

CHAPTER 5 – STORM WATER STANDARDS

5.1 GENERAL INFORMATION

1. The purpose of this document is to provide guidance and standards for the City of Surprise (the city) storm water system requirements in conjunction with the following documents: Maricopa Association of Governments (MAG) Standards, City of Surprise Preliminary and Final Drainage Report Guidelines as published in Appendix 5-3, City of Surprise Underground Retention/Detention Systems Standards and Specifications as published in Appendix 5-4, the Drainage Design Manuals as published by the Flood Control District of Maricopa County (FCDMC) which includes Hydrology, Hydraulics, and Erosion Control, and the FCDMC Wittmann Area Drainage Master Plan Rules of Development. Refer to Chapter 10 for additional information regarding inspection procedures.
2. Any deviation from these standards shall require prior written approval from the city following the Engineering Standards Modification Request procedures explained in Chapter 1, Section 1.5.
3. The standards contained in this section are intended to expand upon and supplement information contained in the SUDC.
4. All developments within the city shall provide such storm drainage facilities as are necessary to ensure that all structures and properties, both within the development and those located upstream and downstream of the development, shall be protected from adverse impacts of storm waters due to the proposed and constructed development.
5. Off-site historical flow must be accepted and released from developments essentially at the same locations, including depth, flows and velocities, less than or equal to those encountered under pre-development conditions.
6. In general, development within or modification of the floodplain is discouraged. Development should be located outside of the 100-year floodplain. If development within the floodplain is necessary, approval from the Flood Control District of Maricopa County for Floodplain Use Permit is required.
7. Development within the floodway is prohibited.
8. The City defers to the Maricopa County Drainage Policies and Standards for first flush retention requirements, when applicable.

5.2 DRAINAGE REPORT

1. A Preliminary Drainage Report shall be submitted in support of Preliminary Plats, Site Plans, and Conditional Use Permits.
2. A Final Drainage Report and Conditional Letter of Map Revision (CLOMR), when required, shall be submitted in support of all civil plans and final plats. Endangered Species Act compliance documentation to FEMA is required prior to the issuance of any CLOMR (see FEMA Procedure Memorandum 64).

3. All Drainage Reports shall adhere to the City of Surprise Preliminary and Final Drainage Report Guidelines as published in Appendix 5-3.

5.3 STREET DRAINAGE

1. Parkways, arterials and collectors shall be designed to carry the ten-year flow between the curbs while maintaining a 12-foot dry lane in each direction, and carry the 100-year flow within the right-of-way.
2. Local streets shall carry the ten-year storm between the curbs and the 100 year storm within the right-of-way.
3. Streets required to provide all-weather access shall be designed with a maximum overtopping depth of six inches during the 100 year design storm.

5.4 LOT GRADING

1. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of six inches within the first ten feet.
2. For residential lots, where conditions prohibit six inches of fall within ten feet, the grade shall slope away from the foundation at a minimum slope of 5%, and the water shall be directed to drains or swales. Impervious surfaces shall have a minimum slope of 2% when located within ten feet of the building foundation.
3. For residential lots where climatic and soil conditions warrant, the slope of ground away from the building foundation is permitted to be reduced to not less than 2.0% slope.
4. Minimum residential side yard slopes shall be 0.5% and shall drain to the street.
5. All finish floors shall be a minimum of 18 inches above the low adjacent top of curb and a minimum of 12 inches above the 100 year water surface elevation.
6. A building permit is required, from City of Surprise Building Safety Division, for retaining walls greater than 4' in height, measured from the bottom of the footing to the top of the wall.
7. Openings in walls may be required to allow the passage of existing flows through the site. Opening requirements will be reviewed on a case-by-case basis.

5.5 BOX CULVERTS

1. Culverts for collector and arterial streets are to be designed to convey, at a minimum, the 100-year 2-hour peak discharge with no flow crossing over the roadway.
2. Adequate fencing or railings must be provided along all walls including wing walls and any other vertical walls that pose a fall hazard. Railings must be painted. The approved paint color for railings is "Rolling Stone #CLC 1249W" as distributed by Frazee Paint, or approved equal. See MAG Detail 145.

3. All culverts constructed must have a minimum of four feet vertical clearance from invert to finished grade.
4. Water mains shall maintain a minimum of six feet of horizontal and two feet of vertical separation from culverts. Protection is required per MAG Standard Details 404-1 to 404-3 and Section 610.5.5 of the MAG Standard Specifications.

5.6 STORM DRAINS

1. The minimum pipe size shall be 18-inch inside diameter (ID) within city rights-of-way.
2. Standard material for storm drains within the right-of-way is to be rubber gasket reinforced concrete pipe (RGRCP) Class III or greater per MAG Standard Specification 618.2.
3. Access barriers/trash racks are required on the exposed ends of all storm drains 18 inches in diameter and greater. See City of Surprise Standard Details 5-04A, 5-04B and 5-04C. Refer to MAG details 502-1 and 502-2 for pipes less than 30 inches in diameter.
4. Water mains shall maintain a minimum of four feet of horizontal and two feet of vertical separation when below storm drain pipes. Protection is required per MAG Standard Details 404-1 to 404-3 and Section 610.5.5 of the MAG Standard Specifications.
5. The installation of storm drain pipe within the right-of-way shall follow MAG Detail 200-1.
6. Manhole construction shall be per MAG standards and specifications.
7. Location of manholes are to be at junctions of one or more pipes, changes in grade, changes in alignment and change in pipe sizes (pipe crowns to match).
8. Manhole spacing shall be a maximum of 400 feet on lines with pipes 18 inches to 36 inches in diameter and 660 feet on lines with pipes greater than 36 inches in diameter.
9. The minimum cover over storm drain pipes shall be two feet.
10. All storm drain within City of Surprise right-of-way is required to be designed in both plan and profile view.

5.7 OPEN CHANNELS

1. Where man-made channels are required, the emphasis should be placed on a "natural" appearance with non-erosive velocities or appropriate erosion protection per the Drainage Policies and Standards for Maricopa County, Arizona.
2. All channelization within regulatory floodplains must be designed so that the cumulative effect of all new development does not raise the 100-year water surface elevation by more than one foot. The one-foot rise in water surface may not occur at the sole expense of the adjacent property.
3. See Table 5-1 for allowable channel side slopes.
4. Channels shall be a minimum of eight feet wide at the bottom.
5. Channels shall not encroach into utility easements or right-of-way.

5.8 STORM INLETS

1. Catch basins or scuppers are required to convey water from a public street to a retention basin or storm system. Depressed curb shall not be utilized as a method to convey flows from a public street.
2. Catch basins are to have curb-opening inlets. Catch basins with grates are not allowed within the right-of-way. Scuppers are also not permitted within the right-of-way in conjunction with detached sidewalks.
3. Per the City of Surprise Details 5-01 to 5-02, the contractor shall identify all new catch basins, scuppers, and headwalls with a storm drain inlet marker inset into the wet concrete during construction. Two-part epoxy shall only be used to attach storm drain inlet markers to existing drainage structures.
4. Catch basins located within commercial or industrial developments that handle, store, dispense, sell, recycle, or dispose of motor vehicle fuels or lubricants shall be designed to include storm drain inlet protection best management practice devices as identified in the FCDMC Drainage Design Manual.

5.9 RETENTION / DETENTION FACILITIES

1. Storm water from a 100-year, 2-hour storm event that falls on the parcel being developed, including the respective one-half of all abutting streets, shall be retained within the boundaries of the parcel being developed.
2. The required retention volume is to be computed using the following formula:
$$V = (C \cdot P \cdot A) / 12$$

Where:

V = volume in acre-feet
C = average runoff coefficient per FCDMC Hydrology Manual.
P = rainfall depth in inches, for the 100-year, 2-hour storm per FCDMC Hydrology Manual Appendix A.
A = area in acres
3. All retention basins shall have a maximum designed depth of three feet.

4. All retention basins shall have a clearly defined positive method of outfall regardless of proposed depth. Surface percolation is explicitly not approved as a sustainable method of positive outfall.
5. All retention basins shall be designed to dissipate within a 36-hour period.
6. Turfed areas are only allowed in designated active recreation areas or within a designated bioswale.
7. Ultimate outfall from the basin must be provided for events causing flows in excess of the 100-year event flow.
8. Maximum side slopes shall be as shown in Table 5-1 below.

Table 5-1 Side Slopes for Basins and Channels

Location Description	Side Slope
Side slopes adjacent to public or private sidewalks or where there is pedestrian-type access within ten feet of that portion of the basin	6:1
Side slopes adjacent to walls, fences, hedges, etc. (i.e., limited or no pedestrian-type access to that area)	4:1

9. The Engineer is to consider potential landscaping to account for the retention basin final volume calculations.
10. Erosion protection shall be provided at all basin inlets/outlets per FCDMC Drainage Design Manual, Erosion Control.
11. Retaining walls (i.e. vertical slopes) may be used in areas adjacent to permanent walls, fences, etc.
12. Retention/detention in parking lots is not allowed.
13. Retention/detention facilities shall not encroach into easements for private utilities without written approval of the encroachment from all companies with utilities within the easement.
14. Retention/detention facilities shall not encroach into public rights-of-way or into public easements.
15. The top of retention/detention facilities shall be at least ten horizontal feet from any building or public right-of-way.
16. The ultimate outfall of all drainage from a development must be a public street, storm drain, drainage channel, or natural watercourse. If such an outfall does not exist, the project must provide an outfall.
17. Underground retention must follow the City of Surprise Underground Retention/Detention Systems Standards and Specifications as published in Appendix 5-4.
18. Surface retention is not required on single-family residential lots under one acre in size and is discouraged on daycare playgrounds.
19. When site walls are also being used for one side of the retention basin, the frontage part of the wall can be a maximum of five feet high on the retention side.

