



STORM WATER DRAINAGE SYSTEM DESIGN MANUAL

FOR THE TOWN OF BUCKEYE



HASSAYAMPA RIVER 2005

DESIGN
MANUAL

August 2007

**TOWN OF BUCKEYE
PUBLIC WORKS**
423 AZ EASTERN AVE.
BUCKEYE, AZ 85326
623.349.6800

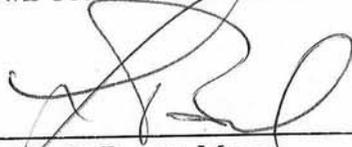
RESOLUTION 67-07

A RESOLUTION OF THE MAYOR AND COUNCIL OF THE TOWN OF BUCKEYE, ARIZONA, DECLARING AS A PUBLIC RECORD THAT CERTAIN DOCUMENT ON FILE WITH THE TOWN CLERK ENTITLED THE "TOWN OF BUCKEYE ENGINEERING STORM WATER SYSTEM DESIGN MANUAL DM#500, INCLUDING APPENDIX A, REFERENCES, AND APPENDIX B, DOWNTOWN DRAINAGE AREAS AND STANDARD CONSTRUCTION DETAILS B-109, B-110, B-500, B-501, B-502, B-505A, B-505B, B-508, B-510A, B-510B, AUGUST 2007"

BE IT RESOLVED by the Mayor and Council of the Town of Buckeye, Arizona:

THAT certain document, the "Town of Buckeye Engineering Storm Water System Design Manual DM#500, including Appendix A, References, and Appendix B, Downtown Drainage Areas and Standard Construction Details B-109, B-110, B-500, B-501, B-502, B-505A, B-505B, B-508, B-510A, and B-510B, May 2007," Town of Buckeye, Arizona, of which three copies are on file in the office of the Town Clerk and open for public inspection during normal business hours, is hereby declared to be a public record, and said copies are ordered to remain on file with the Town Clerk.

APPROVED AND ADOPTED by the Town Council of the Town of Buckeye, Arizona, this 16th day of October 2007.

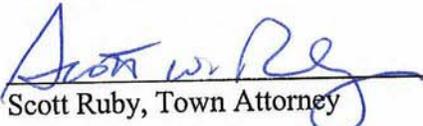

Bobby D. Bryant, Mayor

LEVI BEARD VICE MAYOR

ATTEST:


Linda Garrison, Town Clerk

APPROVED AS TO FORM:


Scott Ruby, Town Attorney

ORDINANCE NO. 59-07

AN ORDINANCE OF THE MAYOR AND TOWN COUNCIL OF THE TOWN OF BUCKEYE, MARICOPA COUNTY, ARIZONA AMENDING THE TOWN CODE BY AMENDING CHAPTER 24, PUBLIC WORKS, BY ADOPTING BY REFERENCE THE TOWN OF BUCKEYE ENGINEERING STORM WATER SYSTEM DESIGN MANUAL DM#500, INCLUDING APPENDIX A, REFERENCES, AND APPENDIX B, DOWNTOWN DRAINAGE AREAS AND STANDARD CONSTRUCTION DETAILS B-109, B-110, B-500, B-501, B-502, B-505A, B-505B, B-508, B-510A, B-510B, AUGUST 2007

BE IT HEREBY ORDAINED THAT:

WHEREAS, the Town of Buckeye desires to continue to consolidate and organize its regulatory provisions relating to the construction and installation of public works in the Town of Buckeye; and

WHEREAS, to accomplish this goal, the Town Council deems it appropriate to add amend Chapter 24, Public Works to address storm water drainage systems;

NOW, THEREFORE, be it ordained by the Mayor and the Town Council of the Town of Buckeye, Maricopa County, Arizona, as follows:

Section 1: The Town Code of the Town of Buckeye is hereby amended by amending Chapter 24, Public Works, as follows, all other provisions of the Town Code remaining unchanged:

CHAPTER 24 – PUBLIC WORKS

ARTICLE 24-2 – ADOPTION OF PUBLIC WORKS STANDARD ENGINEERING AND INFRASTRUCTURE DESIGN SPECIFICATIONS, DETAILS AND REGULATIONS

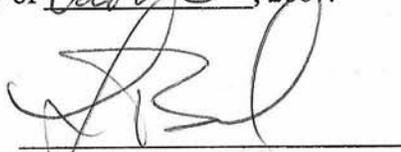
Section 24-2-2. The following are the public works standard specifications, details and regulations adopted by the Town of Buckeye:

- C. Town of Buckeye Engineering Storm Water System Design Manual DM#500, including Appendix A, References, and Appendix B, Downtown Drainage Areas and Standard Construction Details B-109, B-110, B-500, B-501, B-502, B-505A, B-505B, B-508, B-510A, and B-510B, May 2007.

Section 2: The Town Manager, Public Works Director, Town Clerk and Town Attorney are hereby authorized and directed to prepare all documents and take all steps necessary to carry out the purpose of the Ordinance.

Section 3: If any provision of this Ordinance is for any reason held by any court of competent jurisdiction to be unenforceable, such provision or portion thereof shall be deemed separate, distinct and independent of all other provisions and such holding shall not effect the validity of the remaining provisions of this Ordinance.

PASSED AND ADOPTED by the affirmative vote of the members of the Town Council of the Town of Buckeye, Arizona, this 16th day of October, 2007.



Bobby D. Bryant, Mayor

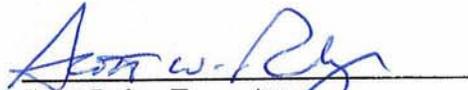
LEVI BEARD VICE MAYOR

ATTEST:



Linda Garrison, Town Clerk

APPROVED AS TO FORM:



Scott Ruby, Town Attorney



Table of Contents

Section 1 - General Information	- 4 -
1.1 General.....	- 4 -
1.2 Definitions	- 4 -
1.3 Storm Drainage & Grading Standards and Policies.....	- 6 -
1.4 Standard Specifications and Details	- 11 -
1.5 Preliminary Plats and Site Plans.....	- 12 -
1.6 Final Grading and Drainage Improvement Plans	- 13 -
1.7 Preliminary Drainage Report	- 16 -
1.8 Final Drainage Report.....	- 18 -
1.9 As-Built Grading and Drainage Plan	- 22 -
Section 2 - Street Drainage	- 23 -
2.1 General.....	- 23 -
2.2 Street Drainage Capacity Design Criteria.....	- 23 -
Section 3 - Hydrology	- 26 -
3.1 General.....	- 26 -
3.2 Calculations	- 27 -
Section 4 - Hydraulics	- 29 -
4.1 General.....	- 29 -
4.2 Storm Drains	- 30 -
4.3 Hydraulic Grade Line (HGL)	- 33 -
4.4 Open Channel Flow	- 34 -
4.5 Catch Basins and Inlets.....	- 38 -
4.6 Scuppers.....	- 38 -
4.7 Manholes.....	- 38 -



Section 5 - Storm Water Storage Facilities	- 40 -
5.1 General	- 40 -
5.2 Calculating Storage Volume Required	- 42 -
5.3 Surface Storage	- 43 -
5.4 Underground Storm Water Storage	- 47 -
5.5 On-Lot Residential Retention	- 50 -
Section 6 - Storm Water Disposal	- 51 -
6.1 General	- 51 -
6.2 Detention	- 51 -
6.3 Retention Infiltration	- 51 -
6.4 Drywells	- 52 -
Appendix A - References	- 55 -
Appendix B - Downtown Drainage Areas	- 57 -



Section 1 - General Information

1.1 General

- 1.1-1 This manual has been created for the design of storm water drainage systems which are to be installed and located within the incorporated boundaries of the Town of Buckeye (Town) and provides basic engineering requirements for development and comprehensive storm water management programs within the Town. In the preparation of construction documents for public and private developments located within the Town, this manual will provide the information needed for storm water drainage design. *Maricopa County Drainage Policies 2007 and Standards* and *Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology 1995* and *Volume II Hydraulics 1996* published by the Flood Control District of Maricopa County (FCDMC) have been adopted by the Town as a basis for design guidance and criteria, except as amended herein.

1.2 Definitions

- 1.2-1 Development: shall mean any man-made change to improved or unimproved real property, public or private, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, drilling, and where the manmade alteration could possibly affect the surrounding real property, or the general public.
- 1.2-2 Detention System: A storm water collection system which captures runoff by means of a temporary storage facility, and releases the runoff in a controlled manner to an approved point of discharge.
- 1.2-3 Retention System: A storm water collection system which captures, contains, and disposes of runoff by means of storage and disposal facilities (i.e. infiltration).
- 1.2-4 Offsite Flows: Storm water flows reaching the development or site from outside the area of development, including but not limited to: washes, rivers, streams, sheet flows from adjacent lands and roadways, or overflow from canals and retention or detention basins.
- 1.2-5 Ultimate Outfall Elevation: Lowest area of elevation within the development or improvement where runoff 'ultimately' flows to, for a storm greater than the 100yr event, or a failure of the drainage system.



- 1.2-6 100 year-two hour storm: 100 year storm event with a duration/intensity of two (2) hours.
- 1.2-7 WS₁₀₀: Water surface elevation of the 100 year-2 hour storm (as required in retention or detention calculations).
- 1.2-8 Ten-year storm: A rainstorm of intensity and duration such that it may be expected to occur or be exceeded not more often than once in ten (10) years. This event has a ten (10) percent statistical probability of being equaled or exceeded during any year.
- 1.2-9 One hundred-year storm: A rainstorm of intensity and duration such that it may be expected to occur or be exceeded not more often than once in one hundred (100) years. This event has a one (1) percent statistical probability of being equaled or exceeded during any year.
- 1.2-10 Storm water facilities: Storm water drainage system physical components that include but are not limited to: retention/detention basins, headwalls, catch basins, flood retarding structures, storm drain pipe, channels, manholes, drywells, scuppers, etc.



1.3 Storm Drainage & Grading Standards and Policies

- 1.3-1** All storm water which falls within a development, including the respective one-half of all abutting streets, shall retain a minimum of the 100 year 2 hour storm water runoff within the boundaries of said development. Predevelopment runoff versus post development runoff retention is not acceptable; except for a "first flush" facility or an approved designated drainage outfall, and shall be approved by the Public Works Department.
- 1.3-2** Drainage retention/detention and conveyance systems shall be designed to eliminate and reduce storm water runoff impact of adjacent or downstream properties. No storm water drainage system shall be approved if the effect may cause an increase in peak discharge, volume, or velocity of runoff or change the point of entry of drainage onto another property during the runoff event.
- 1.3-3** The Public Works Department shall require for review and approval a grading and drainage plan and report be submitted wherever development and/or grading is proposed within the Town limits.
- 1.3-4** Construction documents for grading and drainage submitted to the Town for approval must be sealed by an Arizona Registered Professional Civil Engineer. The Arizona Registered Professional Civil Engineer shall be held solely responsible for the correctness and adequacy of all data, drawings, calculations, and reports submitted to the Town for review and approval. In addition, the Engineer shall comply with all local, state, and federal floodplain regulations in the design of the development. Approval by the Town does not necessarily imply that the design is appropriate, or that the development is in strict compliance with all applicable regulations and standards. Review and approval of drainage submittals shall not create liability on the part of the Town, or its employees, for any flood damages that may result from reliance upon any administrative decision made by the Town or its employees.
- 1.3-5** Changes or additions to sites which require a site plan approval shall be required to address drainage alterations and/or additions on the entire site with approval of the town, and meet storm drainage requirements as set forth in this manual.



- 1.3-6** Retention or detention basins shall not be located within Town of Buckeye's Rights of way (ROW), except in the case of regional public retention or detention basins, or otherwise approved by the Public Works Director.
- 1.3-7** Drainage easements shall be approved by the Public Works Department prior to recording of easements, including temporary or permanent easements (i.e., public retention or detention basins).
- 1.3-8** Existing drainage channels or canals must be tiled, abandoned, piped, or improved when a new development is built across, adjacent to, or around a canal.
- 1.3-9** Storm water drainage system design plans for subdivisions which are located in whole or in part within a delineated Federal Emergency Management Authority (FEMA) 100-year flood zone shall be submitted to the FCDMC and approved by FCDMC prior to approval by the Town.
- 1.3-10** Lowest building finished floor elevations within the Town of Buckeye are to be a minimum of:
- a) 2.0 feet above the 100 year base flood elevation with no floodway delineation.
 - b) 1.0 feet above the 100 year delineated floodway elevation.
- 1.3-11** Finished floor elevations not located within a FEMA or Non-FEMA delineated floodplain shall be a minimum of:
- a) 14.0 inches above the lowest drainage outfall for residential lots.
 - b) 14.0 inches above the ultimate outfall for commercial and industrial developments.
 - c) 1.0 feet above the highest adjacent WS_{100} .
- 1.3-12** Underground storm water storage structures shall be constructed to have a minimum 50-year service life. Underground structures constructed of coated and/or galvanized ferrous metal shall have a minimum average soil side service life of 50 years. Underground storm water storage structures are only allowed in commercial and industrial development.



- 1.3-13** Offsite flows entering the development as a result of the 100 year storm shall be accounted for in flow calculations of entry and exit points on the grading and drainage plans that are to be routed through the development and kept at the original historic points of entry and exit. Offsite flow exiting a development shall not exceed predevelopment flows. If offsite flow terminates within the development, increased amounts of retention will be required. Routing of offsite flows within Town of Buckeye rights of ways are not allowed, except where crossings (culverts, bridges) are permitted by the Public Works Department.
- 1.3-14** Retention or detention basins must drain any storm event up to and including the 100 year 2 hour storm within thirty-six (36) hours. Owner(s) of any basin failing to meet this requirement must take corrective action to bring the basin into compliance.
- 1.3-15** "As-Built" Grading and Drainage Plans shall be submitted to the Town of Buckeye Public Works Department upon completion of the site development work. ([See Section 1.9](#))
- 1.3-16** All developments within the Town of Buckeye including; residential developments subdivided into parcels resulting in the creation of six (6) or more lots, parcels or fractional interests in improved or unimproved land, lots or parcels of any size (subdivision); all types of commercial developments shall provide sufficient storm water facilities to insure:
- a) Regional storm water drainage solutions in accordance with storm water management programs set forth by the Town.
 - b) The protection of the health, safety and welfare of its citizens, their property, the environment, and shall not jeopardize the quality of groundwater resources.
 - c) Minimizing adverse impacts of development to existing downstream properties.
 - d) That all structures, including existing adjacent structures, will be free from flooding and that there is reasonable access for emergency and public service vehicles.
 - e) Such facilities shall include separate and distinct parcels within the development and shall be planned for accordingly (i.e. retention).



- 1.3-17** Retaining walls are required for elevation differences greater than 1.0 foot between the development and adjacent properties on commercial and industrial developments.
- 1.3-18** When all or part of a proposed project lies within a 100-year Flood Zone as designated by the Federal Emergency Management Agency (FEMA) or the Flood Control District of Maricopa County (FCDMC), the following is required for development:
- a) Verification from FCDMC prior to plan review submittals to the Town to determine whether a Flood Plain Use Permit is required.
 - b) Submittal of development plans to the FCDMC for plan review and approval may be required. Flood Plain Use Permit must be obtained prior to improvement plan approval by the Town. Changes to grades, structures, finished floor elevations, etc. will require re-approval by the FCDMC.
 - c) Grading plans, and final plat shall show the location of the flood plain according to the Flood Insurance Rate Map.
 - d) Construction and inspections for work above the lowest floor level is not permitted prior to obtaining finished floor elevation approval from the FCDMC.
- 1.3-19** Engineers are expected to be aware of and comply with permitting regulations contained in Section 404 of the Clean Water Act. Areas of proposed projects that are designated by the Army Corps of Engineers as within the jurisdiction of Section 404 shall be clearly identified and delineated on preliminary plat or site plan, and on improvement plans. The Drainage report shall also identify and delineate Section 404 areas on all applicable exhibits, figures etc. as well as provide a narrative discussion regarding the 404 designation, permit holder identification and procedures to modify 404 jurisdictional designations.
- 1.3-20** The Town of Buckeye does not have the jurisdiction to authorize any alteration, modification, or encroachment to designated 404 areas.
- 1.3-21** Drainage Clearance shall be required prior to permit issuance for any development or substantial improvement which may have an adverse affect on existing drainage.
- 1.3-22** Drainage Inspection Approval shall be obtained prior to issuance of a Certificate of Occupancy or final building inspection of any site or structure



- 1.3-23** In the downtown area of the Town, identified in Figure B-1 of Appendix B, are areas of the Town that have reduced retention requirements. Values of the depth of rainfall for the calculated retention volume within these areas are given in [Table B5.2](#).
- 1.3-24** The Town requires that a full and complete set of all the improvement plans are to be submitted to all applicable utility companies for potential utility conflicts. Prior approval from the utility companies before the final approval of improvement plans is required.



