COACHELLA VALLEY WATER DISTRICT
GUIDELINE K-5
FORMAT AND CONTENTS FOR REPORTS FOR DEVELOPMENT PROJECTS IN CVWD STORMWATER SERVICE AREA

K-5.1 General Requirements

Within the Stormwater Service Area, CVWD reviews and approves proposals for developments as the National Flood Insurance Program (NFIP) Administrator and as the agency responsible for regional stormwater management. The developer is responsible for submitting reports that CVWD reviews to ensure that regional flood hazards are described and mitigated to meet CVWD Ordinances, Riverside County & City Floodplain Ordinances, and State and Federal requirements. Development adjacent or encroaching on CVWD stormwater facilities must also meet the requirements of Guideline K-1.

It is recommended that the developer meet with CVWD prior to starting their technical analyses. CVWD will discuss the requirements for their specific project and provide existing studies of the project area, hydrologic and hydraulic models (where available), and information on the technical methods and approaches that are acceptable to CVWD.

CVWD also recommends that the report address FEMA's minimum standards for a Conditional Letter of Map Revision (CLOMR) as well as CVWD's minimum standards. CVWD will review the report for compliance with FEMA's standards as well as CVWD's standards.

K-5.2 Report Format and Submission

A completed "Submission Checklist for Development Projects" is required with every submittal. CVWD recommends that the proponent's technical report be submitted in stages for review and approval. Such an approach helps avoid repeating project condition studies several times to account for corrections to existing conditions analyses. CVWD has identified three typical stages for reports: Existing Conditions, Proposed Conditions and Final Design. The project proponent will need to identify the corresponding stage for each submittal. The submittals must include all items identified in Table K-5.1, details of which are given in Section K-5.3. Reports that do not meet the minimum requirements will be returned to the developer without a review.

The developer will submit a digital report (PDF format) that is concise, clear and complete, and includes all the information needed for a detailed technical review by CVWD.

K-5.3 Report Contents

Flood hazards at the development site may result from riverine, alluvial fan, valley floor, or coastal processes or from various combinations of these processes. The developer must clearly identify and describe all the hazards at the site and ensure that all are adequately addressed by the proposed mitigation.

Methodologies, technical approaches, adopted models, assumptions, summaries of calculations, and the basis of design of mitigation must be presented in the main body of the report. Detailed technical information, which is too voluminous to include in the main body of the report, will be included in Appendices. Input and output files from computer programs should be

included with the report. Other relevant and pertinent technical material and data should also be included in Appendices.

The following sections provide some additional details on the chapters and subheadings in Table K-5.1. Content and emphasis will vary from project to project.

Executive Summary

Provide a brief description of the project, the flood hazards at the site, the hydrologic and hydraulic and scour analyses, the proposed stormwater management plan and its compliance with ordinances and other regulations, the maintenance plan, and the proposed mitigation, if any.

Introduction

- Objectives: Briefly describe the report objectives and approach and any agreements with CVWD on submissions and report phasing
- Previous Submissions: Describe previous reports and the review comments that are addressed in this draft
- Project Description: Describe the project and its location in sufficient detail for CVWD to understand potential project impacts
- CVWD and Other standards: List the standards and guidelines that will be addressed in the reports
- Background Information: List reports, models or other information provided by CVWD or others that are relevant to the project.
- Topography: Describe the source(s) and vertical datum of topography used in the report and its compliance with FEMA map standards. For new topography suitable certifications will be provided in an Appendix to the main report.

Study Area

- Summary of Hazards: A brief summary of the flood hazards that are anticipated at the development site. The contents of the Study Area chapter will vary depending on the expected hazards and not all the sections below will be required for most developments.
- Riverine Flood Hazards: The study area description for these hazards will match that in Guideline K-1.3.
- Alluvial Fan Hazards: Complete Stages 1 and 2 of FEMA (2016) "*Guidelines for Flood Risk Analysis and Mapping: Alluvial Fans".* The description will include a summary of flooding sources, illustrations of the fan boundaries and active fan areas showing the location of the property, and other features important to hazard interpretation.
- Valley Floor Hazards: Define the boundaries and characteristics of the watershed(s) that potentially contribute flow to the development from the valley floor and flows off the toes of alluvial fans. The description of the watershed(s) will include geology, soils, slopes and other watershed features required for rainfall-runoff modeling.
- Coastal Hazards: Provide the background information on the lake (Salton Sea is an example) or other water feature necessary for estimating 100-year water surface elevations and 100-year wind waves.
- FEMA Effective DFIRM: Describe mapped hazards on the effective map and obtain FEMA's effective model if available and judged useful for analysis of existing and project conditions.
- Other Hazard Studies: Describe hazards identified in studies by other agencies, such as Riverside County, State of California and CVWD.