20. Buildings adjacent to retention basins are to have finish floors a minimum of one foot above the 100-year, 2-hour water surface elevation.
21. Offsite storm runoff should not be routed into or through onsite storm water storage facilities.
22. No more than 50% of a project's primary frontage shall be utilized for retention.
23. Private utilities installed beneath retention/detention basins (if permitted) shall have a minimum of 30 inches of cover.
24. Drywells are required for any depth of retention in excess of one foot and for retention basins that have volume greater than 1,000 cubic feet. Basin bottom percolation shall not be used to reduce the volume used for drywell requirement calculations.
25. Dual chamber drywells are required for all storm water retention applications.
26. Drywells shall be installed according to ADEQ guidelines and shall also be registered with ADEQ by the property owner.
27. Drywells shall be maintained by the land owner or the association formed by the owner.
28. For drywells associated with surface retention basins, a maximum design percolation rate of 0.5 cubic feet per second (cfs) per dry well shall be used in calculating the number of dry wells required. For drywells associated with underground storage systems, a percolation rate of 0.1 cfs per drywell shall be used.
29. The drywell volume shall not be considered in the design calculations for sizing retention/detention.
30. Multi-chamber drywells such as the Envibro System or approved equal are required for fueling stations. A maximum percolation rate of 0.1 cfs may be used for these systems.
31. Drywell rim elevations shall be set a minimum of 0.3 feet above finish grade of basin bottom.

5.10 DETENTION FACILITIES

1. Natural drainage-ways convey flood water and are used for trails and open space corridors. The consideration to maintain natural vegetation and wildlife habitat is an important element that contributes to the sustainability of the land.
2. Natural drainage-ways shall remain in as natural state as is practicable with any modifications proposed, including any erosion mitigation measures.
3. New developments' pre-development and post-development storm water flows that directly outfall into natural drainage-ways shall limit peak flows from both the 10-year and 100-year storm event to the project site pre-development conditions via design of detention facilities.

4. Detention Basin Standards include:
 - a. Detention basin outlet capacity shall not increase downstream channel capacities in the pre-development condition.
 - b. Embankment protection of the detention basin shall be considered for each basin. See FCDMC Drainage Manual, Erosion Control for protection measures.
 - c. Off-channel detention basins shall be required.
 - d. Detention basins shall be designed to dissipate within 36 hours of the storm event.
 - e. All detention basins shall have emergency spillways which safely pass the 100-year storm event without compromising the structural integrity of the facility or diverting flows from their historic drainage pattern.
 - f. A minimum of one foot of freeboard is required above the emergency spillway.
 - g. Allowable peak discharge shall be not greater than the pre-development 100-year, 2-hr storm event flows.

5.11 DRAINAGE EASEMENT

Refer to the SUDC Chapter 122 for dedication of drainage easements.

5.12 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) CHECKLIST

Owners, developers, engineers, and/or contractors are required to prepare a Storm Water Pollution Prevention Plan (SWPPP) for developments within the City of Surprise with a disturbed area of one acre or greater, or are part of a common plan of development or sale that will ultimately disturb one or more acres. Appendix 5-1 contains a checklist for the preparation of a SWPPP.

APPENDIX 5-1

CHECKLIST

FOR

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)



PUBLIC WORKS DEPARTMENT

**16000 N. Civic Center Plaza
Surprise, Arizona 85374
Office: (623) 222-7000
Fax: (623) 222-7001**

Web Site: www.surpriseaz.gov

SWPPP Guidance Document
(Storm Water Pollution Prevention Plan)

Development/Project Name: _____

Parcel/Section Number: _____

Address/Location: _____

Net Area (Acre(s)): _____

SIC/NAICS CODE: _____

The City of Surprise requires all development with a disturbed area of one acre or greater or that is part of a common plan of development or sale that will ultimately disturb one or more acres to submit the required Storm Water Pollution Prevention Plan (SWPPP). The owner/developer must submit all required documents (Storm Water Pollution Prevention Plan (SWPPP), Notice of Intent (NOI), and the Storm Water Management Plan (SWMP)) to the Arizona Department of Environmental Quality (ADEQ) as required by law and under the AZPDES Construction General Permit, AZG2013-001.

In addition, the SWPPP shall include all requirements of Maricopa County Rule 310 and all requirements of the SUDC as it pertains to storm water. Copies of all requirements, forms and guidance are available in the Drainage Design Manual for Maricopa County Erosion Control available at the Flood Control District, 2801 West Durango St., Phoenix, Arizona 85009, Phone No (602) 506-1501 and the City of Surprise website.

The following checklist serves to minimize redline comments on the site plans and to maintain consistency among plan reviewers for storm water. Plan approval, issuing permits, and certain grading clearances depend on compliance with the comments made on this checklist. The engineers of record shall satisfy themselves of the completeness and accuracy of the design.

This review shall serve as a courtesy review only. The Owner/Developer is ultimately responsible to ensure that all of the requirements outlined under AZPDES with ADEQ are followed.

Please return this checklist and the check prints with your next submittal. Discussion of redline-comments on plans or this checklist should be directed to the City of Surprise Review Engineer.

General Requirements:

Site Plan Sheet Information:

- Sheets to be 24" X 36"
- All sheets to be sealed by an active Arizona Registered Professional Civil Engineer

Cover Sheet

- Project title block with name and address of project
- Legal description of project location including Township, Range, and Section
- Total site area (acres)
- Total area of disturbance (acres)
- Vicinity map showing one-mile radius around project with north arrow
- Index of plan sheets if more than one plan sheet
- Owner/developer name, address, and phone number
- Engineer name, address, and phone number
- Contractor name, address, and phone number. If contractor is not known, leave this blank for future completion

Plan Sheets

- Legend
- North arrow and bar scale
- Existing contours
- Floodplains
- Drainage patterns and slopes after grading
- Areas of soil disturbance
- Areas not to be disturbed
- Areas where final stabilization has been accomplished
- Construction ingress/egress to the site
- Locations and methods of structural and nonstructural controls
- Locations where stabilization practices are to occur
- Locations of on-site and off-site material, waste, borrow areas, or equipment storage
- Locations of all surface water bodies
- Locations where storm water is discharged
- Location of other pollutant sources such as fueling operations, asphalt plants, concrete plants, etc.
- Location and quantity of offsite to onsite flows
- Location of all temporary and permanent basins
- Location of equipment maintenance, parking areas
- Details of all applicable BMPs

SWPPP Manual Information:

- A copy of the approved SWPPP shall be maintained on the site and available for review.
- The Notice of Intent (NOI) shall be completed and submitted to the City of Surprise and Arizona Department of Environmental Quality (ADEQ) prior to any construction activity.
- The Contractor, Owner or Operator shall perform a visual inspection of the construction site a minimum of once every seven days and within 24 hours of rainfall events greater than or equal to one-half inch.
- The Contractor, Owner or Operator shall prepare reports documenting any findings on the conditions of the SWPPP controls and note any erosion problem areas.
- Facilities shall be maintained as necessary to ensure their continued functioning.

- All temporary siltation controls shall be maintained in a satisfactory condition until such time that construction is completed, permanent drainage facilities are operational, and the potential for erosion has passed as determined by the City Engineer or designee.
- The implementation of these plans and the construction, maintenance, replacement and upgrading of these facilities is the responsibility of the permittee/contractor until all construction is approved and the Notice of Termination has been submitted.
- The owner/operator/contractor of the site must also maintain records with the following information:
 - The dates when major grading activities occur in a particular area;
 - The dates when construction activities cease in an area, temporarily or permanently;
 - The dates when an area is stabilized, temporarily or permanently; and
 - The dates when any maintenance and or replacement or removal of required BMPs takes place.
- The operator is required to maintain full compliance with the general construction permit, as issued by ADEQ, to maintain an effective SWPPP. The SWPPP must be updated to accurately reflect site features and operations. The plan must also be amended if it is determined by the City Engineer or designee as not effective at minimizing pollutant discharges from the site.
- Once the construction activities have been completed and the site has met the final stabilization requirements of the permit, the authorized site representative may file a Notice of Termination (NOT) with ADEQ. A copy of the NOT must also be submitted to the City of Surprise. This will effectively terminate coverage under the permit.
- The site owner or the authorized representative shall sign and certify the plan.
- The person must certify that all information is true and assumes liability for the SWPPP.
- The registrant preparing the plan may be liable to the site operator/owner.
- Example of plan certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage this system, or those persons directly responsible for gathering the information, I believe the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. In addition I certify that the permittee will comply with all terms and conditions stipulated in the General Permit No. AZG2008-001 issued by the Arizona Department of Environmental Quality (ADEQ).
- Any violations and fines are the responsibility of the operator/owner and site contractor.
- ADEQ also requires that the contractors and subcontractors responsible for implementing measures in the SWPPP be listed in the plan with the measures for which they are responsible.
- Any contractor or subcontractor must also sign a certification statement that they understand the permit requirements as reflected in the SWPPP.
- Example of contractor or subcontractor certification statement:

I (Name of Contractor or Subcontractor) acting as (Job Title) for the (Project Name), an authorized representative, having reviewed this SWPPP and all of the relevant documents, do hereby certify that I understand all components of this plan and will perform all required inspections and maintenance activities as required; and that I will keep all necessary, required and up to date records at the job site.
- In the SWPPP a legend identifying grades, symbols, and lines, etc.
- Maricopa County Rule 310 permit number
- Construction activity description of the purpose or goal(s) of the construction project.
- List of soil disturbing activities necessary to complete the project.
- Location and steepness of slopes after final grading.
- Drainage patterns of the site after major grading activities and the location of the points where storm water will discharge from the site.
- Location and areas of soil disturbing activities or the total area of the site where soil will be disturbed.

- Location and areas of non-disturbance. This would include natural open space, jurisdictional washes and any others noted in Section 404 of the Clean Water Act. All of these non-disturbed areas must be delineated and fenced in the field.
- Post construction drainage patterns must be shown.
- Description of the erosion and sediment controls that are to be used during construction. These controls include stabilization measures for disturbed areas and structural controls to divert runoff and remove sediments. Selected controls must be per the Best Management Practices (BMP) outlined in the Drainage Design Manual for Maricopa County, Erosion Control.
- Show location of all temporary or permanent sediment basins being installed.
- Pollution controls for construction site waste material storage.
- Pollution controls for preventing offsite tracking of sediments and generation of dust.
- Pollution controls for hazardous material storage.
- Pollution controls for equipment maintenance areas.
- Pollution controls for parking areas.
- Description of storm water management controls that will be installed to control pollutants after construction completion.
- All grading activities to be performed on any site that is a part of a larger common plan or development.
- A list and description of BMPs that will be utilized on site.
- Sequence of major activities that would include the installation of all controls, earth disturbing activities, stabilization activities, the maintenance required for the controls and a clear timeline showing the order in which these activities will take place.

