



City of Victorville
Engineering Department
Study & Report Guidelines

STUDY & REPORT GUIDELINES

APRIL 2026

**City of Victorville
Engineering Department**



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Hydrology Study

General Guidance

General Report Structure

1. Title Page with descriptions:
 - Project name, location, and date.
 - Contact Information of owner, client, and engineer of record.
 - Size of the project lot.
 - Scope and purpose of development.
 - APN's and major/minor streets.
 - List of Abbreviations and Definitions.
 - Consistent Units (SI or Mixed; clearly defined).
2. Revision History/ Document Control
3. Table of Contents
4. Include a statement if the site is a "Priority Project"
 - Fully executed Water Quality Management Plan (WQMP) Required.
5. Include a statement of potential compliance regarding the NPDES General Permit.

Project Understanding

6. Clearly state project description.
7. Reference applicable codes and standards.
8. Hydrologic Soil Group:
 - Group A: Low runoff potential. High infiltration rates consisting of well-drained sand and gravel.
 - Group B: Moderate infiltration rates consisting of moderately fine to coarse sands.
 - Group C: Slow infiltration rates consisting of silts.
 - Group D: High runoff potential consisting of clay soils with high expansion characteristics. Very slow rate of infiltration.
9. Antecedent Moisture Condition (AMC)



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- A. AMC I: Lowest runoff potential. The watershed soils are dry enough to allow satisfactory grading or cultivation to take place. Used for the 2 and 5-year return storms.
- B. AMC II: Moderate runoff potential; an average study condition. Used for the case of 10, 25, and 50-year return storms.
- C. AMC III: Highest runoff potential. The watershed is practically saturated from rainfall. Used for 100-year storm analysis.

Site Description

- 10. Include Site location map.
- 11. Show Topography, drainage, and surface features.
- 12. Include onsite/offsite Master Plan of Drainage (MPD) lines and watershed information.
- 13. Identify existing structures and utilities.
- 14. Include any properties of the site and types of studies performed: slope, roughness, disturbance, classifications, percolation, etc.
- 15. Identify the project development location and if it is a single development or if the development is part of a larger development (i.e. phased projects).
- 16. Describe site layout and include percentages of pervious/impervious material.
- 17. Note environmental or contamination concerns.
- 18. Curve Number (CN):
 - Low CN indicates low runoff (high infiltration).
 - High CN indicates high runoff (low infiltration).

Engineering Analysis

- 19. Rainfall Data
 - Discuss and Identify where the onsite and offsite data used in the report was obtained.
 - Model the 100-year/1-hour storm, providing hydrographs.
- 20. On-site Runoff
 - Include separate sub-watersheds with pre and post development flow data.
 - Include a 10-year/24-hour storm and the 100-year/1-hour storm data results. The study and analysis must show that the development does not increase the runoff for the 10-year/24-hour storm and the 100-year/1-hour storm.
 - Include a discussion of the pre and post “Q” for the development while summarizing the improvements and impacts of the development.



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- Include a table that summarizes the pre and post “Q” results for the 10-year/24-hour storm and the 100-year/1-hour storm.
- Include a site plan reflecting the matrix for the various on-site DMAs (drainage management areas), pre-development flows, and post-development flows. The site plan shall summarize the flow paths across the site verifying the data submitted correlates with the site plan and drainage paths.

21. Off-site Runoff

- Include a map and discussion of the water flows around the proposed development including, but not limited to, any/all “Q”s for the MPD lines and surrounding watersheds related to this project.

22. Stormwater Treatment

- Include a discussion on the implementation of temporary BMP’s.
- Include discussion of what post-construction BMP’s should be implemented for the development and how the BMP is mitigating flow for the 85th percentile 24-hour storm and the pre-project flow for the 10-year/24-hour storm.
- Include a statement as to who will maintain the temporary and post-construction BMP’s.
- Include a sample sizing calculation displaying adequate BMP capacity and on-site space to implement the improvements.
- Include a statement that a percolation test may be performed to verify infiltration rates and provide final size for the BMP’s.
- Include discussion on the Operations and Maintenance Manual provided within the WQMP Final Report which states that one will be completed and included in the final report.

Risks, Limitations, and Assumptions

23. State investigation limitations clearly.

24. Identify key uncertainties.

25. Highlight construction risks.

26. Note requirement for geotechnical inspection during construction.

Figures, Tables, and Appendices

27. Figures clear, scaled, and referenced.

28. Borehole logs included and consistent with summary.



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29. Complete Laboratory test results.