Hydrology

The contents of this chapter will depend on whether or not the hydrology of the flood sources to the development has been recently analyzed to meet CVWD Guideline K-6. If so, detailed hydrologic studies may not be required.

- Flooding Sources: Describe and map all the flooding sources that potentially affect the development. A table of watershed characteristics is recommended.
- CVWD (or other) 100-Year Floods: If available, CVWD will provide existing hydrologic analyses or models for the flooding sources that meet Guideline K-6. For alluvial fans, the existing 100-Year floods will usually be calculated at the head of a fan or canyon outlet. The developer will be responsible for routing the 100-year floods to their project boundary based on the discussion in the Hydraulics Chapter.
- Hydrologic Studies: If required, the developer will carry out hydrologic studies to define the 100-year flood for all flooding sources that have not been recently analyzed by CVWD. The studies will use the procedures in Guideline K-6.
- Existing and Project Condition 100-Year Floods: This section will summarize the 100-Year peak flows (and hydrographs, if needed) that will be used in the hydraulic analyses. As discussed, these will typically be calculated at the heads (hydrologic apices) of alluvial fans, where these hazards are anticipated at the development.

Hydraulic Model Development

The contents of this chapter will depend on the nature of the hazards that are to be analyzed. Not all the sections below will be required for most developments.

- Technical Approach to Hazard Analysis: Summarize the proposed approach to evaluating hazards at the development and on adjacent properties.
- Riverine Flood Hazards: Developments exposed to riverine hazards will generally require a two-dimensional hydraulic model to adequately develop a flood hazard mitigation project and to determine impacts on neighboring properties. CVWD has existing conditions models for some areas of riverine flooding that will be provided to the developer. If a suitable model is not available from CVWD or FEMA, the developer will be required to develop existing and proposed condition models. If this modeling is done in a proprietary software, then the developer will need to provide a means for detailed review of the results. CVWD can provide guidance on preferred or typically accepted models upon request.
- Alluvial Fan Hazards: Typically, a two-dimensional hydraulic model is utilized to route the 100-year flood(s) from the fan head(s) to the project site on the active portion of fans. This methodology, while common for this application, is not in the code of federal regulations and would be done at risk of not being approved by FEMA. On inactive fans, where avulsion is not an issue for development, a one-dimensional model is acceptable. The model is extended downstream to a CVWD stormwater facility if the project design may affect the peak flows, the timing of peak flows or flow volumes to the facility. CVWD has some regional two-dimensional hydraulic models. These models may be helpful to provide inflows to a more detailed two-dimensional model of the development site. Generally, the developer will be required to develop a two-dimensional model for their project. The existing conditions model should remove any non-accredited structures on the fan surface that may affect flow paths, such as berms, levees, detention basins, etc. CVWD or FEMA will provide advice on how major roads, such as highways, should be treated in the model.
- Valley Floor Hazards: For floods generated by rainfall on the valley floor, a HEC-HMS model may be adequate for routing peak flows and hydrographs to the edge of the development. If flows are channelized a one-dimensional hydraulic model may be adequate to define existing and project conditions. Where flows are not channelized a

two-dimensional model may be required to route flows, depending on the nature of the proposed flood hazard mitigation. Where flows cross alluvial fans and affect the project site, an alluvial fan hydraulic analysis, as described above, may be required.

- Coastal Flood Hazards: Following procedures in FEMA
- Hydraulic Model Development: The developer will be responsible for selecting and developing an appropriate hydraulic model for the development site and identifying the hydraulic parameters that will be needed to assess flood hazards.
- Hydraulic Model Description: The developer will provide a complete description of the model, including model extent, levees and bank crests, cross sections and structures, ineffective areas, roughness, topography, stations and datums, boundary conditions and calibration or sensitivity analysis. CVWD will review model input, output and run files to determine that the model matches the description.

Sediment Yield or Transport Studies

Existing and project condition sediment yield or transport studies will typically be required where the flood mitigation for a development traps sediment loads, alters the distribution or character of design flows upstream and downstream of the site or where existing shallow flows are channelized or otherwise re-routed through the development site, thus altering sediment transport capacity.

Given that such studies are complex, it is recommended the developer consult with the CVWD prior to undertaking these analyses. The developer will be responsible for providing a complete description of the selected model and providing model input, output and run files for review by CVWD.