Additional Notes or Comments about Storm Water Pollution Prevention on this Construction site:



PUBLIC WORKS DEPARTMENT

16000 N Civic Center Plaza
 Surprise, Arizona 85374
 Office: (623) 222-7000
 Fax: (623) 222-7001

Web Site: www.surpriseaz.gov

Section 404 Certification

Before the city issues development permits for a project, the developer's Engineer or the property owner must certify that it complies with, or is exempt from, Section 404 of the Clean Water Act of the United States. Section 404 administered by the U.S. Army Corps of Engineers (COE), regulates the discharge of dredged or fill material into a wetland, lake (including dry lakes), river, stream (including intermittent streams, ephemeral washes, and arroyos) or other waters of the United States.

Certification of Section 404 Permit Status			
Owner's Name:			
Project Name/Description:			
Project Location/Address:		Phone:	- -
		Case No:	
<p>A registered Engineer or the property owner must check the applicable condition and certify by signing below that:</p> <p>1. Section 404 <u>does apply</u> to the project because there will be a discharge of dredged or fill material to waters of the U.S. and:</p> <p style="margin-left: 20px;"><input type="checkbox"/> A Section 404 Permit has already been obtained for this project.</p> <p style="margin-left: 40px;">OR</p> <p style="margin-left: 20px;"><input type="checkbox"/> This project qualifies for a "Nationwide Permit" and this project will meet all terms and conditions of the applicable nationwide permit.</p> <p>2. Section 404 <u>does not apply</u> to the project because:</p> <p style="margin-left: 20px;"><input type="checkbox"/> No watercourses or other waters of the U.S. exist on the property.</p> <p style="margin-left: 20px;"><input type="checkbox"/> No jurisdictional waters of the U.S. exist on the property. Attached is a copy of the COE's Jurisdictional Determination.</p> <p style="margin-left: 20px;"><input type="checkbox"/> Watercourses or other waters of the U.S. do exist on the property, but the project will not involve the discharge of dredged or fill material into any of these waters.</p> <p>I certify that the above statement is true.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 60%; border-top: 1px solid black; padding-top: 5px;"> Engineer's Signature and Seal, or Owner's Signature </div> <div style="width: 35%; border-top: 1px solid black; padding-top: 5px;"> Date </div> </div> <div style="border-top: 1px solid black; padding-top: 5px;"> Title Company </div>			

APPENDIX 5-2

CHECKLIST

FOR

CONSTRUCTION SITE SWPPP INSPECTION



PUBLIC WORKS DEPARTMENT

16000 N Civic Center Plaza
 Surprise, Arizona 85374
 Office: (623) 222-7000
 Fax: (623) 222-7001

Web Site: www.surpriseaz.gov

Construction Site SWPPP Inspection Checklist

Inspector Information			
Name:		Date:	/ /
Phone:	- -	Time In: Time Out:	: :

Type of Inspection									
<input type="checkbox"/>	Initial Level 1	<input type="checkbox"/>	Level 1 Monthly or Rain Event	<input type="checkbox"/>	Levels 1 and 2	<input type="checkbox"/>	Level 3	<input type="checkbox"/>	Final

Facility Information			
Development/Project:			
Location/Address:			
AZPDES ID	AZCON-		
Parcel or Section #s:			
Owner:		Phone:	- -
Operator:		Phone:	- -

Site Information											
Nature of Project	<input type="checkbox"/>	Residential	<input type="checkbox"/>	Roadway	<input type="checkbox"/>	Utility	<input type="checkbox"/>	Right-of-Way			
	<input type="checkbox"/>	Commercial	<input type="checkbox"/>	Industrial	<input type="checkbox"/>	Geotechnical	<input type="checkbox"/>	Offsite			
Stage of Construction	<input type="checkbox"/>	Clearing	<input type="checkbox"/>	Grubbing	<input type="checkbox"/>	Infrastructure	<input type="checkbox"/>	Vertical			
	<input type="checkbox"/>	Mass Grade	<input type="checkbox"/>	Rough Grade	<input type="checkbox"/>	Final Grade	<input type="checkbox"/>	Stabilization			
Is the site located within one-mile of a river or direct tributary thereof?								<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
If yes, list name and proximity to the site.											

Yes	No	Initial Level 1 Inspection – Basic Permit Information	
<input type="checkbox"/>	<input type="checkbox"/>	Is the development covered by a storm water permit issued by the ADEQ or EPA?	
<input type="checkbox"/>	<input type="checkbox"/>	Is a copy of the NPDES/AZPDES Permit available on-site for review?	
<input type="checkbox"/>	<input type="checkbox"/>	Is there a copy of the approved SWPPP Manual & Plan available on-site for review?	
<input type="checkbox"/>	<input type="checkbox"/>	Is there a copy of the approved NOI available on-site for review?	
<input type="checkbox"/>	<input type="checkbox"/>	Has a copy of the NOI been received by the city?	
Yes	No	Level 1 Inspection – Monthly or After a Rain Event of ½ Inch or More	
<input type="checkbox"/>	<input type="checkbox"/>	Has there been a rain event within the past 24 to 48 hours?	
<input type="checkbox"/>	<input type="checkbox"/>	Are there locations of discharges of sediment or other pollutants from the site?	
<input type="checkbox"/>	<input type="checkbox"/>	Are there locations of BMPs that are in need of maintenance?	
<input type="checkbox"/>	<input type="checkbox"/>	Are there locations of BMPs that are not performing, failing to operate, or were inadequate?	

Yes	No	Level 2 Inspection – After Significant Findings in a Level 1 Inspection
<input type="checkbox"/>	<input type="checkbox"/>	Does the SWPPP contain current information on owners/operators?
<input type="checkbox"/>	<input type="checkbox"/>	Are all operators in the development covered by a single SWPPP?
If no, provide NPDES/AZDES permit numbers for other operators working on common development.		
<input type="checkbox"/>	<input type="checkbox"/>	Has a Compliance Evaluation Report been completed within the past 7 days?
<input type="checkbox"/>	<input type="checkbox"/>	Is construction being conducted during seasonal dry period?
<input type="checkbox"/>	<input type="checkbox"/>	Do the material(s) storage areas show evidence of pollutant discharges?
<input type="checkbox"/>	<input type="checkbox"/>	Will any corrective action be needed on any control BMP's that are visually inspected?
<input type="checkbox"/>	<input type="checkbox"/>	Will a level 3 inspection be required?
<input type="checkbox"/>	<input type="checkbox"/>	Is there evidence of, or the potential for pollutants to enter into the drainage system?

Yes	No	Level 3 Inspection – After Significant Findings in a Level 1 or Level 2 Inspection
<input type="checkbox"/>	<input type="checkbox"/>	Are erosion BMPs listed in SWPPP manual being utilized?
<input type="checkbox"/>	<input type="checkbox"/>	Are sediment BMPs listed in SWPPP manual being utilized?
<input type="checkbox"/>	<input type="checkbox"/>	Are housekeeping BMPs listed in SWPPP manual being utilized?
<input type="checkbox"/>	<input type="checkbox"/>	Is construction operator/owner trying to take corrective action?
<input type="checkbox"/>	<input type="checkbox"/>	Will any corrective action be needed on any control BMP's that are visually inspected?
<input type="checkbox"/>	<input type="checkbox"/>	Will a follow up level 3 inspection be required?

Yes	No	Final Inspection – Yes to All = Post Construction Checklist for Any Future Storm Water Issues
<input type="checkbox"/>	<input type="checkbox"/>	Are all soil disturbing activities complete?
<input type="checkbox"/>	<input type="checkbox"/>	Temporary erosion and sediment control measures have been removed?
<input type="checkbox"/>	<input type="checkbox"/>	All areas of the construction site not covered by permanent pavement have been stabilized with vegetative cover with a density of 70% or more?

Notes:

		Date:	/ /
Inspector:			

APPENDIX 5-3

**PRELIMINARY AND FINAL
DRAINAGE REPORT GUIDELINES**

Preliminary and Final Drainage Report Guidelines

Guidelines for the Preparation of Preliminary and Final Drainage Reports Required for Proposed Development Within the City of Surprise, Arizona



1.0 INTRODUCTION

1.1 Purpose

This document was prepared for the City of Surprise (the city) as a tool for developers and engineers seeking construction permits for any proposed improvements within the city limits that require the preparation and submittal of accompanying ‘preliminary’ and ‘final’ drainage reports. This Drainage Report Guideline will serve as a reference document that defines the city’s minimum standards and requirements for preliminary and final drainage design. Adherence to these minimum drainage requirements by the development and engineering community doing work within the city is imperative to mitigate the hazards associated with the potential for increased runoff that is inherent to the majority of new development.

1.1.1 Intent

The intent of this document is not to provide a comprehensive ‘catch all’ drainage design manual. This document assumes that the user is familiar with the basic concepts and industry best standard practice for hydrologic and hydraulic analysis and computations. Further, it is assumed that the user has a good understanding of the theory and science behind those subjects. Rather, the intent of this document is to convey to the user the minimum topics that a preliminary and final drainage report submitted to the City of Surprise should address. For example, regardless of the existence of offsite flow impacts to a particular project site, offsite flow should always be addressed and explained generally in the preliminary drainage report and then in detail for the final drainage report.

This document should not be expected to address all situations that may be relevant on specific project sites. It will merely provide a guide that will aid developers and engineers in the goal of meeting the basic minimum criteria for *any* drainage design conducted within the City of Surprise. Every project is different and may be associated with a set of drainage design challenges unique to its specific location not common to other projects. Although these issues may not be specifically addressed by this guideline, they must be identified and addressed by the preliminary and final drainage report(s) for that project. The ‘Preliminary’ and ‘Final’ Drainage Report(s) must be stamped, sealed, and signed by a registered Civil Engineer in the state of Arizona.

