Exterior Building Color & Material Samples
Color Drawdowns
Drainage Reports
TIMA
Abbreveated Water & Sewer Need Report
Archaeological Resources
Airport Vicinity Development Checklist
Parking Study
Trip Generation Comparison
Parking Master Plan
Water Study
Wastewater Study
Stormwater Waiver Application

FILE COPY

DRAINAGE REPORT

FOR

Harley Davidson
15656 North Hayden Road
Scottsdale, AZ 85260

Prepared for:

K/G Architects

Prepared by:

TTG Engineers
4300 N. Miller Rd., Suite 122
Scottsdale, AZ 85251
Phone: (602) 371-1333 Fax: (602) 371-0675

Case
~~Plan #~~ 58-DR-2013
Case # _____
Q-S # _____
☑ Accepted
☐ Corrections
2-14-14
Reviewed By Date

REGISTERED PROFESSIONAL ENGINEER(CIVIL)
CERTIFICATE NO
38775
MIKE A.
JACKSON
Date Signed 1-29-14
ARIZONA, U.S.A.
EXPIRES 3/31/2015

January 29, 2014

58-DR-2013
1/30/14

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

Background / General Site Description

Harley Davidson of Scottsdale Arizona is planning to develop a new dealership located at the northwest corner of Northsight Boulevard and Hayden Road, in Scottsdale Arizona. The proposed development referred to in this report as "the project" is approximately 4.3 acres and slopes from north to south at an approximate slope of 0.85%. The project is currently developed with a vacant building and serves as an overflow parking lot for the adjacent auto dealership. The intersection of Hayden Road and Northsight Boulevard is currently under construction due the addition of a new round-a-bout. Offsite drainage will impact the site from the north and will be accounted for in the final grading of the project. All adjacent offsite street drainage is accounted for under a separate permit and will not impact the site.

Design Event

The drainage analysis of the project was performed based on regulatory guidance from the City of Scottsdale and the Flood Control District of Maricopa County. Based on this guidance, the 100 year - 2 hour storm event was selected as the design storm. Onsite and offsite flows will be captured in 3 above ground retention basins.

Scope of Report

The purpose of this report is to provide hydrological and hydraulic analysis for the Harley Davidson of Scottsdale project. This report will address onsite drainage and offsite drainage. Refer to **Appendix 1** for a vicinity map of the project.

DRAINAGE BACKGROUND

Flood Insurance Rate Map

The Flood Control District of Maricopa County;

This project resides in a Zone 'X' as noted on the FEMA / FIRM Map # 04013C1320L dated October 16, 2013.

Zone "X" is defined by FEMA as the following;

> "Areas of 0.2% annual chance of flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less that 1 square mile; areas protected by levees from 1% annual chance flood."

Refer to **Appendix 3** for a FIRM map of this site.

Finished Floor Elevation

The finished floor elevations for the project have been set a minimum of 1 foot above the 100-year flow outfall elevation.

HYDROLOGY

Onsite Drainage

The hydrologic analysis contained in this drainage report was performed using the Rational Method. There are 4 drainage areas; each area has been divided into smaller catchment sub-areas per the geometry of the grading design to calculate the individual peak discharges at critical points throughout the site. The peak flows for the 10-year and 100-year 2 hour storm events storms were calculated for each individual drainage sub-area. The Rational Method uses the following equation to compute the peak discharge:

$$Q = i\,A\,C$$

Where:

Q	=	Peak discharge in cubic feet per second (cfs),
i	=	Rainfall intensity in inches per hour,
A	=	Area of the drainage basis in acres,
C	=	Composite runoff coefficient.

Per the Design Standards & Policies Manual (DSPM) 2010, the composite C value used for this site is 0.86 (Per figure 4.1-4 Commercial & Industrial Areas, **Ref. 4**), however based on a recent conversation with the City, a runoff coefficient of 0.92 was chosen as it more accurately represents the the actual site conditions. The intensity was obtained directly from NOAA 14 **(Ref. 3)**. Refer to **Appendix 8** for the proposed on-site Grading and Drainage plan for the delineated drainage areas. Refer to **Appendix 5** for drainage calculations.

The design utilizes shallow surface flow to catch basins placed around the site which then convey runoff to the proposed retention basins. Surface flows will be routed along concrete gutters or on the asphalt pavement. The asphalt and concrete are designed to have a minimum slope of 1.0% to avoid localized ponding.

In the event that a storm event is greater than the design storm, or back to back storm events cause the retention basins to overflow, an ultimate outfall has been provided at each retention basin to safely pass the drainage to the adjacent offsites.

Offsite Drainage

TTG Engineers obtained the approved copy of as-built plans for the Van Chevrolet Airpark Chrysler-Jeep project from the City of Scottsdale to help identify and quantify the offsite flows that enter the site from the north as a result of the recent parcel lot split. Refer to **Appendix 2** for a copy of the Van Chevrolet Airpark Chrysler-Jeep as-built plans.

The as-built plans and ALTA survey show an existing parking lot, north of the proposed Harley Davidson project, which is separated into two different drainage areas by a CMU wall. Both areas are hydraulically connected to the proposed project; the runoff generated in both areas is collected in a series of 96" CMP underground storage pipes located within the Harley Davidson site. The volume provided from the existing storm drain system is 42,927CF (approximately 854LF). These pipes are located in the southeast corner of the site and are to be removed as part of the proposed improvements of this project.

Currently runoff from the western half of the offsite parking lot (to the north) sheet flows to a single offsite catch basin. This catch basin routes the runoff via underground storm drain pipe through the proposed Harley Davidson project to a series of existing 96" CMP storage pipes. The planned Harley Davidson improvements proposes to remove this existing pipe network and connect the existing offsite catch basin to the new proposed drainage network. As such, in order to not adversely impact the adjacent property, two additional catch basins, for a total of three catch basins, will be used for a maximum ponding elevation of 1.96-inches. The existing conditions allow a maximum ponding elevation (before break-over) of 0.19-feet or 2.28-inches. The flows generated offsite will be conveyed by the proposed onsite storm drain network to retention Basin B. Refer to **Appendix 6** for hydraulic calculations.

Runoff from the eastern half of the offsite parking lot (to the north) currently sheet flows through the proposed Harley Davidson site and enters existing onsite catch basins. The flows are then conveyed by underground pipes to the existing 96" CMP pipes. Because the existing

storm drain network will be removed, a 12" trench drain is proposed at the northern boarder of the project to collect the offsite flows generated on the eastern half of the offsite parking lot. By providing a 12" trench drain at the property boundary, all offsite runoff is captured with a total spread of approximately 9.53 feet. The flow captured in the trench drain will also be conveyed via the proposed pipe network to retention Basin B. Refer to **Appendix 6** for hydraulic calculations.

The aforementioned offsite flows will be retained in the proposed onsite retention Basin B. During the preparation of the final construction drawings, a cross drainage easement will be required for the routing and storage.

See **Appendix 8** for the Proposed On-Site Grading and Drainage Plan. The onsite grading and drainage plan illustrates the proposed drainage areas, flow patterns, proposed catch basins and storm drain pipe, as well as the proposed retention basin areas.

HYDRAULICS

The on-site rainfall runoff from the project will be routed via surface flow, and where necessary, by storm drain pipes to three proposed retention basins. The volume of runoff generated by the 100-year, 2-hour storm will be retained. Details of individual drainage components in the post-development conditions are discussed in the following paragraphs.

The Rational Method was used to calculate 100-year onsite flows for pavement drainage design. Where necessary an underground storm drain network was incorporated to convey the runoff generated from the design storm in each drainage area to a designated retention basin.

The catch-basins and underground system have been designed to collect and convey the 10-year peak flow. Catch basins have been designed with 0.5 foot ponding depth. The minimum storm drain pipe sized use is 18-inches (**Ref. 4**). Civil3D® was used to calculate all storm drain pipe sizing from each catch basin to the designated retention basin. Refer to **Appendix 6** for all storm drain calculations.

Landscape area drains are proposed to be used in the open space areas at the project frontage. The rims of the area drains will be set 0.2' lower than the adjacent hardscape outfall

elevation. They will be connected to an underground storm drain system that will convey by-pass flows to the proposed retention basin B. Refer to **Appendix 5** for hydraulic calculations.

RETENTION

The design storm for storm-water runoff retention is the 100-year 2 (two) hour storm event. The precipitation depth for the design storm event is 2.26 inches according to The National Oceanic and Atmospheric Administration (NOAA) (**Ref. 3**).

A total of 3 (three) above ground retention basins will be located in open spaces throughout the site. These retention basins will have a maximum depth, or high water elevation between 2 (two) and 3 (three) feet. In addition to the proposed retention basins, several landscape areas will be depressed to a 1 foot depth and be considered self-retaining areas. The volume for the onsite retention basins were calculated using Civil3D®. Refer to **Appendix 5** for retention basin calculations and the relative volume calculations (per foot volume).

For calculation purposes the site was divided into 4 drainage areas. Drainage areas 1 through 3 are onsite areas and drain to basins A through C respectively. Drainage area 4 is the offsite parking lot to the north which also drains to Basin B as discussed previously. Each drainage area has been subdivided for further analysis as discussed below.

The total required storage volume is 45,184 cubic feet or approximately 1.037 acre-feet. The following equation was applied to each drainage sub-area to calculate the required storage volume.

$$V_r = \left(\frac{P}{12}\right) * A * C$$

Where:

V_r	=	Required Storage Volume in Acre Feet
P	=	Precipitation Depth in Inches = 2.26 inches, per NOAA 14 (**Ref. 3**)
A	=	Area in Acres
C	=	Runoff coefficient (0.92)

Appendix 5 shows the required storage volume calculated for each drainage sub-area and total for the site. The total volume provided in the three basins is 47,570 cubic feet or 1.092 acre-feet.

The design standards call for positive means to drain retention basins within 36 hours, per Maricopa County and the State of Arizona standards. No percolation tests have yet been performed for this project. Preliminary drywell calculations were performed using an assumed infiltration rate of 0.1 cubic feet per second (cfs). Based on the calculations, a preliminary estimate six (6) drywells will be required; one (1) drywell in retention basins A & C and four (4) drywells in retention basin B. When the final grading is completed, percolation tests for each retention basin will be performed, by a licensed geotechnical engineer. Calculations, based on these results will be performed to verify the number of required drywells.

Refer to **Appendix 8**, Proposed On-Site Grading and Drainage Plan, which shows the proposed drainage areas, flow patterns, proposed catch basins and storm drain pipe, as well as the proposed retention basin areas.

SPECIAL CONDITIONS

None

WARNING AND DISCLAIMER OF LIABILITY

Refer to **Appendix 7** for a copy of the Warning & Disclaimer of Liability form.

CONCLUSION

The proposed Harley Davidson of Scottsdale Arizona development is in compliance with the City of Scottsdale criteria and other required drainage laws. No adverse drainage impacts are expected to either downstream existing properties or drainage ways from the site.

The runoff generated onsite will be conveyed via surface sheet flow or via underground storm drain pipe to above ground retention basins located throughout the projects open space areas. The flows will ultimately discharge into the ground via natural percolation and six (6) proposed drywells.

REFERENCES

1. Flood Control District of Maricopa County, 2003 (draft). Drainage Design Manual for Maricopa County, Arizona, Volume 1 – Hydrology.
2. Flood Control District of Maricopa County, 2003 (draft). Drainage Design Manual for Maricopa County, Arizona, Volume 2 – Hydraulics.
3. NOAA 14 – Hydrometeorological Design Studies Center www.http://dipper.nws.noaa.gov/hdsc/pfds/
4. Design Standards & Policies Manual, Chapter 4 - Grading and Drainage, City of Scottsdale - January 2010

Appendix 1: Vicinity Map

TTG TMAD TAYLOR & GAINES
• STRUCTURAL
• MECHANICAL
• ELECTRICAL
• CIVIL
4300 N. Miller Rd, Suite 122
Scottsdale, Arizona 85251
Phone: 602.371.1333 Fax: 602.371.0675

APPENDIX 1
VICINITY MAP

Date 10.30.13	Scale NTS
TTG Job No. 0613035.00	Sheet No. EX–1
Drawn By SRBS	

Appendix 2: As-built plans for the Van Chevrolet Airpark Chrysler-Jeep

MATCHLINE SEE SHEET C4

MATCHLINE SEE SHEET C4

MATCHLINE SEE SHEET C7

EXISTING CHRYSLER-JEEP SERVICE BUILDING

EXISTING CHRYSLER-JEEP SALES BUILDING
EX. FF 1501.61

NORTHSIGHT BLVD.

