rectangular box of sufficient size to easily allow repair or replacement of the unit(s). Box shall be permanently marked "RECYCLED WATER – DO NOT DRINK/NO BEBER".

L. On-site Recycled Water Piping: All on-site recycled water piping shall be installed in accordance with the Uniform Plumbing Code and all other local governing codes, rules and regulations. Recycled water piping under paved or concreted areas shall be installed within a marked C900 sleeve as approved by the Environmental Utilities Director. All piping shall be continuously and permanently marked with the manufacturer's name or trademark, nominal size and schedule or class indicating the pressure rating.

1. **Minimum Requirements of Piping and Fittings**: The minimum class or schedule of piping and fittings shall be as follows:

   a. Cast-iron fittings for A.C. P.: ANSI 21.10 and AWWA C110.

   b. Galvanized steel: Schedule 40, mild steel screwed pipe.

c. Galvanized malleable iron fittings: ANSI B-16.3.1

d. Hard drawn copper Type K: ANSI H-26.1 and ASTM B 88.

e. Wrought copper or bronze solder fittings: ANSI B.16.22

f. All PVC constant pressure pipe shall be as follows:

- Schedule 40 for lines 2½ inches in diameter and smaller.
- Class 160 rubber-gasketed pipe for lines 3 inches and larger.
- C905 Class 165 for 16 inch pipe.
- DIP or CCP for pipe larger than 16 inches.

g. PVC intermittent pressure lateral line piping: Schedule 40 or Class 200.

h. PVC fittings: PVC Schedule 40 solvent weld and factory manufactured, or Schedule 40 with rubber-ring joint. PVC schedule 80 solvent weld and factory manufactured, or schedule 80 with rubber-ring joint.

i. Tubing for drip irrigation systems: Manufactured from virgin polyethylene conforming to ASTM D 1248, Type II, Class C.

j. Ductile-iron mortar lined fittings: Class 250 AWWA C110.

2. PVC Piping: PVC pipe fittings shall conform to the following:

a. PVC plastic pipe and fittings shall be installed below grade.

b. All PVC pipe shall be made from NSF-approved Type I, Grade I compound conforming to ASTM D 1784.

c. All PVC Schedule 40 and Schedule 80 pipe shall be manufactured conforming to ASTM D 1785 and D 2466 and shall meet requirements set forth in Federal Specifications PS-21.

d. All PVC Class 200 solvent weld and Ring-Tite pipe shall be manufactured conforming to ASTM D 2241 and meet requirements set forth in Federal Specification PS-22 with Standard Dimension Ration (S.D.R.) for pressure rated pipe. Pipe shall be extruded from approved Class 12454-PVC with resin specifications conforming to ASTM D 1784 and rubber rings conforming to ASTM D 169.

e. All PVC C900 and C905 shall be manufactured conforming to ASTM D 2241. Pipe shall be extruded from approved Class 12454 PVC with resin specifications conforming to ASTM 1784 and rubber rings manufactured conforming to ASTM F477.

f. All pipe shall be homogeneous throughout, free from visible cracks, holes or foreign materials.

The pipe shall be free from blisters, dents, wrinkles, ripples, die and heat marks. All piping shall be manufactured per NSF specifications.

g. All PVC plastic pipefittings shall be rigid PVC virgin Type I, minimum Schedule 40, with working pressure no lower than that of the pipe. Sockets shall be tapered to conform to the outside diameter of the pipe, as recommended by the pipe manufacturer. All Schedule 40 fittings shall conform to ASTM D 2466. Schedule 80 fittings shall conform to ASTM D 2464 and D 2467.

h. All fittings shall be injection-molded of an improved PVC fitting compound featuring high tensile strength, high chemical resistance and high strength. The compound must meet the requirements described in ASTM D 1784 and D 2466, cell classification 13454B. Where threads are required for plastic fittings, they shall also be injection molded. All tees and ells shall be side gated.

i. PVC solvent cement shall conform to ASTM D 2564.

j. Class 160 pipe and gasket shall conform to ASTM D 1784, D2241, and D1869

M. On-site Potable Water Piping: All potable water piping installed within the same project limits as the on-site recycled water piping shall be installed in accordance with the Uniform Plumbing Code and all other local governing codes, rules and regulations, and shall also conform to the following provisions:

1. The pipe shall be continuously and permanently marked with the manufacturer's name or trademark, nominal size and schedule or class indicating the pressure rating.