30. Provide calculations/checks available for review.

31. Organize Appendices to include:

- Rational Method Data: Pre and post-storm development.
- Preliminary Priority Project Checklist.
- Calculations.
- Site Plan with Drainage Arrows and Facilities.
- Site Plan Sub-Watersheds: Illustrate locations and show flows around the site and into the City's MS4 Permit.
- Storm Drain Master Plan: Reference City of Victorville's MPD.
- City Watershed: Show City watershed with the site included and how the water travels around the site; Include how water travels with pre and post development.
- Tract Map/Parcel Map.
- APN Map.

See next page for Preliminary Priority Project Checklist →



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Preliminary Priority Project Checklist

Part I – Project Type		YES	NO
1.	10 or more unit homes, including single and multiple family homes, condominiums,		
2.	An Industrial or Commercial development (100,000 SF or more) of impervious surface		
3.	An automotive service facility (5,000 SF or more)		
4.	A retail gasoline outlet (5,000 SF or more)		
5.	A restaurant (5,000 SF or more)		
6.	A parking lot with either 5,000 SF or more or with 25 or more parking spaces		
7.	A single-family hillside dwelling (one acre or more surface area)		
8.	Re-development projects		
9.	Project location in, adjacent to or discharging directly to an ESA <u>and</u> creates 2,500 SF or more of impervious surface area		

If any of the boxes in Part I is checked “YES”, this project will require a WQMP along with a WQMP Maintenance Agreement and Transfer document.

Part II – Project Specific Concerns/ Characters		YES	NO
1.	A single-family hillside dwelling (less than one acre)		
2.	An automotive service facility (5,000 SF or more)		
3.	A retail gasoline outlet (5,000 SF or more)		
4.	A restaurant (5,000 SF or more)		
5.	Vehicle or equipment fueling areas (retail or private)		
6.	Commercial or industrial waste handling or storage		
7.	Outdoor handling or storage of hazardous waste materials		
8.	Outdoor manufacturing areas		
9.	Outdoor food handling or processing		
10.	Outdoor animal care, confinement, or slaughter		
11.	Outdoor horticulture activities		

If any of the boxes in Part II is checked “YES”, this project will require a WQMP along with a WQMP Maintenance Agreement and Transfer document.

Technical Consistency

- 32. Data → interpretation → recommendations logically connected.
- 33. No contradictions in body of report.
- 34. Values consistent throughout report.



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35. All referenced data included.

Editorial and Formatting

- 36. Grammar, spelling, and formatting checked.
- 37. Consistent terminology (units, symbols).
- 38. Correct figure/table numbering.
- 39. Professional engineer signature/seal (if required).

Key Elements

- 40. Hydrographs:
 - Graphical representations of streamflow patterns over time, helping assess the impact of rainfall events.
- 41. Rainfall Analysis:
 - Detailed examination of precipitation data to predict potential flood scenarios.
- 42. Floodplain Mapping:
 - Identifying areas at risk of flooding, aiding in land-use planning and development.



Geotechnical/Soils Report

General Guidance

General Report Structure

1. Title Page with descriptions:
 - Project name, location, and date.
 - Contact Information of owner, client, and engineer of record.
 - Size of the project lot.
 - Scope and purpose of development.
 - APN's and major/minor streets.
 - List of Abbreviations and Definitions.
 - Consistent Units (SI or Mixed; clearly defined).
2. Revision History/ Document Control
3. Table of Contents

Project Understanding

4. Clearly state project description.
5. Reference applicable codes and standards.
6. Define Scope of Geotechnical services.
7. List Design criteria (loads, tolerances, performance requirements).
8. Reference Applicable codes and standards.

Site Description

9. Include Site location map.
10. Show exploration locations, topography, drainage, and surface features.
11. Identify existing structures, and utilities.
12. Note environmental or contamination concerns.

Subsurface Exploration Program

1. Field Investigation



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- Exploration program adequate for project scope.
- Document sampling methods.
- Borehole/test pit logs complete and consistent.
- CPT or geophysical data (if applicable) included.
- Groundwater observations recorded.
- Classifications per ASTM/ISO standards.

2. Subsurface Conditions Summary

- Stratigraphy described with layer boundaries and variability.
- Include Geotechnical profiles and cross-sections.
- Address Groundwater levels and seasonal fluctuations.
- Identify anomalies or uncertainties.

Engineering Analyses

3. Bearing Capacity

- Documents methodology.
- Soil parameters supported by tests
- State safety factors.
- Consistent settlement and bearing analyses.

4. Settlement Analysis

- Evaluate immediate and consolidation settlement.
- Justify modulus values.
- Check settlement tolerances.

