SECTION V

STORM DRAINS, STORM WATER QUALITY, AND WATERSHED PROTECTION

V-1. GENERAL

It is the general purpose of these standards that storm water be contained and treated on the area to be developed. Adjacent improvements, existing or planned, will be free from flood hazard and will not receive a greater volume and intensity of storm water runoff than pre-existing conditions. Flood hazard is defined as potential damage by water having sufficient depth or velocity to damage improvements or to deposit or scour soil.

These specifications are intended to meet the requirements of the National Flood Insurance Program, the City's Flood Plain Ordinance, and the City's Storm Water Management Plan. These specifications reflect numeric storm water control criteria adopted by the Water Board on July 13, 2013 (including subsequent revisions) and modified as specifically applicable to the City of Paso Robles.

The lowest floor of any project that is located within a Special Flood Hazard Area and shown as an A, AE, AH or AO Zone shall be elevated above the highest adjacent grade to a height equal to or exceeding the depth number specified in feet on the Flood Insurance Rate Map (FIRM) by at least one foot, or elevated at least three feet above the highest adjacent grade if no depth number is specified.

Upon completion of a structure in a Special Flood Hazard Area, the elevation of the lowest floor including basement shall be certified by a registered professional engineer or land surveyor, and verified by the city building inspector to be properly elevated. Such certification or verification shall be provided to the City Engineer.

Modification of a flood-plain shall be accomplished in accordance with Federal Management Emergency Management (FEMA) regulations and the City's Floodplain Ordinance. The design engineer shall provide all data necessary for a Conditional Letter of Map Amendment (CLOMA) and a final Letter of Map Amendment (LOMA).

These standards are intended to provide general design criteria. Most design details are left to the responsibility of the consultant. The design standards contained herein are minimal and alternates may be approved, provided such alternates are to a higher standard than those set forth. Exceptions to these standards may be allowed by the City Engineer when it can be determined that such exceptions are in the best interest of the City.

A. Post-Construction Storm Water Quality and Watershed Protection

Reference Attachment 1 of Resolution No. R3-2013-0032 of the California Regional Water Quality Control Board, Central Coast Region adopted July 12, 2013 for definitions associated with the requirements outlined below.

(1) Applicability

Performance requirements apply to all projects that create or replace greater than 2,500 square feet (sf) of impervious surface including:

- Removing and replacing a paved surface resulting in alteration of the original line and grade, hydraulic capacity, or overall footprint of the road
- Extending the paving edge or paving graveled shoulders
- Resurfacing by upgrading from dirt to asphalt, or concrete; upgrading from gravel to asphalt, or concrete; or upgrading from a bituminous surface treatment ("chip seal") to asphalt or concrete

Performance requirements will not apply to:

- Road surface repair including slurry sealing, fog sealing, pothole and square cut patching; overlay of existing asphalt or concrete pavement without expanding the area of coverage; shoulder grading; cleaning, repairing, maintaining, reshaping or regrading drainage systems; crack sealing; resurfacing with in-kind material without expanding the road or parking lot; practices to maintain the original line and grade, hydraulic capacity, and overall footprint of the road or parking lot; repair or reconstruction of the road because of slope failures, natural disasters, acts of God or other man-made disaster.
- Sidewalk or bicycle path projects, where no other impervious surfaces are created or replaced, built to direct storm water runoff to adjacent vegetated areas
- Trails and pathways, where no other impervious surfaces are replaced or created, and built to direct storm water runoff to adjacent vegetated areas
- Underground utility projects that replace the ground surface with in-kind material
- Curb and gutter improvement or replacement projects that are not part of any additional creation or replacement of impervious surface area

(2) Storm Water Control Plan

All projects subject to post-construction storm water quality performance requirements must provide a storm water control plan to complete an application for any discretionary approval and/or grading permit. The Storm Water Control Plan shall be comprised on the following information:

- Project name, application number, address and assessor parcel number
- Name of applicant and land owner
- Project Description
- Total site area
- Show an accounting of pre-project impervious areas and impervious areas created or replaced. Determine total new impervious surface area, total replaced impervious surface area, total new pervious area, and calculation of Net Impervious Area
- Delineate and quantify the impervious area being drained to landscape and/or the extent of pervious pavement
- Divide the project area into discrete Drainage Management Areas
- Statement of water quality treatment performance requirements that apply to the project
- Summary of site design and runoff reduction measures (Performance Requirement No. 1) selected for the project
- Description of all post-construction structural stormwater control measures
- Supporting calculations used to comply with the applicable water quality treatment performance requirements
- Documentation stating that the selection, sizing, and design of the stormwater control measures meet the water quality treatment requirement
- Water quality treatment calculations used to comply with water quality treatment performance requirement/s
- Operations and Maintenance Plan for all structural stormwater control measures

(3) Performance Requirement No. 1 Site Design and Runoff Reduction

Projects that create and/or replace greater than or equal to 2,500 square feet of impervious surface must implement the following design strategies:

- Limit disturbance of creeks and natural drainage features
- Minimize compaction of highly permeable soils
- Limit clearing and grading of native vegetation
- Concentrate improvements on the least sensitive portions of the site
- Implement one or more of the following site design measures:
    1. Direct roof runoff into cisterns or rain barrels for reuse
    2. Direct roof runoff into vegetated areas
    3. Direct runoff from sidewalks, patios, driveways and uncovered parking areas to vegetated areas
    4. Construct driveways, walkways and parking lots with permeable materials

(4) Performance Requirement No. 2 Water Quality Treatment

(a) Projects that create a Net Impervious Area of 5,000 square feet must treat storm water runoff to reduce pollutant loads and concentrations using physical, biological and chemical removal (single family residences are exempted). See City of Paso Robles Stormwater Technical Guide.

Net Impervious Area is the total (new and replaced) post project impervious areas minus any reduction in total imperviousness from the pre-project to the post-project condition:

NIA = New and Replace Impervious Area – Reduced Impervious Area Credit

Reduced Impervious Area Credit is the total pre-project to post-project reduction in impervious area.

(b) Water quality treatment shall be applied in the order of preference listed below (highest to lowest). Water quality performance requirements shall apply to the runoff from existing, new and replaced impervious surfaces on sites where runoff from existing impervious surfaces cannot be separated from runoff from new and replaced impervious surfaces.

Low Impact Development (LID) Treatment Systems:
Implementing harvesting and use, infiltration, and evapotranspiration storm water control measures that collectively achieve the following hydraulic sizing criteria for LID systems:

- Retain storm water runoff equal to the volume of runoff generated by 85th percentile 24-hour storm event (0.80 inches).

Biofiltration Treatment Systems:
Implement biofiltration systems using facilities the must be demonstrated to be at least as effective as a biofiltration system with the following design parameters:

- Maximum surface loading rate appropriate to prevent erosion, scour and changeling within the biofiltration system itself and equal to five inches per hour, based on the flow of runoff produced from a rain event equal to 0.2 inches per hour intensity.
- Minimum surface reservoir volume equal to the biofiltration treatment system surface area times a depth of six inches.
- Minimum planting medium depth of 24 inches. The planting medium must

sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of sand (60%-70%) meeting the specifications of ASTM C33 and compost (30%-40%) may be used. An alternative planting medium may be utilized if it is demonstrated to be equal or more effective at attenuating pollutants than the specified planting medium mixture.

- Proper plant selection as provided by the Central Coast LID Initiative.
- Subsurface drainage/storage (gravel) layer with an area equal to the biofiltration treatment system surface area and having a minimum depth of 12 inches.
- Underdrain with discharge elevation at top of gravel layer.
- No compaction of soils beneath the biofiltration facility.
- No liners or other barriers interfering with infiltration (excepting conditions were lateral infiltration is not feasible).

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Non-Retention Based Treatment Systems:
Stormwater Control Measures that collectively achieve at least one of the following hydraulic sizing criteria for non-retention based treatment systems:

- Volume Design Basis: Treat stormwater runoff equal to the volume of runoff generated by the 85th percentile 24-hour storm event (0.80 inches).
- Flow Design Basis: Treat the flow of runoff produced by a rain event equal to at least 0.2 inches per hour intensity.

(5) Performance Requirement No. 3: Runoff Retention

Projects that create and/or replace greater than or equal to 15,000 square feet of impervious surface are required to meet runoff retention performance requirements using Low Impact Development Standards. See Stormwater Technical Guide.