HACIENDA HARLEY DAVIDSON

HAYDEN ROAD

SONORAN VILLAGE
AMC THEATRE

SEE SHEET C22 FOR OFFSITE IMPROVEMENTS

CONSTRUCTION NOTES

PAVEMENT

1. CONSTRUCT A.C. PAVEMENT FOR TRUCK LANE PER DETAIL ON SHEET C21.
2. CONSTRUCT A.C. PAVEMENT FOR AUTO PARKING PER DETAIL ON SHEET C21.
3. CONSTRUCT VERTICAL CURB AND GUTTER PER M.A.G. STD. DETAIL 220 TYPE 'A'.
4. CONSTRUCT SINGLE CURB PER M.A.G. STD. DETAIL 222, TYPE 'A'.
5. CONSTRUCT TYPE 'F' CATCH BASIN PER M.A.G. STD. DETAIL 535.
6. CONSTRUCT SCREEN 18" WALL PER DETAILS ON ARCHITECTURAL PLANS.
7. CONSTRUCT 3' WIDE VALLEY GUTTER PER M.A.G. STD. DETAIL 240.
8. ADJUST VALVE BOX OR CLEANOUT TO GRADE. PER C.O.S. DETAIL 2270.
9. ADJUST MANHOLE TO GRADE PER C.O.S. STD. DETAIL 2270.
10. INSTALL 4" P.V.C. PIPE FOR MONITORING PURPOSES. SEE DETAIL ON SHEET C20.
11. INSTALL 18" H.D.P.E. STORM DRAIN AND CONNECT TO EXISTING STORM DRAIN WITH COLLAR PER M.A.G. STD. DETAIL 524.
12. INSTALL 12" H.D.P.E. STORM DRAIN.
13. INSTALL 18" H.D.P.E. STORM DRAIN.
14. INSTALL 45° BEND FOR STORM DRAIN.
15. INSTALL 8" P.V.C. DRAIN LINE. CONNECT TO EXISTING ROOF DRAINS AND CONNECT TO 18" STORM DRAIN WITH TEE.
16. SAWCUT CURB AND CONSTRUCT 1' CURB OPENING. RESHAPE PLANTER GRADE TO CURB OPENING.
17. INSTALL 8" DRAIN LINE AND CONNECT TO 18" STORM DRAIN WITH 18"x8" TEE.
18. INSTALL 96" C.M.P. 12 GA. DRAIN PIPE WITH 48" MANHOLE PER M.A.G. STD. DETAILS 520 & 521.
19. INSTALL 1050 GALLON 3 CHAMBER SAND/OIL SEPARATOR PER DETAILS ON SHEET C20.
20. CONSTRUCT STORM DRAIN MANHOLE PER M.A.G. STD. DETAIL 520 WITH SAND PUMP PER DETAILS ON SHEET C20.
21. CONSTRUCT STORM DRAIN MANHOLE PER M.A.G. STD. DETAIL 520 WITH GRATED LID.
22. INSTALL 4" P.V.C. DRAIN LINE FROM STORM DRAIN MANHOLE AND CONNECT TO 12" STORM DRAIN. SEE DETAIL ON SHEET C20.
23. INSTALL 12" P.V.C. DRAIN LINES FROM 96" C.M.P. TO SAND/OIL SEPARATOR TO STORM DRAIN MANHOLE. SEE DETAIL ON SHEET C20.
24. CONSTRUCT JYPE 'M' CATCH BASIN PER DETAILS ON SHEET C21.
25. SAWCUT TO NEAT EDGE FOR MATCHING, SEE SHEET C2 FOR REMOVALS.
26. CONSTRUCT VERTICAL CURB AND GUTTER WITH DEPRESSED LIP PER C.O.S. STD. DETAIL 2220.
27. CONSTRUCT 6' SECURITY WALL PER DETAILS ON ARCHITECTURAL PLANS.
28. CONSTRUCT CH-1 DRIVEWAY PER C.O.S. STD. DETAIL 2257.
29. CONSTRUCT TYPE 'M' CATCH BASIN PER DETAILS P-1560 ON SHEET C21, AND CONNECT 36" C.M.P. WITH 24" C.M.P. CONNECTOR PIPE PER M.A.G. STD. DETAIL 510. L=10

SEE SHEET C9-C12
FOR UTILITIES

SCALE: 1" = 20'
0' 20' 40' 60'

10277
DAVID A. GILBERTSON
12-31-05
REGISTERED PROFESSIONAL ENGINEER
ARIZONA U.S.A.

54222

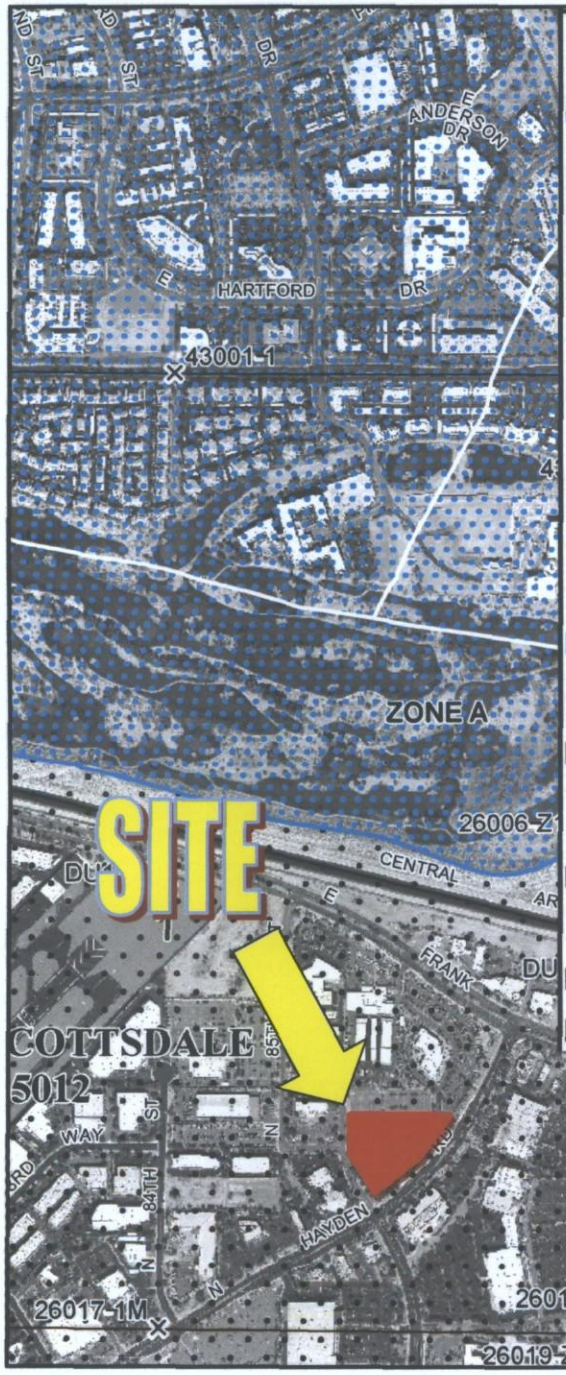
GILBERTSON ASSOCIATES inc.
consulting civil engineers & land surveyors
8502 East Princess Drive . Scottsdale, Arizona 85255-5426 (480)607-2344

VAN CHEVROLET & AIRPARK CHRYSLER-JEEP

GRADING, DRAINAGE, AND PAVING
8585 E. FRANK LLOYD WRIGHT BLVD.
15656 N. HAYDEN ROAD

Designed by TAE	Drawn by RNB / CLM
Date MARCH 7, 2005	Job No. 40128	Sheet C5 of 25

QS 35-48 24-DR-2003 73-NP-04 784-04



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1320L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1320 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1320	L
PHOENIX, CITY OF	040051	1320	L
SCOTTSDALE, CITY OF	045012	1320	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1320L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

Appendix 4: Precipitation/Rainfall Data

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, US*
Coordinates: 33.6271, -111.8955
Elevation: 1500 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.33 (1.93-2.86)	3.04 (2.54-3.72)	4.09 (3.40-5.00)	4.92 (4.06-5.98)	6.01 (4.87-7.28)	6.85 (5.50-8.23)	7.72 (6.07-9.26)	8.57 (6.65-10.3)	9.73 (7.36-11.7)	10.6 (7.86-12.8)
10-min	1.77 (1.47-2.17)	2.31 (1.93-2.83)	3.12 (2.59-3.80)	3.74 (3.08-4.55)	4.57 (3.71-5.54)	5.21 (4.18-6.27)	5.87 (4.63-7.05)	6.52 (5.05-7.82)	7.41 (5.60-8.90)	8.08 (5.98-9.72)
15-min	1.46 (1.22-1.79)	1.91 (1.60-2.34)	2.58 (2.13-3.14)	3.09 (2.55-3.76)	3.78 (3.06-4.58)	4.30 (3.45-5.18)	4.85 (3.82-5.83)	5.39 (4.18-6.46)	6.12 (4.62-7.35)	6.68 (4.94-8.03)
30-min	0.984 (0.818-1.21)	1.29 (1.08-1.58)	1.74 (1.44-2.12)	2.08 (1.72-2.53)	2.54 (2.06-3.09)	2.90 (2.33-3.49)	3.27 (2.57-3.92)	3.63 (2.81-4.35)	4.12 (3.11-4.95)	4.50 (3.33-5.41)
60-min	0.609 (0.506-0.746)	0.796 (0.665-0.976)	1.07 (0.889-1.31)	1.29 (1.06-1.57)	1.57 (1.28-1.91)	1.79 (1.44-2.16)	2.02 (1.59-2.43)	2.25 (1.74-2.69)	2.55 (1.93-3.06)	2.78 (2.06-3.35)
2-hr	0.356 (0.300-0.426)	0.462 (0.390-0.553)	0.614 (0.516-0.732)	0.730 (0.607-0.870)	0.890 (0.733-1.05)	1.01 (0.820-1.19)	1.14 (0.906-1.34)	1.26 (0.990-1.48)	1.43 (1.10-1.68)	1.56 (1.17-1.84)
3-hr	0.263 (0.222-0.323)	0.337 (0.285-0.415)	0.440 (0.370-0.539)	0.522 (0.434-0.635)	0.636 (0.521-0.769)	0.728 (0.588-0.874)	0.822 (0.652-0.987)	0.921 (0.718-1.10)	1.06 (0.799-1.27)	1.17 (0.861-1.40)
6-hr	0.159 (0.137-0.189)	0.201 (0.172-0.239)	0.256 (0.218-0.303)	0.300 (0.254-0.354)	0.361 (0.301-0.423)	0.407 (0.334-0.476)	0.456 (0.369-0.532)	0.506 (0.402-0.592)	0.573 (0.444-0.669)	0.627 (0.474-0.733)
12-hr	0.089 (0.077-0.105)	0.112 (0.096-0.132)	0.141 (0.121-0.166)	0.164 (0.140-0.192)	0.195 (0.164-0.228)	0.219 (0.182-0.255)	0.244 (0.200-0.283)	0.269 (0.217-0.312)	0.302 (0.238-0.352)	0.327 (0.254-0.385)
24-hr	0.052 (0.046-0.060)	0.066 (0.058-0.076)	0.085 (0.075-0.099)	0.101 (0.088-0.116)	0.122 (0.106-0.140)	0.139 (0.119-0.159)	0.156 (0.133-0.180)	0.175 (0.147-0.201)	0.200 (0.166-0.230)	0.220 (0.180-0.254)
2-day	0.028 (0.025-0.032)	0.036 (0.031-0.041)	0.047 (0.041-0.054)	0.056 (0.048-0.064)	0.068 (0.059-0.078)	0.078 (0.066-0.089)	0.088 (0.075-0.101)	0.099 (0.083-0.114)	0.114 (0.094-0.132)	0.126 (0.102-0.146)
3-day	0.020 (0.018-0.023)	0.026 (0.023-0.030)	0.034 (0.030-0.039)	0.041 (0.035-0.046)	0.050 (0.043-0.057)	0.057 (0.049-0.065)	0.065 (0.056-0.075)	0.074 (0.062-0.085)	0.086 (0.071-0.098)	0.095 (0.078-0.110)
4-day	0.016 (0.014-0.019)	0.021 (0.018-0.024)	0.028 (0.024-0.031)	0.033 (0.029-0.037)	0.041 (0.036-0.046)	0.047 (0.041-0.054)	0.054 (0.046-0.061)	0.061 (0.052-0.070)	0.071 (0.060-0.082)	0.080 (0.066-0.092)
7-day	0.010 (0.009-0.012)	0.013 (0.012-0.015)	0.018 (0.016-0.020)	0.021 (0.019-0.024)	0.026 (0.023-0.030)	0.030 (0.026-0.035)	0.035 (0.030-0.040)	0.040 (0.033-0.045)	0.046 (0.039-0.053)	0.052 (0.043-0.060)
10-day	0.008 (0.007-0.009)	0.010 (0.009-0.012)	0.013 (0.012-0.015)	0.016 (0.014-0.018)	0.020 (0.017-0.023)	0.023 (0.020-0.026)	0.026 (0.022-0.030)	0.030 (0.025-0.034)	0.035 (0.029-0.040)	0.039 (0.032-0.044)
20-day	0.005 (0.004-0.006)	0.006 (0.006-0.007)	0.008 (0.007-0.010)	0.010 (0.009-0.011)	0.012 (0.011-0.014)	0.014 (0.012-0.016)	0.015 (0.013-0.018)	0.017 (0.015-0.020)	0.019 (0.017-0.022)	0.021 (0.018-0.024)
30-day	0.004 (0.003-0.004)	0.005 (0.004-0.006)	0.007 (0.006-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.011 (0.009-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.015)	0.015 (0.013-0.017)	0.017 (0.014-0.019)
45-day	0.003 (0.003-0.003)	0.004 (0.003-0.004)	0.005 (0.005-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.012)	0.011 (0.010-0.013)	0.012 (0.011-0.014)
60-day	0.002 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.007 (0.007-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.008-0.011)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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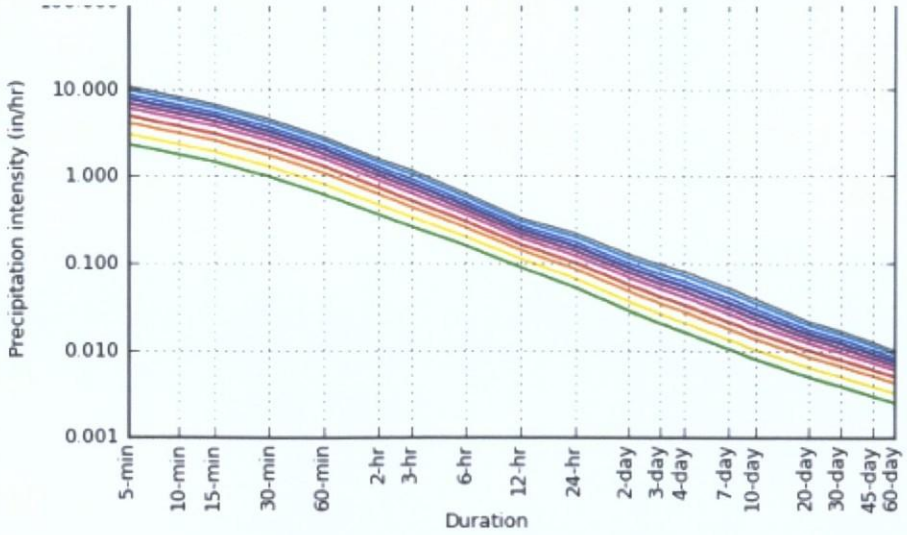
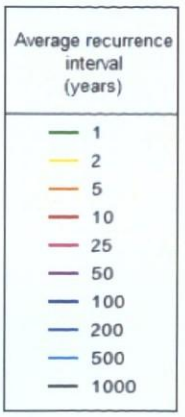
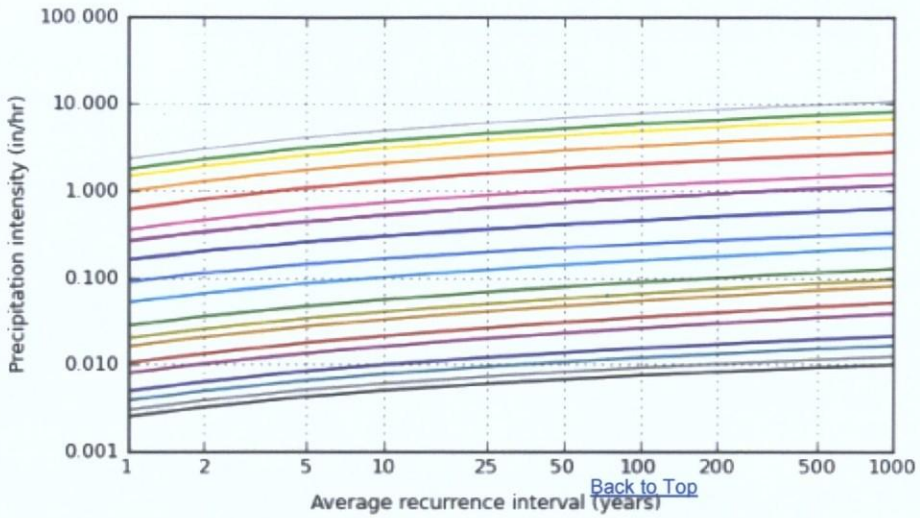
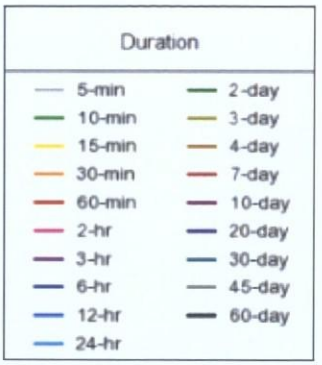
PF graphical









