

Section 8

Design Criteria

Stormwater Facilities

8.1 Introduction

CVWD provides regional flood protection within its Stormwater Unit Boundary (see Appendix K) by collecting, detaining and conveying regional flood flows through the Coachella Valley to the Salton Sea. CVWD owns, operates and maintains the 50-mile Whitewater River/Coachella Valley Stormwater Channel (WWRSC/CVSC) and other tributary facilities. In addition, CVWD operates and maintains facilities owned by the United States Bureau of Reclamation (USBR).

CVWD is the National Flood Insurance Program (NFIP) Administrator for unincorporated areas in Riverside County that lie within the Stormwater Unit Boundary. It also provides floodplain management services to most of the cities in the Stormwater Unit Boundary.

As a result of these responsibilities, CVWD reviews and approves submissions for the following types of projects:

- Projects that will be adjacent to or within the existing regional stormwater facilities and potentially affect their performance. Typical examples are bridges and utility crossings
- New developments within the Stormwater Unit Boundary that are potentially exposed to flood hazards. These projects may or may not construct stormwater facilities for mitigation of existing regional flood hazards

CVWD does not review or approve on-site drainage for new developments within the Stormwater Unit Boundary. This aspect of development is reviewed by Riverside County (unincorporated areas) or the Cities (incorporated areas).

CVWD has adopted standards and guidelines for the design and construction of regional stormwater facilities and for evaluation of new developments. The following sections describe these standards and provide guidance to proponents and their engineers on requirements for approval of the above project types. Section 8 is organized so that general discussion is provided in the main report; technical details, procedures to meet the standards, report outlines, and checklists are included in Appendix K.

8.2 Proviso

CVWD will review and approve studies and reports related to its stormwater system or for development within flood-prone areas for conformance with its regulations and with County, State and Federal regulations, where appropriate. This notwithstanding, CVWD assumes no liability for inadequate design or improper construction. Review and

approval does not absolve the owner, developer, design engineer, or contractor of liability. Compliance with this document or with regulatory standards does not guarantee that properties will be free from flooding or flood damage.

The project engineer retains the responsibility for design of storm water or drainage facilities that meet industry standards of practice and provide public safety. CVWD, its officials, and its employees assume no liability for information, data or conclusions reached by developers or engineers and make no warranty, expressed or implied, when they review or approve projects or studies.

8.3 The Regional Stormwater System

The Whitewater River originates on the southern slopes of the San Bernardino Mountains and flows southeast through the Coachella Valley to the Salton Sea. The drainage area is approximately 1,500 square miles at the Salton Sea. Downstream of Palm Springs, its course is now channelized. From Point Happy (near Washington Street) upstream to Palm Springs the channelized section is referred to as the WWRSC; downstream to the Salton Sea, the channelized extension is referred to as the CVSC. The WWRSC/CVSC is about 50 miles long.

Table 8.1 describes the stormwater facilities which are also shown on a map in Appendix K. Tributary stormwater facilities convey flood flows from the Santa Rosa Mountains on the southwest or from the Little San Bernardino Mountains on the northeast to the WWRSC/CVSC. These facilities include the West Magnesia Channel, Palm Valley Channel, Thousand Palms Channel, Wasteways 2 and 3, La Quinta Evacuation Channel, Deep Canyon Channel, and Avenue 64 Evacuation Channel. CVWD also operates stormwater systems that intercept regional floods and convey them to the tributary stormwater facilities. Examples of these projects include the East Side Dike, Dike No. 4, and the Bear Creek Detention System. CVWD also operates stormwater facilities or systems that discharge directly to the Salton Sea, such as Wasteway No. 1.

CVWD works to re-evaluate, upgrade and certify its existing stormwater facilities to applicable FEMA standards and regulations. In addition, CVWD has developed stormwater plans within its Stormwater Unit Boundary. On-going design and planning projects, in various stages of development, include:

- Thousand Palms Flood Control Project. CVWD is in the process of completing the design and environmental study following the transfer of the project from USACE to CVWD.
- Eastern Coachella Valley Stormwater Master Plan
- North Indio Flood Control Channels North Cathedral City Storm water Master Plan Improvements
- Whitewater River Levee Improvements Upstream of Ramon Road
- East Side Dike North of I-10 Levee Certification

