

# DRAINAGE REPORT LAYOUT AND CONTENTS

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## I. CERTIFICATION STATEMENT

This report for the drainage design of (Name of Development) was prepared by me (or under my supervision) in accordance with the provisions of City of Glendale Post-Construction Program Requirements, and was designed to comply with the provisions thereof. I understand that the City of Glendale does not, and will not, assume liability for drainage facilities designed by others.

By: \_\_\_\_\_  
Licensed Professional Engineer  
State of Colorado  
No. \_\_\_\_\_  
Affix Seal

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## II. GENERAL LOCATION AND DESCRIPTION

- A. Location
  - a. Vicinity Map: A map showing the project location within the City. The project area shall be shaded; major arterial streets labeled; and major water courses and water bodies shall be labeled. The map shall be a minimum of 6" x 6", with a scale ranging from 1" = 1000' to 1" = 3000'.
  - b. Township, range, section, ¼ section
  - c. Local streets within and adjacent to the subdivision with ROW width shown
  - d. Major drainageways, facilities, and easements within or adjacent to the site
- B. Description of Property
  - a. General project description, including proposed land use
  - b. Area in acres
  - c. Existing ground cover (type of trees, shrubs, vegetation, general soil conditions, topography, and slope)
  - d. Impervious area and area of disturbance, including weighted and non-weighted (total square feet of concrete surfaces, asphalt surfaces, roofs, etc.) pre- and post-construction impervious area, and anticipated area of disturbance in acres
  - e. Major drainageways and drainage facilities
  - f. Irrigation facilities
  - g. Easements within and adjacent to the site

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## III. MAJOR DRAINAGE BASINS AND SUB-BASINS

- A. Major Basin Description
  - a. Reference to major drainageway planning studies such as flood hazard delineation reports, major drainageway planning reports, and flood insurance rate maps

- b. Major basin drainage characteristics, existing and planned land uses within the basin.
- c. Identification of all irrigation facilities within the basin, which will influence or be influenced by the local drainage design
- B. Sub-Basin Description
  - a. Discussion of historic and proposed drainage patterns of the property
  - b. Discussion of offsite drainage flow patterns and impact on development under existing and fully developed basin conditions

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#### IV. DRAINAGE DESIGN CRITERIA

- A. Regulations: Discussion of the optional provisions selected or the deviation from the criteria, if any, and its justification
- B. Discussion on implementation of the "Four Step Process" including Runoff Reduction Practices, Water Quality Capture Volume, Stabilizing Drainageways and Source Control BMPs
- C. Development Criteria Reference and Constraints
  - a. Discussion of previous drainage studies (i.e., project master plans) for the site that influence or are influenced by the drainage design and how the plan will affect drainage design for the site
  - b. Discussion of the relationship to and effects of adjacent drainage studies
  - c. Discussion of the drainage impact of site constraints such as streets, utilities, rapid transit, existing structures, and development or site plan
- D. Hydrological Criteria
  - a. Identify design rainfall.
  - b. Hydrologic soil group.
  - c. Identify runoff calculation method
  - d. Identify detention discharge and storage calculation method
  - e. Identify design storm recurrence intervals
  - f. Discussion and justification of other assumptions or calculation methods used that are not referenced by the criteria
- E. Hydraulic Criteria
  - a. Identify various capacity references
  - b. Discussion of other drainage facility design criteria used that are not referenced in the criteria
  - c. If there are proposed modifications to areas within the 100-year floodplain or floodway, a "Floodplain Modeling Report" must be submitted
  - d. If there are proposed modifications to a natural drainageway where a 100-year floodplain has not been designated, a "Floodplain Modeling Study" must be submitted
- F. Water Quality
  - a. Include applicable Stormwater Quality Design Standards Checklist(s) for all stormwater quality control measures (BMPs) included in the design. See Appendix B for checklist(s).
- G. Modifications of Criteria
  - a. Identify provisions by section number for which a modification is requested
  - b. Provide justification for each modification requested

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## V. DRAINAGE FACILITY DESIGN

- A. General Concept
  - a. Discussion of concept and typical drainage patterns
  - b. Discussion of compliance with off-site runoff considerations
  - c. Discussion of anticipated and proposed drainage patterns
  - d. Discussion of the content of tables, charts, figures, plates, or drawings presented in the report
  