1.4 Standard Specifications and Details

- 1.4-1 Maricopa Association of Governments (MAG) *Uniform Standard Specifications for Public Works Construction* and MAG *Uniform Standard Details for Public Works Construction* (1998, revised 2007) have been adopted by the Town of Buckeye. In addition to the adopted MAG Standards, the Town of Buckeye also publishes its own *Town of Buckeye Construction Details*. Storm water drainage system construction details referenced in this design manual are located in the *Town of Buckeye Construction Details* manual.
- 1.4-2 All development within the Town of Buckeye shall comply with all requirements of the Town of Buckeye Codes and Ordinances. Design plans relating to construction shall be in accordance with the latest version of the Uniform Standard Details and Specifications published by the MAG as mentioned above, utilizing the English units of measurement, and as amended by the Town herein.
- 1.4-3 The Town of Buckeye's requirements relating to storm drainage system design and construction are:
- a) Grading construction notes: Use Town of Buckeye Construction Details B-500.
 - b) Standard Drywell system detail and specifications: Use Town of Buckeye Construction Details B-501.
 - c) Petrochemical Drywell system detail and specifications: Use Town of Buckeye Construction Details B-502.
 - d) Under sidewalk scupper detail and specifications: Use Town of Buckeye Construction Details B-505.
 - e) Trash rack detail and specifications: Use Town of Buckeye Construction Details B-508.
 - f) Curb opening catch basin detail and specifications: Use Town of Buckeye Construction Details B-510.
 - g) Hand rails and anchor plates detail and specifications: Use Town of Buckeye Construction Details B-110.
 - h) Standard storm drain/utility location within the Town rights of way: Use Town of Buckeye Construction Details B-141, B-142, B-143, B-144, B-145, B-146, B-149, B-150.



1.5 Preliminary Plats and Site Plans

1.5-1 Preliminary Plats and Site plans relating to storm water drainage shall consist of but are not limited to:

a) Cover sheet:

1. All relevant information such as project name, address, description, and total net and gross project acreage, APN numbers, etc. as defined by the Town Code.

b) Plan View Sheet:

1. Floodplain/floodway limits.
2. Existing 1.0 foot interval contours and topography.
3. Grades on existing adjacent properties.
4. Proposed site grading and drainage with spot elevations, flow arrows, finished floor, pad elevations, and necessary cross sections.
5. Proposed slopes, heights of berming, geometric depths of retention or detention areas and channels, and the respective WS_{100} .
6. Cross-sections of site if slopes exceed 5% percent slope.
7. Identify drainage facilities.
8. Ultimate outfall.



1.6 Grading and Drainage Improvement Plans

1.6-1 All Grading and Drainage improvement plans shall be prepared and signed by an Arizona Professional Civil Engineer. Plans shall be submitted on a minimum viewable size of 22" x 34" sheets and shall be drawn to an engineering scale. Grading and Drainage plans shall be submitted in a digital ".DWG" file and a ".PDF" file. Architectural scales are not allowed. Minimum text height is to be 0.10" on all improvement plans and profiles.

1.6-2 Grading and Drainage improvement plans shall consist of, but are not limited to:

a) Cover sheet:

1. Project name, address, description, and total net and gross project acreage.
2. Developer's name, address, and telephone number.
3. Consultant's name, address, and telephone number.
4. Small vicinity map.
5. Small scale Key map.
6. Sheet index.
7. Earthwork quantities.
8. Town of Buckeye Grading and Drainage construction notes per Town of Buckeye construction detail B-500.
9. All utility contact information.
10. Arizona Professional Civil Engineer's seal and stamp of approval on each sheet.
11. Project Benchmark: Horizontal control datum shall be noted on the cover sheet. All horizontal control shall be tied and noted in NAD 83 (1992 epoch) unless otherwise approved. Vertical control datum shall be noted on the cover sheet. All vertical surveys shall be based on NAVD 88, per FEMA documents unless otherwise approved. The engineer shall utilize the published values by Maricopa County Department of Transportation GDACS. A conversion factor shall be included from NGVD 29 elevations.



b) Detail sheet; a detail sheet is required where:

1. Special construction details are required and shall be provided.
2. Installation, modification, or relocation of existing irrigation structures, channels, canals, and culverts will need to provide details and cross sections.
3. Special construction details and cross sections are required where storm drain facilities and utility locations conflict.
4. Cross sections are required of the tie in of surrounding adjacent properties and rights of ways to the development for the explanation of grading.
5. Other reasons determined by the Consultant and/or the Town as needed to clarify construction.

c) Plan View Sheets:

1. Grading and drainage plan views shall be oriented such that north is either at the top or the right side of the sheet. North shall be clearly indicated for each plan view. Drawing scale shall be clearly indicated for each plan view with a graphic scale and be placed adjacent to each north arrow. Drafting and lettering of new construction shall be sufficiently heavier (darker) than the existing topography to allow it to be clearly identified. New construction notes shall be boxed so that they contrast with general information notes. "Blue Stake" notes shall be provided on each sheet.
2. Existing contours with adequate spot elevations (along adjacent properties) to show drainage (including a minimum 100 feet beyond project limits).
3. Existing utilities (aerial and underground), existing drainage facilities, and existing irrigation facilities.



4. Adjacent land uses (within 100 feet) and APN numbers.
5. Town of Buckeye boundaries where applicable.
6. 100-year floodplain limits where applicable.
7. 100-year floodway limits where applicable.
8. Existing and proposed right-of-ways, existing easements, proposed easements, and property lines. Dimensions of these shall be clearly indicated.
9. Proposed drainage slopes may be shown as a percentage of slope or foot per foot change of grade.
10. Grade breaks shall be clearly shown.
11. Finished floor and Pad elevations.
12. Proposed contours at 1.0 foot intervals.
13. Retention or detention volumes provided and required, bottom and top elevations, and the one hundred year water surface elevations (WS_{100}).

d) Profile View Sheets:

1. Developments with storm drain improvements within the Town of Buckeye rights of way, and/or any private development which connects to storm drain within the Town's rights of way, is required to provide profile view sheets.
2. Profile view sheets may be in combination with Plan view sheets providing the scale be 1:20 plan view and 1:2 profile.
3. Include any existing utilities and utility conflicts in profile view.
4. Include the HGL in profile view.



1.7 Preliminary Drainage Report

- 1.7-1** Proposed developments are required to submit a Preliminary Drainage Report to the Town for an approval which analyzes the storm water drainage design in conjunction with the preliminary plats or site plans. The report shall be typewritten on letter size sheets with necessary maps folded and inserted into the report in the proper order.
- 1.7-2** Drainage reports are required to be sealed by an Arizona Registered Professional Civil Engineer.
- 1.7-3** Individual single residential lots $\frac{1}{2}$ acre and over are allowed to submit either a drainage report, or simple calculations which would be allowed to be shown on the grading and drainage improvement plans. Individual single residential lots $\frac{1}{2}$ acre and over are allowed to have on-lot retention to fulfill retention requirements. (See Section 5.5)
- 1.7-4** The Preliminary Drainage Report shall include:
- a) A cover sheet with submittal number, name of project, address of project, parcel number, subdivision name of the proposed development. Also include the name, address, and phone number of the consulting engineer and property owner.
 - b) A location map of the development or site improvement.
 - c) A FEMA Flood Insurance Rate Map (FIRM or FIRMette)
 - d) Calculations demonstrating required retention or detention volume, tributary areas to each basin, and volume provided.
 - e) Indicate basin grades, depth, side slopes, and ultimate outfall location.
 - f) A narrative discussion within the body of the report that describes:
 - 1. The location and condition of the property the development is located on. This includes identifying floodplains and/or floodways.
 - 2. Onsite and offsite flows. Indicate the routing of any off-site flows through or around the proposed development.



3. Proposed modifications and/or improvements to affect storm water facilities in accordance with Town regulations and standards.
 4. Any relevant and supporting calculations.
 5. Temporary retention shall be addressed and provided for any undeveloped parcels, future phases or adjacent parcels in which overland storm water flows are discontinued from historic flow patterns in the report and on the drainage area map. It is the responsibility of the development to address and provide for temporary retention whether on-site or off-site.
- g) A drainage area map that clearly identifies and includes but is not limited to:
1. Existing contours and topography of the proposed development and surrounding area.
 2. Drainage patterns of the onsite and offsite drainage areas, including all public or private streets within or adjacent to the proposed project shall be delineated on the drainage area map.
 3. Routing of any off-site flows through or around the proposed development.
 4. Proposed and existing retention or detention basin locations, sizes, means of storm water conveyance and disposal (drywells).
 5. Proposed and existing drainage facilities and concentration points shall be shown on the drainage area map.
 6. The location of the Ultimate Outfall elevation for the development or site improvement on the drainage area map.



1.8 Final Drainage Report

- 1.8-1** All land development projects are required to submit to the Town for an approval a Final Drainage Report which analyzes in detail the storm water drainage design along with the grading and drainage improvement plans. Final drainage reports are considered to be further development of preliminary drainage reports with detailed information regarding the developments storm drainage system design. The report shall be typewritten on letter size sheets with necessary maps folded and inserted into the report in the proper order.
- 1.8-2** Drainage reports are required to be sealed by an Arizona Registered Professional Civil Engineer.
- 1.8-3** Individual single residential lots $\frac{1}{2}$ acre and over are allowed to submit either a drainage report, or simple calculations which would be allowed to be shown on the grading and drainage improvement plans. Individual single residential lots $\frac{1}{2}$ acre and over are allowed to have on-lot retention to fulfill retention requirements. ([See Section 5.5](#))
- 1.8-4** A copy of the Geotechnical soils report is required for submittal in conjunction with the Final Drainage Report. Other additional reports may be requested by the Town (i.e. environmental) for final submittal.
- 1.8-5** The Final Drainage Report shall include the following but not limited to:
- a) A cover sheet with submittal number, name of project, address of project, parcel number, subdivision name of the proposed development. Also include the name, address, and phone number of the consulting engineer and property owner.
 - b) A location map of the development or site improvement.
 - c) A FEMA Flood Insurance Rate Map (FIRM or FIRMette).
 - d) Supporting calculations shall be included in the final drainage report. These calculations include the following but are not limited to:
 - 1. Off-site flows that affect the development of the proposed site.



2. Surface and underground retention or detention storage sizing & discharge calculations. Include tributary areas to each retention or detention facility, volume required, volume provided, WS_{100} , and runoff coefficient determination for the 100yr-2hr storm.
 3. Street hydraulic capacity calculations for the 10-year and 100-year storm.
 4. Provide onsite and offsite Time of Concentration calculations. Rational software program results are acceptable.
 5. Storm drain pipe, culvert, channel, inlet, catch basin, and scupper hydraulic calculations for sizing are required for both public and private storm drainage facilities.
 6. Hydraulic Grade Line (HGL) calculations. Include a scaled profile identifying the HGL.
 7. Calculations of the number of drywells, per Town criteria.
 8. Indicate method of disposing of retained storm water within 36 hours, and provide percolation test results and calculations (Geotechnical report).
 9. Any special drainage structures.
 10. Channels and culverts.
- e) A narrative discussion within the body of the report that describes:
1. The location and condition of the property the development is located on. This includes identifying floodplains and/or floodways.
 2. Onsite and offsite flows. Indicate the routing of any off-site flows through or around the proposed development.
 3. Proposed modifications and/or improvements to affect storm water facilities in accordance with Town regulations and standards.



4. Any relevant and supporting calculations.
 5. Temporary retention shall be addressed and provided for any undeveloped parcels, future phases or adjacent parcels in which overland storm water flows are "cutoff" from their historic flow patterns in the report and on the drainage area map. It is the responsibility of the development to address and provide for temporary retention whether on-site or off-site.
 6. Describe the effects on retention or detention overflow due to back-to-back storms or a storm greater than the 100 year storm.
 7. The long term operation and maintenance of the improved storm water facilities, and the exact responsibility relating to performance and maintenance. Specify the name, address, and phone number of the person or agency responsible for ownership.
 8. A concluding statement that summarizes the proposed storm drainage system design associated with the development.
 9. Drainage reports based upon computerized hydraulic models must have all values and variables identified in the report. Software manuals and documentation shall be made available upon request by the Town.
 10. Routing of storm water through surface basins.
 11. Identification of any alluvial fans within the development including erosion analysis.
- f) A drainage area map that clearly identifies and includes but is not limited to:
1. Existing and proposed contours and topography of the proposed development and surrounding area.
 2. Drainage patterns of the onsite and offsite drainage areas, including all public or private streets within or adjacent to the proposed project shall be delineated on the drainage area map.



3. Routing of any off-site flows through or around the proposed development.
4. Proposed and existing retention or detention basin locations, sizes, means of storm water conveyance and disposal (drywells).
5. The location of the Ultimate Outfall elevation for the development or site improvement on the drainage area map
6. Indicate tail water and backwater elevations at all culverts.
7. Indicate points of concentration for flows (Q's) and intake point for catch basins, scuppers, channels, street intersections, etc.
8. Location of proposed and existing drainage facilities and concentration points (Q's) including catch basins, inlets, channels canals, street capacities, etc., shall be shown on the drainage area map.



1.9 As-Built Grading and Drainage Plan

- 1.9-1 After completion of storm water drainage improvements, an As-Built final grading and drainage plan and supplemental report shall be submitted to the Town of Buckeye Public Works Department.
- 1.9-2 As-Built plans must be sealed by a registered Arizona Professional Civil Engineer *or* an Arizona Registered Land Surveyor. Plans shall be certified and marked "As-Built" with all changes noted. Town of Buckeye Construction Detail B-109 shall be placed on the As-Built Grading and Drainage plans certifying the construction has been built according to the improvement plans.
- 1.9-3 All As-Built plans shall be submitted on a minimum viewable size of 22" x 34" Mylars (4 mil thickness).
- 1.9-4 Minimum technical requirements for Grading and Drainage As-Built plans are:
- a) Certification of post construction retention or detention basin percolation rates shall be submitted.
 - b) Certification of retention or detention basin dimensions, grades, volumes, and side slopes.
 - c) Revised retention or detention calculations per As-Built conditions.
 - d) Certification of the maximum water depth of the retention or detention basin for a 100-year, 2-hour storm.
 - e) Certification of underground storage elevations (if applicable).
 - f) Certification of post-construction drywell percolation rates, revised disposal rates, quantity of drywells, and capacity calculations.
 - g) Approved ADEQ drywell registration and drilling logs as required in [Section 6.4](#) of this manual.
 - h) Certification of the Ultimate Outfall location and elevation.
 - i) Certification of locations and elevations of channels and culverts.
 - j) Certification of pad elevations within ± 0.10 feet of the designed elevation.



Section 2 - Street Drainage

2.1 General

2.1-1 A comprehensive approach to storm drainage management includes using the street system to convey runoff to drainage facilities; also to carry runoff from storms that are greater than the capacity of the storm drainage facilities. Street drainage criteria in Section 3 of the *Drainage Manual for Maricopa County, Volume II Hydraulics 1996* shall apply except as amended herein.

2.2 Street Drainage Capacity Design Criteria

2.2-1 Flows across any parkway, arterial, or collector streets are *not* allowed for the 10 year frequency storm flows. However, cross street flows are acceptable on local streets and shall be limited 8.0 inches in depth for the 10 year peak storm.

2.2-2 Storm drainage systems are required to capture the 10 year frequency storm flows into hydraulic facilities (i.e. storm drain pipe, catch basins) from roadways to retention or detention basins. Street capacities are required to convey the difference between the 10 year peak storm and the 100 year peak storm within the maximum allowable flow shown in Table B2.1.

2.2-3 Inverted crown within public streets and roads are not allowed.