- East Side Dike I-10 to Dos Palmas
- Avenue 54 to Thermal Drop Structure Channel Improvements
- Western Shore of Salton Sea Stormwater Master Plan

Table 8.1: CVWD Stormwater Facilities

Facility	Type	Bed/Banks	Length (mi)
Whitewater River/CVSC	Channel/Levee	Earth/Concrete Slope Lining	50.0
Bear Creek System & La Quinta Evacuation Channel	Levee/Basin/Channel	Earth/Concrete/Soil Cement	5.8
Dead Indian System & Deep Canyon System	Levees/Channel	Earthen/Concrete	7.8
Palm Valley Channel & Cat Creek	Basins/Channels	Earthen/Concrete	7.0
East Magnesia Canyon Channel	Channel	Earthen/Concrete	1.8
West Magnesia Canyon Channel	Basin/Channel	Earthen/Concrete	1.3
Thousand Palms Connecting Channel	Channel	Earthen	0.5
Thunderbird Channel	Channel	Concrete/Concrete	1.0
Thunderbird Villas Stormwater Channel	Channel/Storm Drain	Concrete/Concrete	0.8
Peterson Stormwater Channel	Channel/Storm Drain	Concrete/Concrete	0.5
Sky Mountain Channel	Channel/Storm Drain	Concrete/Earthen	1.8
Eastside Dike	Levee	Earthen	25.5
Wasteway 1	Channel	Concrete	3.3
Wasteway 2	Channel	Concrete	2.3
Wasteway 3	Channel	Concrete	1.3
Dike #2	Levee	Earthen	1.0
Dike #4	Levee	Earthen Dike	3.5
Avenue 64 Evacuation Channel/Fillmore Street Irrigation Ditch	Channel	Concrete/ or Pipes/Concrete	6.8
Guadalupe Dike System	Levee	Earthen/ Riprap Dike	1.0

8.4 Guiding Regulations

CVWD relies on four regulations in their review of submissions for projects within the Stormwater Unit Boundary; (1) California Drainage Law, (2) Riverside County Ordinance 458 (latest version), (3) CVWD Ordinance 1234.2, and (4) Municipal Separate Stormwater Sewer System (MS4) Permit. The following sub-sections describe the basic principles behind these regulations.

8.4.1 California Drainage Law

California Drainage Law states that property owners have the right to protect themselves from flooding as long as they do not unreasonably increase flood risk for adjacent property owners. Flows must be reasonably received and released in the historical flow paths at the historical flow depths and velocities.

8.4.2 Riverside County Ordinance 458

This ordinance was adopted by Riverside County as a requirement of its participation in the National Flood Insurance Program (NFIP) of FEMA as stipulated in Title 44, Section 65 of the Code of Federal Regulations (44CFR65). Ordinance 458 specifically regulates development in Special Flood Hazard Areas identified on maps prepared by FEMA, the State of California or the County that result from the one-percent annual chance flood, also referred to as the “Base Flood” and the “100-Year Flood”.

8.4.3 CVWD Ordinance 1234.2

Ordinance 1234.2 provides standards for design and ownership of stormwater facilities within the Stormwater Unit Boundary (please refer to Guideline K-7 for details). The Ordinance provides a common standard (CWD 100-Year Plus) for design and evaluation of all existing and proposed stormwater channels, whether owned by CVWD or a private entity.

8.4.4 Municipal Separate Storm Sewer System (MS4) Permit

The Colorado River Basin Regional Water Quality Control Board has issued a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Permit (MS4 Permit) under Order No. R7-2008-0001. In cooperation with the County of Riverside and incorporated cities within the Whitewater River Watershed, CVWD is responsible for *“implementing that portion of the urban runoff management program for any discharges to and from (its) MS4 facilities”*. As such, any discharge into the Whitewater River/Coachella Valley Stormwater Channel (WWRSC/CVSC) or other stormwater facilities within CVWD’s jurisdiction must comply with the MS4 permit.

To accomplish this, CVWD requires the local Land Use Authority to provide a letter supporting their regulatory authority to control the discharge of pollutants from the proposed outlet in compliance with the MS4 Permit. Typically, an

approved Water Quality Management Plan (WQMP) prepared by the developer gives the city the level of comfort they need to provide CVWD this letter; however specific requirements should be solicited from the respective city or Riverside County. CVWD will provide a Development Review Letter noting this requirement during the entitlement phase of any proposed project with plans to discharge into any CVWD stormwater facility.