Existing Conditions Analysis

The analysis of development impacts generally compares existing (pre-project) and proposed (post-project) hydraulic conditions. The particular hydraulic parameters that will be compared depend on the nature of the hazards and the nature of the project but typically include water surface elevations, depths, velocities and derived parameters such as shear stresses, scour or bed sediment transport rates.

- Riverine Flood Hazards: Existing conditions for developments exposed to these hazards will consist of plots of depths, velocities and water surface elevations from the two-dimensional model output within the portion of the floodplain potentially affected by the project.
- Alluvial Fan Hazards: Existing conditions analysis includes: 1) defining the 100-Year flood (and sediment yield, if required) at the property boundaries; 2) defining existing hazards on the property; and 3) defining the 100-Year flood (and sediment yield, if required) to downstream CVWD stormwater facilities. In general, developments on active alluvial fans or off the toe of an alluvial fan but subject to flooding from the alluvial fan (see Valley Floor hazards), require multiple model runs to simulate avulsions and uncertain flow paths. The simulation may consist of blocking different flow paths on the fan surface, inserting the hydrograph at different points on the fan head, or other procedures acceptable to CVWD. One-dimensional models are acceptable on inactive fan surfaces but a linked one-dimensional/two-dimensional model may be required where overflows from fan channels may inundate the property. Multiple model scenarios, allowing overflows at different points along the channel, may be required to adequately existing hazards at the development.

- Alluvial Fan Hazards Continued: The 100-Year flood at the property boundaries is defined as the maximum peak flow, measured along sections aligned with the boundary

from multiple model runs completed to simulate avulsions and uncertain flow paths. . The 100-Year sediment transport is calculated from this flood. The existing condition hazards on the property and adjacent properties are defined differently. They are based on the maximum observed depths and velocities (or other parameters such as general scour) at each model cell that occurred during the various model runs. Finally, the 100-year flood and sediment yield to downstream CVWD facilities are determined from the maximum peak flow at the head of the facility that occurs during the various model runs.

- Valley Floor Hazards: Existing conditions analysis includes the 100-Year flood at the property boundaries, defined from the hydrologic model for Valley Floor watershed areas or the 100-Year flood defined from inflows from a fan, following the procedures above. Coastal Hazards: Existing conditions analysis consists of defining the 100-Year water surface elevation and the 100-Year wind wave.

Project Condition Analysis

This chapter compares project conditions in the vicinity of the development to those defined for existing conditions, defines impacts on adjacent properties and CVWD facilities, and helps identify the nature of mitigation works. The analysis is based on adding the proposed flood mitigation works for the development to the existing condition hydraulic model. The mitigation works are typically conceptual in nature and the developer may evaluate various designs before adopting a final concept for presentation to CVWD. The hydraulic parameters that will be compared depend on the nature of the hazards and the nature of the project but typically include water surface elevations, depths, velocities and derived parameters such as shear stresses, scour or bed sediment transport rates.

In general, CVWD will only approve projects that have no or very minor differences between existing and project conditions on adjacent properties. The developer will either modify the mitigation works to eliminate impacts or obtain flooding easements on the affected adjacent properties.

The contents of this chapter will depend on the nature of the hazards that are to be analyzed. Not all the sections below will be required for most developments.

- Modifications to Existing Model: This section will describe the changes in inflows to or changes in topography in the hydraulic model domain that were adopted to simulate project conditions. The developer will provide a complete description of the changes to the model. CVWD will review model input, output and run files to determine that the model matches the description.
- Riverine Flood Hazards: The report should map the project condition results for the same area as the existing condition results and provide maps showing the differences in depths, velocities or other parameters between project and existing conditions.
- Alluvial Fan Hazards: As above, impacts on adjacent properties are defined by comparing model outputs for existing and project conditions. However, where the project proposes to trap sediment or intercept and channelize flows, an analysis of the response of upstream and downstream channels to these changes will be required. The analysis will consider adjustments of channel slopes, including incision or deposition, changes in sediment transport or yield and their impact on adjacent properties or CVWD facilities.
- Valley Floor Hazards: As above, impacts to adjacent properties are defined by comparing model outputs for existing and project conditions.
- Coastal Hazards: In general, development projects will not alter coastal hazards on adjacent properties. The main issue for development will lie in protecting the property from these hazards.

- Summary of Impacts and Proposed Mitigation: General description of impacts and any works proposed to mitigate them

CVWD recommends that reporting of project conditions rely on summary maps and tables. Detailed model output will be included in an appendix.