2.2-4 Street drainage design shall not increase runoff onto adjacent properties. Parkway, Arterial, and Collector streets shall not direct surface runoff onto local roadways.

2.2-5 Street drainage facilities:

a) Acceptable street drainage facilities includes but is not limited to:

1. Curb opening catch basin constructed to Town of Buckeye Construction detail 510; Combination curb opening-grated inlet type is *not* allowed within the public rights of way.
2. Grated inlets within the public rights of way require approval of the Public Works Department and shall be constructed in accordance to MAG standard construction detail 537. All grates must be rated H-20 traffic loading and for bicycle traffic.



3. Under sidewalk scupper constructed to Town of Buckeye standard construction detail 505. Metal cover types are not acceptable.
4. Curbs constructed to MAG standard detail 220 and Town of Buckeye construction detail B-205.
5. Streets constructed to Town of Buckeye construction details for typical cross sections B-200 series for transportation.
6. Outflow pipe head walls with handrails constructed to MAG standard detail 501-3 and Town of Buckeye construction detail B-110.
7. Culverts constructed to ADOT Highways Division Structures Section "B" standard details (31-002; June 1992).

2.2-6 Street drainage calculations:

- a) Calculate street/gutter flow and velocity by using the modified Manning's equation in Section 3 of the Drainage Manual for Maricopa County, Volume II Hydraulics.
- b) Calculate catch basin and scupper sizes according to Section 3 of the Drainage Manual for Maricopa County, Volume II Hydraulics, and/or FHWA HEC-12 or HEC-22.



2.2-7 All roadway storm water drainage capacities shall be designed for the 10 year and 100 year peak storms according to Table B2.1 below:

STREET DRAINAGE DESIGN CRITERIA -- Table B2.1

<u>Street Type</u>	<u>Design Storm</u>	<u>Maximum Flow</u>	<u>Maximum Velocity</u>	<u>Required Dry Lanes</u>	<u>Maximum Depth of Water</u>
<u>Parkway</u>	<u>10 year</u>	100 cfs	10 ft/sec	Flood only one lane of traffic per half street	To top of curb; 6 inches maximum from gutter flow line
<u>Fixed Guideway Arterial</u>					
<u>Major Arterial</u>					
<u>Minor Arterial</u>	<u>100 year</u>	100 cfs	10 ft/sec	None	6 inches above top of curb; flow MUST be contained within the Right-of-Way; 12 inches maximum depth from gutter flow line
<u>Industrial Collector</u>					
<u>Collector</u>					
	<u>10 year</u>	100 cfs	10 ft/sec	None	To top of curb
<u>Local Road</u>	<u>100 year</u>	100 cfs	10 ft/sec	None	6 inches above top of curb; flow MUST be contained within the Right-of-Way; 12 inches maximum depth from gutter flow line



Section 3 – Hydrology

3.1 General

- 3.1-1 Hydrology calculations are necessary in the design of storm drainage facilities; when properly designed insure that surrounding structures and properties are safeguarded against storm waters due to the proposed development. Standards contained in this section of the design manual for Storm Drainage System Design are in accordance with the *Maricopa County Drainage Policies 2007* and *Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology 1995*, and is to be followed to provide design criteria necessary for engineers relating to hydrology, except where amended herein.
- 3.1-2 Storm drainage systems within the Town shall be developed within two classifications as follows:
- a) The runoff generated from the 10 year storm shall consist of “Minor System” storm water facilities necessary to collect and convey storm water runoff for more frequent rainfalls. The “Minor System” shall be designed to accommodate storms up to and including a ten year storm as defined in [Section 1.2](#).
 - b) The runoff generated from the 100 year storm shall consist of “Major System” storm water facilities necessary to collect, convey, retain, and/or detain storm water runoff for less frequent rainfalls. The “Major System” shall be designed to accommodate storms up to and including a one hundred year storm as defined in [Section 1.2](#). Design of the “Major System” includes the analysis of the overall drainage system insuring that there will always have positive drainage of the one hundred year flows, which can be retained or detained, and that all structures are above the WS_{100} elevation.
- 3.1-3 The design engineer may use more recent rainfall data from NOAA atlas 14 Volume 1, Semi-arid Southwest study, relating to rainfall depths and intensities within the Town of Buckeye boundaries for hydrology and hydraulic calculations.



3.2 Calculations

3.2-1 The Rational Method shall be used to estimate runoff when the drainage area is less than 160 acres with fairly uniform land use. For watersheds in excess of 160 acres, a rainfall runoff model is required.

a) Rational Method Runoff Equation:

$$Q = C * I * A$$

Q = the peak discharge (cubic feet per second) from a given area.

C = a coefficient relating the runoff to rainfall. (Table B3.1 or B3.2)

I = average rainfall intensity (inches/hour), lasting for a T_C .

T_C = the time of concentration (hours).

A = drainage area (acres).

b) Time of Concentration: iterative process that calculates the interval of time from the beginning of the rainfall event of a specific drainage area; from the most hydraulically remote point to reach the point of concentration. Time of Concentration (T_C) is calculated by utilizing the formula developed by Papadakis & Kazan (1987):

$$T_C = 11.4L^{0.5} * K_b^{0.52} * S^{-0.31} * I^{-0.38}$$

T_C = time of concentration in hours

L = length of the longest flow path in miles

K_b = watershed resistance coefficient

S = watercourse slope in feet/mile

I = rainfall intensity in inches/hour

Engineers shall utilize Table 3.1, Figure 3.1, and Equation 3.3 of the Drainage Design Manual for Maricopa County Volume I Hydrology to estimate the resistance coefficient (K_b) and the adjusted Intensity for the T_C equation.

c) Time of concentration shall not be less than:

1) Ten (10) minutes for Residential developments

2) Five (5) minutes for Commercial developments



3.2-2 The Town uses the following Runoff Coefficients for the Rational Method:

Runoff Coefficients for Rational Formula (C_N) Table B3.1	
Grass Lawns < 7%	0.20
Agricultural	0.25
Undeveloped Lots, Unimproved areas (bare ground)	0.30
Grass Lawns > 7%	0.35
Gravel roadways	0.50
Undeveloped desert < 5%	0.50
Desert Landscaping (rock)	0.55
Undeveloped desert 5% - 10%	0.70
Concrete, Asphalt, Roofs	0.95
Undeveloped desert, mountain terrain > 10%	0.95
Water, Rivers, Lakes, Retention Basins	1.00

3.2-3 Weighted coefficients are allowed as an overall development factor of the Rational Method:

Weighted Runoff Coefficients for Developments Table B3.2	
Golf Courses	0.30
Parks and Cemeteries	0.30
Playgrounds	0.50
Residential < 4 du/acre	0.60
Residential 4 to 6 du/acre	0.80
Commercial , Industrial	0.90
High density Residential > 6 du/acre	0.90
Multi family Residential, Apartments	0.95

a) Where portions of a drainage area are composed of different runoff characteristics, a calculated weighted coefficient for the total drainage area may be used in lieu of Table B3.2. Therefore, C_N values are to be used in the calculation by dividing the summation of the products of the area of the parts and their coefficients by the total area:

$$C_w = \frac{\sum (C_N * A_N)}{A_T}$$

b) Calculated weighted coefficients shall be identified in the calculations by the variable labeled " C_w ".



Section 4 – Hydraulics

4.1 General

- 4.1-1 Hydraulic calculations are necessary in the design relating to the conveyance of storm water runoff; when properly designed insure that surrounding structures and properties are safeguarded against storm waters due to the proposed development. Engineering design requirements contained in this section of the Storm Drainage System Design Manual are in accordance with the FCDMC *Drainage Policies & Standards Manual 2007*; *Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics 1996*, which are to be followed to provide design criteria necessary for engineers relating to hydraulics, except where amended herein.
- 4.1-2 Storm drain systems are required to hydraulically capture the 10 year peak storm into hydraulic facilities (i.e. storm drain pipe, catch basins) from roadways to retention or detention basins. Street capacities are required to convey at least the difference between the 10 year peak storm and the 100 year peak storm to retention or detention facilities. (See [Section 2.2](#))
- 4.1-3 Storm drain systems shall be sized to carry any runoff greater than the 10 year peak storm to meet the street drainage capacity design criteria relating to water depth requirements and flow rates in [Section 2.2](#). (i.e. piping, catch basins, and street capacity)
- 4.1-4 Storm drain conveyance design is based on the design storm. At the upstream end of a storm drainage system the 10-year criteria will govern. At farther ends downstream of the system, the design for the 10-year storm may not meet the criteria stated for the 100-year storm. If this occurs, storm drains will need to be sized to meet the 100-year criteria. Both return periods need to be checked in order to determine which condition governs.
- 4.1-5 When a storm drain is the sole flow path to a retention or detention basin from a development or site improvement, the storm drain shall be sized to carry the 100-year storm peak flow rate.



4.2 Storm Drains

- 4.2-1 Storm drain pipe design, whether public or private, shall follow the Arizona Department of Transportation (ADOT) *Pipe Selection Guidelines and Procedures* manual, except where amended herein.
- 4.2-2 Storm Drain pipe installed within the public rights of way shall have a minimum service life (SL_R) of seventy five (75) years.
- 4.2-3 Criteria for the design of storm drain pipe are the following:
- a) Minimum storm drain pipe size within public storm drainage systems or within the public rights of way for:
 - 1. Storm drain main (trunk) lines shall be 24 inches.
 - 2. Storm drain laterals shall be 18 inches.
 - b) Minimum storm drain pipe size for equalization of retention or detention basins shall be 15 inches.
 - c) All storm drain pipe installed in public rights of ways, under roadways, driveways, or other pavement subject to vehicular traffic, shall be designed to withstand H-20 wheel loading.
 - d) Corrugated metal pipe, corrugated metal pipe arch, HDPE, and PVC are *not* allowed within the Town of Buckeye public rights of way or public storm drain system.
 - e) Minimum horizontal separation of storm drains between sewer lines and water lines shall be 6.0 feet edge of pipe to edge of pipe.
 - f) Minimum vertical separation of storm drains between sewer lines and water lines shall be 2.0 feet edge of pipe to edge of pipe. See MAG standard detail 404.
 - g) Minimum design velocity for storm drain pipe shall be 2.0 feet per second. Maximum design velocity for storm drain pipe shall be 10.0 feet per second.



- h) Minimum slope for main line storm drain pipe shall be 0.003 ft/ft. The minimum requirement is intended primarily to provide minimum drainage of the system after each storm event, including nuisance water flows, and does not eliminate the need to meet the minimum velocity requirement.
- i) Curved storm drain lines are not allowed.
- j) Minimum required ground cover of storm drain within the public rights of way shall be that no encroachment of the storm drains into the pavement section (including the sub grade).

4.2-4 Acceptable material for constructing storm drain pipes within the public rights of way is the following, unless otherwise approved:

- a) Rubber Gasket Reinforced Concrete Pipe (RGRCP) conforming to MAG Standard Specifications Section 618; Section 735; Section 765; which is the standard pipe material allowed in the Town of Buckeye rights of way. RGRCP rating shall be class IV or class V.

4.2-5 Acceptable material for constructing storm drain pipes within on site private development is the following:

- a) Rubber Gasket Reinforced Concrete Pipe (RGRCP) conforming to MAG Standard Specifications Section 618; Section 735; Section 765.
- b) Reinforced Concrete Pipe (RCP) conforming to MAG Standard Specifications Section 618 and Section 735.
- c) Corrugated High Density Polyethylene Pipe (CHDPEP) smooth invert type conforming to MAG Standard Specifications Section 738 and Section 603.
- d) For onsite equalizer pipes, catch basins or inlets pipes, and pipes to drywells, corrugated metal pipe (CMP) or polyethylene C-900 pipe material may be used, not within the public rights of way. CMP pipes shall have a 50-year service life. Both CMP and polyethylene C-900 pipes in the traffic areas shall be designed to withstand H-20 wheel load.



4.2-6 Calculations for the hydraulic capacity of storm drain pipes, Manning's Equation shall be used.

$$Q = \frac{1.486}{n} * A * R^{2/3} * S_f^{1/2}$$

A = Area of Pipe in square feet

R = Hydraulic Radius in feet

Q = Discharge, cubic feet per second

n = Manning's Roughness coefficient

S_f = Slope of pipe invert

See table 4.1 of the FCDMC Drainage Design Manual Volume II-Hydraulics for Manning's "n" values.



4.3 Hydraulic Grade Line (HGL)

- 4.3-1** Criteria for storm drainage systems relating to hydraulic design require careful consideration of the hydraulic grade line design element. Hydraulic design of storm drainage systems requires an understanding of basic hydrologic and hydraulic concepts and principles. When the hydraulic grade line rises above ground level, storm water can be found shooting out of catch basins or popping manhole covers, which can lead to damage and inconvenience to pedestrian and vehicular traffic.
- 4.3-2** Regardless of full flow conditions or partial flow conditions, calculations for establishing the hydraulic grade line (HGL) for storm drainage catch basins, pipes, and other drainage structures are to be submitted with the Grading and Drainage improvement plans. The HGL shall be shown on storm drain piping profile drawings and in the Final drainage report on a small scale profile.
- 4.3-3** Storm drainage facilities within or in connection to the public rights of way require the Hydraulic Grade Line (HGL) be at least 1.0 feet below finished grade, flow line of gutter, top of grate elevation, or manhole cover.
- 4.3-4** Hydraulic Grade Line calculations shall comply with the Section 4.3 of the FCDMC Drainage Design Manual Volume II Hydraulics.



4.4 Open Channel Flow

- 4.4-1** Open channel flow, relating to this manual, consists of the design of man-made or artificial methods of storm water conveyance such as canals, channels, and other open conduits. Engineering design requirements contained in this section of this manual are in accordance with the FCDMC *Drainage Policies & Standards Manual 2007* Section 6; *Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics 1996*, Section 6; which are to be followed to provide design criteria necessary for engineers relating to open channel flow, except where amended herein.
- 4.4-2** Open channels are not allowed within the public rights of way unless approved by the Public Works Director.
- 4.4-3** Offsite historical flows entering the development as a result of the 100 year storm shall be accounted for in flow calculations of entry and exit points that are to be routed through the development. If offsite flow terminates within the development, increased amounts of retention or detention will be required. Routing of offsite flows within Town of Buckeye Rights of ways are not allowed, except where crossings (culverts, bridges) are permitted. Conveyance of the historical flows shall be maintained.
- 4.4-4** Calculations are required in the design of open channel flow and shall comply with Section 6 of the FCDMC *Drainage Policies & Standards Manual* and the *Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics* Section 6.
- 4.4-5** Channels adjacent to public right-of-way shall be limited to 3.0 feet in geometric depth and have safety guard railings per Town of Buckeye construction detail B-110; except at street/culvert crossings and where approved by the Public Works Department.
- 4.4-6** Channels between residential lots are not allowed unless approved by the Public Works Director.
- 4.4-7** For channel drop structures, the maximum vertical drop height from invert crest to invert toe for any single step shall be 2.5 feet. A 6.0 foot wide (minimum) horizontal apron shall be provided for every 2.5 feet of vertical drop in a "stair step" fashion. Drop structures constructed of concrete or shotcrete shall have a roughened surface to discourage inappropriate recreational use.



- 4.4-8** For engineered channels geometric depths greater than three feet deep, access ways to the channel and ramps into the channel or basin shall be required:
- a) Access ramps shall be a minimum of 20 feet wide with a longitudinal slope no steeper than 10%. Access ways approaching channels or basins shall be a minimum of 16 feet wide within a clear 20-foot wide tract such that emergency and ordinary maintenance vehicles can freely maneuver.
 - b) Paved access ramps shall be required for the portions that will be inundated by the 100-year peak event, and shall be properly "toed-in" to protect the ramp from erosion during storm events.
 - c) Access ways or ramps may be combined with portions of multi-use trails, subject to approval by Community Development and Parks & Recreation departments.
- 4.4-9** All engineered channels shall have a minimum of 1.0 feet of freeboard. The design engineer will consider greater amounts of freeboard due to velocity, transitions, etc. where applicable.
- 4.4-10** Rational Method shall only be allowed to predict storm water peak flow and run-off volume estimates for design of minor channels with contributing drainage areas up to 160 acres.
- 4.4-11** Rational Method shall not be used for channel routing procedures or detention storm water storage facilities. Contributing drainage areas greater than 160 acres, and for channel routing and detention storm water storage facilities design, the HEC-1 methodology described in the *Drainage Design Manual for Maricopa County, Arizona Volume I Hydrology* shall be used.
- 4.4-12** Water surface elevations shall not exceed the geometric depths at any point of the channel, and comply with freeboard requirements set forth in section 4.4 of this manual. Water surface in channels adjacent to Town of Buckeye rights of way shall not overtop and encroach into public streets or public rights of way.