8.5 Design Standards for Regional Stormwater Channels

The following subsections describe CVWD standards for the design of regional stormwater channels. Reference is provided to appropriate guidelines in Appendix K for further details on analytic procedures.

8.5.1 Hydrologic Design

The 100-Year flood, also referred to as the one-percent annual chance flood by FEMA, is the standard for design and analysis of regional stormwater channels. CVWD has calculated or adopted 100-Year design floods for the facilities in Table 8-1 and these flows will be used for analysis of existing facilities or design of projects within or near the channels, unless specifically directed otherwise by CVWD.

For design of new facilities or re-evaluation of the hydrology of existing facilities, the 100-Year flood will be estimated from records of annual peak flows (where a sufficient length of record is available near the development site). If no suitable records are available, it is then estimated from rainfall-runoff modeling. Guideline K-6 provides procedures to calculate 100-Year peak flows and hydrographs.

8.5.2 Hydraulic Design

CVWD recognizes two types of stormwater channels: incised and leveed (Ordinance 1234.2; Appendix K-7). Incised channels are those where the 100-Year water surface elevation, calculated from the 100-Year flood, lies below the adjacent ground or bank top elevation. Leveed channels are those where the 100-Year water surface elevation is higher than that of adjacent ground and a levee is required for flood protection.

For existing facilities, incised channels are distinguished from leveed channels through comparison of the 100-Year water surface profile to one of adjacent ground or levee crests, as prepared from surveys or topography. New facilities shall generally be designed as incised channels meeting the 100-Year Plus freeboard standards.

Ordinance 1234.2 provides design minimum freeboard standards for the two channel types:

- 1) Incised Channels: Incised stormwater channels shall be designed to convey the 100-Year Flood with a minimum of 3 feet of freeboard as

measured from the lowest adjacent ground to the design water surface. CVWD may require additional freeboard based on the size and location of the watershed and the associated flood hazard potential.

- 2) Leveed Channels: Levees shall be designed with a minimum of 4 feet of freeboard from the levee crest elevation to the 100-Year Flood water surface elevation. CVWD may require additional freeboard based on the size and location of the watershed and the associated flood hazard potential.

Where superelevation of the water surface is expected along a stormwater channel during the 100-Year flood, the above freeboard standards are applied above the super-elevated water surface elevation.

8.5.2.1 Hydraulic Models for Existing Facilities

Analysis of existing facilities or analysis of impacts on adjacent lands will require 100-Year existing and proposed water surface profiles and, potentially, other hydraulic characteristics, such as depths, velocities, and shear stresses.

For the analysis of existing facilities or analysis of lands adjacent to existing facilities, the proponent will obtain CVWD's most recent HEC-RAS hydraulic model of the facilities and update the geometry and channel characteristics to reflect existing conditions. Updating the model may require new surveys, field inspection, and model revision and calibration. Once existing conditions are established and confirmed by CVWD, the model can be modified as required to calculate post-project hydraulic conditions.

Where an adequate hydraulic model is not available for an existing channel the proponent will develop a hydraulic model for the site based on recent surveys or topography that meets FEMA map standards. CVWD requires that proponents use HEC-RAS for hydraulic modeling. An unsteady model may be required where significant volumes of water leave the channel or return from the floodplain. For these circumstances, CVWD recommends HEC-RAS 2D, which defines lateral weirs that allow floodwaters to pass onto and back from the floodplain. Two-dimensional models may be required in areas of complex topography, such as on fans, or where flows are complex, such as at the confluences of major tributaries or confluences with the WWRSC/CVSC.

8.5.2.2 Hydraulic Models for New Channels

The proponent will develop a hydraulic model for existing and project conditions based on recent surveys or topography that meets FEMA map standards. CVWD requires that proponents use HEC-RAS for hydraulic modeling, as described above.

8.5.3 Erosion Design

CVWD requires analysis of erosion for the evaluation of existing channels and for design of new channels. Erosion consists of both lateral erosion of banks (bank retreat) and vertical erosion of the bed, including channel incision (scour).