- B. Specific Details
  - a. Discussion of drainage problems encountered and solutions at specific design points
  - b. Discussion of detention storage and outlet design
  - c. Discussion of measures implemented to treat the WQCV
  - d. Structural and non-structural control measures (best management practices (BMPs) ) that will be part of the stormwater management design.
  - e. A summary table for each detention storage pond on the site to include:
    - i. Stage-Storage Curve
    - ii. Stage-Discharge Curve
    - iii. Detention Pond Volume Required
    - iv. Detention Pond Volume Provided
    - v. Water Quality Capture Volume (WQCV)
    - vi. Water Quality Elevation
    - vii. Spillway Elevation
    - viii. Pond Freeboard
    - ix. Outlet(s) size(s)
  - f. Discussion of maintenance access and maintenance responsibility
  - g. Discussion of easements and tracts for drainage purposes, including the conditions and limitations for use
  - h. Discussion of the facilities needed offsite for the conveyance of minor and major flows to the major drainageway

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## VI. CONCLUSIONS

- A. Compliance with Standards
  - a. Compliance with City Glendale Post-Construction Program Requirements
  - b. Compliance with any existing Master Drainage Plans
  - c. Compliance with the City's floodplain regulations
  - d. Compliance with applicable State and Federal regulations
  
- B. Drainage Concept
  - a. Effectiveness of drainage design to control damage from storm runoff
  - b. Influence of proposed development on the Master Drainage Plan recommendation(s)

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## VII. REFERENCES

Reference all criteria and technical information used

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## VIII. APPENDICES

- A. Vicinity Map
- B. Hydrologic Computations
  - a. Land use assumptions regarding adjacent properties
  - b. Initial and major storm runoff at specific design points
  - c. Historic and fully developed runoff computations at specific design points
  - d. Hydrographs at critical design points
  - e. Time of concentration and runoff coefficients for each basin
- C. Hydraulic Computations
  - a. Culvert capacities
  - b. Storm sewer capacity. Allowable models include StormCAD, UDSewer, FlowMaster, and Extran. Other models will be accepted on a case by case basis upon prior approval from the City
  - c. Street flow calculations for the 2-year and 100-year events regarding street encroachment, theoretical capacity, and allowable gutter flow
  - d. Storm inlet capacity including inlet control rating at connection(s) to storm sewer system
  - e. Open channel design
  - f. Check dam and/or channel drop design
  - g. Detention facility design including area/volume capacity, outlet capacity, soil analysis, and ground water table elevations
  - h. Downstream/outfall system capacity to the major drainageway system
  - i. Design of erosion protection measures for culverts, and storm sewer outlets
- D. Letters of intent to acquire all necessary off-site easements
- E. Water quality design calculations
- F. Printed copies of input and output files for all computer models used in the analysis and design
- G. Digital copies of input and output files for all computer models used in the analysis and design
- H. Drainage Plan (Overall Drainage Plan, Detailed Drainage Plans)

# DRAINAGE PLAN CONTENTS

All final drainage plan drawings shall be 24" X 36" in size and signed and sealed by a professional engineer, registered in the State of Colorado. All drawings should include title block, project name, project address, date of preparation, and north arrow, legend to define map symbols and scale as applicable. An overall drainage plan and detailed drainage plan should be provided with the information provided below. Some information may be repeated on several plans but should be repeated as necessary.

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## I. OVERALL DRAINAGE PLAN

- A. Boundaries of entire development or project
- B. Limits of all major basins, including offsite basins.
- C. General drainage patterns and flow paths, including those entering and leaving the site.
- D. Any existing or proposed major stormwater management facilities, upstream, downstream, or within the site.

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## II. DETAILED DRAINAGE PLAN