4.4-13 Open channels shall be designed to the following conveyance requirements but are not limited to:

<u>Rainfall Criteria - Table B4.1</u>	
Analysis for undisturbed drainage ways and design of engineered channels, bridges and culverts.	
<u>Purpose</u>	<u>Criteria</u>
Drainage Area: 0 to 160 acres	100 year peak; minor channel design only
Drainage Area: 160 acres to 20 square miles (Unit Hydrograph)	100 year-6 hour local storm event (defined by FCDMC).
Drainage Area: 20 to 100 square miles (Unit Hydrograph)	Critically centered local 100 year-6 hour storm or a 100 year-24 hour general storm (defined by FCDMC), which ever is greater in peak discharge.
Drainage Area: 100 to 500 square miles (Unit Hydrograph)	100 year-24 hour general storm (defined by FCDMC).

4.4-14 Geometric depths for open channels less than or equal to 3.0 feet have the following requirements but are not limited to:

<u>Channel Design Criteria - Table B4.2</u>			
Geometric depth less than or equal to ≤ 3.0 feet			
<u>Acceptable Type of Channel Lining</u>	<u>Maximum permissible side slopes (h:v)</u>	<u>Maximum allowed velocity (fps)</u>	<u>Safety Requirements</u>
Grass (maintained)	4:1	6.0	N/A
Riprap	3:1	9.0	Adequate safety measures must be taken (i.e. safety railings, safety fence, warning signs etc.) where accessible to the public.
Structural Concrete	1:1	15.0	Safety Guard Hand railing per Town of Buckeye construction detail B-110 & warning signs



4.4-15 Geometric depths for open channels greater than 3.0 feet have the following requirements but are not limited to:

<u>Channel Design Criteria - Table B4.3</u> Geometric depth greater than > 3.0 feet			
<u>Acceptable Type of Channel Lining</u>	<u>Maximum permissible side slopes (h:v)</u>	<u>Maximum allowed velocity (fps)</u>	<u>Safety Requirements</u>
Grass (maintained) Riprap	6:1	6.0	Adequate safety measures must be taken (i.e. safety railings, safety fence, warning signs etc.) where accessible to the public.

4.4-16 Acceptable types of channel lining shall comply with table B4.2 and B4.3 of this manual, as shown above, unless otherwise approved by Public Works Department



4.5 Catch Basins and Inlets

- 4.5-1 Catch basins shall be the curb opening type constructed to Town of Buckeye construction detail B-510; Combination curb opening-grated inlet type is *not* allowed within Town of Buckeye rights of way.
- 4.5-2 Grated inlets within the public rights of way are not allowed. Instances where grated inlets are absolutely necessary require approval of the Public Works Director and shall be constructed in accordance to MAG standard construction detail 537. All grates must be rated H-20 traffic loading and for bicycle traffic.
- 4.5-3 Catch basins and inlets located within the Town of Buckeye rights of way shall not be connected in series, except where two catch basins are the entire collection system which directly outflow to a retention or detention basin.
- 4.5-4 Calculations for sizing catch basins and inlets, including friction losses, shall comply with Section 3 of the *Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics*.
- 4.5-5 Slotted drains are not allowed within the Town of Buckeye rights of way.

4.6 Scuppers

- 4.6-1 Under sidewalk scupper constructed to Town of Buckeye construction detail B-505. Metal cover types are not acceptable.
- 4.6-2 Calculations of scupper sizes shall be according to Section 3 of the Drainage Manual for Maricopa County, Volume II Hydraulics, and/or FHWA HEC-12 or HEC-22.

4.7 Manholes

- 4.7-1 Criteria for manhole placement include the following but not limited to:
 - a) Directional changes in storm drain pipe will require a manhole.
 - b) Junctions of two or more pipes including laterals.
 - c) Changes in pipe sizes. Elevation of pipe crowns, not inverts, are to be matched at manholes and structures.



- 4.7-2** Required manhole spacing:
- a) Storm drain diameter less than or equal to 30 inches, maximum manhole spacing is 300 feet.
 - b) Storm drain diameter greater than 30 inches and less than or equal to 48 inches, maximum manhole spacing is 400 feet.
 - c) Storm drain diameter greater than 48 inches and less than or equal to 84 inches, maximum manhole spacing is 600 feet.
 - d) Storm drain diameter greater than 84 inches, maximum manhole spacing is 1300 feet.
- 4.7-3** Directional changes of storm drains requiring a manhole shall have a minimum 0.10 feet drop in elevation between storm drain inverts.
- 4.7-4** Deflection angle of storm drain pipes entering manholes shall not be greater than 90 degrees.
- 4.7-5** Storm drain manhole materials and construction shall follow MAG Uniform Standard Details and Specifications for Public Works Construction details: 520, 521, 522, and 523.
- 4.7-6** Storm drain manhole, frame, or cover shall not be located in the curb, gutter, sidewalk, or driveways.
- 4.7-7** Public storm drain manhole frame and cover shall be constructed per MAG standard detail 423 and 424. The label on the cover shall read "Buckeye Storm Drain".



Section 5 - Storm Water Storage Facilities

5.1 General

- 5.1-1 The purpose of storm water storage systems is to retain or detain sufficient volumes of runoff and reduce the impact of downstream properties. Public streets are not considered an acceptable method of retention or detention of runoff.
- 5.1-2 In the downtown area of the Town, identified in Figure B-1 of Appendix B, are areas of the Town that have reduced retention requirements. Values of the depth of rainfall for the calculated retention volume within these areas are given in [Table B5.2](#).
- 5.1-3 Retention: storage method by capturing and holding storm water in which disposal of such storm water evacuates by means of natural infiltration.
- 5.1-4 Detention: storage method by capturing and holding storm water temporarily for the duration of a storm event, then a controlled release of the storm water to alternate or existing drainage facility.
- 5.1-5 Volume Provided (V_P): calculated capacity of a storm water storage facility (i.e. surface basins, underground storage).
- 5.1-6 Volume Required (V_{REQ}): calculated amount of storm water runoff required to retain/detain from the respective tributary area. ([See Section 5.2](#))
- 5.1-7 All storage facilities shall be sized to retain one hundred (100) percent of the 100 year-2 hour storm event.
- 5.1-8 Permanent retention or detention basins are not allowed within the Town's rights of way.
- 5.1-9 Anticipated percolation during the storm duration used to decrease the volume required is not allowed.



- 5.1-10** Multiple surface basins may be required to achieve actual runoff volume of the tributary drainage area. Excess volume provided (capacity) of an individual basin can not be transferred to another basin in relations to calculating volume required. Each basin must correspond individually to a respective tributary area; exceptions are staged or inter-connected basins only.
- 5.1-11** Runoff coefficients to be used in calculating volume required are given in [Section 3.2](#). Calculated weighted coefficients (C_w) may be used.



5.2 Calculating Storage Volume Required

5.2-1 Calculations for volume required of storm water storage facilities are as follows:

$$V_{REQ} = (D/12)*A*C$$

Where:

V_{REQ} = Storage volume required, cubic feet

D = 100-year, 2-hour depth of rainfall, inches

A = Area of project, including street improvements, square feet

C = Runoff coefficient (Table B3.1 or B3.2)

Depth values for "D" can be found in Section 3 of the *Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology* isopluvial maps.

5.2-2 Calculations for volume required located within the Downtown Buckeye area within the boundaries set forth in Figure B-1 in Appendix B shall use the following "D" values in Table B5.2:

Reduced depth for Downtown Buckeye TABLE B5.2	
<i>Drainage area</i>	<i>depth D (inches)</i>
Downtown Drainage District North	Zero
Downtown Drainage District South	Zero



5.3 Surface Storage

5.3-1 The most common method of storm water storage is surface retention or detention basins. Where surface storage of the required retention is planned and provided, the basin shall comply with the following:

a) Basins that are located adjacent to the rights of way have the following requirements:

1. Basins must be landscaped in accordance to requirements set forth by Community Development Department and Parks & Recreations Department.
2. Maximum side slopes of 4:1 (h:v).
3. Maximum WS_{100} of 3.0 feet in depth.
4. Retention/detention is not allowed within the rights of way.
5. Retention/detention is not allowed within a Public Utility Easement (PUE).

b) Basins within private development that are not located adjacent to any rights of way have the following requirements:

1. Maximum side slopes of 4:1.
2. Maximum WS_{100} of 3.0 feet in depth.
3. Landscaping.

c) Basins within private commercial and industrial developments not located adjacent to any rights of way are allowed greater WS_{100} depths with the following requirements but not limited to:

1. Vertical side slopes (1:1) when using concrete walls, otherwise maximum side slope of 3:1 (h:v).
2. A six (6.0) foot tall viewable fence around the retention basin.
3. A twenty (20) feet wide drivable access to the bottom of the basin.
4. Approval of the Public Works Director.



- 5.3-2 All retention and detention basins shall have a minimum of one foot (1.0) of freeboard above the WS_{100} .
- 5.3-3 All retention and detention top of basins shall be at least one (1.0) foot below any adjacent finished floor building elevation.
- 5.3-4 All retention/detention facilities must be disposed of or evacuated within 36 hours.
- 5.3-5 Retention basins must have percolation tests performed in the retention areas planned to determine natural percolation rates.
- 5.3-6 Retention basins greater than one (1.0) foot deep require a minimum of one drywell for storm water disposal.
- 5.3-7 All surface retention basins requiring a drywell, as required by Section 6 of this manual, shall have a sloped bottom of 0.50% to a low point at one end of the basin, in which the drywell(s) shall be located, but not less than ten (10) feet from the toe of the basin side slopes.
- 5.3-8 Drywells located within retention or detention basins shall have the inlet grate set at least 0.30 feet above the bottom basin finished grade elevation (i.e. turf, riprap, etc).
- 5.3-9 Storm water pipes discharging into retention or detention basins are required to be 0.50 feet above the bottom elevation of the basin with the appropriate sized rip-rap and/or concrete aprons for control of scour per MAG standard detail 555.
- 5.3-10 Storm water out flow pipe ends located in retention or detention basins shall have headwalls per MAG standard detail 501-3, and shall have trash racks per Town of Buckeye construction detail B-508.
- 5.3-11 Headwalls greater than 30 inches in height, and any headwalls adjacent to sidewalks require hand rails per Town of Buckeye construction detail B-110.
- 5.3-12 Recreational facilities located within retention/detention areas (tennis courts, basketball courts, playgrounds, pedestrian walkways, etc.) shall be elevated above the 10 year-2 hour ponding level.
- 5.3-13 Washes, rivers, and swimming pools are not allowed for retention/detention.



- 5.3-14** Equalizer pipes between basins shall be a minimum size of 15 inches in diameter.
- 5.3-15** Retention in paved parking lot areas are allowed only in commercial and industrial developments with the following restrictions:
- a) No more than 25% of the total required volume of the 100 year-2 hour storm event may be retained or detained within the paved parking areas.
 - b) A maximum depth of 6.0 inches within the paved parking area of the 100 year-2 hour storm.
 - c) Each parking space remains dry to the driver's side door (one-third front to two-thirds rear).
 - d) All storm water retained within parking area must be evacuated within 36 hours.
- 5.3-16** Detention basins capture runoff by means of a temporary storage facility, and release the runoff in a controlled manner. Detention basins have the following additional requirements:
- a) Controlled releases into existing rivers, washes, and public storm water storage facilities must be discussed in the drainage report, and shall not exceed 2.0 cubic feet per second.
 - b) Detention basins shall have passive outlet pipes with or without orifice plates. Optional gates and valves shall remain in the closed position until the storm period has passed and shall be easily accessible.
 - c) Minimum outlet pipe or orifice plate size is 4.0 inches. The design engineer shall provide calculations that confirm the appropriate pipe diameter to drain the required volume within the 36 hour time period.
 - d) Detention basins with a piped outlet shall require the invert be a minimum of 0.50 feet above the bottom of basin.
 - e) The controlled outflow from the detention basin shall be a point of discharge such as a river, wash, or regional facility approved by the Town, FCDMC, or the Corps of Engineers.



- 5.3-17** All commercial and industrial developments that have fueling areas, bulk fuel storage, or bulk oil storage shall have a separate drainage area and drain to a storage facility that includes a petrochemical drywell system per the Town of Buckeye construction detail B-502.
- 5.3-18** Engineers shall incorporate methods to address the inevitable nuisance waters that are introduced into retention or detention basins and drainage structures. Nuisance water must be disposed of due to vector control issues, and adequate volume is available for future storms.



5.4 Underground Storm Water Storage

- 5.4-1** As more efficient use of land is necessary, the engineer may use underground storage as a method in storage of storm water runoff. Underground storm water storage utilizes storage tanks, vaults, chambers, etc. to place the required storm water retention or detention volume underground within the development site. The engineer shall consider the following during the design process for any project involving underground storage:
- a) Soil conditions.
 - b) Access to the underground structure for routine maintenance.
 - c) Structural loads including H-20 traffic loads.
 - d) Buoyancy of the structure.
 - e) Drainage of the underground structure within the required 36 hour period.
- 5.4-2** Underground storage is *not* allowed in residential developments.
- 5.4-3** Underground storm water storage is allowed for:
- a) Commercial developments.
 - b) Industrial developments.
 - c) Multifamily developments such as condominiums and apartments.
- 5.4-4** Underground storage is *not* allowed within the Town of Buckeye rights of way.
- 5.4-5** Underground storm water storage is not allowed beneath surface retention or detention basins unless an anchor system is used and buoyancy calculations are provided.
- 5.4-6** A fifty (50) year service life of any underground storm water storage is required.



- 5.4-7** A geotechnical report is required by an Arizona Registered Professional Engineer detailing the following:
- a) Ground water table elevation with respect to the bottom elevation of underground storage structure.
 - b) Soil pH.
 - c) Soil resistivity in ohm-cm.
 - d) Chloride and sulfate concentration in ppm.
 - e) Moisture content.
- 5.4-8** Underground storm water storage structures must be structurally designed to accept H-20 loading for traffic loading. D-load calculations are required for concrete structures.
- 5.4-9** Underground storm water storage structures minimum cover shall be at least 3.0 feet in depth, or 3.0 feet below the pavement section.
- 5.4-10** Underground storm water storage structures must drain within 36 hours by means of:
- a) Pump and release as defined in the detention design criteria in [Section 5.3-14](#).
 - b) Drywell;
 - 1. Provide drywell detail relating to the connection of the underground storm water storage structure.
 - 2. The drywell sediment chamber must be lower than the bottom elevation of the structure for positive drainage.
 - 3. Drywell must be constructed to the Town of Buckeye construction details B-501 and B-502. See drywell standards in [Section 6.4](#).
 - 4. In use of multiple drywells for commercial and industrial developments, each drywell shall be 25.0 feet apart.



- 5.4-11** Underground storm water storage structures must provide a minimum of two (2) access points:
- a) Access manholes shall be 48 inches in diameter with a 30 inch bolted manhole frame and cover (solid or grated). The cover shall be labeled "Retention Tank."
 - b) Access manholes must include a fixed ladder.
 - c) Concrete collars are required per MAG standard detail 422.
- 5.4-12** Installation of corrugated metal pipe (CMP) type for underground storm water storage has the following requirements:
- a) Installation of CMP underground storm water storage must be in accordance with MAG specification #621 and manufacturers specifications.
 - b) Metal type, corrugation sizes, and lining must be designed to the National Corrugated Steel Pipe Association (NCSPA), unless otherwise approved by the Public Works Director.
 - c) Engineer must provide construction details and specifications for CMP underground storm water storage including but not limited to:
 - 1. End walls.
 - 2. Access risers.
 - 3. Excavation, bedding, and backfill according to MAG specifications #601 and #760 with material and compaction requirements.
 - 4. Water tight joints.
 - d) Installation of CMP underground storm water storage is not allowed where high a groundwater table encroaches onto the storage tank.