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Small scale terrain

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National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, US*
Coordinates: 33.6273, -111.8961
Elevation: 1499 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.193 (0.160–0.236)	0.252 (0.211–0.308)	0.339 (0.281–0.414)	0.407 (0.336–0.494)	0.498 (0.404–0.603)	0.567 (0.455–0.681)	0.639 (0.504–0.767)	0.710 (0.551–0.850)	0.807 (0.610–0.968)	0.881 (0.653–1.06)
10-min	0.293 (0.243–0.359)	0.383 (0.321–0.469)	0.516 (0.428–0.629)	0.619 (0.511–0.753)	0.757 (0.615–0.917)	0.863 (0.693–1.04)	0.973 (0.767–1.17)	1.08 (0.838–1.29)	1.23 (0.929–1.47)	1.34 (0.993–1.61)
15-min	0.364 (0.302–0.445)	0.475 (0.398–0.581)	0.640 (0.530–0.780)	0.768 (0.634–0.933)	0.939 (0.763–1.14)	1.07 (0.859–1.29)	1.21 (0.951–1.45)	1.34 (1.04–1.60)	1.52 (1.15–1.83)	1.66 (1.23–1.99)
30-min	0.490 (0.407–0.599)	0.640 (0.536–0.782)	0.862 (0.714–1.05)	1.03 (0.853–1.26)	1.27 (1.03–1.53)	1.44 (1.16–1.73)	1.62 (1.28–1.95)	1.80 (1.40–2.16)	2.05 (1.55–2.46)	2.24 (1.66–2.69)
60-min	0.606 (0.503–0.741)	0.792 (0.663–0.968)	1.07 (0.884–1.30)	1.28 (1.06–1.56)	1.57 (1.27–1.90)	1.78 (1.43–2.14)	2.01 (1.59–2.41)	2.23 (1.73–2.67)	2.54 (1.92–3.04)	2.77 (2.05–3.32)
2-hr	0.709 (0.597–0.847)	0.917 (0.776–1.10)	1.22 (1.03–1.45)	1.45 (1.21–1.73)	1.77 (1.46–2.09)	2.01 (1.63–2.37)	2.26 (1.80–2.65)	2.50 (1.97–2.94)	2.84 (2.19–3.34)	3.10 (2.33–3.66)
3-hr	0.788 (0.664–0.965)	1.01 (0.853–1.24)	1.32 (1.11–1.61)	1.56 (1.30–1.90)	1.90 (1.56–2.30)	2.18 (1.76–2.61)	2.46 (1.95–2.95)	2.76 (2.15–3.30)	3.16 (2.39–3.78)	3.49 (2.58–4.17)
6-hr	0.950 (0.816–1.13)	1.20 (1.03–1.43)	1.53 (1.30–1.81)	1.79 (1.51–2.11)	2.15 (1.79–2.52)	2.43 (2.00–2.84)	2.72 (2.20–3.17)	3.02 (2.40–3.53)	3.42 (2.65–3.99)	3.74 (2.83–4.37)
12-hr	1.07 (0.916–1.26)	1.34 (1.15–1.58)	1.69 (1.45–1.99)	1.97 (1.67–2.30)	2.34 (1.97–2.73)	2.62 (2.18–3.06)	2.92 (2.39–3.39)	3.21 (2.60–3.74)	3.61 (2.85–4.22)	3.92 (3.03–4.61)
24-hr	1.24 (1.09–1.44)	1.58 (1.38–1.83)	2.03 (1.78–2.35)	2.39 (2.09–2.77)	2.90 (2.51–3.34)	3.30 (2.83–3.80)	3.72 (3.15–4.29)	4.15 (3.48–4.78)	4.76 (3.91–5.48)	5.23 (4.25–6.06)
2-day	1.34 (1.16–1.55)	1.70 (1.48–1.97)	2.23 (1.93–2.57)	2.64 (2.28–3.05)	3.22 (2.76–3.71)	3.68 (3.12–4.23)	4.16 (3.50–4.80)	4.66 (3.89–5.39)	5.36 (4.40–6.21)	5.92 (4.78–6.89)
3-day	1.44 (1.26–1.65)	1.84 (1.61–2.11)	2.42 (2.11–2.77)	2.88 (2.51–3.30)	3.54 (3.06–4.05)	4.07 (3.49–4.65)	4.63 (3.94–5.30)	5.22 (4.40–6.00)	6.05 (5.02–6.97)	6.73 (5.51–7.78)
4-day	1.54 (1.36–1.76)	1.97 (1.74–2.25)	2.61 (2.29–2.97)	3.12 (2.74–3.55)	3.86 (3.36–4.39)	4.46 (3.86–5.07)	5.10 (4.38–5.81)	5.78 (4.91–6.61)	6.75 (5.65–7.73)	7.54 (6.24–8.68)
7-day	1.74 (1.52–1.99)	2.22 (1.95–2.54)	2.94 (2.58–3.37)	3.53 (3.08–4.04)	4.37 (3.79–4.99)	5.05 (4.35–5.77)	5.78 (4.93–6.61)	6.55 (5.54–7.53)	7.66 (6.38–8.82)	8.56 (7.04–9.90)
10-day	1.88 (1.66–2.15)	2.41 (2.12–2.76)	3.19 (2.80–3.64)	3.82 (3.34–4.35)	4.71 (4.09–5.36)	5.44 (4.69–6.17)	6.20 (5.31–7.06)	7.02 (5.95–8.01)	8.16 (6.83–9.35)	9.10 (7.51–10.5)
20-day	2.33 (2.06–2.66)	3.00 (2.65–3.41)	3.97 (3.49–4.51)	4.71 (4.13–5.34)	5.70 (4.99–6.47)	6.48 (5.64–7.35)	7.27 (6.29–8.28)	8.09 (6.95–9.23)	9.19 (7.81–10.5)	10.0 (8.47–11.6)
30-day	2.74 (2.41–3.11)	3.52 (3.11–4.00)	4.65 (4.09–5.27)	5.51 (4.84–6.24)	6.68 (5.83–7.56)	7.58 (6.59–8.57)	8.50 (7.35–9.62)	9.45 (8.11–10.7)	10.7 (9.13–12.2)	11.7 (9.88–13.4)
45-day	3.19 (2.82–3.61)	4.11 (3.64–4.65)	5.42 (4.80–6.13)	6.40 (5.65–7.24)	7.71 (6.76–8.71)	8.70 (7.60–9.84)	9.71 (8.43–11.0)	10.7 (9.26–12.2)	12.1 (10.3–13.8)	13.1 (11.1–15.0)
60-day	3.53 (3.14–3.99)	4.57 (4.06–5.16)	6.02 (5.34–6.78)	7.08 (6.26–7.98)	8.47 (7.46–9.55)	9.51 (8.34–10.7)	10.6 (9.21–11.9)	11.6 (10.1–13.1)	13.0 (11.2–14.8)	14.0 (12.0–16.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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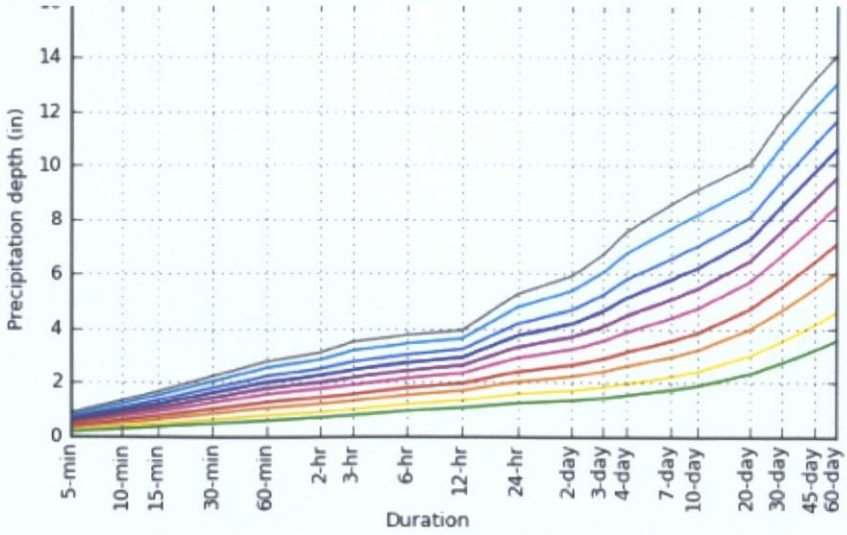
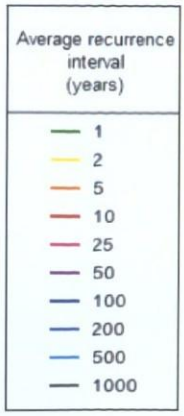
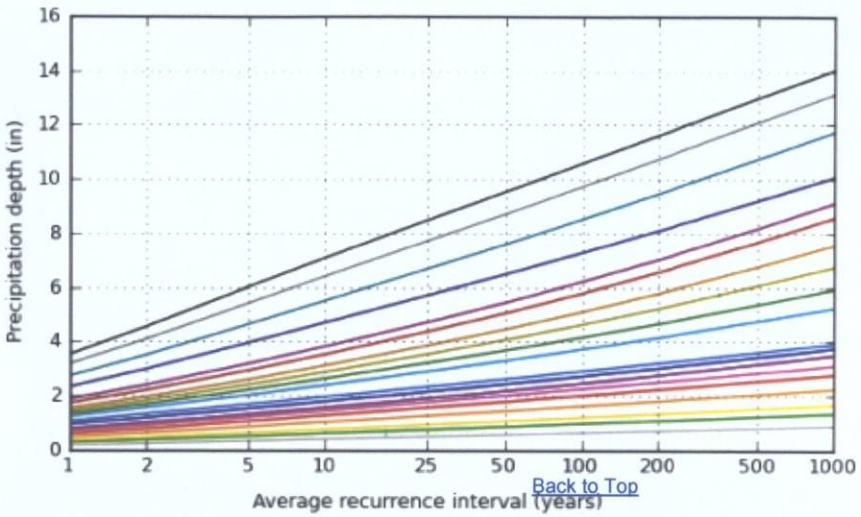
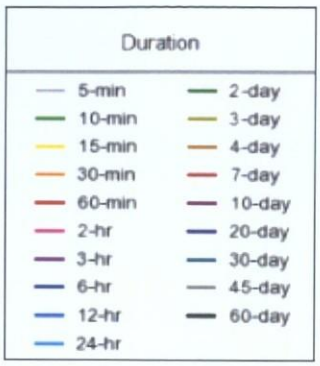
PF graphical









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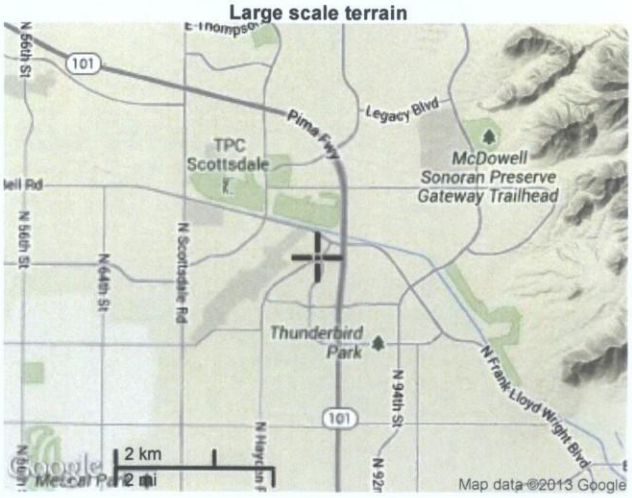
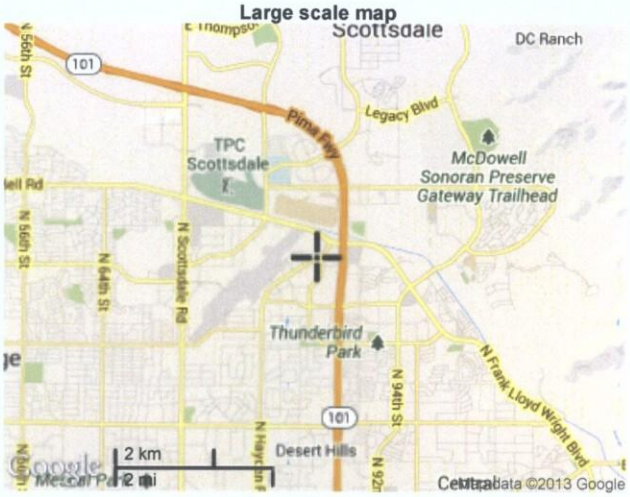
Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