5. Slope Stability (if applicable)

- Model geometry and groundwater
- Justify strength parameters.
- Acceptable Factors of Safety.

6. Lateral Earth Pressures

- Active/Passive/At-rest conditions.
- State wall movement.

7. Pavement/Subgrade Design

- Interpret CBR/R-value/modulus data.
- State traffic loading assumptions.



8. Seismic Considerations

- Determine site class
- Address Liquefaction potential.
- State regional seismic hazards

Recommendations

9. Foundations

- Shallow or deep foundation selection
- Allowable bearing pressures
- Minimum embedment, width, and spacing
- Settlement estimates.
- Uplift/lateral resistance values.
- Pile/drilled shaft recommendations (if applicable).

10. Earthworks

- Excavation and grading guidance.
- Temporary shoring notes.
- Compaction requirements (density, lifts, equipment).
- Suitability of excavated material.
- Dewatering and groundwater control recommendations.

11. Retaining Structures

- Backfill specifications.
- Drainage and filter requirements.
- Wall movement assumptions consistent with design pressures.

12. Pavements

- Recommended pavement sections.
- Subgrade improvement required (if any).

13. Ground Improvement (if applicable)

- Justification and method description.
- Verification/testing requirements.

14. Environmental/Corrosion Considerations

- Sulfate/chloride testing results.
- Material compatibility recommendations.



Risks, Limitations, and Assumptions

- 15. State investigation limitations clearly.
- 16. Identify key uncertainties.
- 17. Highlight construction risks.
- 18. Note requirement for geotechnical inspection during construction.

Figures, Tables, and Appendices

- 19. Figures clear, scaled, and referenced.
- 20. Borehole logs included and consistent with summary.
- 21. Complete Laboratory test results.
- 22. Provide calculations/checks available for review.
- 23. Organize Appendices.

Technical Consistency

- 24. Data → interpretation → recommendations logically connected.
- 25. No contradictions in body of report.
- 26. Values consistent throughout report.
- 27. All referenced data included.

Editorial and Formatting

- 28. Grammar, spelling, and formatting checked.
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Traffic Study

General Guidance

General Report Structure

1. Title Page with descriptions:
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 - Size of the project lot.
 - Scope and purpose of development.
 - APN's and major/minor streets.
 - List of Abbreviations and Definitions.
 - Consistent Units (SI or Mixed; clearly defined).
2. Revision History/ Document Control
3. Table of Contents

Project Understanding

4. Clearly state project description.
5. Reference applicable codes and standards.
6. Define Scope of Traffic Study.
7. List Design criteria (loads, tolerances, performance requirements).
8. Reference Applicable codes and standards.

Site Description

9. Include Site location map.
10. Identify existing structures, and utilities.
11. Note environmental or contamination concerns.

Traffic Impact Study and Analysis

12. The following supplemental guidelines, in conjunction with SANBAG CMP guidelines, shall be used when preparing traffic impact studies and the traffic impact analysis portion



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of Environmental Clearance in the City of Victorville. The guidelines specifically address the procedures when determining intersection Level of Service (LOS) and when identifying improvement needs due to project impacts.

- A scoping meeting shall be conducted between the Traffic Engineering Consultant and the City's Traffic Engineering staff prior to conducting the study. The agreed upon scope of the study, including all study intersection locations, shall be summarized and sent to the City.
- All traffic counts required for the study shall be conducted by a professional traffic data collection firm and attached to the report. If counts are taken in a period when traffic counts are unusually low (i.e., January/February), an agreed upon seasonal factor shall be applied to the raw data.
- The Consultant shall send the trip distribution figures to the City for approval prior to commencing the analysis.
- All approved and current planned development projects shall be obtained from the City and added to the proposed development trip generation. These cumulative projects are to be displayed graphically and summarized in a matrix table that includes reference number, name of project, location, description, ADT, whether included (yes/no), and reason why not included (completed, etc.).

13. All analyses shall be based on Highway Capacity Manual (HCM) operations methodology for determining LOS and appropriate mitigation measures. For evaluating operational characteristics at signalized intersections, the following criteria shall be used:

- A pre-approved list of intersections for analysis shall be obtained from the City. Intersection critical movements LOS shall be maintained at LOS "D" or better, volume-to-capacity (V/C) ratios shall be less than 0.95 for each movement, and queue storage shall be adequate for a design queue as detailed below.
- Adjust all field turning movement volumes to peak hour volumes using the peak hour factor determined from the count data, or use 4 times the peak 15-minute data.
- Match existing coordination cycle length; otherwise, use a cycle lengths ranging from a minimum of 70 seconds to a maximum of 120 seconds. A 90-second cycle length is preferred.
- Use a saturation flow rate recommended in the SANBAG CMP guidelines. Saturation flows may also be field measured. Typically, the saturation flow rates do



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not need to be adjusted, except when field conditions dictate. Permissive left turns and shared through/left turns require an engineering determination of saturation flow rates.