5.5 On-Lot Residential Retention

- 5.5-1 Individual single residential developments (one dwelling unit per lot) on lots greater than or equal to one half acre (0.50) are allowed to fulfill retention requirements with on-lot retention. The following are requirements of on-lot retention:
- a) Calculations and design criteria of on-lot retention shall comply with [Section 5](#) of this manual.
 - b) Where on-lot retention is allowed, the engineer has an option to submit either a drainage report or simple calculations which would be allowed to be shown on the grading and drainage improvement plans.
 - c) Calculations provided by the engineer are to include onsite and the respective half street runoff.
 - d) Individual single residential developments with on-lot retention that receives flood irrigation shall include a minimum of 75% of the gross lot area of the lot multiplied by 0.50 feet in additional volume required by irrigation.
 - e) On-lot retention shall not be located within a Public Utility Easement (PUE).
 - f) Runoff coefficients used in calculating runoff shall comply with [Section 3.2](#) of this manual and be a minimum of 0.60.
 - g) Parcels with on-lot retention shall be identified on the final plat.
 - h) Copy of recorded covenant requiring the 100 year 2 hour retention including adjacent half street runoff in perpetuity on parcel deed shall be submitted with building permit applications where lots are subject to on-lot retention.
 - i) As Built grading and drainage plan shall be submitted to the Town prior to the obtaining a Certificate of Occupancy.



Section 6 - Storm Water Disposal

6.1 General

- 6.1-1 All retention, detention, and underground storm water storage facilities shall have a positive method of disposing captured storm water within a 36 hour time period.
- 6.1-2 Public streets are not considered an acceptable method for disposal of retained or detained runoff.

6.2 Detention

- 6.2-1 Detention basins are a system of storage with a controlled disposal when discharging to an existing storm drain or drainage channel (approved by the Town, FCDMC, or the Corps of Engineers) of sufficient capacity to convey the anticipated flows from the tributary drainage area after the storm via a outflow pipes an/or orifice plates. Detention systems require the approval of the Public Works Department.

6.3 Retention Infiltration

- 6.3-1 Post construction percolation tests shall be performed in each retention basin location to determine natural percolation according to Section 6 of Maricopa County Drainage Policies. Certified test results shall be submitted and sealed by a registered Arizona Professional Civil Engineer to the Public Works Department prior to approval of drainage improvement plans.
- 6.3-2 When calculating preliminary retention time in a basin, the engineer shall use an infiltration rate of 1.0 inches/hour, unless a geotechnical report is submitted with percolation test results with the preliminary plat/site plan. Final calculations shall reflect the geotechnical report and the engineer shall use fifty (50.0) percent of the certified tested percolation rate to allow for degradation. Test results and calculations determining time of disposal shall be included in the final drainage report prior to plan approval, mass grading, or any other site disturbance.



6.4 Drywells

- 6.4-1 Drywells are allowed to dispose of captured storm water in surface retention basins. Drywells shall be installed when percolation tests reveal natural infiltration rates will exceed a 36 hour period for disposal.
- 6.4-2 Single chamber drywells are not acceptable.
- 6.4-3 All drywells shall conform to Town of Buckeye construction details B-501 and B-502.
- 6.4-4 Drywells are not allowed within public street right-of-way or private street roadway tracts.
- 6.4-5 Drywell infiltration or volume can not be considered in retention calculations in efforts to reduce the size of the retention area.
- 6.4-6 A maximum disposal rate of 0.20 cubic feet per second may be used for estimating the number of drywells required for preliminary plat/site plan.
- 6.4-7 Each drywell shall be tested after installation and constant head percolation test is required. Fifty (50) percent of the tested percolation rate shall be used in calculations for drywell storm water disposal, up to but not exceeding 0.50 cubic feet per second, compensating for deterioration of percolation rates over time. If the post construction percolation testing results in the storm water storage facilities disposal time greater than 36 hours, additional drywells are required to be installed.
- 6.4-8 Certification of post-construction drywell percolation rates, revised disposal rates, quantity of drywells, and capacity calculations are required by the engineer in the [As-Built plans](#). ([Section 1.9](#))
- 6.4-9 Certified percolation test results are to be filed with the Public Works Department.
- 6.4-10 Drywells are to be equipped with a secured grate to prevent unauthorized removal.
- 6.4-11 Calculations are required in the final drainage report showing the minimum amount of drywells required to drain retention facilities in 36 hours using the certified infiltration test rate.
- 6.4-12 Drywells must penetrate at least 10 feet into a permeable stratum and a percolation test must be carried out on the drywell before acceptance.



- 6.4-13** When multiple drywell installations are required each drywell shall be located a minimum of 20-feet away from a basin inlet and a minimum of 100 feet apart; except in commercial for underground storage.
- 6.4-14** Drywells shall be located a minimum of 100 feet away from water wells and septic systems.
- 6.4-15** Drywells shall be located a minimum of 25 feet from storm water underground storage structures.
- 6.4-16** Drywells shall be located a minimum of 50 feet from permanent foundations and structures.
- 6.4-17** Drywells receiving storm water runoff directly from paved areas containing fuel or oil storage, and also fuel dispensing facilities must install the environmental type oil interceptor drywell per Town of Buckeye construction detail B-502.
- 6.4-18** Top of the drywell grates shall be set a minimum of 0.30 feet above the bottom finished grade elevation of retention basins.
- 6.4-19** Drywell drilling logs at 5.0 foot intervals including lithology changes, along with an engineer's certification that the drywells have been installed in accordance with plans, specifications and Arizona Department of Environmental Quality requirements shall be submitted to the Public Works Department upon completion of drywell installation.
- 6.4-20** Property owners of record shall be responsible for the design, performance, operation, and maintenance of all drywells in the development. Drywells that cease to drain a project area in a 36-hour period shall be replaced by the property owner with new ones.
- 6.4-21** Drywells design and construction shall comply with [Section 6.4](#) of this manual and ADEQ standards. Requirements of ADEQ and the Town of Buckeye Public Works Department include but not limited to the following:
- a) 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 described herein. A copy of the application for registration by ADEQ of the proposed drywell shall be submitted prior to approval of grading and drainage plans.



- b) All drywells shall be registered with the ADEQ.
- c) All drywells shall be constructed by an ADEQ licensed contractor.
- d) The approved drywell registration from ADEQ shall be submitted to the Town of Buckeye Public Works Department by the developer or his/her engineer at the time As-Builts are submitted. A tabulation showing drywell number, registration number, and certified test percolation rates will be added to Grading Plan coversheet before submitting As-Builts.



Appendix A - References

Arizona Department of Transportation (ADOT). Pipe Selection Guidelines and Procedures. Roadway Engineering Group (ADOT). March 1996.

California Department of Transportation (CalTrans). Highway Design Manual. CalTrans. September 2006.

City of Chandler Public Works and Engineering. Storm Drainage System Design. City of Chandler, January 2002.

City of Flagstaff Engineering Division. Storm Water Design Manual. City of Flagstaff, July 2000.

City of Glendale Engineering Department. Engineering Standards. City of Glendale, 2002.

City of Goodyear Engineering Department. Storm Water Management. City of Goodyear. July 1997.

City of Mesa Development Services Department. "Storm Water Drainage and Retention." Engineering Procedure Manual: 2005 Engineering & Design Standards Volume 2. Engineering Division. City of Mesa, September 2004. Chapter 8.

City of Scottsdale Municipal Services. "Grading and Drainage". Design Standards and Policies Manual. Storm Water Management Division. City of Scottsdale, July 2006. Chapter 4.

City of Peoria Engineering. "Infrastructure Development Guidelines". Storm Drainage Facilities Design and Construction.

City of Phoenix Development Services, City of Phoenix Storm Water Policies and Standards. City of Phoenix, March 2004.

City of Prescott. "Street and Utility Drainage Regulations". Prescott City Code Title 16. City of Prescott, July 2006.

City of Tempe Public Works Department. Engineering Design Criteria. City of Tempe, August 2006.



City of Tucson Department of Transportation. "Standards Manual for Drainage Design and Floodplain Management". Engineering Division. City of Tucson, December 1989 (Revised 1998).

Connecticut Department of Transportation. ConnDOT Drainage Manual. ConnDOT. October 2000.

Flood Control District of Maricopa County. "Drainage Design Manual for Maricopa County Arizona". Volume I Hydrology. FCDMC. Maricopa County, January 1, 1995.

Flood Control District of Maricopa County. "Drainage Design Manual for Maricopa County Arizona". Volume II Hydraulics. FCDMC. Maricopa County, January 28, 1996.

Flood Control District of Maricopa County. Drainage Policies and Standards for Maricopa County. FCDMC. Maricopa County, January 2007.

Maricopa Associations of Governments (MAG). Uniform Standard Specifications for Public Works Construction. MAG. 1998 (Revised 2007)

Maricopa Associations of Governments (MAG). Uniform Standard Details for Public Works Construction. MAG. 1998 (Revised 2007)

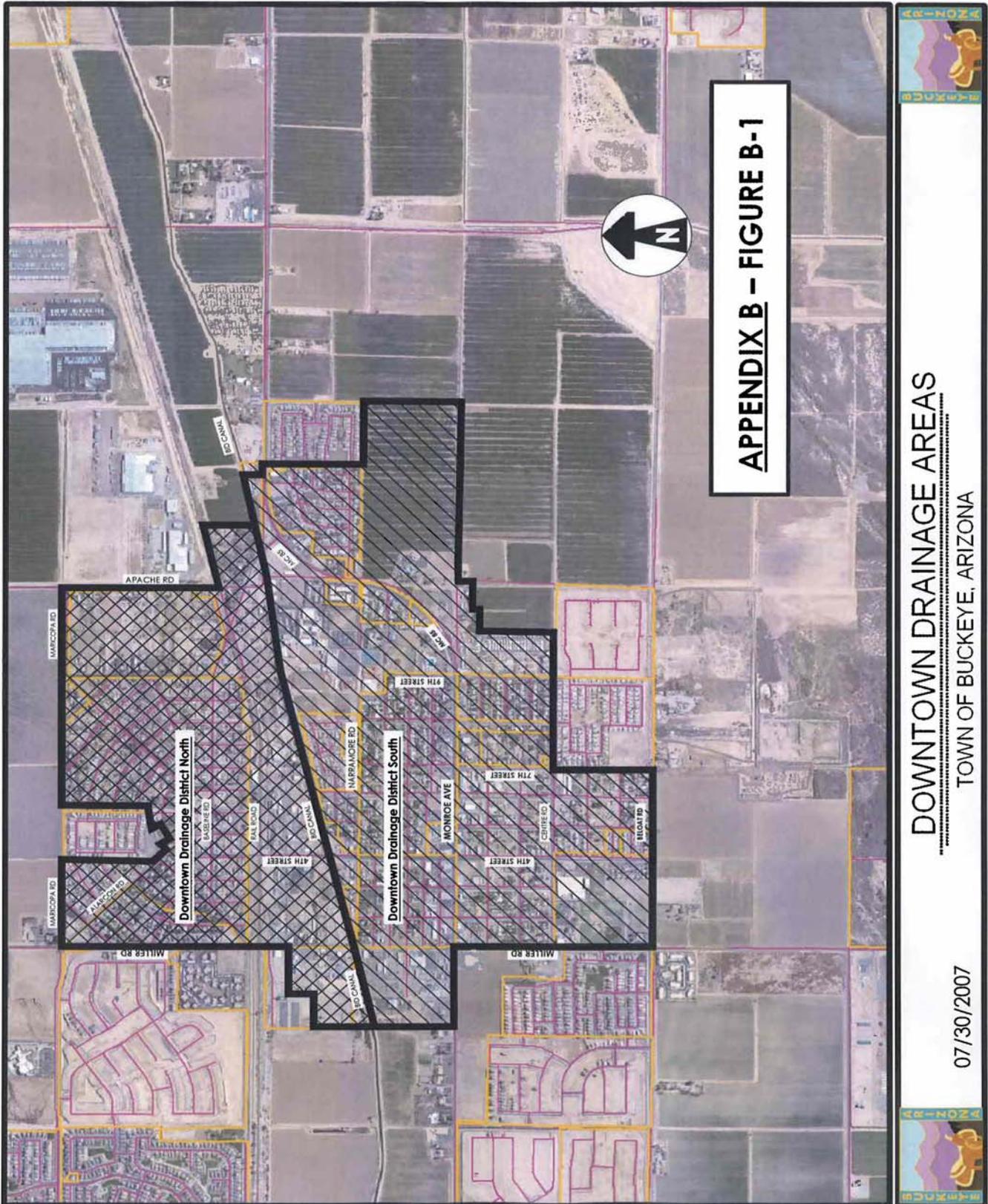
Federal Highway Administration (FHWA). "Hydraulic Engineering Circular #12 (HEC-12)". Drainage of Highway Pavements. U.S. Department of Transportation. March 1984.

Federal Highway Administration (FHWA). "Hydraulic Engineering Circular #22 (HEC-22)". Urban Design Manual. U.S. Department of Transportation. July 2001.

Town of Gilbert Public Works Department. Public Works and Engineering Standards and Details. Town of Gilbert, March 2005.



Appendix B - Downtown Drainage Areas



5.00"

AS-BUILT CERTIFICATION

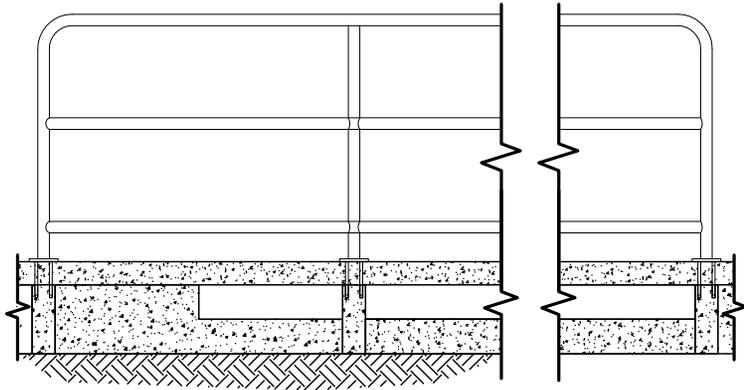
I hereby certify that the "As-Built" measurements as shown or noted hereon were made by myself or under my supervision and are true and correct.