Flood Hazard Mitigation Design

This chapter describes and provides the basis of design for the structures proposed to mitigate 100-Year regional flood hazards on the development property and adjacent properties. Design will typically be based on a hydraulic model that is appropriate for the project. Design of stormwater channels and other conveyance features may be based on steady one-dimensional models; other features may require two-dimensional models. Channel adjustment and sediment transport calculations may be required for adequate design of some structures

- Description of Works: Describe the general nature of the works – levees, stormwater channels, bank protection, sediment traps, etc – and show their location and extent on a map of the development
- Design Standards: Describe the applicable CVWD and other guidelines and standards that are applicable to the design of the mitigation features
- Basis of Design: Describe the procedures adopted for the design of the various works.

Mitigation Plans

CVWD will review plans for flood mitigation works. Typically, the initial submission consists of conceptual plans (30% standard).They will show plans, profile and typical sections of the mitigation works with suitable stationing, design water levels, top of slope elevations, channel bottom elevations, typical sections, and design details for hydraulic structures.

CVWD will advise the developer on the schedule for submission of draft and final plans for review.

Long Term and Post Storm Operation and Maintenance Plans

Refer to DDM Section 8.9 for details on the requirements for this submission.

Results and Conclusions

Provide a narrative of the results of studies and describe compliance of the project with California Drainage Law, CVWD Ordinances and other standards and guidelines, or with other applicable standards and guidelines.

References

CVWD requires a complete bibliography of all reports, publications, or books that are referred to in the report. The bibliography should be adequate to identify and locate specific publications. In general, CVWD does not recommend referencing draft reports; however, in some circumstances these may provide the most up-to-date technical approaches and methods.

Appendices

The appendices should include photographs, technical information that is too voluminous to be included in the main body of the report, specific studies (such as bed material measurements), raw data, and computer model input and output files. These data should be presented in electronic forms on DVD or CD or other storage media.

Submission Checklist for Development Projects in CVWD Stormwater Service Area

Submittal Instructions

To better streamline project approvals CVWD has expanded on the instructions within Guideline K-5 and developed a checklist to aid project proponents through a more efficient review process. Details on the necessary analysis and contents that are required are given within Guideline K-5. This form must be filled out, signed and provided with a transmittal as an attachment for all developer submissions.

Initial submittals need to include a deposit of $10,000.
Initial Submittal (Y/N): _____

Submittal Stages

CVWD has defined three sequential stages of submittal within the review process**.** The project proponent is required to identify which stage the submittal corresponds to, to help guide the review. The stages are defined as:

- Stage 1 includes the necessary analysis to establish the existing baseline conditions;
- Stage 2 provides a project conditions analysis including a description of the project features and proposed preliminary mitigation plans;
- Stage 3 provides the final detailed design details, mitigation and plans for the project.

Completion of Stage 2 is required before CVWD provides approval to local land agencies for entitlement. Completion of Stage 3, which includes the final design, is required prior to grading and construction of the project. For project's with established regional hydrology completion of Stage 1 is not required prior to submittal of Stage 2 information for review, although it may be beneficial to reduce potential rework.

In the table below put an (X) next to the level of submittal. If the submission does not fit into any of these categories, please coordinate with CVWD.

Stage	Description of Submission	(X)	Approved (y/n)
1	Existing Conditions		
2	Proposed Conditions and Concept Acceptance		
3	Final Design		

Flood Hazards

In the table below identify which potential hazards are present or impact your project site. Requirements specific to each flood hazard are listed within Guideline K-5. Each respective flood hazard is addressed in Sections 4, 6 and 7 of Table K-5.1.

Flood Hazards	Yes/No	Notes/Comments
Riverine		
Alluvial Fan		
Valley Floor		
Coastal*/Other		

*Includes Salton Sea

Minimum Report Requirement Checklist

The developer shall submit a digital report that is clear, concise, complete, and includes all the information needed (as identified in Table K-5.1) for a detailed technical study. Below is a list of requirements for such submissions to CVWD based on stage. This includes chapters and headings for sections of the report and typical illustrations required. The project proponent should consult Guideline K-5 for details. If the submissions provided are missing items listed in the checklist, the reports will be rejected without detailed review. Submissions that do not meet these minimum requirements will only be reviewed upon written request to CVWD. A space for additional notes is provided after the checklist.