Prevent off-site discharge from events up to the 95th percentile 24-hour rainfall event (1.45 inches). Retention is to be achieved by optimizing infiltration. Project design shall be founded in Low Impact Development principles. Site opportunities and constraints shall be identified and a site assessment shall include:

- Topography, structures, utilities, easements
- Hydrologic features including natural areas, wetlands, watercourses, seeps, or springs.
- Depth to seasonal high groundwater
- Locations of wells
- Depth to impervious bedrock
- Presence of unique geology

- Geotechnical hazards
- Soil and/or groundwater contamination
- Soil types and hydrologic soil groups
- Vegetative cover/trees
- Run-on characteristics (estimate off-site runoff discharging to the project area)
- Existing drainage infrastructure
- Zoning, setbacks and open space requirements
- Define the development envelope and protected areas, identifying areas that are most suitable for development and areas to be left undisturbed.
- Conserve natural areas including existing trees, vegetation and soils
- Limit the overall impervious footprint of the project
- Set back development from creeks, wetlands and riparian habitats
- When runoff reduction measures and natural landscape areas have been maximized to the extent feasible storm water control measures shall be used to comply with performance requirements. Storm water control measures associated with small-scale, decentralized facilities designed to infiltrate, evapotranspirate, filter, or capture storm water shall be optimized. Refer to the City's technical guidelines for sizing of storm water retention facilities.

(6) Performance Requirement No. 4: Peak Management

All projects that create and/or replace greater than or equal to 22,500 square feet of impervious surface in Watershed Management Zone 1 shall manage peak stormwater runoff as required below as well as meeting Water Quality and Runoff Retention requirements.

Post-development peak flows, discharged from the site, shall not exceed pre-project peak flows for the 2 through 10-year storm events.

A Stormwater Control shall be provided in conformance with the Stormwater Technical Guide on File with the Stormwater Control Manager in the Department of Public Works.

(7) Operation and Maintenance for Structural Stormwater Control Measures

The design of all structural stormwater control measures must be accompanied by an operation and maintenance (O and M) plan. Minimum requirements for the O and M plan are described in the City's Technical Guide.

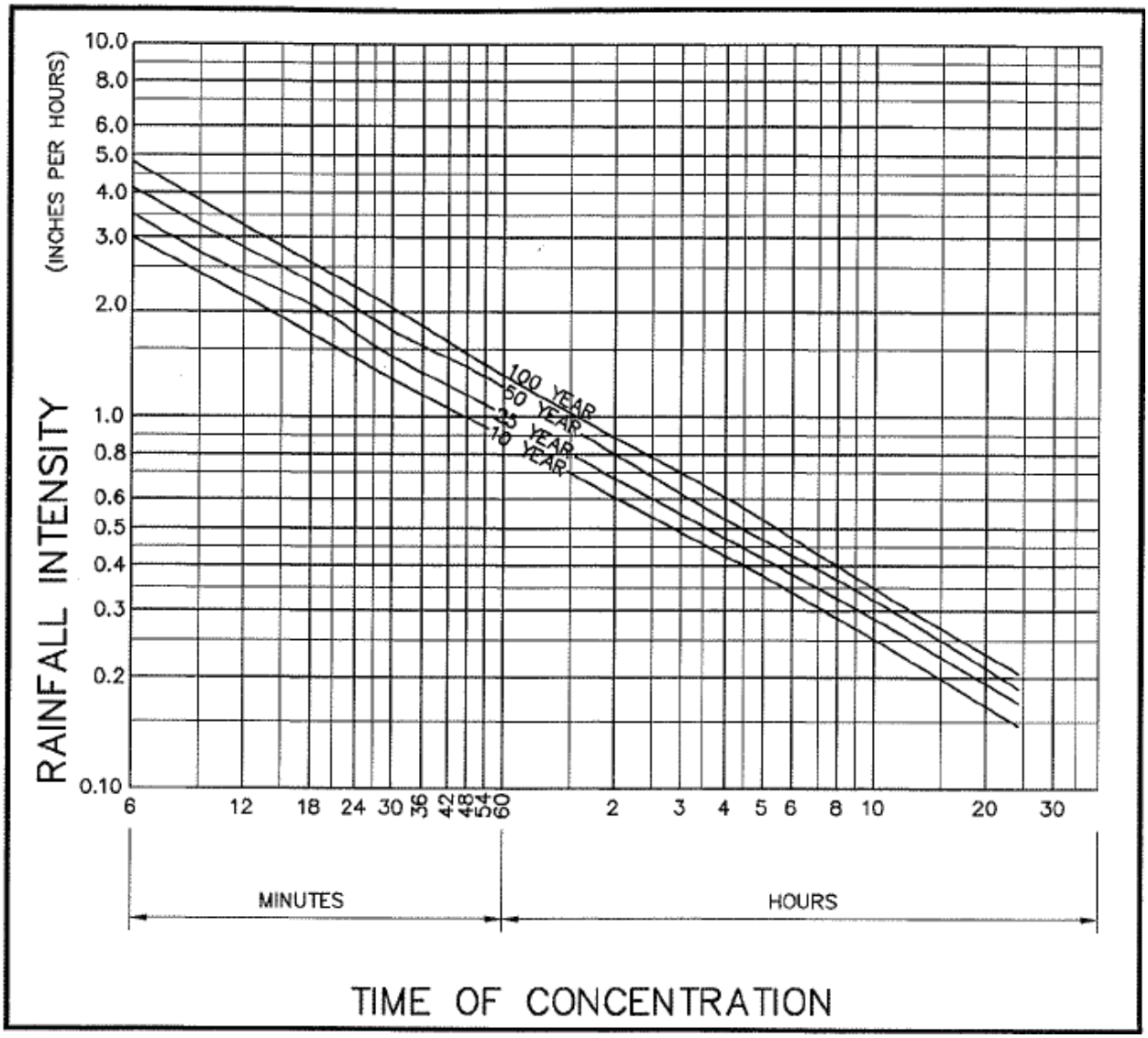
Prior to project acceptance or occupancy, verification of on-going maintenance of structural stormwater control measures must be established by legal binding agreements.