1.1.2 Objective

The objective of this document is to provide developers and engineers proposing projects within the City of Surprise with a ‘preferred’ format to follow when submitting both preliminary and final drainage reports. This document includes the following information:

- A section describing the minimum elements that must be included with any preliminary and final drainage report submitted to the City of Surprise for review and approval.
- A checklist to follow when preparing a preliminary drainage report submittal to ensure that the minimum content required for a comprehensive drainage review of a proposed development and preliminary plat is clearly presented.
- A checklist to follow when preparing a final drainage report submittal to ensure that the minimum content required for a comprehensive drainage review of a proposed development is clearly presented.

2.0 PRELIMINARY DRAINAGE REPORT SUBMITTAL

2.1 Minimum Elements Required

This section will briefly summarize the basic elements that should be addressed by all preliminary drainage reports submitted to the City of Surprise for review and approval. For a summary of the basic elements that should be addressed by all final drainage reports submitted to the City of Surprise for review and approval refer to section 3.0.

The following ‘suggested’ table of contents for preliminary drainage report submittals is not required. However, a similar report format that addresses each element listed will be the minimum expectation of the applicant or his/her representative by the city.

Note that a general discussion of items listed below is required for the preliminary drainage report submittals. At the preliminary drainage report submittal, the discussion of the ‘suggested’ items may be brief and general with the understanding that these items will be addressed in greater detail with the subsequent submittal of the final drainage report. It is important that the suggested items below are addressed at the preliminary plat stage for the proposed development to minimize the number of drainage issues that may otherwise not come to light until the project is much further along.

Several additional items (see section 3.0) that are not usually required for inclusion with the preliminary drainage report must be discussed in the final drainage report. In certain cases, it may be appropriate to include some of those items in the preliminary drainage report submittal. It is up to the developer/engineer to use his or her judgment when determining the appropriate contents of a preliminary drainage report. The following items should be addressed at a minimum:

1. Introduction

1.1. Project Description

- 1.1.1. Project Name & Address if known
- 1.1.2. Location & Topography
- 1.1.3. Purpose
- 1.1.4. Existing/On-Going Studies
- 1.1.5. Regional Drainage Plan
- 1.1.6. Site Location Relative to Known FEMA Flood Hazard Zones

2. Hydrologic Analysis

2.1. Off-Site Hydrology

- 2.1.1. Impact(s) to Proposed Project Site
- 2.1.2. Existing Land Use

2.2. On-Site Hydrology

2.2.1. Methodology and Criteria

3. Proposed Drainage Infrastructure

3.1. Conveyance of Runoff Through Project Site

3.2. Onsite Retention Requirements

3.2.1. Required Retention Volume

3.2.2. Provided Retention Volume

3.2.3. Retention Basin Ultimate Outfall

4. Special Issues or Considerations

4.1. 401/404 Permit

4.2. Floodplain Use Permit with FCDMC

5. Summary and Conclusions

6. References

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Each of the elements listed above is briefly described below. Each element should include a brief discussion and may include some preliminary analysis if required to support/document any data shown within the text or on tables. If any of the elements listed above and described below are not applicable to a particular project site the developer/engineer should still include the element heading within the preliminary drainage report. A single sentence explaining why the element is not applicable to the specific project site must be provided. This is important since it indicates that the developer/engineer is generally aware of such elements and has addressed them as far as they need to. If an element is simply 'left-out' of the report, it is unclear whether it was considered and/or the reason or reasons it was deemed 'not applicable'.

If required, the appendix provided for the preliminary drainage report will contain detailed calculations and data sheets necessary to develop the summary tables.

Introduction – Every preliminary drainage report must include a short introductory section that describes the general area within which the project site is located, some 'context' for the project site and a brief summary of the overall area.

Project Description – This will include the specific project site location, a simple vicinity map (showing the project site relative to the overall region), topographic characteristics, hydrologic character of the area, the purpose of the report; any existing or past studies in, near or otherwise relevant to the project area; any existing regional drainage facilities, features such as irrigation canal, CAP, Railroad, and the location of the project site relative to known FEMA flood hazard

zones. At the preliminary level, the above items may be explained in general/broad terms. These and other elements will be described in much more detail in the final drainage report.

Project Name and Address if Known – Briefly state the name of the project and the address if known.

Location and Topography – A very brief description of the hydrologic character within which the project site is located (natural desert, mountain, alluvial fan, valley, foothills, etc.) as well as the major existing land uses (Industrial, Commercial, Lot Split & Subdivision).

This section should also include a description of the topography in terms of overall direction of flow. Any other major features such as existing washes or flood control channels should be noted as well.

Purpose – A brief statement as to the necessity for the drainage report. What is the improvement project that requires the preparation of the drainage report?

Existing/On-going Studies – This is a list of any past/on-going studies available within the vicinity of the project site that may have an impact on the site. These are usually relevant to offsite discharges impacting proposed project sites. These may include, but are not limited to, Flood Delineation Studies (FDS), Area Drainage Master Studies (ADMS), and Area Drainage Master Plans (ADMP). At the preliminary level, the report can list relevant studies as a ‘bullet’ list. The final drainage report will contain a more detailed description and summary of each study listed.

Regional Drainage Plan – This should be a very general description of regional drainage features and/or the existence of a regional drainage plan. At the preliminary report level, these features need only be acknowledged with a full discussion following in the final drainage report. It is important to be aware of such features early in the project as they impact ultimate outfall for proposed project sites and can provide a means of draining storm water stored within retention basins once the event has passed.

Site Location Relative to Known FEMA Flood Hazard Zones – This is very important to establish any known flood hazards that may exist around or on the project site. This information will be used as a basis for determining the need for the mitigation of known hazards through site improvements that could require a CLOMR/LOMR process. Regardless of the existence of a known flood hazard zone, a figure must be provided illustrating the overall project site superimposed onto the appropriate ‘current’ published Flood Insurance Rate Map (FIRM). The panel number and effective date of the FIRM must be visible on the figure. This information is very important at the preliminary level as it can have a significant impact on the proposed preliminary plat.

Hydrologic Analysis – This section will contain a brief description of the ‘existing condition’ hydrology, as well as the ‘proposed condition’ hydrology. The description will explain the methods, criteria and assumptions used to determine both preliminary onsite and offsite discharge rates necessary for the support of the preliminary plat. This section will also briefly

describe the detailed methodology, criteria and assumptions that will be used to develop the final drainage design.

Off-Site Hydrology – This will be a general description of the offsite discharges impacting the project site. This section of the report must contain a summary table of offsite sub basin area discharges and a corresponding concentration point that can be quickly and easily referenced on a figure (minimum 11”x17”) within the report. Finally, the appendix will contain documentation for any calculations and computations used to develop the data contained within the summary table.

Impact(s) to Proposed Project Site– This section will briefly describe the potential impacts to the project site due to offsite discharges. If there are no impacts, this section will explain why.

Existing Land Use – This section is contained within the ‘Off-Site Hydrology’ section of the report. It will provide a general overview of the existing offsite land use.

On-Site Hydrology – This portion of the report will describe in general the nature of the onsite proposed land use and an approximation of the weighted roughness coefficient (“C” value) based on Table 3-2 of the Flood Control District of Maricopa County’s (FCDMC) Drainage Design Manual, Hydrology.

Methodology and Criteria – A brief description of the methodology and criteria followed to develop any onsite peak flow rates necessary to support the preliminary plat. This section must reference the methods and criteria required by the City of Surprise. This section should explain in general terms the more detailed approach that will be used in the final drainage report.

Proposed Drainage Infrastructure – This is a very general discussion of the proposed drainage system that will be used within the project site to safely collect and dispose of excess runoff generated during 10, 50 and 100-year peak storm events. The detailed description and accompanying analysis will be presented in the final drainage report.

Conveyance of Off-site Runoff Through Project Site – As a sub-section of ‘Proposed Drainage Infrastructure’, this section will provide a general description of the proposed conveyances that will be detailed in the final drainage report. This section will give a summary of those conveyances as well as their expected operation during the 10, 50 and 100-year peak events per the City of Surprise requirements.

Onsite Retention Requirements – This section will explain the City of Surprise requirements for onsite retention including, freeboard, side slopes, ponding depths, drain time and means of draining the basin. The equation used to compute the required volume of retention onsite should be shown with all of the terms clearly labeled and defined within the text.

Required Retention Volume- This section should show the equation used to determine the required retention volume, define the terms and direct the reader to the appendix for detailed calculations and data documenting the computation of the required retention volume for the project site.

Provided Retention Volume- This section should show the equation used to determine the provided retention volume, define the terms and direct the reader to the appendix for detailed calculations and data documenting the computation(s). This section should provide the information necessary to show that areas designated for retention on the preliminary plat are sufficient given the basin geometry constraints (per City of Surprise requirements) and in light of the required volume computed in the previous section.

Retention Basin Ultimate Outfall – This section should provide a brief description of the ultimate outfall for the basin sites proposed on the preliminary plat. This section should describe (in concept) the way in which basin surcharges will be conveyed through the site. Such basin surcharge could be due to a non-design storm event that results in more volume intercepted by the basin than is provided by the basin.

Special Issues or Considerations – This section of the report should include an overview of any issues or considerations that could become significant during the preparation of the final drainage report and are unique to this project site. Such issues or considerations may include but are not limited to the following:

- 401/404 permit requirements
- Floodplain use permit

Summary and Conclusions – This section will provide a quick summary of the proposed preliminary drainage concept for the project site and make conclusions as to its operation and ability to support the proposed preliminary plat as well as meet the City of Surprise requirements.

References – This section will provide a set of references that will document any and all explanation, calculations, methodology, criteria, past & on-going studies, etc... that were contained within the text of the preliminary report. At a minimum these references should include a title, author and date.

TABLES – This portion of the table of contents will list all tables provided in the preliminary report and the corresponding page number.