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Appendix 5: Hydrologic/Hydraulic Calculations

Hydrology - Retention Calculations

Drainage Area	Area Total ($ft.^2$)	Area Total (ac)	Composite Runoff Coefficient "C"	Required Storage Volume ($ft.^3$)	Provided Storage Volume ($ft.^3$)	Designated Basin	Bypassed Volume ($ft.^3$)	Bypass Downstream Basin (name)	Total Required Storage Volume with Bypass Volume ($ft.^3$)	Provided Storage Volume ($ft.^3$)	Excess Volume ($ft.^3$)
1	20,823	0.48	0.92	3,608	3,758	A	0	--	3,608	3,758	-150
2	153,620	3.53	0.92	26,617	42,356	B	0	--	40,712	42,356	-1,644
3	4,991	0.11	0.92	865	1,456	C	0	--	865	1,456	-591
4	81,346	1.87	0.92	14,095	0	Bypass	14,095	Basin B	--	0	--
Total	260,780	5.99	--	45,184	47,570		--	--	45,184	47,570	-2,386

Flow Volumes are to be considered: (-) Surplus and (+) Shortage

Runoff coefficient C = 0.92

100-yr, 2 hr precipitation = 2.26" Per NOAA14

Hydraulics - Peak Discharges

Scupper Drainage Area	Area Total ($ft.^2$)[1]	Area Total (ac)	Weighted Runoff Coefficient "C"	Min time of Concentration (min.)	Street Length (ft.)	Minimum Street Slope (ft-ft)	Street Travel Time- (min)	Calculated Time of Concentration (min.)	Minimum Time of Concentration (min.)	Precipitation Intensity 10yr (in./hr.)	Precipitation Intensity 100yr (in./hr.)	10-Year Peak Discharge (cfs)	100-Year Peak Discharge (cfs)
2A	10,767	0.25	0.92	5	156	0.005	1.3	1.3	5.0	4.92	7.72	1.12	1.76
2B	19,852	0.46	0.92	5	132	0.005	1.1	1.1	5.0	4.92	7.72	2.06	3.24
2C	20,818	0.48	0.92	5	12	0.005	0.1	0.1	5.0	4.92	7.72	2.16	3.39
2D	706	0.02	0.92	5	218	0.005	1.8	1.8	5.0	4.92	7.72	0.07	0.12
4A	31,039	0.71	0.92	5	161	0.005	1.3	1.3	5.0	4.92	7.72	3.23	5.06
4B	50,307	1.15	0.92	5	227	0.005	1.9	1.9	5.0	4.92	7.72	5.23	8.20
Total	133,489	3.06	--	--	--	--	--	--	--	--	--	13.87	21.77

NOTES

1. Total areas include only those hardscape areas draining to a catch basin or curb opening
2. Minimum time of concentration shall be 5 minutes
3. 100-yr, 2 hr precipitation = 2.26" Per NOAA14
4. 10-yr, 2 hr precipitation intensity = 4.92" Per NOAA14
5. 100-yr, 2 hr precipitation intensity = 7.72" Per NOAA14

Relative Volume Calculations (per foot depth)

Basin Name	Depth	Required Storage Volume ($ft.^3$)	Provided Storage Volume ($ft.^3$)	Volume - 1ft depth	Volume - 2ft depth	Volume - 3ft depth
A	2	3,608	3,758	1,243	3,758	--
B	3	40,712	42,356	10,803	24,923	42,356
C	2	865	1,456	370	1,456	--
Total	--	45,184	47,570			

Flow Volumes are to be considered: (-) Surplus and (+) Shortage

Runoff coefficient C = 0.92

100-yr, 2 hr precipitation = 2.26" Per NOAA14

Dry Well Calculations

Volume Provided & Drained Times

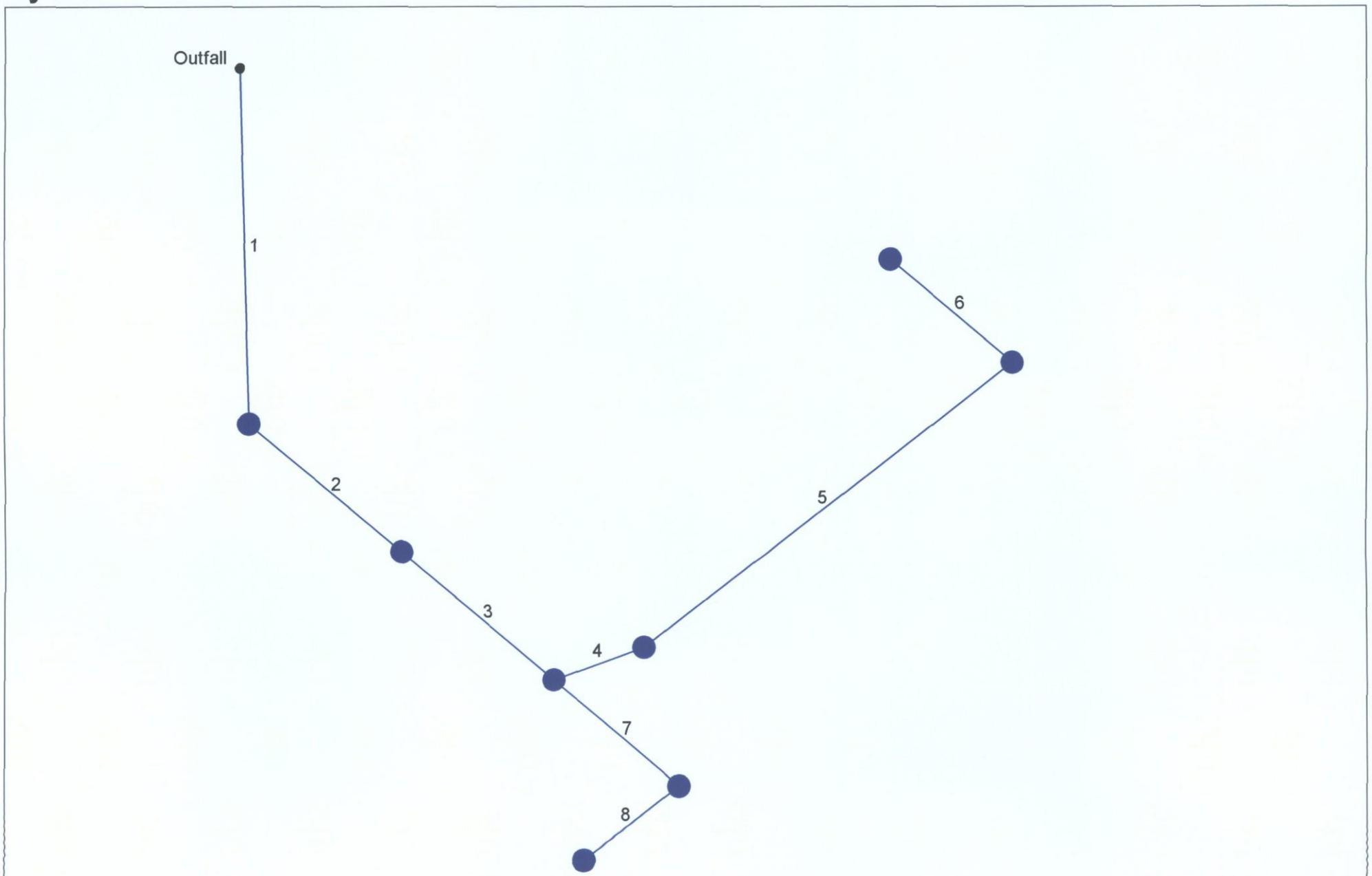
Basin Name	Required Storage Volume ($ft.^3$)	Pond Drainage Rate (ft^3/hr)	Pond Drainage Rate (cfs)	Calculate Number of Drywell	Required Number of Drywells
A	3,608	101	0.028	0.28	1
B	40,712	1,131	0.314	3.14	4
C	865	25	0.007	0.07	1

Notes

1. Assume infiltration rate is 0.1 cfs.
2. Basin drainage rate is based on 36 hours (time allowed for runoff to drain)

Appendix 6: Hydraflow Storm Sewer Calculations and Report

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2013 Plan



Project File: STORM DRAIN.stm	Number of lines: 8	Date: 1/28/2014

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
8	7	24.000	90.000	DrGrt	5.06	0.00	0.00	0.0	1499.22	0.29	1499.29	18	Cir	0.012	1.00	0.00	8
7	3	33.040	0.000	MH	0.00	0.00	0.00	0.0	1499.12	0.30	1499.22	18	Cir	0.012	1.00	0.00	7
6	5	32.000	-90.000	DrGrt	0.12	0.00	0.00	0.0	1498.95	0.31	1499.05	18	Cir	0.012	1.00	0.00	6
5	4	93.000	-19.612	DrGrt	3.24	0.00	0.00	0.0	1499.17	0.30	1499.45	18	Cir	0.012	1.50	0.00	5
4	3	18.000	-70.388	DrGrt	1.76	0.00	0.00	0.0	1499.12	0.28	1499.17	18	Cir	0.012	0.58	0.00	4
3	2	40.115	0.000	MH	0.00	0.00	0.00	0.0	1498.50	0.30	1498.62	24	Cir	0.012	0.95	0.00	3
2	1	40.115	-42.565	DrGrt	3.39	0.00	0.00	0.0	1498.38	0.30	1498.50	24	Cir	0.012	0.50	0.00	2
1	End	80.000	88.807	DrGrt	8.20	0.00	0.00	0.0	1497.50	0.61	1497.99	24	Cir	0.012	1.08	0.00	1

Project File: STORM DRAIN.stm | Number of lines: 8 | Date: 1/28/2014

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
8	4A	DropGrate	0.00	Cir	4.00	4.00	18	Cir	1499.29			
7	MH1	Manhole	0.00	Cir	4.00	4.00	18	Cir	1499.22	18	Cir	1499.22
6	2D	DropGrate	0.00	Cir	4.00	4.00	18	Cir	1499.05			
5	2B	DropGrate	0.00	Cir	4.00	4.00	18	Cir	1499.45	18	Cir	1498.95
4	2A	DropGrate	0.00	Cir	4.00	4.00	18	Cir	1499.17	18	Cir	1499.17
3	MH2	Manhole	0.00	Cir	4.00	4.00	24	Cir	1498.62	18 18	Cir Cir	1499.12 1499.12
2	2C	DropGrate	0.00	Cir	4.00	4.00	24	Cir	1498.50	24	Cir	1498.50
1	4B	DropGrate	0.00	Cir	4.00	4.00	24	Cir	1497.99	24	Cir	1498.38

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
8	1.77	1.77	7	0.20	0.50	0.90	6.15	0.86	0.020	0.020	....	90.000	1.50	1.50	7	0.00	334.43	1501.75	1501.80	0.047
7	1.77	1.77	3	0.20	0.50	0.90	6.26	0.86	....	....	....	0.000	1.50	1.50	3	0.00	351.76	1501.56	1501.62	0.065
6	1.77	1.77	5	0.20	0.50	0.90	6.36	0.13	0.020	0.020	....	-90.000	1.50	1.50	5	0.00	390.37	1501.71	1501.71	0.000
5	1.77	1.77	4	0.20	0.50	0.90	6.24	0.70	0.020	0.020	....	-19.612	1.50	1.50	4	0.00	412.50	1501.60	1501.68	0.081
4	1.77	1.77	3	0.20	0.50	0.90	6.00	0.86	0.020	0.020	....	-70.388	1.50	1.50	3	0.00	345.33	1501.56	1501.60	0.036
3	3.14	3.14	2	0.20	0.50	0.90	13.40	1.13	....	....	....	0.000	2.00	2.00	2	0.00	328.91	1501.37	1501.44	0.069
2	3.14	3.14	1	0.20	0.50	0.90	13.40	1.30	0.020	0.020	....	-42.565	2.00	2.00	1	0.00	301.17	1501.23	1501.35	0.123
1	3.14	3.14	Sag	0.20	0.50	0.90	19.18	1.65	0.020	0.020	....	88.807	2.00	2.00	Outfall	0.00	273.42	1500.25	1500.88	0.632

Project File: STORM DRAIN.stm | Number of lines: 8 | Date: 1/28/2014

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)
5.06	0.198	0.198	2.00	2.00	2.00	0.00	0.00	0.35	Sag	37.41	2.00	1501.62	1501.67	1501.80	....	....	0.00	5.06	0.35
5.06	0.198	0.198	....	....	....	0.00	0.00	....	....	....	....	1501.43	1501.50	1501.62	....	....	0.00	0.00	....
0.12	0.000	0.000	2.00	2.00	2.00	0.00	0.00	0.03	Sag	4.92	2.00	1501.71	1501.71	1501.71	....	....	0.00	0.12	0.03
3.36	0.087	0.087	2.00	2.00	2.00	0.00	0.00	0.26	Sag	28.30	2.00	1501.54	1501.62	1501.71	....	....	0.00	3.24	0.26
5.12	0.203	0.203	2.00	2.00	2.00	0.00	0.00	0.18	Sag	19.50	2.00	1501.43	1501.47	1501.54	....	....	0.00	1.76	0.18
10.18	0.173	0.173	....	....	....	0.00	0.00	....	....	....	....	1501.21	1501.28	1501.43	....	....	0.00	0.00	....
13.57	0.307	0.307	2.00	2.00	2.00	0.00	0.00	0.27	Sag	29.10	2.00	1500.94	1501.06	1501.21	....	....	0.00	3.39	0.27
21.77	0.790	0.790	2.00	2.00	2.00	0.00	0.00	0.58	Sag	60.22	2.00	1499.50	1500.13	1500.94	....	....	0.00	8.20	0.58