Arizona Registered Land Surveyor Date

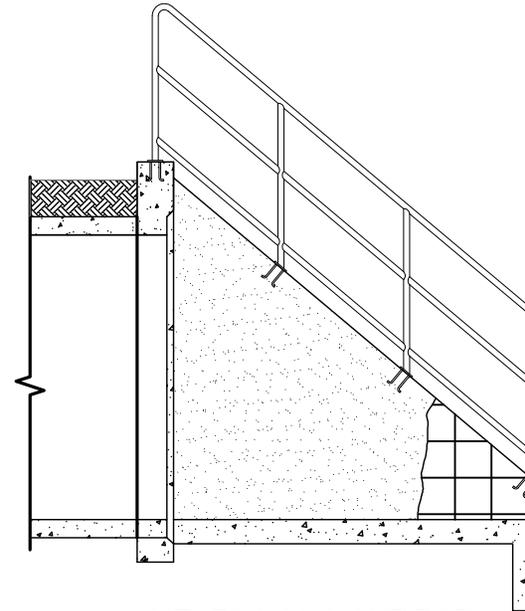
2.50"



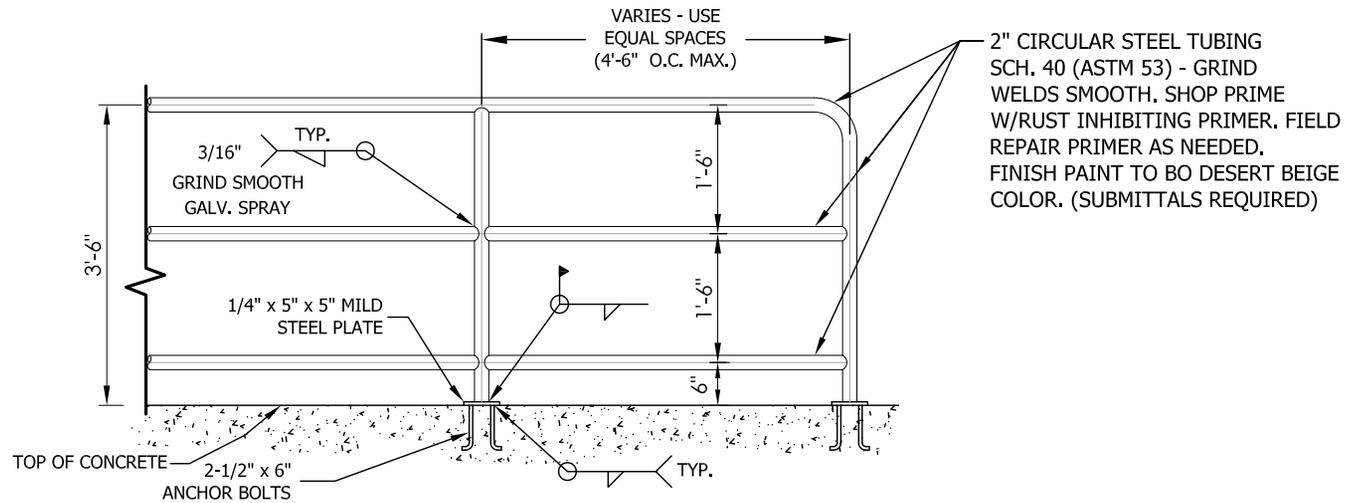
DATE	REVISED	DETAIL #
06/2007	N/A	B-109



SCUPPER HANDRAIL



HEADWALL HANDRAIL



TYPICAL ANCHOR PLATE & HANDRAIL



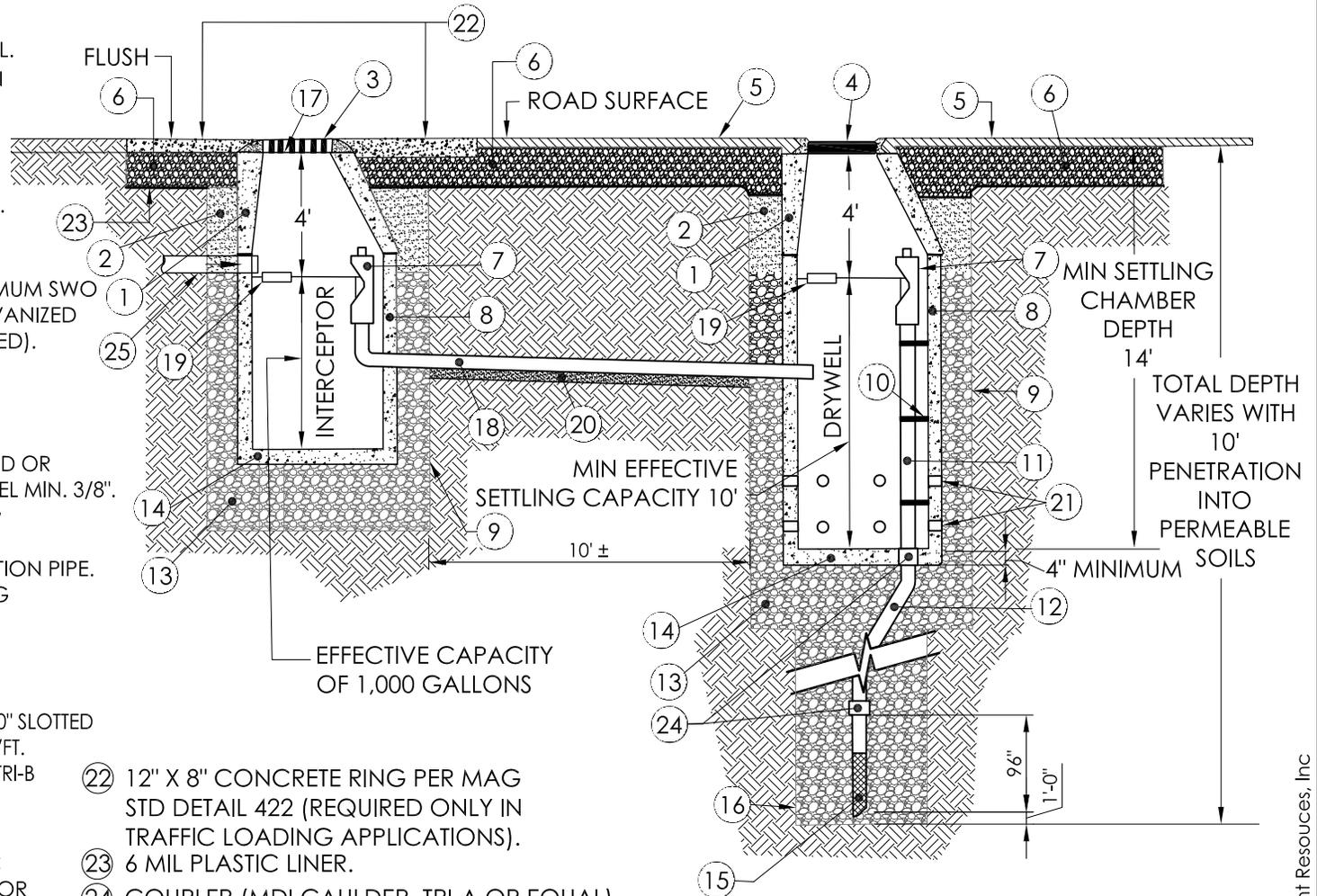
1. All design and construction must be in accordance with the Uniform Standard Specifications and Details for Public Works Construction published by the Maricopa Association of Governments (MAG) except as amended by the Town of Buckeye Standard Construction Details. All improvements within the development including offsite improvements shall be in accordance with the latest Town of Buckeye engineering design standards.
2. No grading shall begin without a permit from the Town of Buckeye.
3. Offsite construction requires a separate permit by the Town of Buckeye.
4. Contractor shall notify the Town of Buckeye Public Works Department assigned inspector at least twenty-four (24) hours in advance of any required construction inspection.
5. Contractor must call the Arizona Blue Stake Center (602) 263-1100, forty-eight (48) hours before digging or excavating for location of all underground utilities.
6. It is the responsibility of the developer and his/her agent in coordinating the relocation of power poles from the applicable utility company.
7. No minimum finished floor elevation shall be altered, unless approved by Public Works and the developer's civil engineer.
8. All staking including finished floor elevations is the sole responsibility of the developer's registered civil engineer and land surveyor. Submission of certified pad elevations is required prior to final acceptance.
9. Contractor shall provide grading for positive drainage in all retention basins at elevations as abutting public right of way.
10. Drywell inlet grate shall be 0.30 feet above finish grade at bottom elevation of the retention basin.
11. Drilling logs for drywells at 5.0 foot intervals including lithology changes will be furnished to the Town of Buckeye Public Works Department prior to final acceptance.
12. Percolation tests will be required of completed drywells prior to acceptance. Should existing soil conditions be encountered which lack sufficient percolation rates, additional drywells or an alternate method of storm water run-off disposal will be required. Final certified percolation test rates from ASTM D 3385 shall be submitted at the time of As-Builts, with the required 50% reduction factor.
13. Drywell construction shall be done only by a contractor licensed by the Arizona Department of Environmental Quality with the approved registration for each drywell.

14. The approved drywell registration shall be submitted to the Town by the developer or his/her civil engineer at the time As-Builts are submitted.
15. Contractor shall comply with the provisions for Work Zone Safety and Traffic Control protection as indicated in Part IV of the Manual on Uniform Traffic Control Devices (MUTCD 2003 Edition) and where applicable across jurisdictional authorities but within the Town of Buckeye, MCDOT, and ADOT's Traffic Control Manual for Highway Construction and Maintenance (most current edition).
16. All retention basins must drain any storm event up to and including the 100 year 2 hour storm within thirty-six (36) hours of post development construction. Owner(s) of any basin failing to meet this requirement must take corrective action to bring the basin into compliance.
17. The Contractor shall not disturb existing survey monuments or benchmarks noted on the plans. Removal and replacement shall be done by an Arizona Registered Land Surveyor only.
18. The contractor shall have sufficient means to provide dust control. Dust shall be controlled in accordance with the Maricopa County Environmental Services.
19. Perimeter wall fences are required to be compacted no less than 90% by the contractor.
20. Arrangements for construction water can be made by calling the Town of Buckeye Public Works Department at 623-349-6800.
21. The contractor shall provide adequate means for the elimination of mud and dust accumulation in public streets by trucks leaving the site (track out devices). Public right of ways shall be kept clean and free of debris from construction sites.
22. Disposal of excess material within the Town's limits is prohibited. A use permit is required for disposal and/or stockpiling materials within a residential area.
23. Approved construction plans shall be kept on the jobsite at all times. Deviation from the plans is not acceptable unless an approved plan revision has been granted by Public works department.



DATE	REVISED	DETAIL #
08/2007	N/A	B-500

- ① MODIFIED MANHOLE CONE.
- ② 2 SACK SLURRY STABILIZED BACKFILL.
- ③ MINIMUM 30" Ø BOLTED CAST IRON RING AND GRATE.
- ④ MINIMUM 30" Ø BOLTED C.I. RING AND COVER WITH RAISED LETTERS "STORM WATER DRYWELL".
- ⑤ GRADED PARKWAY OR PAVEMENT.
- ⑥ COMPACTED ABC.
- ⑦ DEBRIS SCREEN - ANTI SIPHON (ROLLED 13 GAGE BY 0.265" MAXIMUM SWO FLATTENED EXPANDED STEEL. GALVANIZED OR FUSION BONDED EPOXY COATED).
- ⑧ PRECAST CONCRETE LINER, 4000 PSI - 48" ID, 54" OD.
- ⑨ MINIMUM 6' Ø DRILLED SHAFT.
- ⑩ SUPPORT BRACKET (TYP), GALVANIZED OR FUSION BONDED EPOXY COATED STEEL MIN. 3/8".
- ⑪ 8" Ø SCHEDULE 40 PVC OVERFLOW PIPE.
- ⑫ 6" - 12" Ø SCHEDULE 40 PVC INJECTION PIPE. NO PERFORATIONS BELOW SETTLING CHAMBER.
- ⑬ 3/8" TO 1-1/2" WASHED ROCK.
- ⑭ 4" THICK CONCRETE BASE.
- ⑮ INJECTION SCREEN - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. 6"-12" Ø. OVERALL LENGTH = 96" WITH TRI-B COUPLER.
- ⑯ MINIMUM 4' Ø DRILLED SHAFT.
- ⑰ FABRIC SEAL - PLACE FILTER FABRIC UNDER GRATE UNTIL PAVING AND/OR LANDSCAPING IS COMPLETE (FILTER FABRIC TO BE UV RESISTANT).
- ⑱ 4" Ø SCHEDULE 40 CONNECTOR PIPE WITH FLOW REGULATOR.
- ⑲ HYDROPHOBIC PETROCHEMICAL SPONGE. MIN 128 oz CAPACITY.
- ⑳ STABILIZED BACKFILL - 2 SACK CONCRETE SLURRY
- ㉑ 8 PERFORATIONS PER LINEAR FOOT FOR BOTTOM 3 FEET OF CHAMBER.



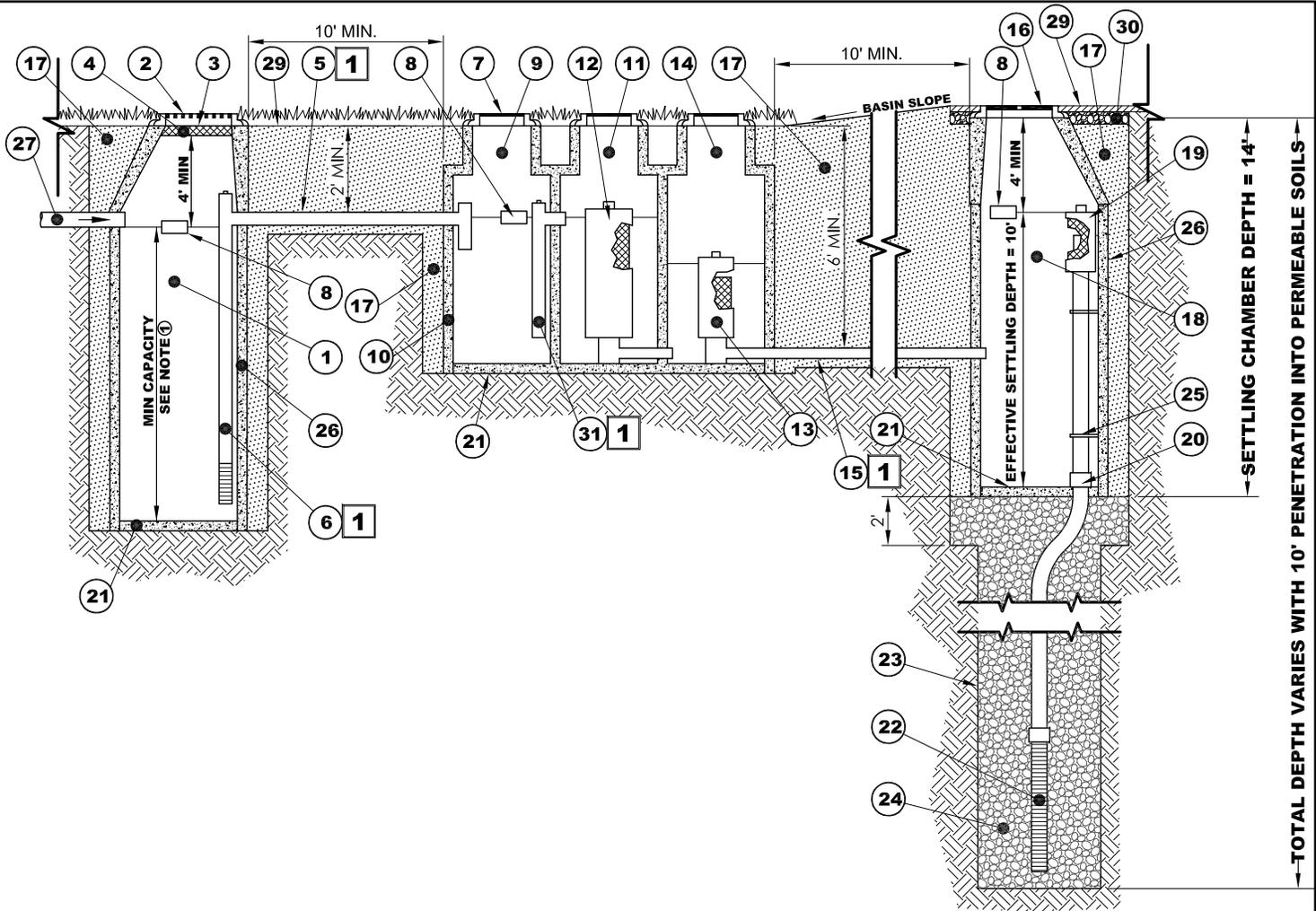
- ㉒ 12" X 8" CONCRETE RING PER MAG STD DETAIL 422 (REQUIRED ONLY IN TRAFFIC LOADING APPLICATIONS).
- ㉓ 6 MIL PLASTIC LINER.
- ㉔ COUPLER (MDI CAULDER, TRI-A OR EQUAL).
- ㉕ OPTIONAL INLET PIPE - FREE BOARD DEPTH VARIES WITH PIPE INLET ELEVATION. INCREASE INTERCEPTOR/SETTLING CHAMBER AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.