FIGURES - This portion of the table of contents will list all figures provided in the preliminary report and the corresponding page number.

APPENDICES – This portion of the table of contents will list all appendices provided in the preliminary report and a brief description of their contents.

EXHIBITS – This portion of the table of contents will list all exhibits provided in the preliminary report and their location. At a minimum, every preliminary drainage report submitted MUST provide an onsite and offsite drainage exhibit.

The onsite drainage exhibit should be plotted at a size and scale appropriate for verification of any preliminary drainage sub basin areas, proposed retention/detention basin volumes, etc...

At a minimum, this exhibit must show project property boundaries, all existing structures, existing drainage patterns/features, existing contours and/or spot elevations, phase labels in the appropriate phase, proposed retention/detention basin locations, expected onsite flow patterns and flow arrows.

The offsite drainage exhibit may be at a smaller scale than that used for the onsite exhibit but must be easily readable. Any delineated sub basin areas necessary for the support of the proposed preliminary plat must be at a scale suitable for area verification using a standard planimeter. This exhibit must show the entire offsite area contributing to the discharge at the project boundary and must include all information necessary for verification of the developed flow rates used in the drainage report.

If the offsite discharges were developed under a separate study or provided for use with this project, the source of these discharges must be clearly referenced and specified within the report. In this case, the offsite drainage exhibit may be much less detailed and need only serve as a reference to the reader that will establish the geographic context within which the project site exists.

2.2 Preliminary Drainage Report Checklist

Figure 1.0 contains a checklist of the major elements associated with most preliminary drainage reports submitted in support of preliminary plats. If there are other relevant issues, concerns or requirements not addressed by Figure 1.0 of this document, they must still be addressed within the preliminary drainage report.

Figure 1.0
City of Surprise
Typical Elements of a Preliminary Drainage Report

	N/A	Not Applicable to this project
X		Item was addressed by report
X	X	Item addressed by others and referenced in this report

Project Location

Site Description		
		Location and topography
		Purpose
		Existing/on-going studies
		Regional Drainage Plan
		Site location relative to known FEMA Flood Hazard Zones

Hydrologic Analysis

Off-Site Hydrology		
		Impact(s) to proposed project site
		Existing land use

On-Site Hydrology		
		Methodology and criteria
		Existing land use
		Future land use

Proposed Drainage Infrastructure

On-Site Retention		
		Minimum 1 foot freeboard provided
		Maximum 3 foot ponding as measured from adjacent low top of curb
		Required retention volume computed with calculations documented in appendix
		Provided retention volume computed with calculations documented in appendix
		Retention summary table prepared
		Ultimate outfall for proposed retention basins

On-Site Drainage Exhibit		
		On-site drainage exhibit provided
		Scale suitable (1"=100' min.)
		Existing features, topography, etc...
		Phase lines and proposed lots are labeled
		Proposed drainage sub-basin areas, proposed retention and detention basins are labeled
		Flow arrows

Figure 1.0
City of Surprise
Typical Elements of a Preliminary Drainage Report

	N/A	Not applicable to this project
X		Item was addressed by report
X	X	Item addressed by others and referenced in this report

Off-Site Drainage

Impacts To Others		
		Exhibit showing project site relative to off-site area and delineated off-site drainage areas with concentration points

General Site Considerations

Other Considerations		
		Project site meets minimum open space requirements
		401/404 Permit issues addressed
		Mitigation of known flood hazards addressed
		Historic drainage patterns and relevance to proposed project site discussed
		Existence of regional drainage facilities
		Existence and implications of a regional area drainage master plan in the vicinity of the propose project site
		Coordination with other development and/or agencies that may be impacted by project site
		Impact of on-going or completed drainage studies or plans implemented in the proposed project site
		Floodplain Use Permit - FCDMC

3.0 FINAL DRAINAGE REPORT SUBMITTAL

3.1 Minimum Elements Required

This section will briefly summarize the basic elements that should be addressed by all final drainage reports submitted to the City of Surprise for review and approval. The following ‘suggested’ table of contents is not required. However, a similar report format that addresses each element listed below will be the minimum expectation of the applicant or his/her representative by the city for final drainage report submittals.

Many of the elements listed below were included in the preliminary drainage report guideline above. Unlike the general/broad element discussions contained within the preliminary drainage report, those items addressed by the final drainage report must be presented at a much greater level of detail and will usually include extensive analysis with supporting data and calculations provided in an appendix and summarized on tables.

1. Introduction

1.1. Project Description

- 1.1.1. Project Name & Address if known
- 1.1.2. Location & Topography
- 1.1.3. Purpose
- 1.1.4. Existing/On-Going Studies
- 1.1.5. Regional Drainage Plan/Characteristics
- 1.1.6. Site Location Relative to Known FEMA Flood Hazard Zones
- 1.1.7. Reference to established Bench Mark, address location of any proposed On-site Temporary Bench Marks

2. Hydrologic Analysis

2.1. Off-Site Hydrology

- 2.1.1. Impact(s) to Proposed Project Site
- 2.1.2. Development of Off-Site Peak Discharges
- 2.1.3. Conveyance of Off-Site Discharge
- 2.1.4. Discharge at the entrance and exit points
- 2.1.5. Existing Land Use

2.2. On-Site Hydrology

- 2.2.1. Methodology and Criteria
- 2.2.2. Existing Condition Discharges
- 2.2.3. Proposed Condition Discharges
 - 2.2.3.1. Future Land Use

3. Proposed Drainage Infrastructure

3.1. Conveyance of Runoff Through Project Site

- 3.1.1. Street Conveyance
- 3.1.2. Proposed Channel Conveyance
- 3.1.3. Proposed Storm Drain Conveyance
- 3.1.4. Inlet Sizing

3.2. Onsite Retention Requirements

- 3.2.1. Proposed Basin Geometry and Freeboard
- 3.2.2. Required Retention Volume
- 3.2.3. Provided Retention Volume
- 3.2.4. Dissipation of Stored Runoff
- 3.2.5. Onsite Retention Summary
- 3.2.6. Ultimate Retention Basin Outfall

4. Interim Condition Drainage Concept/

5. Special Issues or Considerations

- 5.1. 401/404 Permit
- 5.2. NPDES
 - 5.2.1. SWPP
 - 5.2.2. First Flush
- 5.3. Downstream Impacts of Proposed Improvements
- 5.4. Upstream Impacts of Proposed Improvements
- 5.5. Floodplain Use Permit with FCDMC
- 5.6. Drywell Registration with ADEQ

6. Summary and Conclusions

7. References

TABLES

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APPENDICES

EXHIBITS

Each of the elements listed above is briefly described below. Note that although these descriptions may be brief, the actual element may require an extensive discussion and supporting analysis with calculations provided within the final drainage report. In contrast however, some of the elements listed above and described below may not be applicable to a particular project

site. In this case, the developer/engineer should provide the element heading within the report and then a sentence explaining why this is not applicable to the specific project site. This is important since it indicates that the developer/engineer is generally aware of these elements and has addressed them as far as they need to. If the element is simply ‘left-out’ of the report, it is unclear if it was considered and/or the reason or reasons it was deemed ‘not applicable’.

Introduction – Every final drainage report must include an introductory section that describes the general area within which the project site is located, some ‘context’ for the project site and a brief summary of the overall area.

Project Description – This will include the specific project site location, vicinity map, USGS drainage map, aerial photo, topographic characteristics, hydrologic character of the area, the purpose of the report; any existing or past studies in, near or otherwise relevant to the project area; any existing regional drainage facilities, features such as irrigation canal, CAP, Railroad, and the location of the project site relative to known FEMA flood hazard zones.

Project Name and Address if Known – Briefly state the name of the project and the address if known.

Location and Topography – A very brief description of the hydrologic character within which the project site is located (natural desert, mountain, alluvial fan, valley, foothills, etc.) as well as the major existing land uses (Industrial, Commercial, Lot Split & Subdivision). This section should also include a description of the topography in terms of overall direction of flow and existing approximate percent grade through the project site. Any other major features such as existing washes or flood control channels should be noted as well. A plan view figure should be provided at a scale sufficient for the reader to see the adjacent streets/features that will place the project site in a clear context of the region within which it exists.

Purpose – A brief statement as to the necessity for the final drainage report. What is the improvement project that requires the preparation of the final drainage report?

Existing/On-going Studies – This is a list of any past/on-going studies available within the vicinity of the project site that may have an impact on the site. These are usually relevant to offsite discharges impacting proposed project sites. These may include, but are not limited to, Flood Delineation Studies (FDS), Area Drainage Master Studies (ADMS), and Area Drainage Master Plans (ADMP).

Regional Drainage Plan/Characteristics – This should be a description of regional drainage features. Such features could be an engineered flood control channel or a major existing wash corridor. These features are important when considering ultimate outfall for proposed project sites as well as providing a potential means of draining proposed retention/detention basins using gated outlet/bleed pipes that may be opened after a storm event passes.

Site Location Relative to Known FEMA Flood Hazard Zones – This is very important to establish any known flood hazards that may exist around or on the project site. This information will be used as a basis for determining the need for the mitigation of known hazards through site

improvements that could require a CLOMR/LOMR process. Regardless of the existence of a known flood hazard zone, a figure must be provided illustrating the overall project site superimposed onto the appropriate 'current' published Flood Insurance Rate Map (FIRM). The panel number and effective date of the FIRM must be visible on the figure.

Reference to Established Bench Mark – This will include a discussion of any proposed onsite Temporary Bench Marks.

Hydrologic Analysis – This section will contain the detailed description of the 'existing condition' hydrology, the 'proposed condition' hydrology, and a detailed description of the hydrologic analysis with references to detailed calculations in the appendix. The description will explain the methods, criteria and assumptions used to determine both onsite and offsite discharge rates used for the design of the proposed drainage system within and around the project site.

Off-Site Hydrology – This will be a detailed description of the offsite discharges impacting the project site. This section of the report must contain a summary table of offsite sub basin area discharges and a corresponding concentration point that can be quickly and easily referenced on a drainage exhibit provided in the back of the report. Finally, the appendix will contain all detailed calculations and computations.