Where existing bank materials are expected to erode during passage of the 100-Year flood, CVWD requires that bank protection is designed and constructed along the stormwater facility to protect adjacent developments. Guideline K-2 describes acceptable types of bank protection and their design procedures. In some circumstances, a lateral erosion setback for developments may be acceptable rather than construction of bank protection.

For earthen or natural bottom stormwater channels, CVWD requires an analysis of scour, including channel incision (profile degradation), both for existing and new channels. Guideline K-3 describes CVWD's procedures for calculating scour for different engineering applications.

8.5.4 Sediment Transport Design

Where projects have the potential to alter existing sediment transport conditions by modifying channel dimensions, adding or removing flows, or trapping sediment CVWD requires a comparison of existing and project conditions. This analysis will evaluate potential changes in sediment transport, potential for channel filling or erosion, and potential impacts on regional stormwater channels or adjacent properties. Where the changes in sediment transport may negatively affect channels or properties, appropriate mitigation measures are to be included in the flood hazard design.

Given the complexity of sediment transport analysis, it is recommended the proponent discuss methods with CVWD before proceeding.

8.6 Submissions for Projects near or within CVWD Facilities

Where a structure is proposed that may affect hydraulic conditions within an existing stormwater channel, CVWD requires a proponent to submit a report documenting the impact of the structure on the channel and providing mitigation if the function of the channel is impaired. In general, the report will provide analyses of existing and proposed hydrology, hydraulics, scour and other engineering analyses and compare existing and proposed conditions to determine mitigation. Section 8.5 provides design standards for existing and proposed conditions.

Appendix K-1 describes the minimum requirements for submissions to CVWD on proposed projects near or within CVWD's facilities. The following subsections provide guidance for typical projects such as bank protection, utility crossings, bridges or other crossings, storm drains entering a stormwater channel, modification or repair of levees, and other projects that may affect performance.

8.6.1 Slope (Bank) Protection for Adjacent Developments

Slope (bank) protection is required on the banks and levees of stormwater channels where developments near the facilities are at risk from lateral erosion, or as directed by CVWD.

CVWD recommends that slope protection consist of a concrete revetment extending from above the 100-Year water surface elevation to the elevation of the lowest point of the channel bed, with a cutoff wall extending from that point to the maximum scour depth or minimum scour elevation (Guideline K-2). Guideline K-3 provides guidance on calculating minimum scour elevations. ~~In some cases, where hydraulic conditions are appropriate, the concrete revetment can be combined with, or replaced by reinforced turf or other grass and soil combinations.~~

The requirement for slope protection may be waived for a proposed development that will have buildings and/or structures 300 or more feet away from the top edge of incised channels such as the Whitewater River/Coachella Valley Stormwater Channel (WWRSC/CVSC). [See Appendix K-2 for further discussion on determining setback requirements.](#)

An exception to the requirement of slope protection within 300 feet of a building and o/or structure is the La Quinta Evacuation Channel (LQEC) where a detailed analysis indicated that the LQEC has a nearly flat (gentle) slope and lower velocities (4 ft/sec or lower) during the 100-year flood. The analysis indicated the potential of LQEC bank failure due to erosion and the associated risk of inundation during the 100-year flood is minimal. For the LQEC the City of Austin (2013) Erosion Hazard Zone guidelines for setback determination was followed. **Consequently, proposed developments adjacent to the LQEC** may receive a variance on the slope protection requirement if all the following apply:

- Proposed footprints of buildings are 75 feet or more away from the top edge of the LQEC,
- The proposed finish floor elevations for the buildings are higher than the water surface elevation within the LQEC plus three feet of freeboard (incised) or four feet of freeboard (levee).

Proposed developments that satisfy these criteria and are adjacent to the unlined portion of the LQEC can request for a waiver of the slope protection requirement which applies to the WWRSC/CVSC and other regional stormwater facilities. The waiver will not apply for proposed developments that are adjacent to existing stormwater facilities which do not satisfy CVWD's or FEMA's design standards for regional stormwater facilities.

8.6.2 Utility Crossings

Crossings are only allowed in special circumstances after review and approval of engineering plans and specifications. Guideline K-2 provides details on standards for utility crossings of both “soft-bottom” or earthen channels and concrete-bottom channels; Guideline K-3 provides details on scour calculations.