2. All potable water piping shall have a blue plastic tape identifying it as a potable water line. Potable water warning tape shall be a minimum of 3 inches wide and shall run continuously for the entire length of each line. The tape shall be attached to the top of the pipe with nylon tie-wrap banded around the warning tape and the pipe every 5 feet on center. Warning tape for the potable water piping shall be blue in color with the words "CAUTION: POTABLE WATER LINE" imprinted in minimum 1 inch high, black letters. Imprinting shall be continuous and permanent.

141-13 TESTING PROCEDURES

Recycled water facilities testing shall be performed once joint utility crossings, sewer pressure test and TV inspection and subgrade is made and in accordance with Section 81-13 of these Construction Standards, and as provided herein:

A. Public System (Offsite): Tests and procedures for recycled water systems to be accepted and maintained by the City shall consist of the following:

1. **Pressure Test**: Shall conform to Section 81-13.A of these Construction Standards.

2. **Topside Improvements:** Shall conform to Section 81-13B of these Construction Standards.

3. **Chlorine Disinfection**: Shall conform to Section 81-13.C of these Construction Standards.

4. **Water Quality Testing**: Shall conform to Section 81-13.D of these Construction Standards.

5. **Cross-Connection Testing**: Testing for cross-connection shall be in accordance with the California Plumbing Code, Chapter 16 part II, and the following requirements prior to acceptance and use. All potable and recycled water valves shall be in the open position prior to testing. During the potable water system pressure testing process, the recycled water system shall be depressurized to atmospheric pressure. Once the potable water system has passed the pressure test, it shall be depressurized to atmospheric pressure. The recycled water system shall be pressurized for pressure testing per these standards. The pressure testing shall be performed the same day.

6. **Continuity**: Shall be in conformance with Section 81-13.F of these Construction Standards.

7. **Corrosion Protection System Testing**: Shall conform to Section 81-13G of these Construction Standards.

B. Private System (On-site): Tests and procedures for recycled water systems for private use and maintenance shall conform to the following:

1. **Pressure Test**: The constant pressure recycled water system including appurtenances shall be tested at 125 PSI for 1 hour with non-detectable leakage.

2. **Cross-Connection Testing**: Testing for cross-connections shall be in accordance with the California Plumbing Code, Chapter 16 part II prior to use.

141-14 REPAIRING INSTALLED IMPROVEMENTS

All PVC and concrete cylinder pipe recycled water mains shall be repaired by the following procedure:

A. PVC: PVC repairs shall consist of the following:

1. Damaged or failed pipe sections shall be removed and replaced with new pipe in the presence of the Development Services Construction Inspector. Replacement can be accomplished by the use of City-approved ductile iron mechanical joint repair sleeves. Pipe restraints may be required, depending on repair locations.

2. After the repair has been completed, the excavation shall be backfilled and compacted to grade as specified. The repairs shall then be re-tested per these Construction Standards.

3. At the direction of the City, the Contractor shall repair damage to the polyethylene encasement as described within ANSI/AWWA C-105/A21.5 or shall replace all damaged polyethylene film sections.

B. Concrete Cylinder Pipe Repairs: Concrete cylinder pipe repairs shall be coordinated with the Environmental Utilities Department on a case-by-case basis.

141-15 PUNCHLIST PROCESS

When the Contractor feels all improvements are substantially complete, a punchlist of final outstanding items may be requested. With the assistance and presence of the contractor, the punchlist shall be generated by the Development Services Construction Inspector. The cost in generating the punchlist shall be borne by the Contractor/Developer.

141-16 MATERIALS

A. Approved Equal: The words "approved equal" shall mean any material deemed by the Environmental Utilities Department to be acceptable for use within the City's recycled water system as compared to products of specified manufacturers. Contractors proposing to use materials which are not specifically named shall submit all necessary documentation to allow review of said material for use as an approved equal.