Impact(s) to Proposed Project Site– This section will explain the nature and extent of the impacts to the project site due to offsite discharges. If there are no impacts, this section will explain why.

Development of Off-Site Peak Discharges– This section will describe the methods, criteria and assumptions used to develop offsite discharges. If offsite discharges were developed by another study, that study should be referenced and documented in the appendix.

Conveyance of Off-Site Discharge – Explain how offsite discharges impacting the project site will be conveyed through and/or around the site.

Discharge of Entrance and Exit Points – This will be a discussion of the existing discharges along the proposed project site boundary. This discussion will establish a basis for the existing condition that a proposed development may not change unless the change is an improvement to the existing condition.

Existing Land Use – This section is contained within the 'Off-Site Hydrology' section of the report. This will provide a description of the existing offsite land use and (if required) an exhibit illustrating the existing ground cover, structures and discharges.

On-Site Hydrology – This portion of the final drainage report will explain in detail the nature of the onsite proposed land use, land use dimension and areas, roughness coefficient and weighted "C" value used based on Table 3-2 of the Flood Control District of Maricopa County's (FCDMC) Drainage Design Manual, Hydrology.

Methodology and Criteria – A detailed description of the methodology and criteria followed to develop the onsite peak flow rates. This section must reference the methods and criteria required by the City of Surprise.

Existing Condition Discharges – This section will provide the detailed discussion of the existing drainage condition sheet flows or concentrated washes ingress/egress if applicable. This section of the final drainage report must contain a summary table of onsite discharges and corresponding concentration points that can be referenced on a drainage exhibit provided in the back of the report. Finally, the appendix will contain all detailed calculations and computations.

Proposed Condition Discharges – This section will provide a detailed discussion of the proposed condition discharges. This section of the report must contain a summary table of onsite (proposed condition) discharges and a corresponding concentration point that can be referenced on a drainage exhibit provided in the back of the final drainage report. At a minimum, the summary table should include the following:

- Proposed concentration point and the Discharge at the entrance to the site must be labeled.
- Contributing sub basin area(s) ID and corresponding area of each and the Discharge at the concentration point must be stated. If there is more than one contributing area at a particular concentration point, provide a total summation of the individual areas. Footnote the table to direct the reader to the detailed calculation and data documenting the proposed condition discharges.
- The proposed discharge at the concentration point for the 10, 50 and 100-year storm events.

Finally, the appendix will contain all detailed calculations and computations. At a minimum, the 10, 50 and 100-year storm events must be analyzed.

Proposed/Future Land Use – This section is contained within the ‘Proposed Condition Discharges’ section of the final drainage report. This will provide a description of the proposed/future land use and if required an exhibit illustrating it. A paragraph should be added to explain how this proposed/future land use relates to the most recent version of the City of Surprise General Plan.

Proposed Drainage Infrastructure – This is a very detailed discussion of the proposed drainage system that will be constructed within the project site to safely collect and dispose of excess runoff generated during 10, 50 and 100-year peak storm events. Such systems may include or be a combination of local street conveyance, catch basins and storm drain or open channels.

Conveyance of Off-site Runoff Through Project Site – As a sub-section of ‘Proposed Drainage Infrastructure’, this section will provide the detailed description of the proposed conveyances within the project site. This section explains how these conveyances operate during the 10, 50 and 100-year peak events and illustrates that the water surface elevations associated with those return periods are at least 1 foot below the proposed adjacent finish floor elevations.

Street Conveyance – Should provide a summary table of all proposed streets within the development, the corresponding longitudinal slope, the estimated peak discharge within the street at the appropriate concentration point and the water surface elevation within the street relative to the proposed adjacent finish floor elevation. This section must demonstrate that the City of Surprise conveyance requirements are met for the 10, 50 and 100-year peak storm events. The concentration points shown in the summary table must be clearly labeled on a drainage exhibit provided in the back of the final drainage report. The final drainage report must address that each lot has an all weather access road.

Proposed Channel Conveyance – Provide a detailed Hydraulic Analysis using appropriate methodology. Provide a summary table of all proposed channels within the development (if applicable). The table must include flow distribution, and the estimated peak discharge within the channel at appropriate cross sections & concentration points. The summary table will also provide the discharge, velocity, depth, top width, bottom width, side slopes, “C” value, energy grade line and the water surface elevations along the channel relative to adjacent finish floor elevations. This section must demonstrate that the City of Surprise conveyance requirements are met for the 10, 50 and 100-year peak storm events for proposed channels.

Freeboard should be provided within the channels for the 100-year peak storm event and a detailed discussion of the analysis of channel capacity should be documented with supporting calculations in the appendix. This discussion should explain the nature of the flow (subcritical, supercritical), the proposed channel lining, velocities, side slopes bank protection method and any effects due to backwater effect.

The concentration points shown in the summary table must be clearly labeled on a drainage exhibit provided in the back of the final drainage report.

Proposed Storm Drain Conveyance – This section will provide a summary table of all proposed storm drainpipe inlet and outlet elevations, within the development. The table will include the corresponding longitudinal pipe slopes, the estimated peak discharge within each pipe, the corresponding concentration point and the computed hydraulic grade line at each node along the proposed storm drain system as well as at each proposed inlet to the system. If applicable, clogging factors must be considered and addressed.

This section must explain the need for a storm drain system within the development. If required, spread calculations on arterial or collector streets should be provided to show that the proposed storm drain system is required at a particular location. Exceeding the City of Surprise street conveyance capacity requirements usually indicates the need for a storm drain system.

A detailed discussion of the methods, criteria and assumptions used to design the proposed inlets that will convey surface runoff to the proposed storm drain system should be provided in the ‘Inlet Sizing’ section below.

The concentration points shown in the summary table must be clearly labeled on a drainage exhibit provided in the back of the final drainage report.

Inlet Sizing – This section is a detailed discussion of the methods, criteria and assumptions used to design the proposed inlets within and around the project site that will convey surface runoff to the proposed drainage facilities such as storm drains, retention basins, channels, etc. A summary table of all proposed inlets should be included. At a minimum, this table should include the inlet label, the corresponding concentration point, the inlet type and size (scupper, curb-cut, catch basin, etc...) the design discharge, the calculated inlet capacity, the ponded water surface elevation at the inlet and the adjacent finish floor elevation(s). The table should be footnoted with a reference to the appendix for the detailed calculation and data sheets. This section must demonstrate that all of the City of Surprise requirements for inlet design are met.

The concentration points shown in the summary table must be clearly labeled on a drainage exhibit provided in the back of the final drainage report.

Onsite Retention Requirements – This section will explain the City of Surprise requirements for onsite retention including, freeboard, side slopes, ponding depths, drain time and means of draining the basin. The equation used to compute the required volume of retention onsite should be shown with all of the terms clearly labeled and defined within the text.

Proposed Basin Geometry and Freeboard – Briefly explain the proposed basin geometry including side slopes, ponding depths and freeboard.

Required Retention Volume- This section should show the equation used to determine the required retention volume, define the terms and direct the reader to the appendix for detailed calculations and data documenting the computation of the required retention volume throughout the project site.

Provided Retention Volume -This section should show the equation or equations used to determine the estimate for the amount of storage provided by proposed retention basins throughout the project site. The applicability of the equation based on the geometry of the proposed basin should be explained and the reader should be directed to the appendix for detailed calculations and data documenting the computation of the retention volume provided by each proposed retention basin. If applicable this section will also provide detailed explanation and appropriate references to any relevant calculations used to determine equalizer pipe sizes between two or more basins acting as a single facility.

Dissipation of Stored Runoff – This section will briefly explain the time it should take each proposed retention basin to drain following a storm event. The drain time of all proposed retention basins must be less than or equal to the 36-hour time limit per the City of Surprise requirements. If drywells are being used, there must be a reference in the text to detailed calculations and data in the appendix of the report showing the number of drywells required in each basin. Similarly, if some other method of bleeding the basin volume is used, this must be supported with calculations and data in the appendix and referenced in this section.

A summary table should be provided in this section showing the proposed retention basin label, the total volume retained within the basin, the total number of drywells proposed to dissipate the retained volume and the estimated time to drain. The table should provide a footnote directing the reader to the appendix for the detailed calculations and data used to estimate the number of

drywells and the corresponding drain times. The reader should be referred to the drainage exhibit in the back pocket of the report for the drywell locations within the proposed retention basins.

The table should also summarize any alternative method used to drain proposed retention basins and the corresponding drain time estimates. A footnote should be included to direct the reader to the appendix for the supporting calculations and data.

Onsite Retention Summary – This section will contain a summary table that clearly labels each proposed retention basin on the project site. The proposed retention basin labels should be clearly shown on the drainage exhibit provided in the back pocket of the final drainage report.

The proposed retention basin summary table must include but is not limited to the following:

- The proposed retention basin label.
- The individual labels of each drainage sub basin area contributing runoff to a proposed retention basin.
- The sum total of the individual drainage basin areas contributing runoff to the proposed retention basin.
- The computed runoff coefficient (weighted “C” value) for the total contributing area at a proposed retention basin.
- The rainfall intensity “I”.
- The proposed bottom elevation of the retention basin, the proposed top elevation of the retention basin.
- The proposed high water surface elevation within the proposed retention basin.
- The adjacent finish floor elevations.
- The total storage volume required.
- The total storage volume provided by the retention basin.
- The proposed basin side slopes.
- The proposed surface area of the retention basin.
- Footnotes directing the reader to the appendix for detailed calculations and data documenting all of the data summarized within the table.

Ultimate Basin Outfall – This section should provide a brief description of each proposed retention basin and its corresponding ultimate outfall elevation and location. This section should describe where the overflow from a particular proposed basin would be conveyed. Such a basin surcharge could be due to a non-design storm event that results in more volume intercepted by the basin than is provided by the basin.