8.6.3 Bridges or Crossings

Bridges or other crossings shall be designed to pass the design flood with no increase or rise of upstream water levels and provide adequate clearance in accordance with Ordinance 1234.2. Any project alteration of upstream and downstream conditions must be fully mitigated. CVWD may relax the “no rise” standard and not require mitigation where there is substantial existing freeboard.

CVWD requires a factor of safety on the toe depth of bank protection upstream, through and downstream of the bridge opening. The lower toe elevation, as compared to that for bank protection further from the bridge, is to ensure that the bridge structure and adjacent facilities survive flows greater than the 100-Year flood. Guideline K-3 provides further details on procedures to calculate minimum scour elevations for design of bank protection near bridges and the required extent of protection. The proponent shall also ensure that the toes of bank protection near the bridge are not undermined by erosion or scour holes that form around piers or abutments.

CVWD also recommends that proposed bridges integrate utility corridors in their design.

8.6.4 Storm Drains

Storm drain outlets discharging into CVWD stormwater facilities shall provide adequate protection at their outlets to prevent scour and erosion in “soft-bottom” channels, such as the WWRSC/CVSC, Thousand Palms Stormwater Channel, or La Quinta Evacuation Channel. Protective measures may include riprap or concrete blankets. The outlet protection works will be designed in accordance with Guideline K-4.

Where storm drain outlets are proposed to discharge into concrete-bottomed channels (e.g. Palm Valley Channel or West Magnesia Channel), box culverts or pipes, the proponent should consult with CVWD to determine if the discharge is feasible, given capacity constraints and the highly-engineered hydraulic design of these channels.

Refer to subsection 8.3.4 for information on compliance with the MS4 Permit.

8.6.5 Modification or Construction of Levees

Ownership, maintenance and certification to FEMA of levees are CVWD's responsibility. Private ownership and maintenance of levees along CVWD's facilities is not allowed. Development projects that include modification and/or construction of levees, berms, floodwalls, training dikes, etc., as part of a flood control scheme should consult with CVWD prior to designing such a project, as the studies and requirements are typically very onerous.

Construction plans that involve modification of or encroachment on a United States Bureau of Reclamation (USBR) dike (levee) will require review and approval by the USBR following review and approval of design and flood management plans by CVWD.

8.6.6 Other Projects

Contact CVWD for discussion of requirements for projects not described above or in Guideline K-5.

8.7 Submissions for Development Projects

Where a development is proposed within an identified flood hazard zone or where hazards have not been identified but are likely, CVWD requires a proponent to submit a report describing the development, existing flood hazards, proposed mitigation, and the impact of the project and mitigation on adjacent properties. Where the mitigation includes channels or other features to manage regional stormwater, these channels must meet the standards described in Subsections 8.5 and 8.6.

CVWD reviews the submission for compliance with CVWD standards, Riverside County or City Floodplain Ordinances, and State and Federal requirements, such as California Drainage Law. Guideline K-5 provides minimum requirements for developer reports submitted to CVWD.

8.7.1 Existing Hazard Studies and Maps

Existing flood hazards are shown on FEMA County-wide Flood Insurance Rate Maps (FIRM), CVWD Stormwater Master Plans and in other studies prepared by, or for, CVWD. Please contact CVWD to obtain information on the most recent hazard studies for sites with the Stormwater Boundary Unit.

CVWD recognizes that there are sites that have flood hazards but the hazards are not identified on FEMA County-wide Flood Insurance Rate Maps (FIRM). Developers of sites in such areas will be required to carry out studies to define the specific hazards on their property.

8.7.2 Types of Flood Hazards

The following specific flood hazards occur within CVWD's Stormwater Unit Boundary:

- Riverine hazards, including high in-channel velocities, overtopping or eroding of banks and spreading of floodwaters across the floodplain.
- Alluvial fan hazards, including unpredictable flow paths, a broad extent of flooding and erosion that may undermine structures. "Alluvial Fan Flooding", prepared by the Committee on Alluvial Fan Flooding (1996) and "Guidelines for Flood Risk Analysis and Mapping: Alluvial Fans" prepared by FEMA (2016) further describe these processes.
- Valley floor hazards, flooding at sites not on alluvial fans or within a riverine hazard zone.
- Coastal or lakeshore hazards relating to inundation from the Salton Sea, including wave erosion and other coastal hazards described in various FEMA publications.