Project File: STORM DRAIN.stm | Number of lines: 8 | Date: 1/28/2014

NOTES: ** Critical depth

MyReport

Inlet Eff (%)	Inlet ID	Inlet Loc	Inlet Spread (ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC
100	4A	Sag	37.41	0.0	0.00	0.00	1499.22	1499.29	....	....	0.00	0.00	1.00	Dp-Grate	5.06	868	781	738
....	MH1	Sag	....	0.0	0.00	0.00	1499.12	1499.22	....	....	0.00	0.00	1.00	MH	0.00	1,156	1,040	983
100	2D	Sag	4.92	0.0	0.00	0.00	1498.95	1499.05	....	....	0.00	0.00	1.00	Dp-Grate	0.12	1,124	1,012	955
100	2B	Sag	28.30	0.0	0.00	0.00	1499.17	1499.45	....	....	0.00	0.00	1.50	Dp-Grate	3.24	3,076	2,768	2,615
100	2A	Sag	19.50	0.0	0.00	0.00	1499.12	1499.17	....	....	0.00	0.00	0.58	Dp-Grate	1.76	676	608	575
....	MH2	Sag	....	0.0	0.00	0.00	1498.50	1498.62	....	....	0.00	0.00	0.95	MH	0.00	1,540	1,386	1,309
100	2C	Sag	29.10	0.0	0.00	0.00	1498.38	1498.50	....	....	0.00	0.00	0.50	Dp-Grate	3.39	1,540	1,386	1,309
100	4B	Sag	60.22	0.0	0.00	0.00	1497.50	1497.99	....	....	0.00	0.00	1.08	Dp-Grate	8.20	2,980	2,682	2,533

Project File: STORM DRAIN.stm | Number of lines: 8 | Date: 1/28/2014

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line ID	Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)
8	24.000	18	0.29	Cir	....	....	0.012	0.13	69.48	0.14	0.00	5.06	0.00	18	0.00	18	0.00	0.00	0.00	0.0
7	33.040	18	0.30	Cir	....	....	0.012	0.13	86.07	0.19	....	....	....	18	0.00	18	0.00	0.00	0.00	0.1
6	32.000	18	0.31	Cir	....	....	0.012	0.00	204.73	7.85	0.00	0.12	0.00	18	0.00	18	0.00	0.00	0.00	0.0
5	93.000	18	0.30	Cir	....	....	0.012	0.08	181.62	0.82	0.00	3.24	0.00	18	0.00	18	0.00	0.00	0.00	7.9
4	18.000	18	0.28	Cir	....	....	0.012	0.08	117.30	0.10	0.00	1.76	0.00	18	0.00	18	0.00	0.00	0.00	8.7
3	40.115	24	0.30	Cir	....	....	0.012	0.16	109.94	0.21	....	....	....	24	0.00	24	0.00	0.00	0.00	8.8
2	40.115	24	0.30	Cir	....	....	0.012	0.15	138.91	0.15	0.00	3.39	0.00	24	0.00	24	0.00	0.00	0.00	9.0
1	80.000	24	0.61	Cir	....	....	0.012	0.81	167.88	0.19	0.00	8.20	0.00	24	0.00	24	0.00	0.00	0.00	9.1

Project File: STORM DRAIN.stm | Number of lines: 8 | Date: 1/28/2014

NOTES: ** Critical depth

MyReport

Throat Ht (in)	Total Area (ac)	Total CxA	Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
....	0.00	0.00	0.00	2.86	2.86	0.13	0.13	2.86	n/a	n/a	42.40
....	0.00	0.00	0.00	2.86	2.86	0.13	0.13	2.86	n/a	n/a	58.37
....	0.00	0.00	0.00	0.07	0.07	0.00	0.00	0.07	n/a	n/a	56.54
....	0.00	0.00	0.00	1.90	1.90	0.06	0.06	1.90	n/a	n/a	164.31
....	0.00	0.00	0.00	2.90	2.90	0.13	0.13	2.90	n/a	n/a	31.80
....	0.00	0.00	0.00	3.24	3.24	0.16	0.16	3.24	n/a	n/a	126.00
....	0.00	0.00	0.00	4.32	4.32	0.29	0.29	4.32	n/a	n/a	126.00
....	0.00	0.00	0.00	6.93	6.93	0.75	0.75	6.93	n/a	n/a	251.28

Project File: STORM DRAIN.stm | Number of lines: 8 | Date: 1/28/2014

NOTES: ** Critical depth

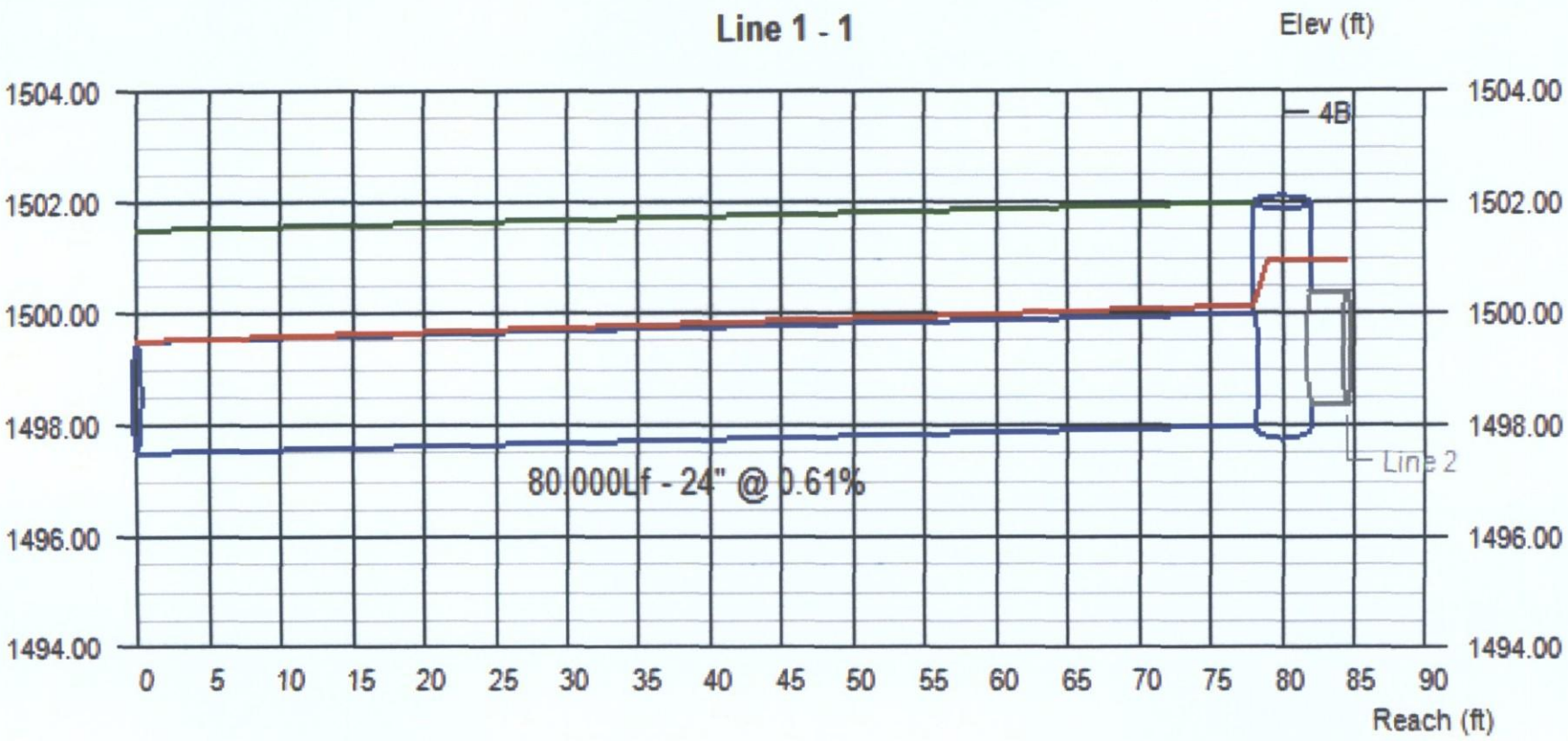
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
8	18	5.06	1499.22	1501.62	1.50	1.77	2.86	0.13	1501.75	0.198	24.000	1499.29	1501.67	1.50	1.77	2.86	0.13	1501.80	0.198	0.198	0.047	1.00	0.13
7	18	5.06	1499.12	1501.43	1.50	1.77	2.86	0.13	1501.56	0.198	33.040	1499.22	1501.50	1.50	1.77	2.86	0.13	1501.62	0.198	0.198	0.065	1.00	0.13
6	18	0.12	1498.95	1501.71	1.50	1.77	0.07	0.00	1501.71	0.000	32.000	1499.05	1501.71	1.50	1.77	0.07	0.00	1501.71	0.000	0.000	0.000	1.00	0.00
5	18	3.36	1499.17	1501.54	1.50	1.77	1.90	0.06	1501.60	0.087	93.000	1499.45	1501.62	1.50	1.77	1.90	0.06	1501.68	0.087	0.087	0.081	1.50	0.08
4	18	5.12	1499.12	1501.43	1.50	1.77	2.90	0.13	1501.56	0.203	18.000	1499.17	1501.47	1.50	1.77	2.90	0.13	1501.60	0.203	0.203	0.036	0.58	0.08
3	24	10.18	1498.50	1501.21	2.00	3.14	3.24	0.16	1501.37	0.173	40.115	1498.62	1501.28	2.00	3.14	3.24	0.16	1501.44	0.173	0.173	0.069	0.95	0.16
2	24	13.57	1498.38	1500.94	2.00	3.14	4.32	0.29	1501.23	0.307	40.115	1498.50	1501.06	2.00	3.14	4.32	0.29	1501.35	0.307	0.307	0.123	0.50	0.15
1	24	21.77	1497.50	1499.50	2.00	3.14	6.93	0.75	1500.25	0.790	80.000	1497.99	1500.13	2.00	3.14	6.93	0.75	1500.88	0.789	0.790	0.632	1.08	0.81

Project File: STORM DRAIN.stm | Number of lines: 8 | Run Date: 1/28/2014

; c = cir e = ellip b = box

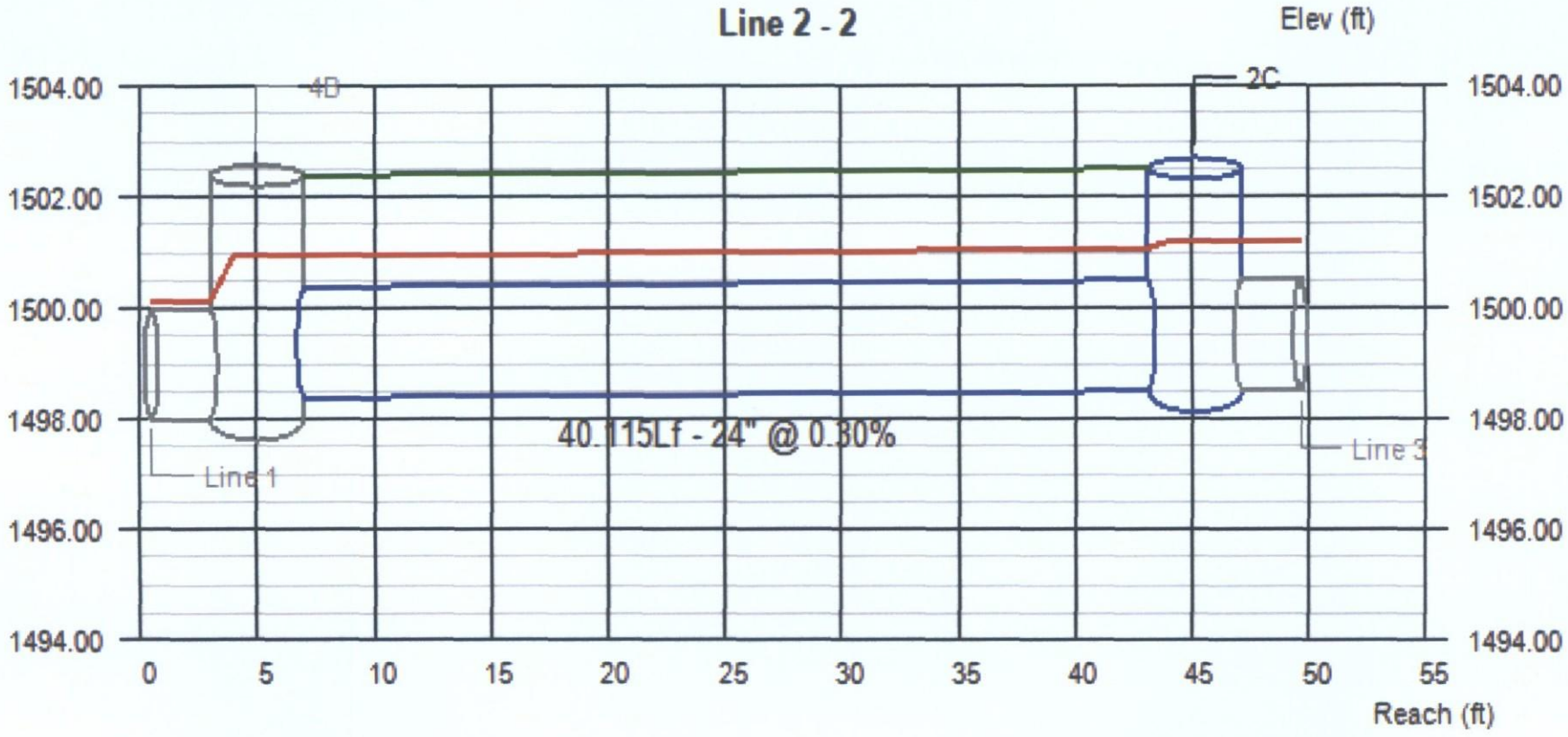
Line Profile (Line 1) - 1



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	21.77	1497.50	1497.99	2.00	2.00	2.95	1499.50	1500.13	1500.94	6.93	6.93	2.00	2.00