Basic design courtesy of Torrent Resources, Inc

 TOWN OF BUCKEYE, ARIZONA CONSTRUCTION DETAILS	STANDARD DRYWELL	DATE	REVISED	DETAIL #
		08/2007	N/A	B-501

ITEM NUMBERS

1. COLLECTOR CHAMBER - MINIMUM 2500 GALLON CAPACITY WHEN USED AS PRETREATMENT IN FUELING AREAS, OTHERWISE MINIMUM 1000 GALLON CAPACITY REQUIRED.
2. MINIMUM 30" Ø BOLTED CAST IRON RING AND GRATE WHEN LOCATED IN RETENTION BASIN. MINIMUM 30" Ø BOLTED CAST IRON MANHOLE VENTED COVER WITH RAISED LETTERS "STORM WATER DRYWELL" IN PAVEMENT.
3. FABRIC SEAL - 100X U.V. RESISTANT GEOTEXTILE - TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION.
4. DEBRIS BASKET - 6" X 30" Ø, 10 GA. FLATTENED EXPANDED STEEL SCREEN. FUSION BONDED EPOXY COATED.
5. CONNECTING PIPE - 4" Ø SCH. 40 PVC.
6. OVERFLOW PIPE - 4" Ø SCH. 40 PVC WITH ANTI-SIPHON VENT, FLOW REGULATOR AND SCREEN.
7. BOLTED RING & COVER - 30" Ø CAST IRON WATERTIGHT MANHOLE (TYP OF 3) WITH RAISED LETTERS "STORM WATER DRYWELL".
8. HYDROPHOBIC PETROCHEMICAL SPONGE, MIN. 128 OZ. CAPACITY.
9. PRIMARY SEPARATOR CHAMBER - MINIMUM CAPACITY 500 GALLONS.
10. 2,500 GALLON TANK. 156" LENGTH X 81" WIDTH X 80" HEIGHT.
11. FILTRATION CHAMBER- MINIMUM CAPACITY 500 GALLONS.
12. SILT FILTER - MINIMUM 3,600 SQ. IN. POLYPROPYLENE FABRIC MESH.
13. HYDROPHOBIC PETROCHEMICAL BEAD DRAIN FIELD.
14. IMBIBATION CHAMBER- MINIMUM CAPACITY 500 GALLONS.
15. CONNECTOR PIPE - 4" Ø SCH. 40 PVC PIPE.
16. MINIMUM 30" Ø BOLTED CAST IRON MANHOLE VENTED COVER WITH RAISED LETTERS "STORM WATER DRYWELL".
17. STABILIZED BACKFILL - 2 SACK ABC CONCRETE SLURRY BACKFILL.
18. DRAINAGE WELL WITH WATERPROOF INSPECTION CHAMBER.
19. DEBRIS SCREEN - ROLLED 16 GA. STEEL X 24" LENGTH WITH ANTI-SIPHON VENT AND INTERNAL SCREEN X 12" LENGTH. FUSION BONDED EPOXY COATED.
20. DRAIN PIPE - 8" Ø SCH. 40 PVC PIPE.
21. CONCRETE BASE - 4" THICK NON-REINFORCED.
22. DRAINAGE SCREEN - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT, 96" OVERALL LENGTH WITH TRI-B COUPLER.
23. MINIMUM 4" Ø SHAFT - DRILLED TO MAINTAIN PERMEABILITY OF DRAINAGE SOILS.
24. GRAVEL PACK - CLEAN AND WASHED GRAVEL SIZED BETWEEN 3/8" AND 1-1/2" TO BEST COMPLEMENT SOIL CONDITIONS.
25. SUPPORT BRACKET - FORMED 12 GA. STEEL. FUSION BONDED EPOXY COATED.
26. PRE-CAST LINER - 4000 PSI CONCRETE 48" ID. X 54" OD. CENTER IN HOLE AND ALIGN SECTIONS TO MAXIMIZE BEARING SURFACE.
27. OPTIONAL INLET PIPE - INLET PIPE INVERTS DEEPER THAN 3 FEET BELOW GRADE REQUIRE HEAVY DUTY LID(S). INVERTS DEEPER THAN 5 FEET REQUIRE A LIFT STATION WITH A SUMP PUMP. ENGINEER MUST PROVIDE A DETAIL PERTAINING TO THE CONNECTION OF THE OPTIONAL INLET PIPE.
28. MODIFIED MANHOLE CONE.
29. GRADED BASIN OR PAVEMENT SURFACE.
30. COMPACTED ABC.
31. OVERFLOW PIPE - 4" Ø SCH. 40 PVC WITH ANTI-SIPHON VENT



GENERAL NOTES:

1. WHEN USED IN CONJUNCTION WITH UNDERGROUND STORAGE, THE PETROCHEMICAL SYSTEM MAY BE USED PRIOR TO ENTRY OF UNDERGROUND, AND DRYWELL MAY BE USED AFTER UNDERGROUND. OVERFLOW AND CONNECTOR PIPES SHALL BE A MINIMUM OF 6"Ø WHEN SYSTEM IS USED PRIOR TO UNDERGROUND.

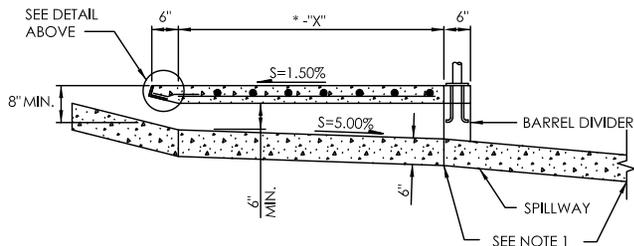
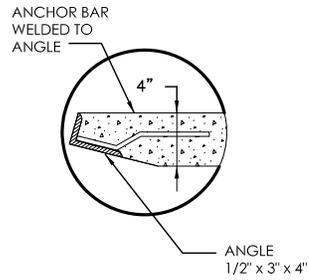
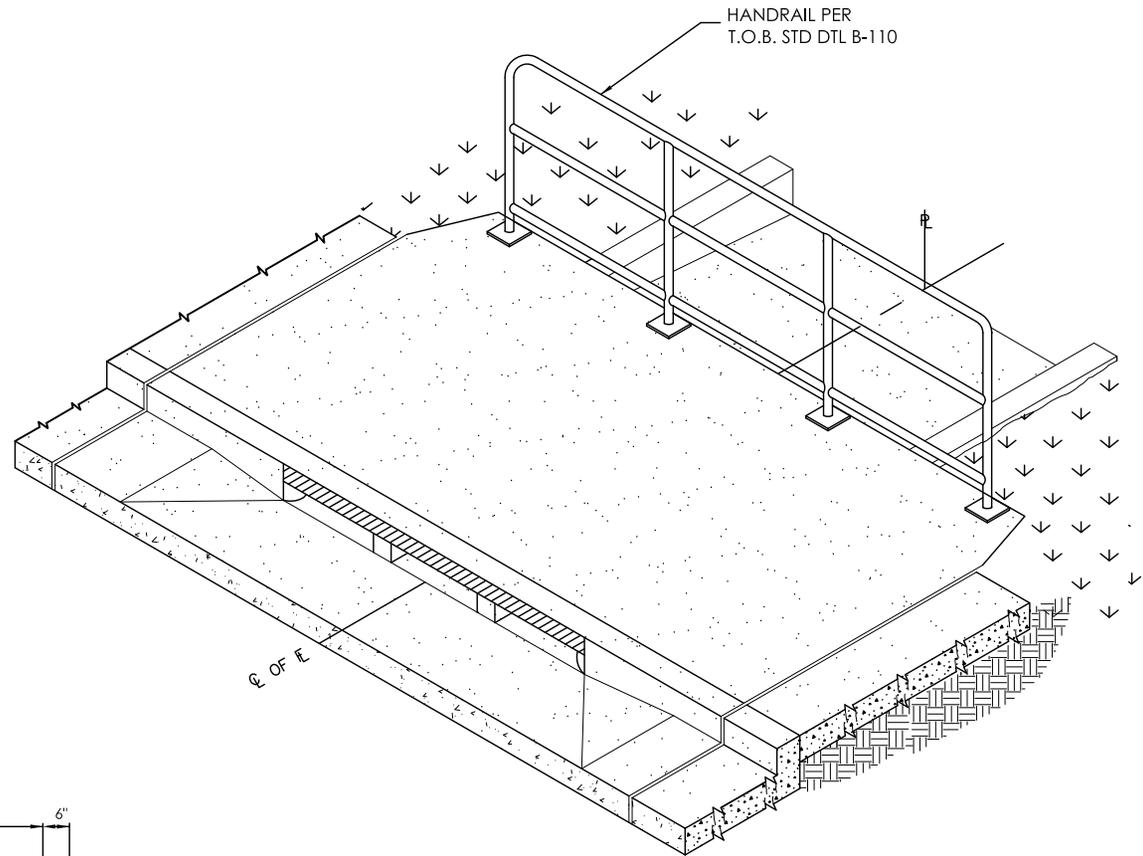
Basic design courtesy of
Torrent Resources, Inc



TOWN OF BUCKEYE, ARIZONA
CONSTRUCTION DETAILS

PETROCHEMICAL DRYWELL SYSTEM

DATE	REVISED	DETAIL #
08/2007	N/A	B-502



SECTION D-D
N.T.S.

- * - IF 4' SIDEWALK X=5'
- * - IF 6' SIDEWALK X=7'

S=10% IF APPROVED FOR USE
OVER DISTRICT IRRIGATION
PIPELINES

NOTES:

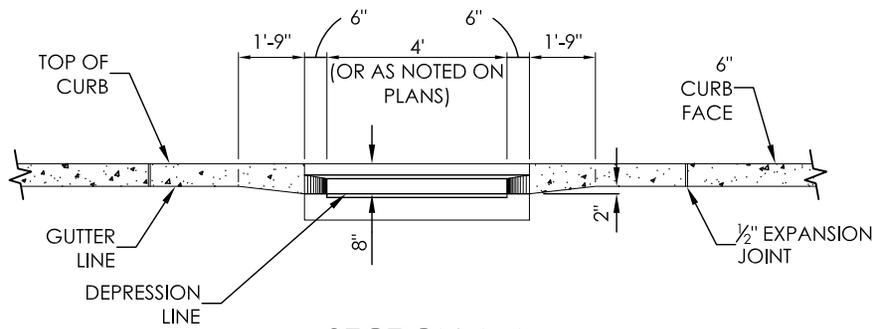
1. TRANSITION TO SPILLWAY/CHANNEL AS PER APPROVED PLANS.
2. A CENTER WALL SHALL BE INSTALLED IN SCUPPERS WIDER THAN 4' OR IF MORE THAN 1 SCUPPER IS BUILT IN SERIES.
3. EXPANSION JOINT FILLER SHALL BE 1/2" BITUMINOUS TYPE PREFORMED EXPANSION JOINT FILLER, A.S.T.M. D-1751.



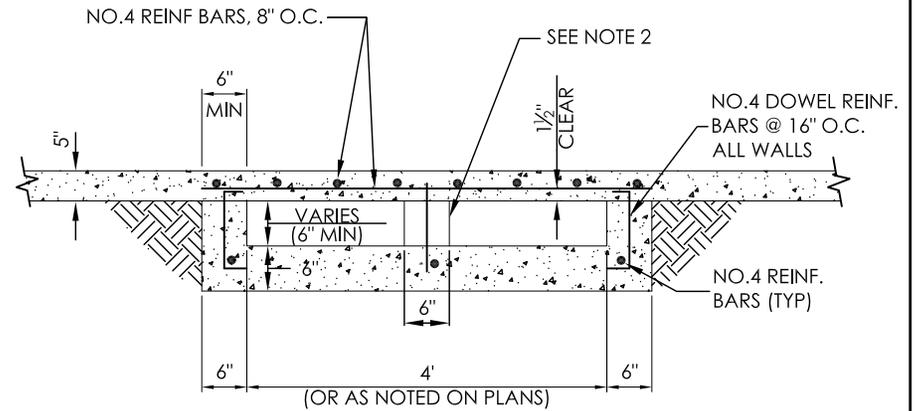
TOWN OF BUCKEYE, ARIZONA
CONSTRUCTION DETAILS

UNDER SIDEWALK SCUPPER

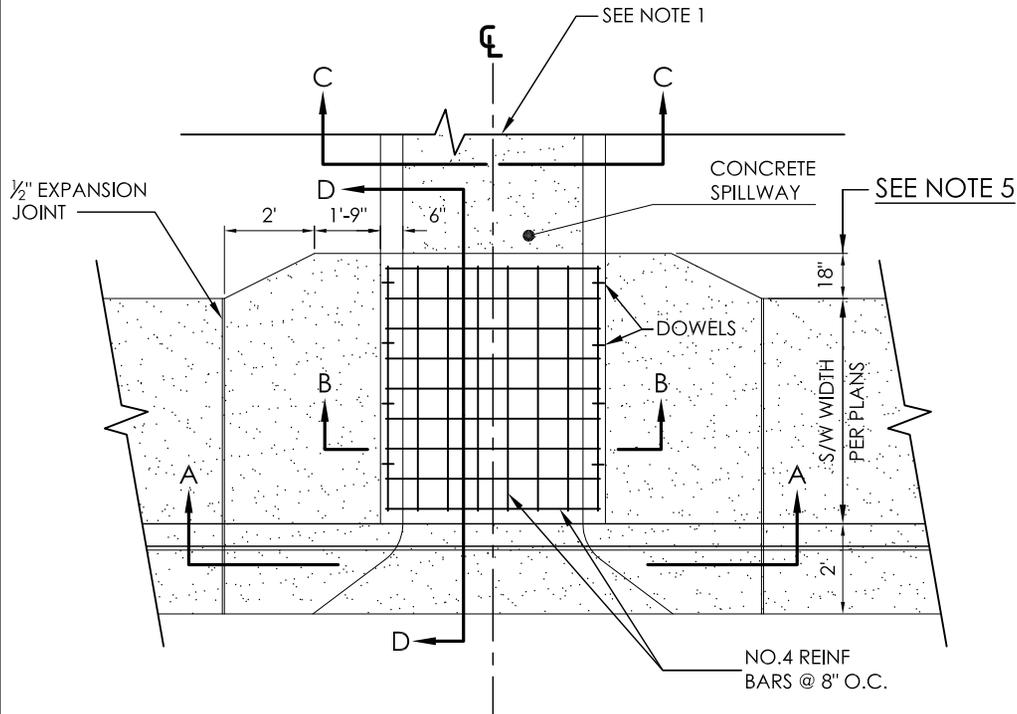
DATE	REVISED	DETAIL #
08/2007	N/A	B-505A