Some sites may be exposed to more than one type of hazard. For instance, sites near the toes of fans may also be exposed to riverine flooding. The general requirements for submissions for the four types of hazard areas are described below. Guideline K-5 provides further details on minimum reporting requirements.

8.7.3 Developments in Floodplains

Riverine flood hazards occur along or adjacent to natural and stormwater channels in the Coachella Valley, such as the flow of the Whitewater River through WWRSC/CVSC. CVWD's stormwater channels mostly either contain the 100-year flood or have accredited levees that provide protection to the floodplain. However, overtopping of banks and levees does occur along the CVSC, from downstream of Monroe Street to the Salton Sea.

CVWD has also identified riverine flood hazards along the I-10 corridor between North Gene Autry Trail and Washington Street as a result of conveyance of floods from Morongo Wash and other north side tributaries along the corridor to the east (Northwest Hydraulic Consultants 2014).

Given the complexity of flows on floodplains, existing and proposed 100-year hydraulic conditions will be based on two-dimensional models developed to meet FEMA's analysis standards for non-accredited levees, where these are present. CVWD has prepared two-dimensional floodplain models for the CVSC downstream of Monroe Street and for the riverine flows along the I-10 corridor. Developers or their engineers should contact CVWD to obtain the most recent versions of these hydraulic models. Developers are responsible for modifying the models to reflect project conditions. If no suitable model exists, developers are

responsible for developing existing and proposed conditions two-dimensional models.

Some development sites exposed to riverine flooding may also be exposed to flows from alluvial fans. Where this occurs, the developer must determine if the two hazards are independent or not. Where independent, conditions for design are adopted by calculating depths and velocities for each hazard type and then selecting the maximum depths and velocities over the property. Multiple simulations of both types of flood hazard may be required to determine combined “worst case” existing and project conditions and to determine project impacts on lands adjacent to the development.

Design of mitigation facilities for riverine floodwaters crossing the property will be based on determining peak discharges from appropriate cross sections in the two-dimensional model. The design may need to consider that flows arrive from different directions for different flood hazard types and under some flood conditions.

8.7.4 Developments on Alluvial Fans

Hazard studies for properties or sites on or adjacent to an alluvial fan follow the *Guidelines for Flood Risk Analysis and Mapping: Alluvial Fans* (FEMA 2016). This document recommends a three stage process to study these hazards: Stage 1-identify alluvial fan landform boundaries and Stage 2-identify active and inactive areas on the fan. CVWD’s approach to Stage 3 (flood hazard analysis) is discussed below.

The hydrologic standard for analysis of flood hazards and design of regional facilities on alluvial fans is the 100-Year flood. CVWD has calculated 100-Year floods for the canyons at the head of many alluvial fans as part of Stormwater Master Plans within their Stormwater Unit Boundary and these flows will be used for analysis, unless specifically directed otherwise by CVWD. Some tributaries may not have been analyzed in these documents because they were not significant to regional flows, as a result of timing or small watershed areas. It is the responsibility of the developer to identify all potential sources of floodwater to their project and prepare hydrologic analyses to meet Guideline K-6 if they have not been previously analyzed.

For projects on active alluvial fans, CVWD generally requires that hazard analysis and peaks flows for design of mitigation be calculated via a two-dimensional hydraulic model that routes the 100-year fan head hydrograph(s) to the development site and, if necessary, downstream to a regional stormwater facility. Generally, multiple scenarios are recommended to adequately define the hydraulic conditions at the development site. These scenarios often consist of blocking different channels on the fan surface to simulate avulsions. CVWD will provide further details, if required.

For simple projects, CVWD will accept design of flood mitigation facilities based on the sum of the 100-year peak flows from all of the fans that potentially flow towards the project. Such a design peak flow will almost certainly be larger than the one calculated by routing with a two-dimensional model.

If the development is on an inactive portion of a fan, a one-dimensional hydraulic model may be utilized to define the design hydraulics if confined and stable channels cross the inactive surface. Here, uncertainty with regard to flow paths may be disregarded. The one-dimensional models may require a more detailed hydraulic analysis at the fan head to determine the distribution of the design flood over the various channels and surfaces on the fan. Hydrologic analysis will also be required for flow generated by rainfall on the inactive fan surface that reaches the development.

CVWD requires analysis of project impacts on adjacent properties and also on their downstream facilities. The impacts to be analyzed for their facilities will include changes in 100-year floods, changes in sediment loads and adjustments of the channel as result of changed hydrology or sediment. All impacts to CVWD facilities will require mitigation.