Project File: | No. Lines: 8 | Run Date: 1/28/2014

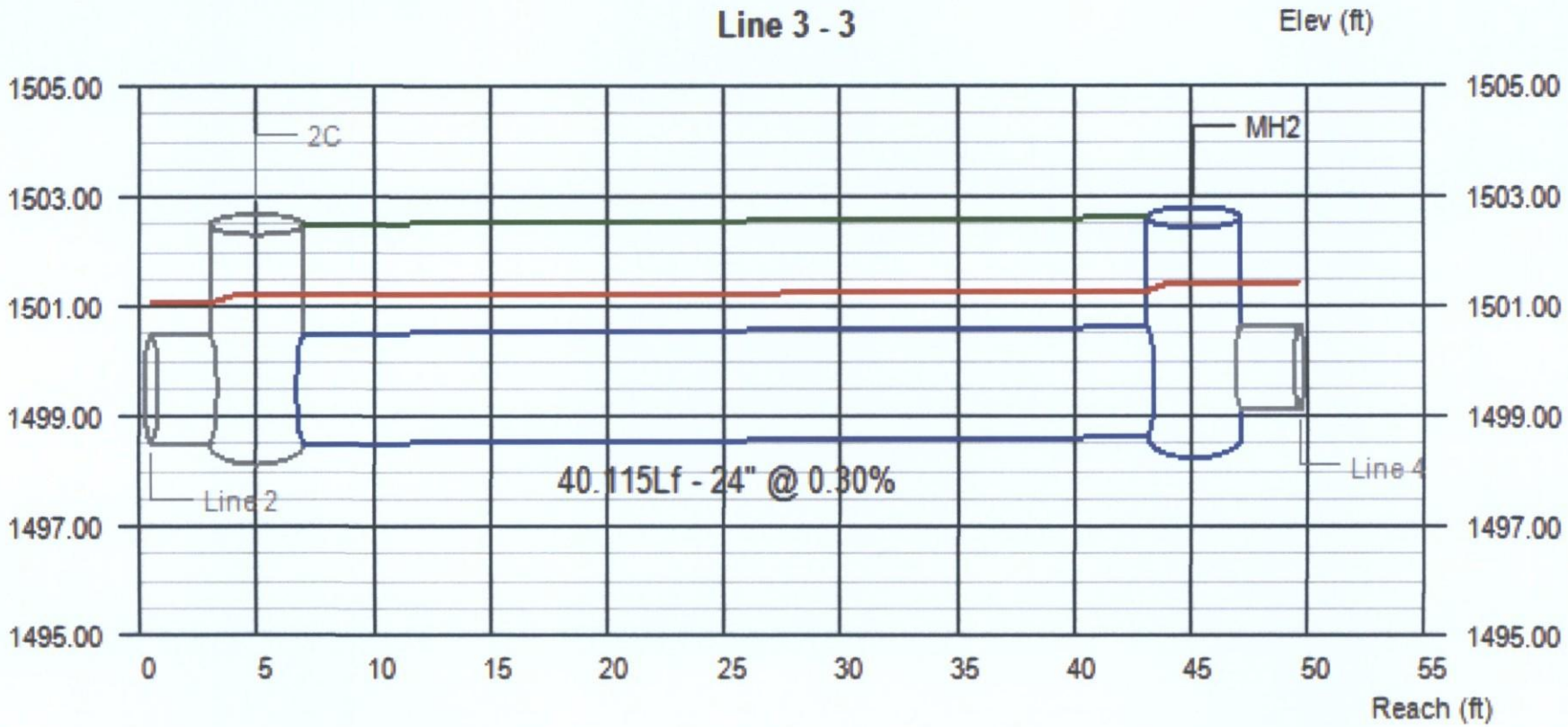
Line Profile (Line 2) - 2



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	13.57	1498.38	1498.50	2.00	2.00	2.71	1500.94	1501.06	1501.21	4.32	4.32	2.00	2.00

Project File:	No. Lines: 8	Run Date: 1/28/2014

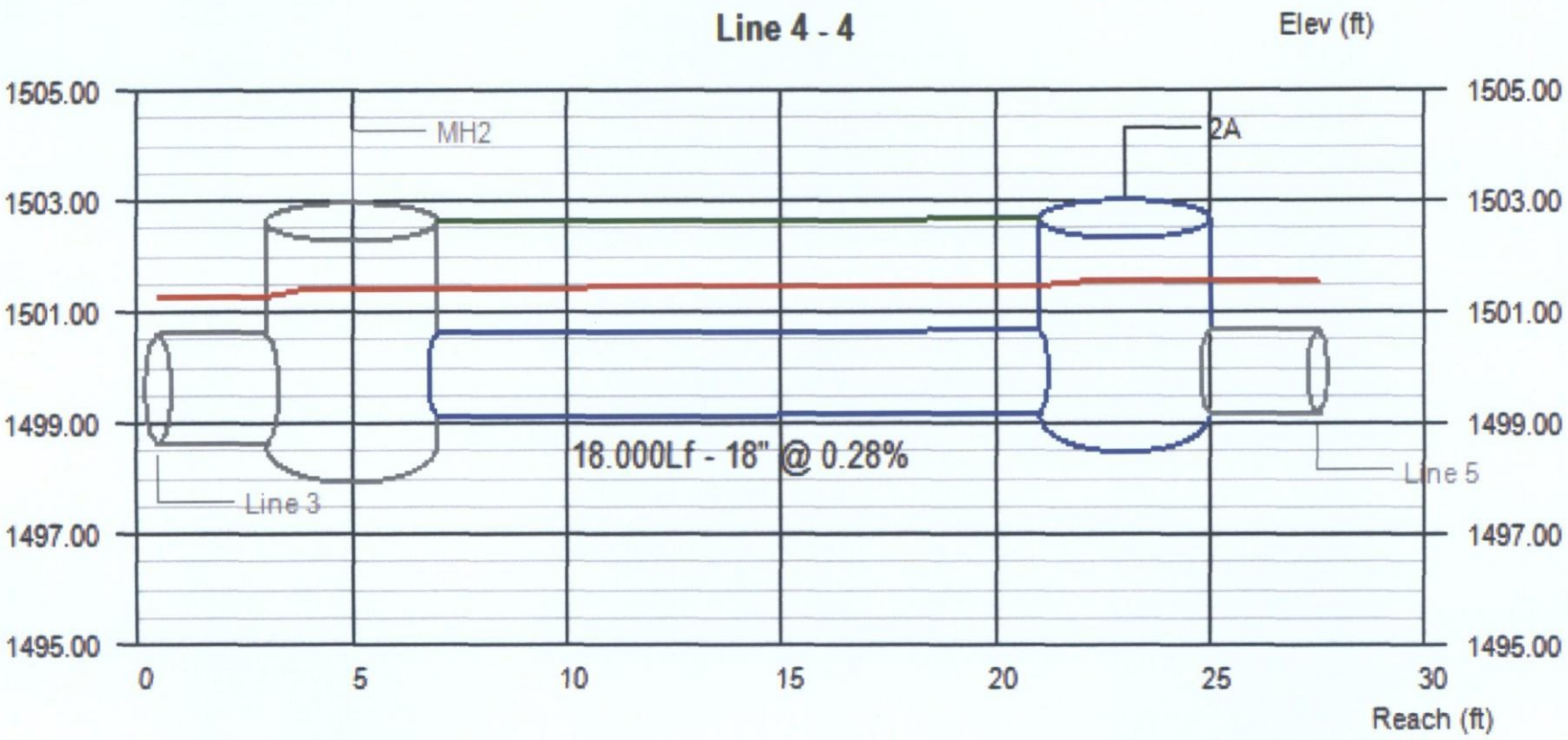
Line Profile (Line 3) - 3



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	10.18	1498.50	1498.62	2.00	2.00	2.81	1501.21	1501.28	1501.43	3.24	3.24	2.00	2.00

Project File: | No. Lines: 8 | Run Date: 1/28/2014

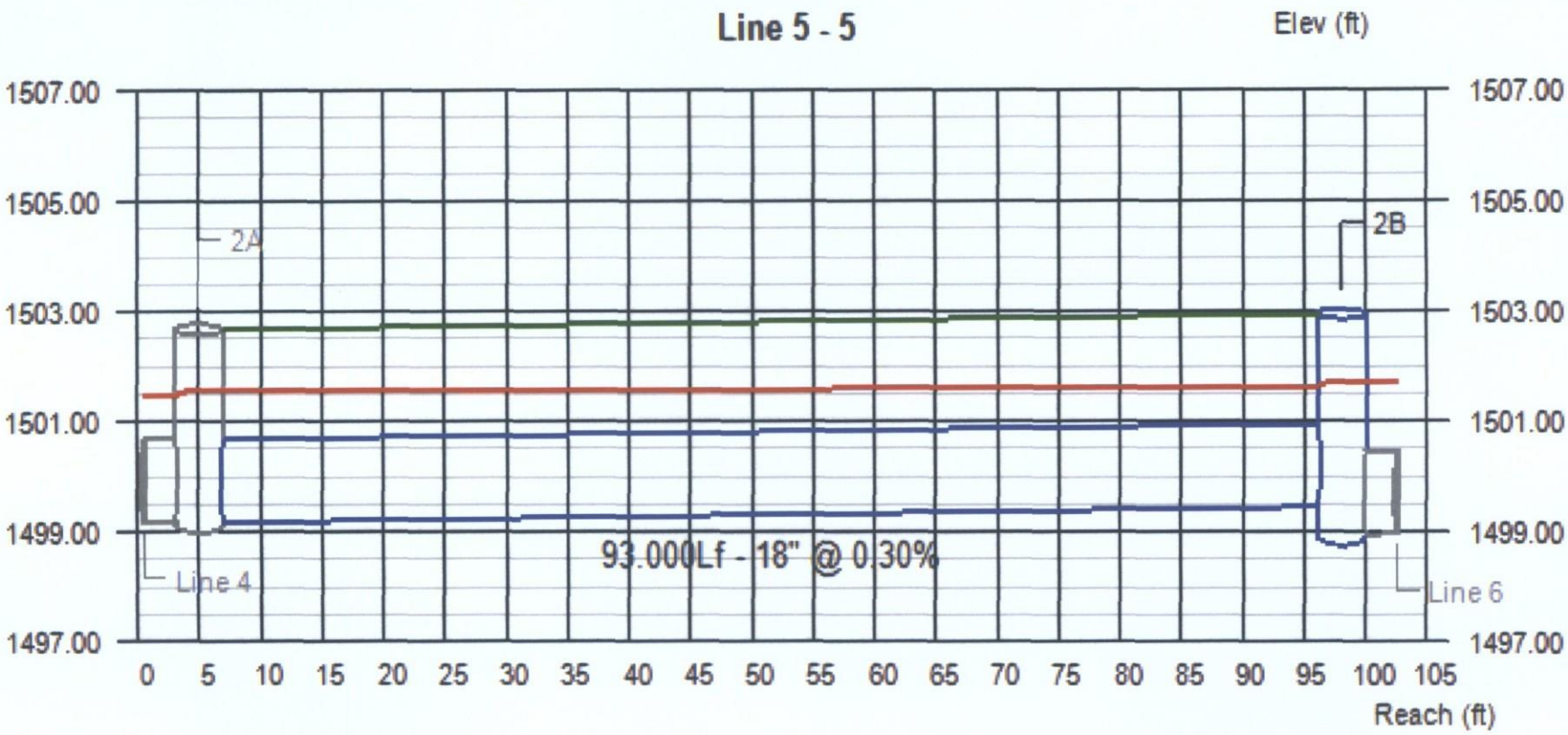
Line Profile (Line 4) - 4



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	5.12	1499.12	1499.17	1.50	1.50	2.37	1501.43	1501.47	1501.54	2.90	2.90	2.00	2.00

Project File:	No. Lines: 8	Run Date: 1/28/2014

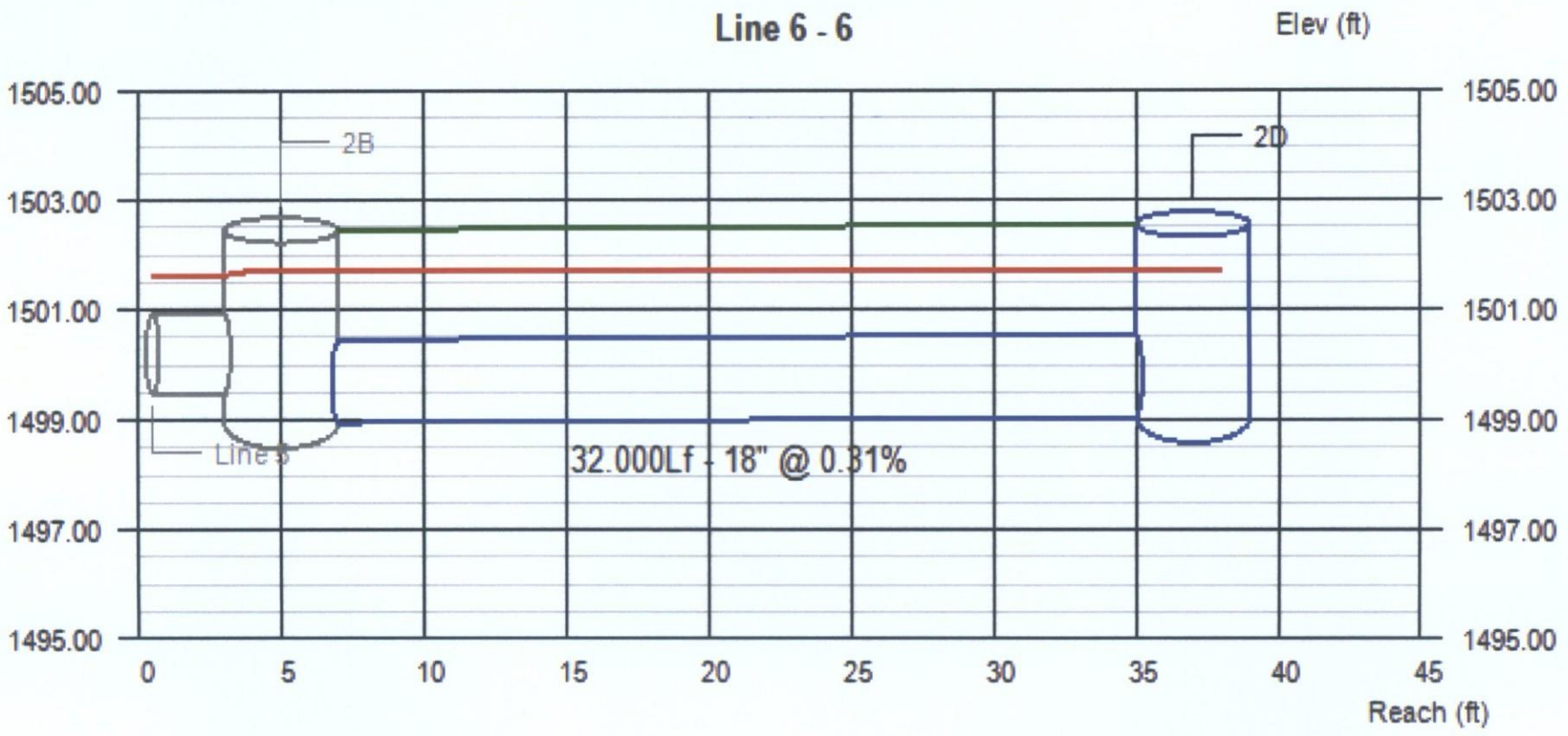
Line Profile (Line 5) - 5



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
5	3.36	1499.17	1499.45	1.50	1.50	2.26	1501.54	1501.62	1501.71	1.90	1.90	2.00	2.00