B. Off-Site Hydrology, Cross-Culverts, Open Channels

1. Hydrology Calculations

The Rational Method shall be used to compute the total volume of runoff from a development with an area less than 200 acres. For drainage areas in excess of 200 acres, or where the design engineer determines that the Rational Method is not practical or appropriate, the design engineer shall provide all documents necessary to confirm computations.

All calculations shall be prepared by a registered professional engineer with a current license to practice in the State of California. The rainfall intensity curve included herein is available for use as part of the hydrology calculations. In computing runoff in a partial development, adequate provisions must be made for the drainage of the overall improvements and/or drainage tributary. Hydrology calculations shall be based upon ultimate land use designations in accordance with the adopted General Plan.


RAINFALL INTENSITY
(INCHES PER HOURS)
10.0
8.0
6.0
5.0
4.0
3.0
2.0
1.0
0.8
0.6
0.5
0.4
0.3
0.2
0.10
100 YEAR
50 YEAR
25 YEAR
10 YEAR
6
12
18
24
30
36
42
48
54
60
2
3
4
5
6
8
10
20
30
MINUTES
HOURS
TIME OF CONCENTRATION

2. Closed Conduits

Design considerations for closed conduits are as follows:

- Pipe friction losses determined by Manning's equation.
- Entrance and exit losses.
- Tail-water impacts.
- Entrance control headwater.

For each length of pipe, the hydraulic grade line (hgl) at the pipe entrance and exit shall be determined assuming both inlet control and outlet control. The more restrictive shall control. The storm drain system shall be designed to meet the following conditions:

1. The hydraulic grade line shall be a minimum of 0.50 feet below the elevation of inlet grates and manhole covers of all structures for a design storm of 25 years. Said gradient shall be shown on the profile for storm drain systems.
2. Minimum pipe diameter allowable on any public storm drain shall be 18 inches.
3. Storm drain systems shall be designed for the 25-year storm. In a sump condition a secondary overland flow shall be included such that during the 100-year storm, all buildings or first floor elevations shall be at least one foot (1') above the 100-year storm.
4. Street capacity shall be defined as the 10-year storm confined between the crown of the street and the top of curb. Where the street capacity is exceeded at either the curb or the crown, a storm drain or other approved facility shall be provided to convey the excess flows. In all cases, the 100-year storm shall be contained within the right-of-way.