The submittal shall include a letter with:

1. **Product**: A description of the product and the appropriate materials specification section number. A sample of the product may be required for review and testing.

2. **Contact**: The name and telephone number of the contact person for the proposed product.

3. **Reference**: A list of a minimum of 3 agencies that are using the proposed product (include names and telephone numbers).

4. **Performance**: Information and reference for 3 locations with a performance record of 3 years in operation of the installation.

5. Address the letter to the Environmental Utilities Department Engineering Division, 2005 Hilltop Circle, Roseville CA 95747, ATTN: EUD, Chairman of METAC. City staff may request a sample of the product for review.

6. The contractor shall submit all material for review 35 day prior to contract award. All submittals shall include documentation verifying the contract award date. Contractors shall allow 2 to 4 weeks review time by the Environmental Utilities Department.

B. Conditionally Approved Material: Materials or products that have met the reference and performance requirements shall be conditionally approved for a minimum trial period of 2 years. Upon completion of the 2 year period. The product may be approved or the evaluation period may be extended as required by the Environmental Utilities Director. A list of conditionally approved products may be obtained from the Environmental Utilities Department.

C. Unapproved Materials: Materials not approved for use on the project shall be removed from the site within 24 hours if requested by the Development Services Construction Inspector.

D. Recycled Water Main: Unless noted on the approved plans, all recycled water mains shall be either Polyvinyl Chloride Pressure Pipe (PVC), Concrete Cylinder Pipe, or DIP.

1. **PVC Pressure Pipe**: PVC Pressure Pipe shall be manufactured in accordance with Section 81-16 of these Construction Standards, except as modified herein:

   a. All PVC transmission mains up to 12 inches in diameter shall be purple colored (Pantone 522) PVC. Mains 12 inches in diameter and smaller shall be AWWA C-900 class 150. pipe manufacturers include: Aquaspring C900 Certa-Lok, Diamond Plastics Corporation, J-M Manufacturing, Pacific Western Pipe, Vinyl Tech-White Knight, PW-Eagle, North American Pipe Corporation or approved equal.

   b. PVC pipe shall be manufactured within the 18 month period prior to installation. All PVC pipe shall be purple in color with stenciling identifying it as recycled water, in accordance with the AWWA manual "Guidelines for the Distribution of Non-Potable Water". Markings on the PVC pipe shall be placed continuous on two sides of the pipe and shall include:

   - "RECYCLED WATER – DO NOT DRINK"

- The pressure rating of the pipe, in pounds per square inch (PSI).
- The ASTM designation.

2. **Concrete Cylinder Pipe (CCP)** – The use of CCP is one option for recycled water transmission mains larger than 16 inches in diameter, CCP shall be in accordance with AWWA designations.

   Approved concrete cylinder pipe manufacturers include: Ameron, Pacific-States, or approved equal.

3. **Ductile Iron Pipe (DIP)** – Mains 16" in diameter or larger shall be DIP. DIP shall conform to Section 81-16 of these Construction Standards.

E. Services

1. **Brass Material**: Shall conform to Section 81-16.F of these Construction Standards.
2. **Copper Tubing**: Shall conform to Section 81-16.F,c.2 of these Construction Standards.
3. **Corporation Stops**: Shall conform to Section 81-16.F,3 of these Construction Standards.
4. **Curb Stops**: Shall conform to Section 81-16.F,4 of these Construction Standards.
5. **Service Saddles**: PVC Pressure Pipe Saddles shall conform to Section 81-16.F,6 of these Construction Standards.

F. Appurtenances

1. **Air Release Valves**: Shall conform to Section 81-16.G,1 of these Construction Standards.
2. **Blocking for Boxes**: Shall conform to Section 81-16.G,6 of these Construction Standards.
3. **Boxes**: All box lids are to permanently be marked with the appropriate label (i.e., Recycled Water, ARV, Blow-Off, CPT, etc.). Boxes and manufacturers shall conform to Section 81-16.G,33 of these Construction Standards.
4. **Cadwelds**: Shall conform to Section 81-16.G,8 of these Construction Standards.
5. **Fittings**: PVC fittings shall conform to Section 81-16.G,9 of these Construction Standards.
6. **Gaskets**: Shall conform to Section 81-16.G,11 of these Construction Standards.