Project File:	No. Lines: 8	Run Date: 1/28/2014

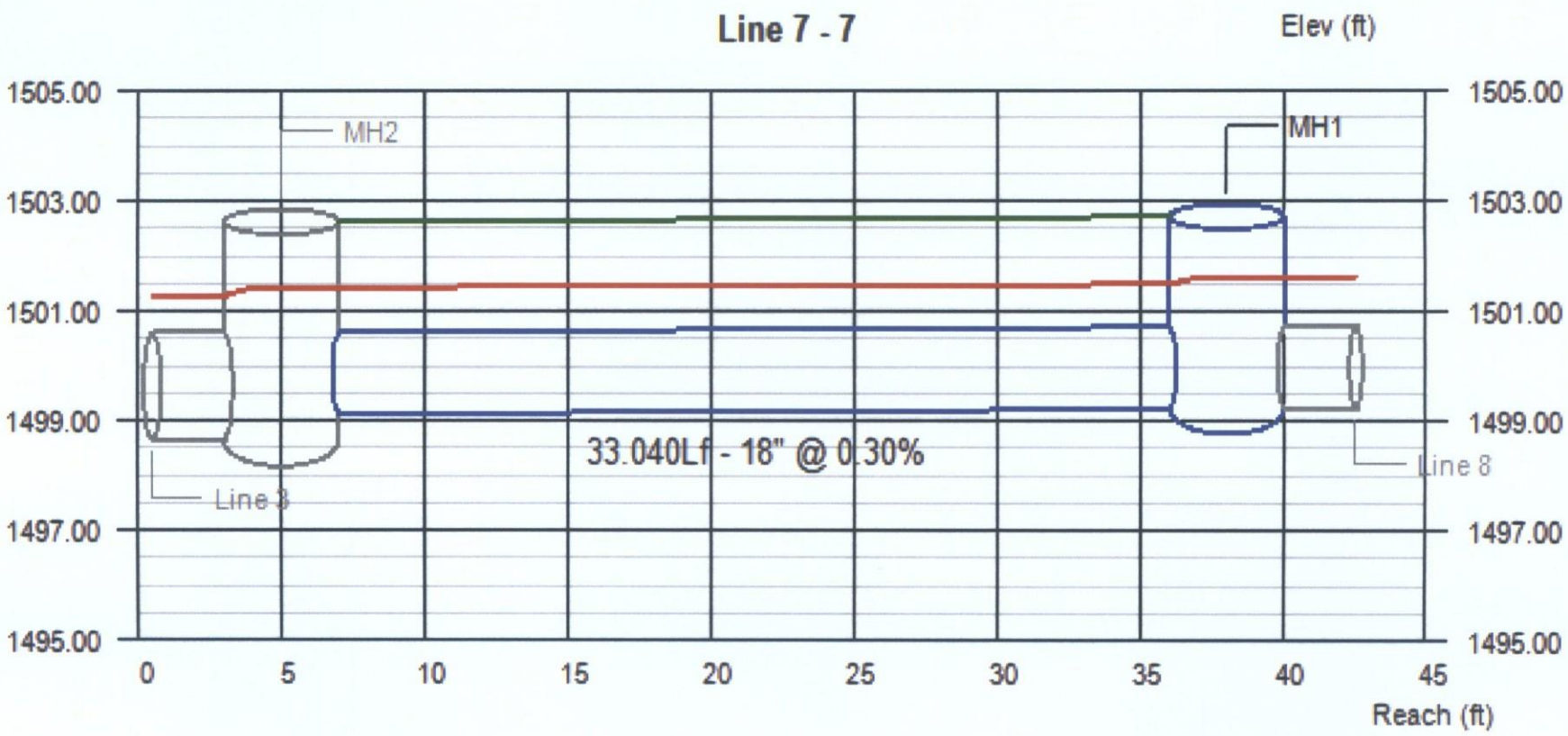
Line Profile (Line 6) - 6



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
6	0.12	1498.95	1499.05	1.50	1.50	2.66	1501.71	1501.71	1501.71	0.07	0.07	2.00	2.00

Project File: | No. Lines: 8 | Run Date: 1/28/2014

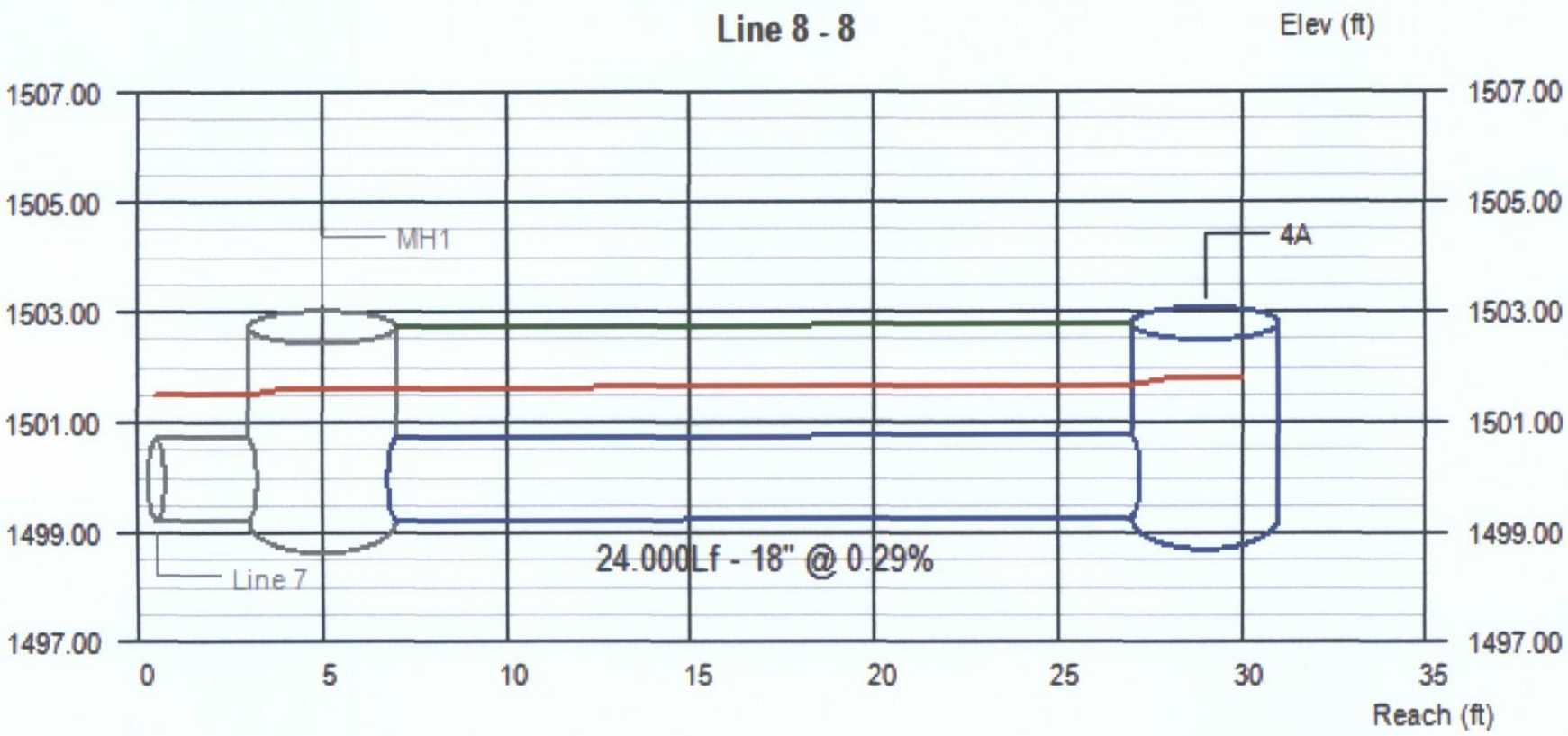
Line Profile (Line 7) - 7



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
7	5.06	1499.12	1499.22	1.50	1.50	2.40	1501.43	1501.50	1501.62	2.86	2.86	2.00	2.00

Project File: | No. Lines: 8 | Run Date: 1/28/2014

Line Profile (Line 8) - 8



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
8	5.06	1499.22	1499.29	1.50	1.50	2.51	1501.62	1501.67	1501.80	2.86	2.86	2.00	2.00

Project File: | No. Lines: 8 | Run Date: 1/28/2014

Inlet Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Wednesday, Jan 15 2014

OFFSITE DRAINAGE AREA 4A

Drop Grate Inlet

Location	= Sag
Curb Length (ft)	= -0-
Throat Height (in)	= -0-
Grate Area (sqft)	= 11.05
Grate Width (ft)	= 2.50
Grate Length (ft)	= 10.25

Gutter

Slope, Sw (ft/ft)	= 0.005
Slope, Sx (ft/ft)	= 0.005
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

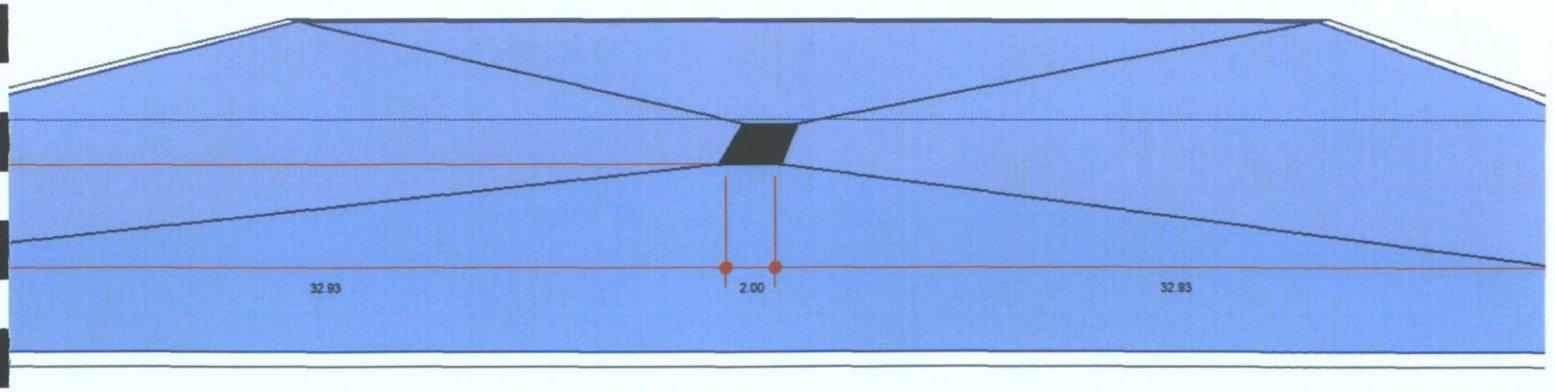
Compute by:	Known Q
Q (cfs)	= 5.06

Highlighted

Q Total (cfs)	= 5.06
Q Capt (cfs)	= 5.06
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 1.96
Efficiency (%)	= 100
Gutter Spread (ft)	= 67.86
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

(x3) MAG 535. Area includes a 50% clogging factor and reduction for the bar/plate areas.

All dimensions in feet



Inlet Report

OFFSITE DRAINAGE AREA 4B

Drop Grate Inlet

Location	= Sag
Curb Length (ft)	= -0-
Throat Height (in)	= -0-
Grate Area (sqft)	= 29.20
Grate Width (ft)	= 1.00
Grate Length (ft)	= 146.00

Gutter

Slope, Sw (ft/ft)	= 0.011
Slope, Sx (ft/ft)	= 0.011
Local Depr (in)	= -0-
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

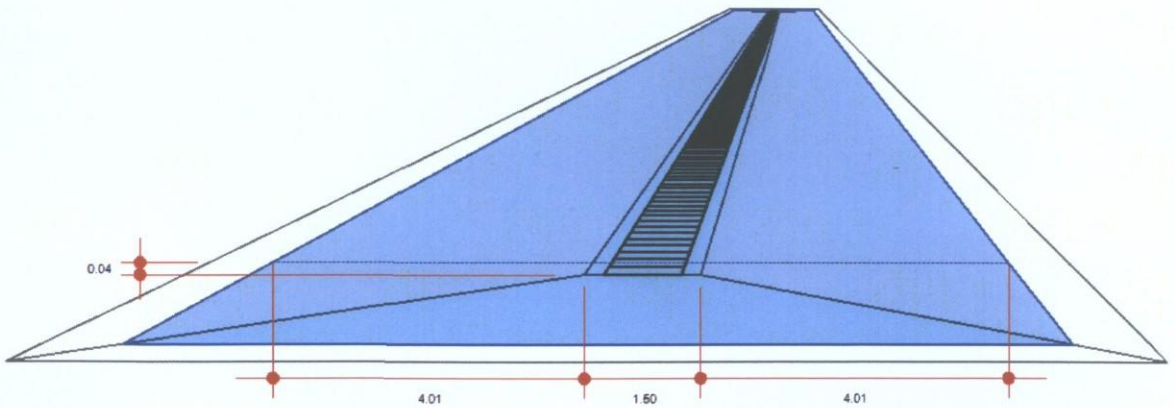
Compute by:	Known Q
Q (cfs)	= 8.20

Highlighted

Q Total (cfs)	= 8.20
Q Capt (cfs)	= 8.20
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 0.53
Efficiency (%)	= 100
Gutter Spread (ft)	= 9.53
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

ZURN Z712 12" Trench drain. Area includes a 50% clogging factor and reduction for the bar/plate areas.