8.7.5 Developments on Valley Floors

Some development sites do not lie within the riverine Special Flood Hazard Area (SFHA) and are not on a fan. Flood hazards result from fan flows that discharge onto the valley floor toward the development and from flows resulting from rainfall on upstream areas on the valley floor.

If the site is exposed to flows leaving an active alluvial fan, a 2-dimensional hydraulic model is extended from the apex of the active fan, or other suitable points, to include the development area. Multiple scenarios may be needed to route flows across the fan, onto the valley bottom, and to a downstream stormwater facility, if appropriate. Such a model might also include inflows from the valley bottom tributary area and inactive fan surface.

Where the development site is only exposed to flows from the valley floor, the developer will calculate the 100-year flood from the procedures in Guideline K-6. This flood will then be used to design mitigation works.

8.7.6 Projects on Lakeshores

Coastal or lakeshore hazards related to the Salton Sea have not been studied nor have the extent of these hazards been mapped. CVWD may require developers of properties adjacent to the Salton Sea to complete specific studies of these hazards that follow applicable FEMA Guidelines.

8.8 Flood Hazard Mitigation

The basic standard for stormwater management on the development site is to protect it from flooding while conveying water through or around the site in such a manner that flood hazards are not modified for adjacent properties. To help meet this goal, the disturbance of natural watercourses on the site shall be minimized and the points where channels or runoff historically have entered or exited a property shall be maintained (California Drainage Law).

The recommended approach for evaluating potential impacts of development on adjacent properties is to repeat the hydraulic analysis or modeling for existing conditions with the development and the proposed flood hazard mitigation in place. The existing and project hydraulic conditions are then compared for upstream, downstream and adjacent to the development site. Where the project changes water levels, velocities, or other hydraulic parameters on adjacent properties or stormwater channels, either the flood hazard mitigation works are modified to eliminate these changes or suitable protective works are developed for the adjacent channels and properties.

8.9 Long Term and Post Storm Operation & Maintenance Plans

Operations and Maintenance (O&M) plans are required for proposed flood control facilities, whether the facilities are to be deeded to CVWD or owned by the development. O&M plans will include maintenance access easements through the development, equipment access routes in and out of facilities, disposal sites, vegetation management plans, and provide local, state and federal permits which allow long-term and post-storm repair and restoration activities. The O&M plans will provide detailed instructions and requirements for the long-term maintenance required to ensure performance and for post-storm maintenance and repairs to restore functioning.

Developers are required to submit long term and post storm O&M plans concurrently with each phase of design plans (conceptual to final). This will help ensure that an adequate O&M plan is provided as part of design and development plans.

8.10 Conditional Letters of Map Revision

The Ordinance 1234.2 freeboard standards provide greater flood protection to adjacent lands than FEMA's freeboard standards. Developers that plan to submit a Conditional Letter of Map Revision (CLOMR) to FEMA will need to demonstrate that their proposed regional facilities meet both CVWD and FEMA standards before CVWD will support the CLOMR submission.

Development projects that may affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations (BFEs), or the Special Flood Hazard Area (SFHA) are required to prepare a Conditional Letter of Map Revision (CLOMR) report for review and approval by CVWD for submittal to the FEMA.

Similar to the CLOMR, a Letter of Map Revision (LOMR) will be submitted to CVWD for review and approval. The developer shall submit the report to FEMA to obtain a LOMR which removes the development from the special flood hazard area.

8.11 Technical Appendix

Further technical guidance and recommended report formats and contents are included in Appendix K to the Design Manual. This Appendix includes CVWD's Stormwater Unit Boundary Map and the following specific guidelines:

- Guideline K-1: Report Format and Contents for Projects Adjacent to CVWD Stormwater Facilities
- Guideline K-2: Bank (Slope) Protection Design Guidance
- Guideline K-3: Scour Calculation Guidance
- Guideline K-4: Storm Drain Outlet (Laterals) Design Guidance
- Guideline K-5: Report Format and Contents for Development Projects
- Guideline K-6: Framework for Hydrologic Modeling
- Guideline K-7: CVWD Ordinance No. 1234.2
- Guideline K-8: Stormwater Annexation Form

8.12 References

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