Interim Condition Drainage Concept – If the proposed development is going to be constructed in phases, how will drainage be handled in the interim condition? This section must address these issues and clearly show that all of the City of Surprise drainage requirements are met. All supporting calculations and data should be included in the final drainage report appendix. Any summary tables required to clearly show the results of any calculations necessary to demonstrate that the interim drainage facilities will work must be included in this section of the final drainage report. Avoid retention basins outside of the proposed site. However, if a temporary basin is required outside of the site, a letter of easement acknowledgement and approval is required from the property owner. The letter must state the intent, volume to be retained, and the estimated time the basin will be in temporary use.

Special Issues or Considerations – This section of the final drainage report should include issues or considerations unique to this project site that have not been adequately covered in the preceding sections of the report. Such issues or considerations may include but are not limited to the following:

- 401/404 permit requirements
- National Pollutant Discharge Elimination System (NPDES) Phase I (1990) and Phase II (1998)
 - Storm Water Pollution Prevention Plan - storm water runoff and impacts on water quality during construction
 - First flush considerations with proposed onsite detention
- Downstream impacts of proposed improvements
- Upstream impacts of proposed improvements
- Other: ADOT, ADEQ, FCDFMC, MCDOT, ACDC, & SRP

Floodplain Use Permit with FCDFMC – This section will address any situation where the proposed development/improvement would require the procurement of a floodplain use permit from the FCDFMC.

Drywell Registration with ADEQ – This is a brief description of any drywells proposed in the drainage report and the registration of these elements with ADEQ per the City of Surprise requirements.

Summary and Conclusions – This section will provide a quick summary of the proposed drainage design for the project site and make conclusions as to its operation and ability to meet the City of Surprise requirements.

REFERENCES – This section will provide a complete set of references that will document any and all explanation, calculations, methodology, criteria, past & on-going studies, etc... that were contained within the text of the final drainage report. At a minimum these references should include a title, author and date.

TABLES – This portion of the table of contents will list all tables provided in the final drainage report and the corresponding page number.

FIGURES - This portion of the table of contents will list all figures provided in the final drainage report and the corresponding page number.

APPENDICES – This portion of the table of contents will list all appendices provided in the final drainage report and a brief description of their contents.

EXHIBITS – This portion of the table of contents will list all exhibits provided in the final drainage report and their location. At a minimum, every final drainage report submitted **MUST** provide an onsite and offsite drainage exhibit.

The onsite drainage exhibit should be plotted at a size and scale appropriate for verification of drainage sub basin areas, flow path lengths, proposed retention/detention basin volumes, etc... This exhibit should never be smaller than 1 inch equals 100 feet. The preferred scale is a scale that will result in the largest possible plot with the least number of sheets (match lines) required.

At a minimum, this exhibit must show project property boundaries, all existing structures, existing drainage patterns/features, existing contours and/or spot elevations, proposed slopes on streets, proposed curb and gutter lines, proposed phase lines with phase labels in the appropriate phase, proposed contours, proposed lots (numbered), proposed finish floor elevations, proposed pad elevations, proposed lot dimensions and grading, proposed top of curb and gutter elevations, proposed grade breaks, proposed drainage sub basin delineations and labels, proposed concentration point locations and labels, all proposed drainage infrastructure (see drainage infrastructure as defined above), proposed retention/detention basins, proposed drywells and locations, and any other information necessary for verification of the proposed drainage design concept documented within the final drainage report. In addition, this map should indicate the direction of flow within individual sub basins using spot elevations and flow arrows.

An ideal basis for this type of an exhibit is to overlay the proposed drainage information onto the proposed site-grading plan. This can then be used in the final drainage report to show all data required by the reviewer to easily and quickly verify the hydrologic and hydraulic calculations contained within the final drainage report.

A maintenance manual for the underground storage facilities and drywells, as described in Appendix 5-4, shall be included as an attachment to the Final Drainage Report.

3.2 Final Drainage Report Checklist

Figure 2.0 contains a checklist of the major elements associated with the most common drainage design concepts required for proposed development and documented within a final drainage report. If there are other relevant issues, concerns or requirements for engineered drainage facilities not addressed by Figure 2.0 of this document, they must still be addressed within the final drainage report.

Figure 2.0
City of Surprise
Typical Elements of a Final Drainage Report

	N/A	Not applicable to this project
X		Item was addressed by report
X	X	Item addressed by others and referenced in this report

Project Location¹

Site Description		
		Location and topography ¹
		Purpose ¹
		Existing/on-going studies ¹
		Regional drainage plan ¹ /Characteristics
		Site location relative to known FEMA Flood Hazard Zones ¹
		Reference to established bench mark, including on-site temporary bench marks

Hydrologic Analysis¹

Off-Site Hydrology		
		Impact(s) to proposed project site ¹
		Development of off-site peak discharges
		Conveyance of off-site discharge
		Off-site peak discharge summary table for the 10-, 50-, and 100- year storms
		Discharge at the entrance and exit points
		Existing land use ¹

On-Site Hydrology		
		Methodology and criteria ¹
		Existing condition discharges
		Proposed condition discharges
		Existing land use ¹
		Future land use ¹
		On-site peak discharge summary table for the 10-, 50-, and 100- year storms

1. Element must be addressed in the preliminary drainage report submittal as well as the final.

Figure 2.0
City of Surprise
Typical Elements of a Final Drainage Report

	N/A	Not applicable to this project
X		Item was addressed by report
X	X	Item addressed by others and referenced in this report

Proposed Drainage Infrastructure¹

Street Conveyance		
		Local street conveyance
		Arterial and collector streets – one 12 foot lane dry each direction, 10-year
		Street conveyance summary table

Channel Conveyance		
		Proposed channel conveyance (HEC-RAS)
		Proposed channel conveyance (normal depth)
		Proposed channel conveyance (freeboard)
		Proposed channel conveyance (erosion protection)
		Proposed channel summary table

Storm Drain Conveyance		
		Starting water surface elevation at outlet – document assumptions and analyze
		All appropriate losses have been applied
		Inlet calculations
		Water surface elevations at inlets meet requirements for 10-, 50-, And 100-year storms
		Proposed storm drain summary table
		Proposed inlet summary table

Culvert Sizing		
		Assumed tailwater condition analyzed
		Larger of inlet/outlet control used
		Headwater does not exceed maximum allowable
		Appropriate pipe material and headwall configuration
		Ponding at inlets meets requirements for 10-, 50-, and 100-year storms
		Proposed culvert summary table

1. Element must be addressed in the preliminary drainage report submittal as well as the final.

Figure 2.0
City of Surprise
Typical Elements of a Final Drainage Report

	N/A	Not applicable to this project
X		Item was addressed by report
X	X	Item addressed by others and referenced in this report

Proposed Drainage Infrastructure¹
(cont.)

On-Site Retention		
		Maximum side slope of 4:1, or explanation if different
		Proposed retention basin bleed time with calculations documented in appendix
		Minimum 1 foot freeboard provided ¹
		Maximum 3 foot ponding as measured from adjacent low top of curb ¹
		Required retention volume computed with calculations documented in appendix ¹
		Provided retention volume computed with calculations documented in appendix ¹
		Retention summary table prepared ¹
		Ultimate outfall for proposed retention basins ¹

On-Site Drainage Exhibit		
		On-site drainage exhibit provided ¹
		Scale suitable (1"=100' min.) ¹
		Existing features, topography, etc... ¹
		Phase lines ¹ , proposed lots ¹ , proposed finished floor elevations and proposed pad elevations are labeled
		Proposed slopes, curb and gutter elevations, proposed grading in basins and channels
		Proposed lot grading, proposed grade breaks, and longitudinal street grades
		Proposed drainage sub-basin areas ¹ , proposed retention and detention basins ¹ , concentration points, proposed drywell locations and other proposed infrastructure are labeled
		Flow arrows ¹ and spot elevations provided
		Invert elevation, pipe lengths and any other information necessary to verify calculations contained within the report

1. Element must be addressed in the preliminary drainage report submittal as well as the final.

Figure 2.0
City of Surprise
Typical Elements of a Final Drainage Report

	N/A	Not applicable to this project
X		Item was addressed by report
X	X	Item addressed by others and referenced in this report

Proposed Drainage Infrastructure¹
(cont.)

Interim Condition Drainage		
		Interim condition infrastructure
		Interim condition retention basin sizing
		Interim condition drainage concept meets city requirements

Off-Site Drainage¹

Impacts to Others		
		There are no impacts to downstream areas
		There are no impacts to upstream areas
		Exhibit showing project site relative to offsite area and delineated off-site drainage areas with concentration points ¹

General Site Considerations¹

Other Considerations		
		Project site meets minimum open space requirements ¹
		401/404 Permit issues addressed ¹
		Mitigation of known flood hazards addressed ¹
		Storm water pollution prevention plan (SWPPP)
		First flush accounted for in proposed detention basins discharging to regional facilities
		Historic drainage patterns and relevance to proposed project site discussed ¹
		Existence of regional drainage facilities ¹
		Existence and implications of a regional area drainage master plan in the vicinity of the proposed project site ¹
		Coordination with other development and/or agencies that may be impacted by project site ¹
		Impact of on-going or completed drainage studies or plans implemented in the proposed project area ¹
		Floodplain Use Permit – FCDMC ¹
		Drywell registration with ADEQ ¹

1. Element must be addressed in the preliminary drainage report submittal as well as the final.

APPENDIX 5-4

UNDERGROUND RETENTION/DETENTION SYSTEMS STANDARDS AND SPECIFICATIONS

Underground Retention/Detention Systems Standards and Specifications City of Surprise

General Discussion:

The use of underground storage to meet retention/detention requirements is discouraged by the City of Surprise (the city). Wherever possible, storm water storage shall be provided in depressed open areas with provision for emergency overflows. However, underground storage of the 100-year, 2-hour runoff volume requirement is allowed in commercial and industrial sites. The use of underground storage in other developments may be allowed by meeting the requirements specified herein.

The property owner of record shall be responsible for the design, performance, operation, and maintenance of underground storage facilities for on-site retention. Underground storage facilities are not to be located within public street right-of-way or utility easements.

The design, construction and maintenance of underground storage shall be in accordance with the following standards and specifications.

Approved Underground Retention/Detention Systems:

The system approved for use in the city is large diameter pipes with drywells, or an approved equivalent system.