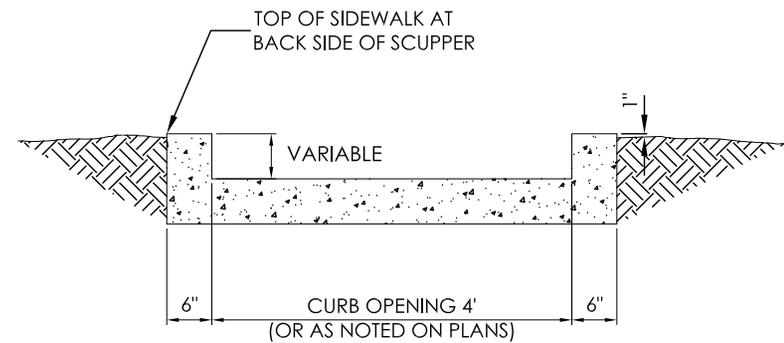
SECTION A-A



SECTION B-B



SCUPPER PLAN VIEW



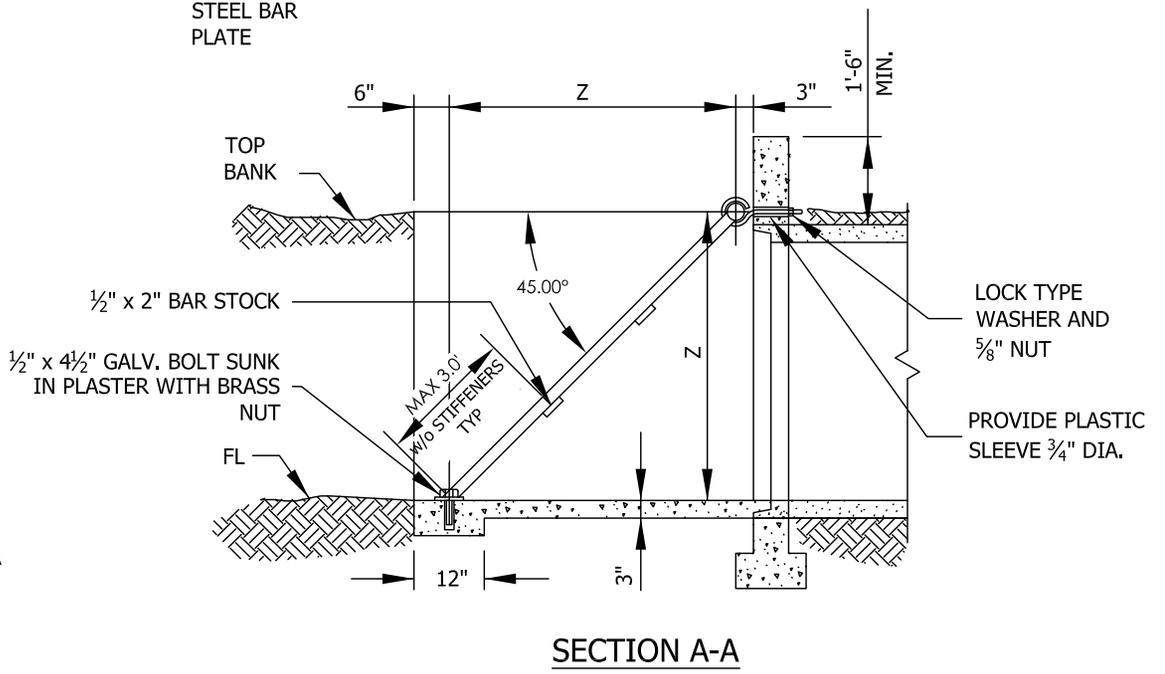
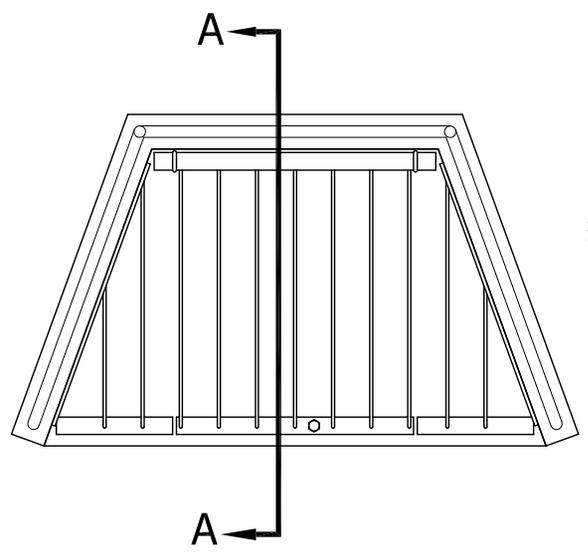
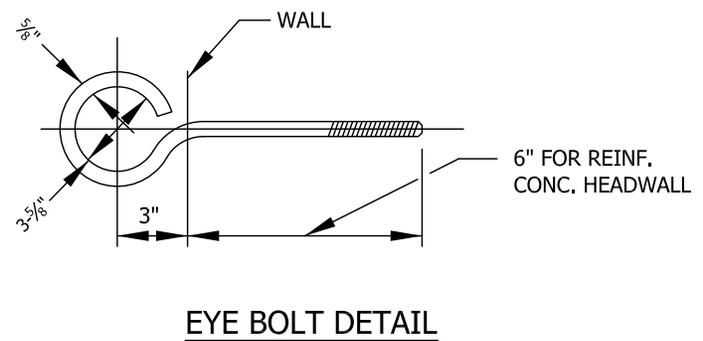
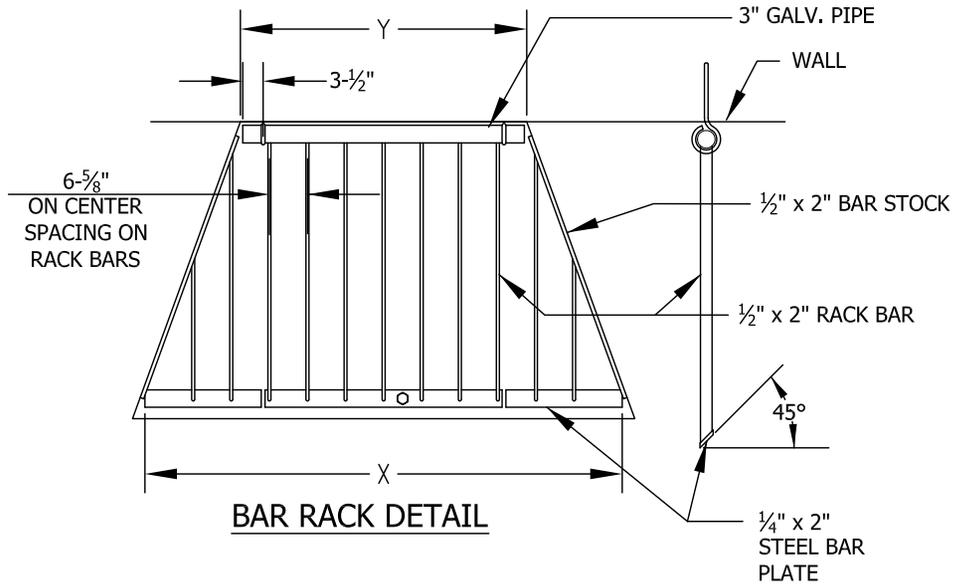
SECTION C-C SPILLWAY

NOTES:

1. TRANSITION TO SPILLWAY/CHANNEL AS PER APPROVED PLANS.
2. A CENTER WALL SHALL BE INSTALLED IN SCUPPERS WIDER THAN 4' OR IF MORE THAN ONE SCUPPER IS BUILT IN A SERIES.
3. EXPANSION JOINT FILLER SHALL BE 1/2" BITUMINOUS TYPE PREFORMED EXPANSION JOINT FILLER, ASTM D-1751.
4. CONCRETE FOR THE SCUPPER SHALL BE CLASS 'A' PER SECTION 725. CONCRETE FOR THE SPILLWAY SHALL BE CLASS 'A' OR CLASS 'B'.
5. 18" OFFSET DISTANCE SHALL BE INCREASED TO 3' FOR DESIGNATED BICYCLE PATHS.

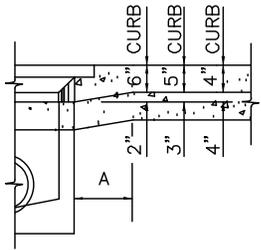


DATE	REVISED	DETAIL #
08/2007	N/A	B-505B

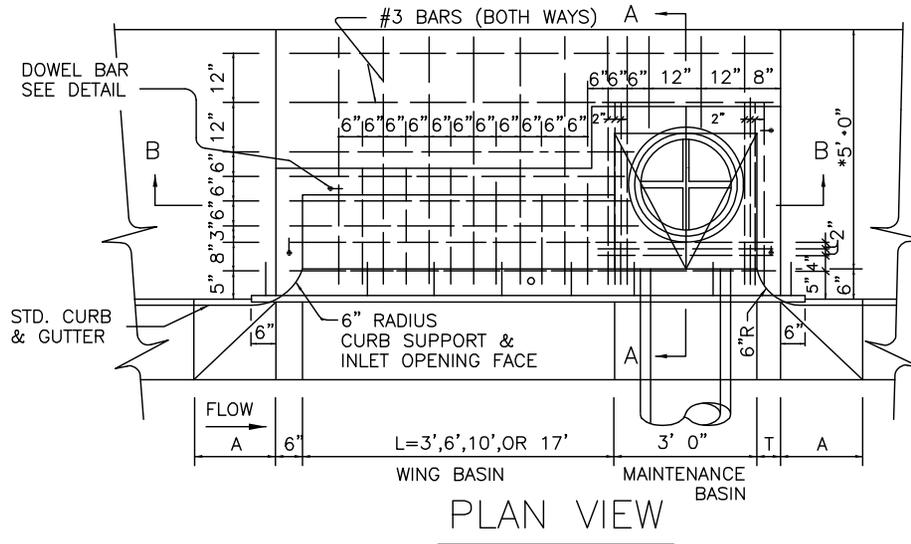


 TOWN OF BUCKEYE, ARIZONA CONSTRUCTION DETAILS	TRASH RACKS		DATE	REVISED	DETAIL #
			08/2007	N/A	B-508

GUTTER TRANSITION	
CURB HEIGHT	DIM 'A'
4"	3'-3"
5"	2'-6"
6"	1'-9"



DEPRESSED GUTTER

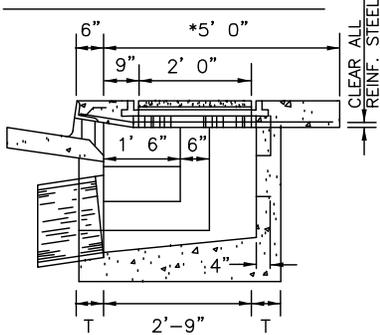


PLAN VIEW

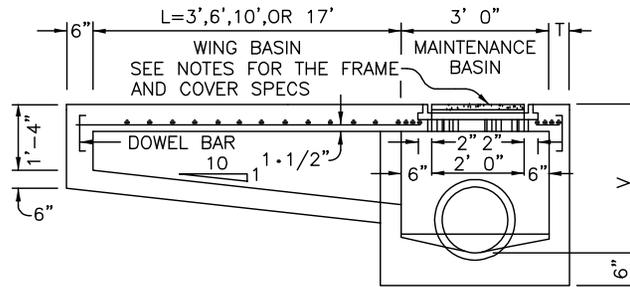
NOTES

1. ALL CONCRETE SHALL BE CLASS 'A'.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS AND SHALL CONFORM TO A.S.T.M. SPECIFICATION 615.
3. CONNECTOR PIPES SHALL BE PLACED IN THE APPROPRIATE WALL OF THE MAINTENANCE BASIN.
4. FLOOR OF BASIN SHALL BE TROWELLED TO A HARD, SMOOTH SURFACE AND SHALL SLOPE FROM ALL DIRECTIONS TO OUTLET.
5. CONSTRUCTION DRAINS SHALL BE INSTALLED IN WHEN NOTED.
6. LOCATE WING BASIN ON UPSTREAM SIDE OF MAINTENANCE BASIN FOR TYPE M-1. WING BASINS FOR TYPE M-2 SHALL BE BOTH SIDES OF MAINTENANCE BASIN.
7. ACCESS FRAME AND COVER PER MAG STD DETAIL 423 & 424

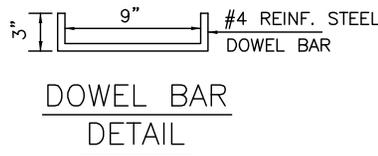
TRANSITION (BOTH SIDES)



SECTION A - A



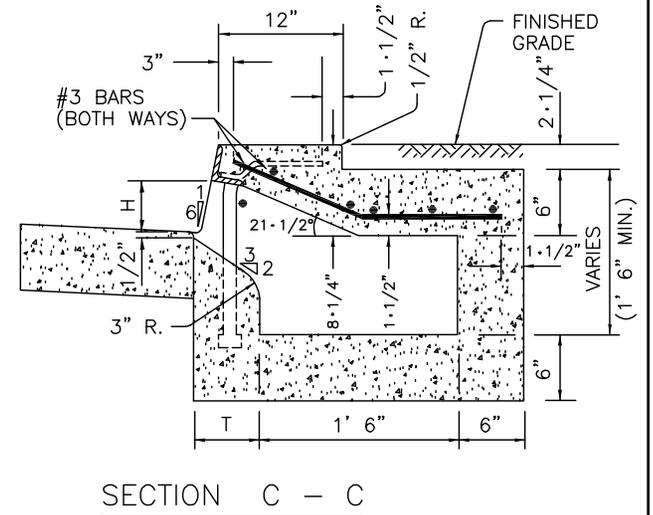
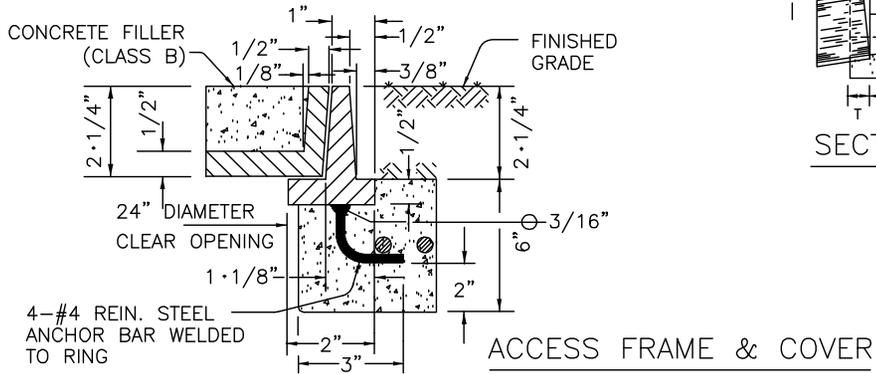
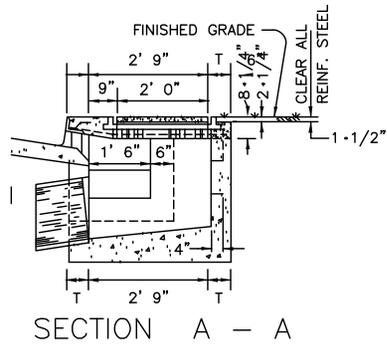
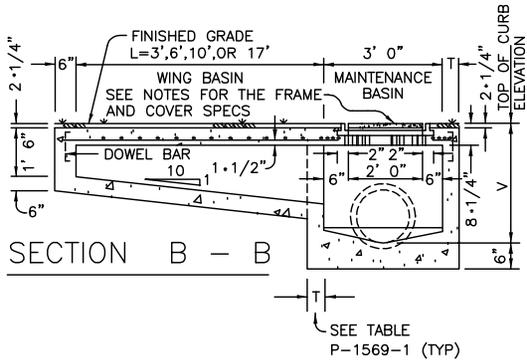
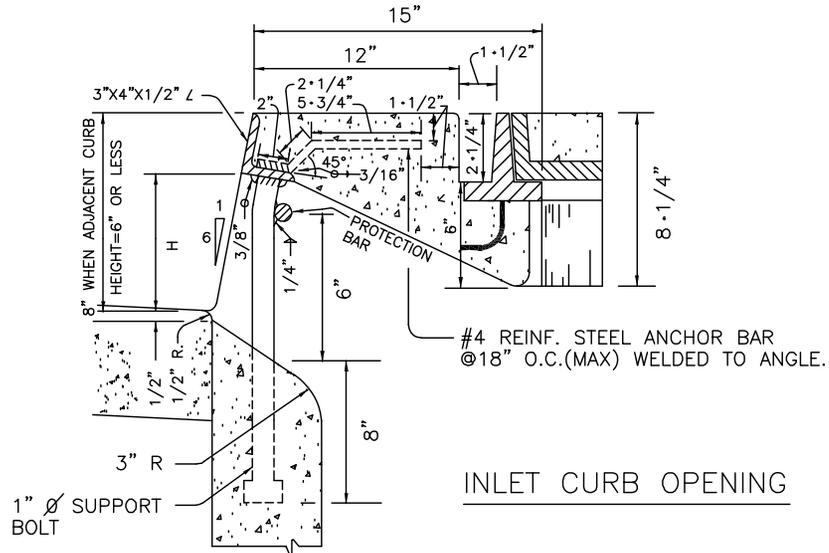
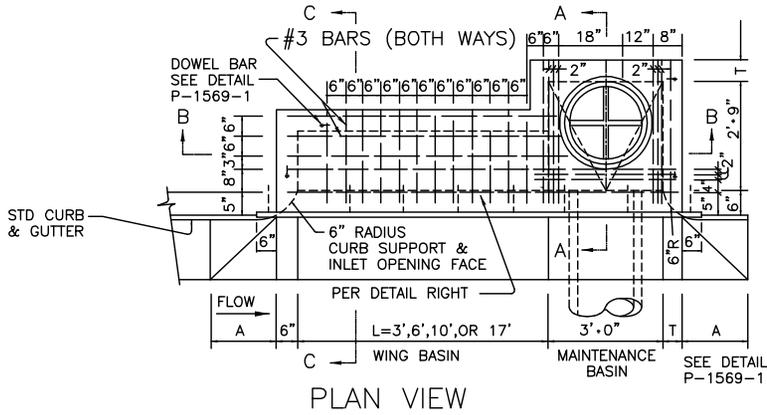
SECTION B - B



DOWEL BAR
DETAIL

CATCH BASIN WALL THICKNESS
T = 6" IF V = 4' OR LESS
T = 8" IF V = 4' TO 8'
(IF V EXCEEDS 8', SPECIAL DESIGN IS REQUIRED.)
L = 0' UNLESS SPECIFIED ON THE PLANS
V = 3'-6" MIN. WHEN L = 3' OR 6'
V = 4'-0" MIN WHEN L = 10' OR 17'

*4'-0" IN LOCATIONS WHERE 4' SIDEWALK IS REQ'D.



DATE	REVISED	DETAIL #
08/2007	N/A	B-510B