- Provide adequate timing (i.e., phase splits) to accommodate pedestrian crossing times per current MUTCD requirements. The existing timing at signalized intersections can be obtained from the City. Walk times shall typically be at least 5 seconds and pedestrian clearance times shall be from curb to at least the far side of the traveled way, and shall include Yellow and All Red intervals. Therefore, the minimum Pedestrian Time = Walk + FDW + Yellow + All Red. The crossing distance for each leg of the intersection shall be calculated and documented for each intersection.
- Additional turn lanes should be considered and incorporated in the LOS analysis when left turn volume exceeds 300 vph. Right Turn Only (RTO) lane should be considered to address operational and safety needs.
- For intersections that have left turn phasing, provide a minimum of 10 seconds of total split time (Green + Yellow + All Red time), even though vehicular volume could be accommodated with a lower split time. With Protected/Permissive Left Turn (PPLT) phasing, a minimum of 8 seconds is acceptable.
- Lost Time shall be 2 seconds per critical movement. A two-phase intersection would have a total of 4 seconds lost time. An eight-phase intersection would have a total of 8 seconds of lost time (4 critical movements times 2 seconds each).
- Right turn overlap timing may be used as a recommended improvement, if appropriate. However, the corresponding through movement minimum timing (i.e., the corresponding pedestrian timing) shall be increased by an amount equal to Yellow plus All Red time to provide adequate time for the pedestrians to clear the crosswalk before the start of right turn overlap phasing (this is because right turn overlaps typically begin at the end of the through Green), unless the controller can be programmed to delay the beginning of the overlap.
- Progression factors may be used in the analysis as follows:
 - 0.80 if coordinated move (including lead/lag left turns).
 - 1.00 for free operation.
 - 1.20 for Leading Left turns
- Justification of selected values shall be provided. The above values are not mandatory.
- Queue lengths shall be calculated on a per lane basis using vehicle spacing of 20 feet. The design queue shall be 1.5 times the average queue at the beginning of Green.



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The queue determination methodology must be pre-approved by the City Traffic Engineer. One pre-approved methodology is that provided in the City- furnished WEBSTER software package.

- Design Queue lengths must be tabulated and documented to not extend beyond left turn pocket storage areas or beyond 75% of the distance between the closest stop bars of adjacent signalized intersections. If queue lengths exceed these limits, appropriate mitigations must be provided.
- Because queuing is a function of signal timing, some typical mitigations include:
 - Adjust or implement coordination timing.
 - Implement lead/lag left turn phasing with appropriate offsets.
 - Implement PPLT phasing, if appropriate.
 - Re-stripe for more lanes (and re-time the signals accordingly).
 - Widen roadway, re-stripe, and re-time the signals.
- On-street traffic analysis scenarios, as a minimum, must include Project Opening Day and Year 2025 impacts with required mitigations at all study intersections. The purpose of Opening Day analysis is to determine which of the identified 2025 improvements are needed by project Opening Day. Therefore, Opening Day conditions must include all existing traffic, growth, and traffic from all projects presently being considered for approval by the City. Year 2025 traffic determinations will be made based on modeling or other methodologies approved by the City.
- The City will determine fair share cost of mitigations, with consideration given to pre-assessed traffic fees and other funding sources approved for the master plan of needed improvements. In addition to conducting opening and 20 year analyses, the City will require a mid-term (10 year horizon) analysis with agreed upon growth rates on specific intersections.
- Project access and circulation, along with parking, must be fully analyzed.
- Cost estimates shall be according to the City's standard unit costs.
- Project fair share mitigation cost calculations shall be clearly shown in a table as follows: Intersections requiring mitigation improvements shall be listed separately in each row of the table.
- The following columns shall also be shown in the table: Intersection, total cost, peak hour (AM or PM), existing traffic, year 2027 with project traffic, project traffic, total new traffic, project % of new traffic, AM project cost share, PM project cost share.



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- After the project fair share mitigation cost table has been completed, the information is used to calculate a per lot mitigation fee for residential projects. Please refer to the attached spreadsheet for instructions on how to calculate the per lot fee.

Risks, Limitations, and Assumptions

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