Name of Report: _____

Date: _____

TABLE K-5.1:
DEVELOPERS MINIMUM REPORT REQUIREMENT CHECKLIST

Chapter and Subheadings		Typical Illustrations	Stage Requirements			Included (X)
			1	2	3	
	Executive Summary		*	*	*	
1	***Introduction***					
1.1	*Objectives*		*	*	*	
1.2	*Previous Submissions*		*	*	*	
1.3	*Project Description*	Vicinity and Local Maps showing project boundaries and location	*	*	*	
1.4	*CVWD and Other Standards*		*	*	*	
1.5	*Background Information*		*	*	*	
1.6	*Topography*	Area covered by topo source	*	*	*	
			*	*	*	
2	***Study Area***					
2.1	*Summary of Hazards*	Air photograph map showing project boundaries and nearby features	*	*	*	
2.2	*Riverine Hazards (if required)*	Project Reach Map, Extent of concrete slope protection, Other instream structures, Photographs of Reach (Appendix)	*	*	*	
2.3	*Alluvial Fan Hazards (if required)*	Flood sources, Geological maps, surficial geology or soils maps, historical air photos, interpreted boundaries and active zones	*	*	*	
2.4	*Valley Floor Hazards (if required)*	Flood sources, watershed maps, soils maps	*	*	*	
2.5	*Coastal Hazards (if required)*	Water feature map, wind direction roses, existing protection, other features	*	*	*	
2.6	*FEMA Effective DFIRM*	Firmette of project reach	*	*	*	
2.7	*Other Hazard Studies*	Relevant maps with legends	*	*	*	
3	***Hydrology***					

3.1	*Flood Sources*	Map identifying all flood sources	*	*	*	
3.2	*CVWD 100-Year Flood*		*	*	*	
3.3	*Hydrologic Studies* (if required)	Watershed subdivisions, soils and geology, land use, land cover, etc	*	*	*	
3.4	*Recommended Existing and Project Flows*		*	*	*	
4	**Hydraulic Model Development**					
4.1	*Technical Approach*		*	*	*	
4.2	*Flood Hazards (if required)*		*	*	*	
4.3	*Alluvial Fan Hazards (if required)*		*	*	*	
4.4	*Valley Floor Hazards (if required)*		*	*	*	
4.5	*Coastal Hazards (if required)*		*	*	*	
4.6	*Hydraulic Model Development*	Model domain and boundaries	*	*	*	
4.7	*Hydraulic Model Description*	Modifications to topography to remove non-accredited features	*	*	*	
5	***Sediment Yield or Transport***					
5.1	*If required, content determined in discussion with CVWD*		*	*	*	
6	***Existing Condition Analysis***					
6.1	*Flood Hazards (Riverine/Alluvial*	Maps of hydraulic conditions on property and adjacent properties	*	*	*	
6.2	*Alluvial Fan Hazards (if required)*	Maps of hydraulic conditions on property and adjacent properties	*	*	*	
6.3	*Valley Floor Hazards (if required)*	Maps of hydraulic conditions on property and adjacent properties	*	*	*	
6.4	*Coastal Hazards (if required)*		*	*	*	
7	***Project Condition Analysis***					
7.1	*Modifications to Existing Models*			*	*	
7.2	*Riverine Flood Hazards (if required)*	Maps showing differences between existing and project conditions		*	*	
7.3	*Alluvial Fan Hazards (if required)*	Maps showing differences between existing and project conditions Profile analysis for impacts on existing channels		*	*	
7.4	*Valley Floor Hazards (if required)*	Maps showing differences between existing and project conditions		*	*	
7.5	*Coastal Hazards (if required)*					
7.6	*Summary of Impacts and Proposed Mitigation (30% plans)*			*	*	

8	***Flood Hazard Mitigation Design***					
8.1	*Description of Works*	Extent and Location of Required Works			*	
8.2	*Standards for Design*				*	
8.3	*Basis of Design*				*	
9	***Mitigation Plans***					
9.1	Conceptual to Final Design Plans	Provided in an Appendix or submitted separately			*	
10	**Long Term and Post Storm Maintenance Plans**					
	Meet DDM requirements				*	
11	**Results and Conclusions**		*	*	*	
12	**References**		*	*	*	
	Appendices					
	Photographs		*	*	*	
	Bed Material Analyses		*	*	*	
	Hydrologic Model Input/Output	Digital files only	*	*	*	
	Existing Hydraulic Model Input/Output	Digital files only	*	*	*	
	Project Hydraulic Model Input/Output	Digital files only		*	*	
	Mitigation Works Plans				*	

Notes: Any additional information required or reasoning or justification for exclusion of items identified in the checklist should be given below:

Developer Signature (Not Valid Without)
The above form was filled out to the best of my ability for the project specified.

Name: _____

Firm/Company Submitting: _____

Address: _____

Phone: _____