All dimensions in feet



ZURN

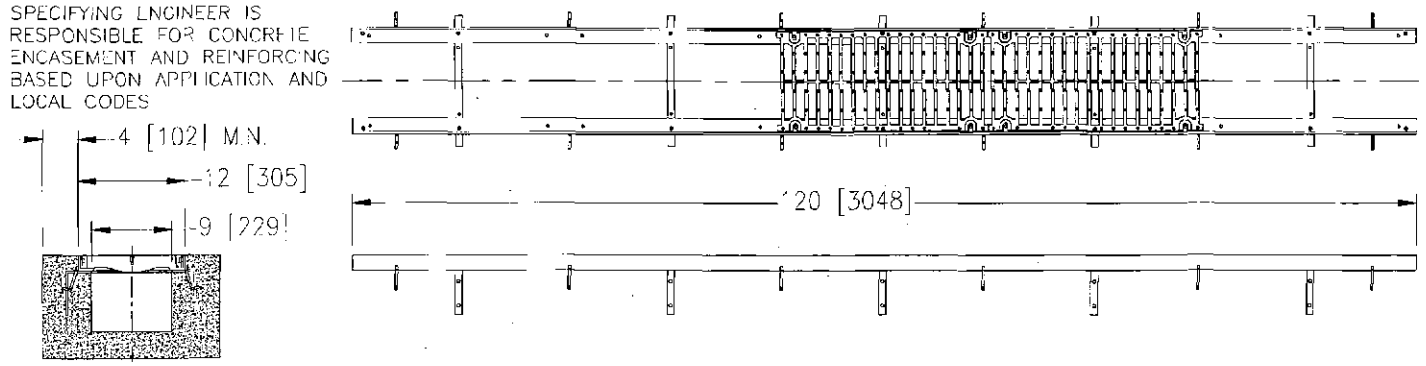
SPECIFICATION SHEET

Z712

12 [305] WIDE REVEAL FRAME AND GRATE SYSTEM

TAG _____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



ENGINEERING SPECIFICATION: Zurn Z712
Frame and Grate System are 120 [3048] long, 12 [305] wide reveal and have a 8-1/2 [216] clear opening. Channels mechanically lock into the concrete surround every 12 [305]. Channels provided with standard DGC grates that lock down to frame. Zurn 12 [305] wide reveal Ductile Iron Slotted Grate conforming to ASTM specification A536-84, Grade 80-55-06. Ductile Iron grate is rated class C per the DIN EN1433 top load classifications. Supplied in 24 [608] nominal lengths with 13/16 [21] wide slots, and 1-1/2 [38] bearing depth. Grate has an open area of 57.50 sq. in per ft. [121708 sq. mm per meter]. The 1/4 [6] thick Heavy-Duty Carbon Steel Frame Assembly conforms to ASTM specification A36 with 12 - 4 [102] long concrete anchors per 120 [3048]. Grate lockdown bars are to be integral to the frame The frame is supplied with a powder coated finish. All welds must be performed by a certified welder per ASTM standard AWS D1.1. Frames produced in the U.S.A.

PREFIX OPTIONS (Check/specify appropriate options)

___ Z Ten-foot Heavy Duty Carbon Steel Frame *

SUFFIX OPTIONS (Check/specify appropriate options)

Frame Options

___ -CBF Black Acid Resistant Coated Top Frame
___ -CWF White Acid Resistant Coated Top Frame
___ -GFA Galvanized Frame Assembly
___ -SF Type 304 Stainless Steel Top Frame

Grade Options (Load Classifications are per DIN EN1433)

___ -BG Galvanized Steel Bar Grate - Class D
___ -BDC Black Acid Resistant Ductile Grate - Class C
___ -BDE Black Acid Resistant Ductile Grate - Class E
___ -BDF Black Acid Resistant Ductile Grate - Class F
___ -DC Ductile Iron Solid Cover - Class E
___ -DGC Ductile Iron Slotted Grate - Class C *
___ -DGE Ductile Iron Slotted Grate - Class E
___ -DGF Ductile Iron Slotted Grate - Class F
___ -GDC Galvanized Ductile Slotted Grate - Class C
___ -GDE Galvanized Ductile Slotted Grate - Class E
___ -GDF Galvanized Ductile Slotted Grate - Class F
___ -GHPD Galvanized Heel-Proof Ductile Slotted Grate - Class B
___ -GHPDE Galvanized Heel-Proof Ductile Slotted Grate - Class E
___ -GG Fiberglass Grate - Class A
___ -HPD Heel-Proof Ductile Slotted Grate - Class B
___ -HPDE Heel-Proof Ductile Slotted Grate - Class E
___ -RFGC Reinforced Slotted Galvanized Grate - Class C
___ -RPGC Reinforced Perforated Galvanized Grate - Class C
___ -RPGRC Reinforced Perforated Galvanized Reverse Punch Grate - Class C
___ -RFSC Reinforced Slotted Stainless Steel Grate - Class C
___ -RPSC Reinforced Perforated Stainless Steel Grate - Class C
___ -RPSRC Reinforced Perforated Stainless Steel Reverse Punch Grate - Class C

MADE in the U.S.A.

___ -ADA-USA Meets Americans with Disabilities Act Requirements - Class C
___ -BDE-USA Black Acid Resistant Ductile Grate - Class E
___ -DGC-USA Ductile Iron Slotted Grate - Class C
___ -DGE-USA Ductile Iron Slotted Grate - Class E
___ -FG Fabricated Galvanized Steel Slotted Grate - Class A
___ -FS Fabricated Stainless Steel Slotted Grate - Class A
___ -GADA-USA Galvanized Ductile ADA Slotted Grate - Class C
___ -GDC-USA Galvanized Ductile Slotted Grate - Class C
___ -GDE-USA Galvanized Ductile Slotted Grate - Class E
___ -GHPDE-USA Galvanized Ductile Slotted Grate - Class E
___ -HPDE-USA Heel-Proof Ductile Slotted Grate - Class E
___ -PG Perforated Galvanized Steel Grate - Class A
___ -PGR Perforated Galvanized Reverse Punch ADA Grate - Class A
___ -PS Perforated Stainless Steel Grate - Class A
___ -PSR Perforated Stainless Steel Reverse Punch ADA Grate - Class A
___ -RFG Reinforced Galvanized Slotted Grate - Class B
___ -RFS Reinforced Stainless Steel Slotted Grate - Class B
___ -RPG Reinforced Galvanized Perforated Grate - Class B
___ -RPGR Reinforced Galvanized Perforated Reverase Punch Anti-Slip ADA Grate - Class B
___ -RPS Reinforced Stainless Steel Perforated Grate - Class B
___ -RPSR Reinforced Stainless Steel Perforated Reverse Punch Anti-Slip ADA Grate - Class B
___ -SBG-L Stainless Steel Bar Grate - Class C
___ -SSCD Reinforced Stainless Steel Solid Cover - Class B

Miscellaneous Options

___ -RC Rebar Clip (Set of 2)
___ -VP Vandal-Proof Lockdown

*REGULARLY FURNISHED UNLESS OTHERWISE SPECIFIED

REV. G DATE: 09/24/13 C.N. NO. 129977

PROD./DWG. NO. Z712

ZURN INDUSTRIES, LLC ♦ SPECIFICATION DRAINAGE OPERATION ♦ 1801 Pittsburgh Ave. ♦ Erie, PA 16514
Phone: 814\455-0921 ♦ Fax: 814\454-7929 ♦ World Wide Web: www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V1L2 ♦ Phone: 905\405-8272 Fax: 905\405-1292

Appendix 7: Warning & Disclaimer of Liability

Appendix 4-1C

WARNING & DISCLAIMER OF LIABILITY

The Drainage and Floodplain Regulations and Ordinances of the City of Scottsdale are intended to "minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding caused by the surface runoff of rainfall" (Scottsdale Revised Code §37-16).

As defined in S.R.C. §37-17, a flood plain or "*Special flood hazard* area means an area having flood and/or flood related erosion hazards as shown on a FHBM or FIRM as zone A, AO, A1-30, AE, A99, AH, or E, and those areas identified as such by the floodplain administrator, delineated in accordance with subsection 37-18(b) and adopted by the floodplain board." It is possible that a property could be inundated by greater frequency flood events or by a flood greater in magnitude than a 100-year flood. Additionally, much of the Scottsdale area is a dynamic flood area; that is, the floodplains may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY PURSUANT TO S.R.C §37-22

"The degree of flood protection provided by the requirements in this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by man-made or natural causes. This article (Chapter 37, Article II) shall not create liability on the part of the city, any officer or employee thereof, or the federal government for any flood damages that result from reliance on this article or any administrative decision lawfully made thereunder."

Compliance with Drainage and Floodplain Regulations and Ordinances does not insure complete protection from flooding. The Floodplain Regulations and Ordinances meet established local and federal standards for floodplain management, but neither this review nor the Regulations and Ordinances take into account such flood related problems as natural erosion, streambed meander or man-made obstructions and diversions, all of which may have an adverse affect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above. If I am an agent for an owner I have made the owner aware of and explained this disclaimer.

_____	_____	_____
Plan Check No.	Owner or Agent	Date

Appendix 8: Proposed On-Site Grading and Drainage Plan

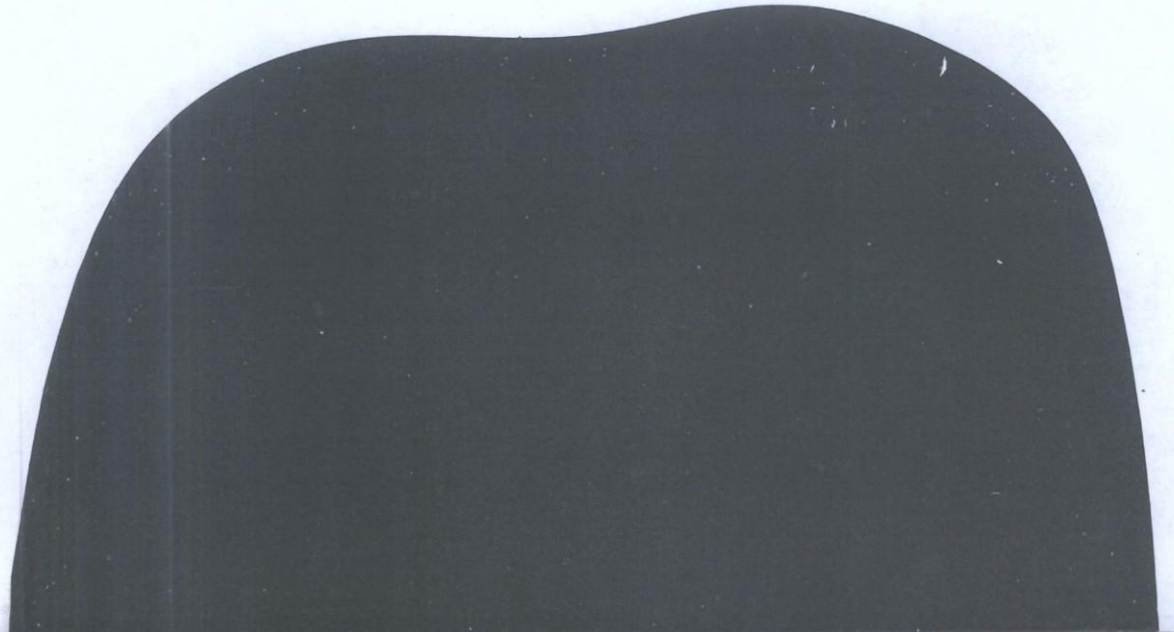
Cu
Jol
Cc
Cc

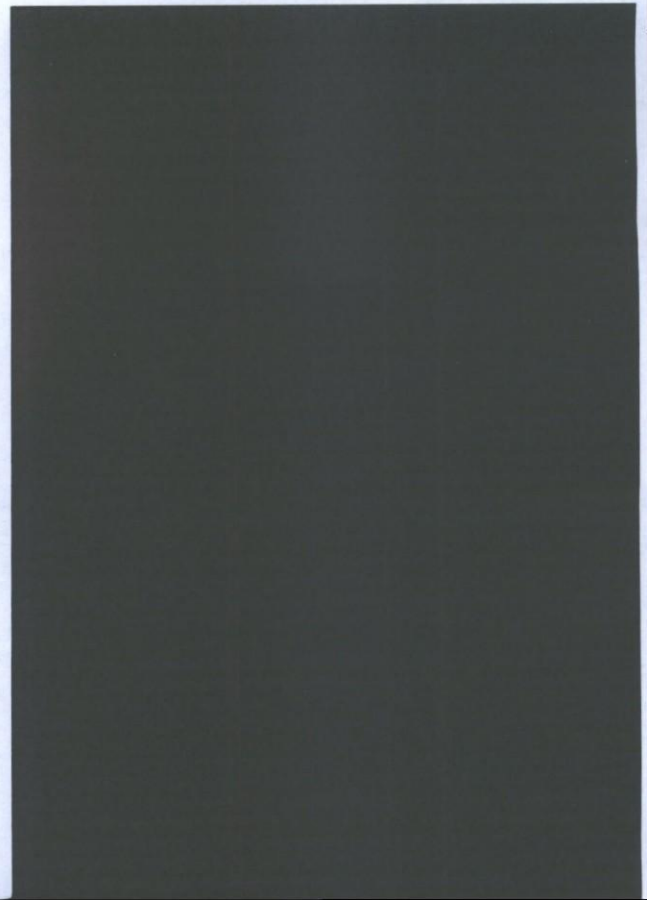
KG ARCHITECTS 2014
CONTEMPORARY WHI 20YY 66/066
2200-0110V White 2200V Fortis 350 Ext A
1/7/2014 QUART
BLK 0P6 OXR 0P2
YOX 0P6

Glidden PROFESSIONAL ®

NEW

Harley Davidson of Scottsdale, AZ
258-PA-2013





KG ARCHITECTS
SILVER MICA
4216-0400L Deep
10/15/2009

50BG 10/019
4216L Devflex HP WB A
Gallon

BLK 3 P 52 + OXR 0 P 3
YOX 0 P 21 WHT 0 P 51 +

58-DR-2013
STIPULATION SET
RETAIN FOR RECORDS
APPROVED
4/3/14
DATE INITIALS