Cross culvert design shall be determined on the basis of a twenty-five year storm with no head. The hydraulic entrance condition shall be such that the 25-year discharge will have the specified freeboard in the upstream channel or waterway and that the 100-year discharge will be contained within the banks of the upstream waterway or drainage easement. The entrance to the closed conduit minor waterway may be submerged provided that the above criteria are satisfied. The invert elevation of the closed conduit entrance shall not be set lower than the natural flowline of the waterway or open channel flowing into it.

3. Open Channels

Open channels shall be designed based on Manning's equation. The impacts of culverts, bridges or other structures affecting the hydraulic performance of the channel shall be considered as appropriate.

The City Engineer may require more complete analysis if he/she determines conditions merit a more thorough study. This additional analysis may include determination of the water surface profile, analysis of critical sections, and analysis of erosion and/or sedimentation.

Maximum velocity for channels flowing full shall be limited to preclude erosion. Freeboard of at least one foot based on 25-year volumes shall be provided for all channels. Lining treatments shall extend to the full height of freeboard. The 100-year discharge shall be contained within the banks or within the easement established for the channel. For natural waterways, the design flow may be allowed in the natural overflow area.

4. Retention Basins

Storm water retention for flood control purposes shall be applied as determined by the design engineer; typically where downstream conditions are constrained and properties are threatened or have been flooded in conditions existing prior to upstream development. Criteria for the design of retention basins may be reviewed on a case by case basis. Typically, the volume of storage for flood control purposes is based upon the post-development 100-year, 24-hour storm event.

5. Detention Basins

A detention basin is defined as a holding facility where the rate of flow from the basin is limited to that rate historically occurring prior to development. The volume of storage of a detention basin shall be determined by theoretically matching the historical hydrograph of flows leaving the previously undeveloped land under consideration.

6. Storm Drain Alignment Criteria

Storm drain lines shall be parallel with street centerlines to the extent practical and typically twelve feet southerly or easterly of the centerline **(Standard Detail U-1)**.

Maximum spacing for manholes shall be 500 feet. Manholes shall be located at junction points, changes in gradient and changes in conduit size. The alignment between any two manholes may consist of one curve and one tangent section. A manhole must be placed at the beginning or end of any curve. Reverse curves are not acceptable between manholes. Curve radii shall conform to pipe manufactures recommendations. All manholes must be located in areas accessible for maintenance.

7. Easements

Drainage facilities must be located in a public street right-of-way or within a public drainage easement. Easements for closed conduits shall be a minimum width of twenty feet (20). Easements for open channels shall have sufficient width to contain the channel with a minimum ten foot (10) setback to side slopes and a fifteen (15) foot wide service road on at least one side.

V-2. MATERIALS

Closed Conduits shall be high density polyethylene (HDPE) with water tight couplings, reinforced concrete pipe (RCP), or hot-dipped galvanized Corrugated Metal Pipe (CMP).

Standard pre-cast concrete manholes shall be typical **(Standard Detail D-2)**. Special designs of manholes or junction boxes shall be approved by the City Engineer.

Open conduits may be natural watercourses, earthen channels, or channels lined with materials such as:

- Native grass which forms a thick, dense sod without irrigation;
- Turf reinforcement mats, erosion control blankets, or geotextile materials. Such material may be interplanted with vegetation;
- Rock slope protection in accordance with Caltrans specifications;
- Bioengineering methods recommended in Natural Resource Conservation Service's *Streambank Soil Bioengineering Field Guide for Low Precipitation Areas*;

Drain inlets shall conform to **Standard Detail D-1**. Grates shall be adequate for AASHTO's HS-20 traffic loading and shall be double dipped hot galvanized or approved equal.

All headwalls, wing-walls, and end-walls shall be constructed of Class "A" reinforced Portland cement concrete. Trash racks shall be provided where necessary to prevent clogging of culverts and storm drains.

V-3. CONSTRUCTION GUIDELINES

A. General

Excavation, pipeline placement and backfill shall conform to **Section VI-3** of these specifications for sanitary sewers.

Concrete structures shall be placed in accordance with these Standards and Specifications and shall conform to the requirements of Section 51 of Caltrans Standard Specifications.