7. **Location Stakes**: Shall conform to Section 81-16.G,15 of these Construction Standards.

8. **Mainline Valve Lockout**: Shall conform to Section 81-16.G,16 of these Construction Standards.

9. **Manhole Frame and Cover**: Shall conform to Section 81-16.G,17 of these Construction Standards.

10. **Meters:** All meters are to be purchased through the Environmental Utilities Department Water Division at (916) 774-5750.

11. **Meter Idlers**: Shall conform to Section 81-16.G,19 of these Construction Standards.

12. **Meter Setters**: Shall conform to Section 81-16.G,20 of these Construction Standards.

13. **Meter Spud Couplers**: Shall conform to Section 81-16.G,21 of these Construction Standards.

14. **Nuts and Bolts**: Shall conform to Section 81-16.G,22 of these Construction Standards.

15. **Nylon Bushing**: Shall conform to Section 81-16.G,23 of these Construction Standards.

16. **Patching Material**: Shall conform to Section 81-16.G,24 of these Construction Standards.

17. **Polyethylene Encasement**: Shall conform to Section 81-16.G,26 of these Construction Standards.

18. **Pressure Regulators**: Shall conform to Section 81-16.G,27 of these Construction Standards.

19. **Restraints**

    a. 12 Inches and Smaller Diameter c-900 PVC – Approved restraint systems for PVC Pressure Pipe include: Aquaspring C900 Certa-Lok (for straight runs only), Romac Grip Rings, or approved equal.

    b. Roman 470 or approved equal for mechanical joint restraint or bell and spigot restraint**.**

    c. Restraint systems for pipe diameters 24 inches and larger shall conform to Section 81-16.G,28 of these Construction Standards.

20. **Riser Aligners**: Shall conform to Section 81-16.G,29 of these Construction Standards.

21. **Riser Stock**: Shall conform to Section 81-16.G,30 of these Construction Standards. Purple pipe shall be used.

22. **Sampling Station**: Sampling stations shall be purchased from the Environmental Utilities Department Water Division at (916) 774-5750.

23. **Tracing Wire**: Shall conform to Section 81-16.G,36 of these Construction Standards.

24. **Tracing Wire Connectors**: Shall conform to Section 81-16.G,37 of these Construction Standards.

25. **Traffic Boxes**: Shall conform to Section 81-16.G,35 of these Construction Standards.

26. **Valves**: Shall conform to Section 81-16.G,39 of these Construction Standards.

27. **Valve Boxes**: Shall conform to Section 81-16.G,40 of these Construction Standards.

28. **Valve Nut Extensions**: Shall conform to Section 81-16.G,41 of these Construction Standards.

29. **Zinc Caps**: Shall conform to Section 81-16.G,43 of these Construction Standards.

SECTION 151

SOLID WASTE CONSTRUCTION

151-1 GENERAL - Solid Waste enclosures shall be constructed in accordance with the requirements of these Construction Standards and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times.

151-2 APPROVED PLANS - Planning Department and Building Division approvals of the solid waste enclosure shall be obtained prior to beginning construction.

151-3 INSPECTION - Enclosures shall be inspected per the following procedure:

1. Contractor shall meet with the designated Development Services Construction Inspector prior to beginning work.

2. A City approved detailed structural design for the enclosure shall be provided to the inspector.

3. Footings, enclosure floor reinforcements, approach floor reinforcement, vertical wall reinforcement, and bollards shall be inspected prior to pouring concrete.

4. Gates shall be inspected prior to and after installation.

5. Signage and striping shall be inspected prior to and after installation.

151-4 PUNCHLIST PROCESS - When all improvements are substantially complete, the contractor shall provide a written request for a punchlist inspection of the improvements.

151-5 MATERIALS - Materials shall be as specified on these Construction Standards and as approved by the architect and the City for the specific project.