- A. Scale of 1"=20' to 1"=100'
- B. The boundary lines of the subdivision or project, right-of-way lines of streets, easements and other rights of way with purposes noted, irrigation ditches, detention ponds, watercourses, and lot lines, with accurate bearings and distances.
- C. Designations of all streets and other rights of way, including dimensions and names of such streets.
- D. Floodplain boundary based on the most current information.
- E. The location, size, and type of all existing utilities.
- F. The location, size, and type of all storm sewers.
- G. The location, size, and type of all culverts, including box culverts.
- H. The location, size, and type of all open channels, including irrigation ditches with profile views where applicable.
- I. The location, size, and type of all inlets, cross pans, manholes, and other storm sewer appurtenances.
- J. Major basin and sub-basin boundaries.
- K. Drainage sub-basin boundaries and concentration points for the developed site clearly delineated and labeled
- L. Any offsite feature or basin influencing development.
- M. Show the lowest floor elevation (the basement floor elevation or the bottom of the crawl space) and grade at foundation elevations of all buildings.
- N. Street slope and flow direction and cross-pan.
- O. Existing (dashed or screened) and proposed (solid) contours (use NAVD 88 Datum) with a 2-foot maximum interval. The contours must extend a minimum of 100 feet beyond property lines.

- P. Spot elevations or one foot contours where two foot contours do not show on the property or where needed to depict the grading. Spot elevations may be needed in critical areas, especially adjacent to existing developed property.
- Q. Spot elevations critical to describe drainage features and their function (e.g., inlets, cross pans, spillways, inlets/outlets of manholes, culverts, and storm sewers).
- R. A summary table of site hydrology, including offsite flows entering the site for the 10-year and 100-year design storms, basin numbers, basin areas, runoff coefficients, and onsite flows for the 10-year and 100-year design storms at the concentration points
- S. Cross-sectional views of all open channels, including irrigation ditches, trickle channels, spillway structures, etc. These views must include applicable easement/right-of-way boundaries and water surface elevations such as the 100-year storm depth, 2-year storm depth, major storm freeboard, and operating irrigation level
- T. Capacity, discharge, outlet structure, spillways, permanent pool water level (if any), and 100-year high water level for all detention ponds, including both the water quality and water quantity elevations. Cross-hatching of the area inundated by the 100-year water surface elevation is recommended
- U. If SWMM modeling is used, a sub-basin map and a SWMM schematic diagram are required to depict the sub-basins and conveyance elements represented in the model
- V. All existing and proposed drainage facilities (e.g., detention facilities, storm sewers, swales, riprap, outlet structures, irrigation ditches, culverts, cross pans and other appurtenances, including riprap protection).
- W. Water surface profiles for all major open channels, or as required
- X. Proposed outfalls or exit points for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
- Y. Proposed detention basin grading and detention basin outlet schematic, include overflow directions and amount and emergency spillway.
- Z. Runoff summary table.
- AA. Detention basin summary table.
- BB. Location and footprints of detention facilities.
- CC. Include benchmark.
- DD. Water quality enhancement BMPs schematic.
- EE. Construction details for stormwater quality BMPs including, but not limited to, outlet structures, trickle channels, and forebays.
- FF. Profile views of all subsurface drainage facilities showing their size, slope, lengths, design storm hydraulic grade lines (2-year and 100-year), cover, details of structures Golden Standard Details (or equivalent details), and relationship with existing utilities.
- GG. General notes relating to the design of the drainage features of the development are required on the utility plan cover sheet. (Additional notes are required by other departments, such as Engineering and Water/Wastewater.) The required drainage notes are as follows:
  - a. All street, sanitary sewer, storm sewer and water construction shall conform to City Standards and Specifications current at date of execution of the Development Agreement pertaining to this development. Any construction occurring three years after the execution of the development agreement shall require re-examination of the plans by the Director who may require that they be made to conform to standards and specifications current at that time.
  - b. The type, size, location, and number of all known underground utilities are approximate as shown on the drawings. It shall be the responsibility of the

contractor to verify the existence and location of all underground utilities along the route of the work. Before commencing new construction, the contractor shall be responsible for locating unknown underground utilities.

- c. These plans have been reviewed by the City for concept only. The review does not imply responsibility by the reviewing department, the City Engineer, or the City for accuracy or correctness of the calculations. Furthermore, the review does not imply that the quantities of the items on the plans are the final quantities required. The review shall not be construed in any reason as acceptance of financial responsibility by the City for additional quantities of items shown that may be required during the construction phase.
- d. Maintenance of onsite drainage facilities shall be the responsibility of the property owners, the maintenance procedures of any permitted proprietary BMPs must meet the requirements of City of Glendale Public Works Department.
- e. If fill or dredged material is discharged into waters of the United States, a USACE 404 permit is required.
- f. If construction affects any Colorado Highway, a Colorado Department of Transportation Right-of-Way permit is required.