Underground Retention/Detention System Requirements:

1. The following statements shall appear on all plans which include the use of underground storage facilities and disposal facilities:
 - a. "All underground storage facilities and disposal facilities shown on this project shall be maintained by the owners. These underground storage facilities shall be modified, upgraded, or replaced with similar or other appropriate devices/measures by the owners when they cease to drain the water within a 36-hour period. Regular maintenance of the silting chamber is required to achieve the best operation of the drywell/underground percolation chamber(s)."
 - b. "During site development, all drywells/underground percolation chambers shall be securely covered with filter cloth or other material to prevent the introduction of excessive sediment into the settling chamber."
2. The storage facility shall be sized for the 100-year, 2-hour runoff volume, and the volume shall not be decreased for anticipated percolation volume during the storm duration.
3. An engineer registered in Arizona shall prepare a geotechnical report showing depth to groundwater and the depth of the proposed installation. Soil boring profiles shall be provided to at least ten feet below the bottom of the proposed storage facility and/or disposal facility, such as a drywell. Plans shall include the results of the soil investigation and shall provide data for the following parameters:
 - a. Soil pH
 - b. Resistivity in ohm-cm
 - c. Chloride concentration in ppm
 - d. Sulfate concentration in ppm

Underground Retention/Detention Systems Standards and Specifications City of Surprise

- e. Moisture content
 - f. Soil Permeability in inches/hour
4. The facilities shall be designed for a 75-year life expectancy. The construction plans shall specify material type including lining and coating requirements. For pipe material, the methodology for determining the soil side service life shall be based on the *Pipe Selection Guidelines and Procedures*, February 1, 1996 with March 21, 1996 Revisions, Arizona Department of Transportation. For storage systems using materials not listed in these guidelines, the manufacturer needs to certify the 75-year life expectancy based on independent testing.
 5. Traffic/load bearing capacity of the installation must be specified; for example, pipe gage and corrugation size for corrugated metal pipe and D-Load for reinforced concrete pipe. Storage structures shall be designed for an HS-20 loading. For pipes, the loading shall be based on the "Fill Height Tables" contained in the *Pipe Selection Guidelines and Procedures*, February 1, 1996 with March 21, 1996 Revisions, Arizona Department of Transportation, which can be found at: http://azdot.gov/highways/roadway_engineering/roadway_design/guidelines/manuals/pdf/roadwaydesignguidelines.pdf. Open "Appendices" and "Appendix A". For other types of storage systems, an engineer registered in Arizona shall provide calculations or manufacturer certification (based on independent testing) stating that the product meets HS-20 loading requirements.
 6. A detailed drawing of how the installation will drain into the outfall structure, such as drywell/percolation chamber, storm drain system, drainage channel, or natural wash shall be provided. The system must drain completely within 36 hours.
 7. Access to underground storage facilities shall be secured with a bolted grate or solid cover to prevent unauthorized entry.
 8. A watertight storage facility may be required, if the subgrade soil's bearing capacity is significantly affected by saturation such as with expansive clays or karst soils. Specify watertight manufactured joints and provide end walls for pipe per manufacturer(s) recommendation with a detailed drawing. An alternative solution would be an impermeable liner to create a watertight chamber system. An engineer registered in Arizona shall prepare a geotechnical report stating whether a watertight storage system is required.
 9. Connection details are required for manhole shafts, end walls, inlet and outlet pipe connections, and end structures.
 10. A minimum of two inspection locations into each storage unit shall be provided. 48 -inch minimum manhole shafts at each access point shall be provided. A fixed ladder must be installed at each inspection location. A 30-inch manhole frame and cover can be used at grade with a concrete collar where subject to wheel loads.
 11. Provide a backfill detail including material and compaction requirements. For circular pipes, particular care shall be given to the area under haunches and to the springline of the storage pipe, which shall be backfilled with 3/8" minus crushed aggregate or aggregate base course (ABC). Provide a geosynthetic fabric wrap around the limits of the aggregate or ABC bedding per MAG specification 796.2.2, and Table 796-2, Class A, so as to not allow infiltration of fines into the aggregate or ABC after completing backfill.

Underground Retention/Detention Systems Standards and Specifications City of Surprise

12. An engineer registered in Arizona shall provide calculations showing that failure of the underground structure will (a) not jeopardize adjacent overhead power structures or adjacent building structures proposed for the development and/or (b) not collapse soil beyond the property boundaries. In lieu of calculations, the designer may assume that the plane of failure is a 1:1 angle of repose from the outside edge of the underground structure plus two feet. For circular pipes, the outside edge of the structure is defined as the springline of the pipe. Structures shall be designed to resist uplift pressures.

Disposal of Storm Water:

Underground retention/detention systems are required to drain within a 36-hour period by infiltration through a drywell, percolation through the bottom of each storage unit or by gravity flow into a drainage system, such as a storm drain, drainage channel, or natural wash.

Drywells shall comply with the Arizona Department of Environmental Quality (ADEQ) publication *Guidance for Design, Installation, Operation, Maintenance, and Inspection of Drywells* and the additional requirements listed below:

1. Drywells shall be constructed by an ADEQ licensed contractor and registered by the same contractor with ADEQ. The contractor is also responsible for submitting a drilling log for the drywell to ADEQ. The approved drywell registration shall be submitted to the city by the developer or his engineer at the time As-Built Plans are submitted. A tabulation showing drywell number, registration number, and percolation rate (both tested and design) shall be added to the Grading Plan coversheet before submitting As-Built Plans.
2. An engineer registered in Arizona shall provide certification that the drywell(s) has been installed in accordance with plans, specifications and Arizona Department of Environmental Quality requirements as contained in the ADEQ publication *Guidance for Design, Installation, Operation, Maintenance, and Inspection of Drywells*. This certification along with drywell drilling logs shall be submitted to the City of Surprise upon completion of the drywell installation. A copy of the application for registration by ADEQ of the proposed drywell shall be submitted prior to approval of the grading plans.
3. Drywells can be designed with a maximum disposal rate of 0.1 cfs per well and the construction requirement that the drywells penetrate a minimum of ten feet into a permeable stratum. However, if a higher disposal rate is desired and/or the ten-foot penetration requirement is not met, then a percolation test must be performed on the drywell before acceptance. To allow for degradation, calculation of the retention time in the storage facilities shall be based on 50% of the tested percolation rate. No degradation is required if the maximum disposal rate is set at 0.1 cfs per well and the well penetrates a minimum of ten feet into a permeable stratum. The maximum allowable design rate, based on 50% of the tested percolation rate, is 0.5 cfs. Drywell disposal rate shall not be considered in design calculations in order to reduce the size of the storage facilities.
4. All drywells shall be dual chamber drywells, which is the MaxWell Plus® or equivalent. Single chamber drywells will not be accepted. Additional requirements for the design and installation of drywells are:
 - a. The preferred location for the drainage system is at right angles to the sides of the storage facility. Drywells cannot be drilled in backfill material, and therefore, a

Underground Retention/Detention Systems Standards and Specifications City of Surprise

minimum offset distance must be maintained. This is normally five to ten feet beyond the over-excavation needed for the storage facility.

- b. Both the interceptor and drywell chambers shall be precisely located and identified, including rim and invert elevations.
- c. The practical depth limitation for either chamber is 27 feet. Required distance between chamber centers based on depth of chamber is:
 - i. Chamber Depth = 0 to 8-feet: 16-foot center to center
 - ii. Chamber Depth = 8 to 12-feet: 20-foot center to center
 - iii. Chamber Depth > 12 feet: 22-foot center to center
5. Multiple drywells shall be located a minimum of 30 feet apart (center to center), unless waived by the City Engineer or designee. Drywells shall not be located within 20 feet of an active septic system nor within 100 feet of an active water well.
6. All drywells receiving storm water directly from areas containing fuel or oil storage and dispensing facilities must have oil-water separators with replaceable petrochemical absorbent material installed.

Maintenance Standards:

Privately owned storage facilities should be maintained according to the following.

1. The property owner of record shall be responsible for the design, performance, operation, and maintenance of underground storage facilities for on-site retention. Drywells/percolation chambers that cease to drain a project area within a 36-hour period shall be replaced/refurbished.
2. An engineer registered in Arizona shall prepare a maintenance manual for underground storage facilities and drywells. This manual shall be included as an attachment to the approved Final Drainage Report. The manual shall contain the name, address, and telephone number of the selected maintenance company, maintenance schedule (frequency of inspection), ADEQ's inspection checklist and any other necessary inspection lists and requirements, such as manufacturer's lists and requirements. It shall also contain a blank table for documentation of necessary maintenance and upgrades recommended by the inspections. The documentation shall include inspection dates and repair dates.
3. Underground storage facilities inspections shall be performed annually or whenever ponding remains after a storm. The drywell facility owner shall document inspection of drywells utilizing ADEQ's inspection checklist and shall keep these inspections on file. A new drywell/percolation chamber shall be installed if an inspection reveals that a drywell/percolation chamber is no longer effective and cannot be returned to effective use.
4. Drywell/sedimentation chamber maintenance shall occur when inspection shows:
 - a. Ten percent of the drywell capacity is filled with sediment, for drywells in paved areas. Sediment has accumulated to three inches or more inside the sedimentation chamber in paved areas.

**Underground Retention/Detention Systems
Standards and Specifications
City of Surprise**

- b. Twenty-five percent of the drywell capacity is filled with sediment for drywells in landscaped areas. Sediment has accumulated to three inches or more inside the sedimentation chamber in landscaped areas.
 - c. Drainage has increased beyond 36 hours.
 - d. A non-storm water discharge has entered the well/sedimentation chamber.
 - e. Upon change of ownership of the well/sedimentation chamber.
5. Drywell/sedimentation chamber maintenance shall include:
- a. Removal of dirt and debris.
 - b. Replacement of filter fabrics and petrochemical absorbent material (if any).
 - c. Cleaning of screens.
 - d. Opening of liner weep hole.
 - e. Purging of accumulated silt out of the aggregate fill by jetting, surging, or pumping.