Preliminary Drainage Report

for a

New Warehouse Building

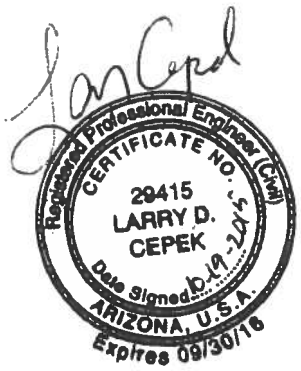
at

60 Sinagua Drive
Sedona, Arizona 86336

by

Larry Cepek, P.E.
Constructive Solutions, Inc.
PO Box 216
Sedona, AZ 86339
928-282-6110

October 19, 2015



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Project: New Warehouse Building
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Sedona, Arizona 86336

SUMMARY and CONCLUSIONS

The project consists of a new warehouse located on a vacant lot in a commercial area of Sedona, Arizona. Larry Cepek, P.E. of Constructive Solutions, Inc. was retained to prepare this drainage report, as well as the project site plans and specifications.

The post-construction storm water runoff of the improvements were calculated, and is less than one cubic foot per second increase over the pre-construction runoff; the lot size is less than one acre; therefore, detention will not be required according to the City of Sedona Land Development Code Table 8.1 No.5:0.

A FloGard inlet filter is used to capture most of the suspended sediment, trash, and petroleum hydrocarbons from the first flush of stormwater runoff from this new development. A 36" CMP inlet and short discharge pipe will flow into a existing adjacent City of Sedona 142" by 91" CMPA pipe.

Stormwater off-site, on-site, inlet, filter and overflow calculations and discussions are below. The HydroCAD system was used to calculate flow rates.

The project is not located in a FEMA flood plain.

A runoff map, as well as the HydroCad Calculations is attached. The report consists of 4 pages, with one drainage map and 16 pages of HydroCad calculations.

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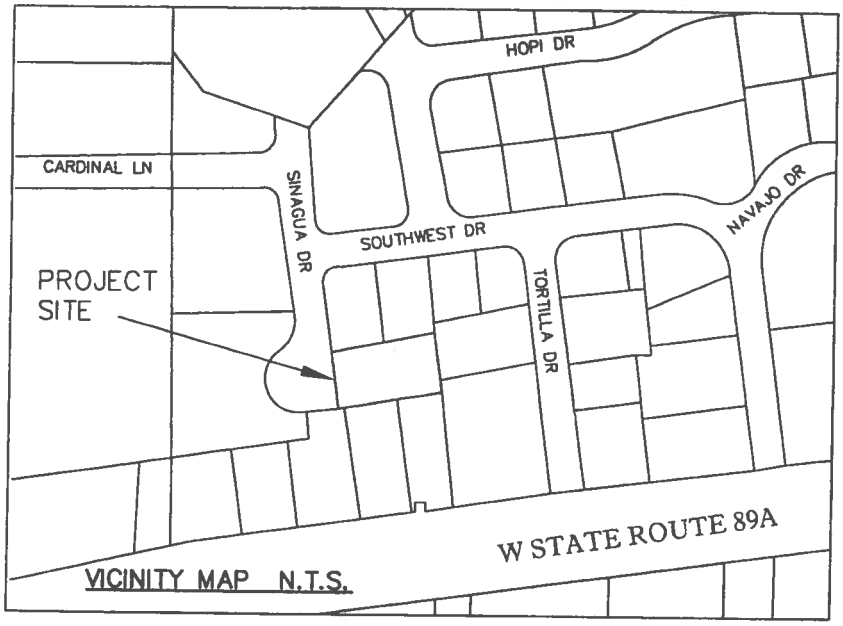
PROJECT LOCATION MAP



HYDROLOGY

Surfaces consist of mostly street and parking asphalt paving and buildings. There is one vacant lot whose soil consists of silty loam, and high desert grass, trees and bushes. Rainfall rates were taken from the City of Sedona Land Development Code.

Storm water runoff rates were calculated using the HydroCad version 9.10 computer aided modeling system. HydroCad is a computer aide design program for modeling the hydrology and hydraulics of the storm water runoff. It is based largely on hydrology techniques developed by the Soil Conservation Service (now the Natural Resources Conservation Service) combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed.

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STORMWATER RUNOFF CALCULATIONS

The site area is 0.32 acres; which is less than the 1 acre detention trigger requirement of the City of Sedona Land Development Code Table 8.1 No.5:0. The 100 year pre-development project stormwater runoff event is 2.27 cfs, with the post-development runoff event at 2.52 cfs. The difference is 0.25 cfs is less than the 1 cfs detention trigger requirement of the City of Sedona Land Development Code Table 8.1 No.5:0. Therefore, no detention is required. The 2 year stormwater event is used at the first flush flow rate.

There is 1.97 acres of **off site** runoff resulting in the following flow rates in cubic feet per second (cfs):

Stormwater Event	**2 Year**	**10 Year**	**25 Year**	**100 Year**
Flow Rate (cfs)	3.91	6.39	7.95	10.43

There is 0.32 acres of **project site pre-development** runoff resulting in the following flow rates:

Stormwater Event	**2 Year**	**10 Year**	**25 Year**	**100 Year**
Flow Rate (cfs)	0.87	1.40	1.74	2.27

There is 0.32 acres of **project site post-development** runoff resulting in the following flow rates:

Stormwater Event	**2 Year**	**10 Year**	**25 Year**	**100 Year**
Flow Rate (cfs)	1.13	1.66	1.99	2.52

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INLET CALCULATIONS

Using the weir equation, with a 33" diameter inlet having a perimeter 8.6 feet, and at a flow depth of 4", will allow 5.43 cfs to enter the inlet. The 2 year stormwater runoff from the site is 1.13 cfs. The inlet size is adequate for a first flush event.

FILTER CALCULATIONS

The filter selected is the FloGard Model number FGP-RF30F with a filter flow of 1.5 cfs. The 2 year stormwater runoff from the site is 1.13 cfs. The filter size is adequate for a first flush event.

OVERFLOW CALCULATIONS

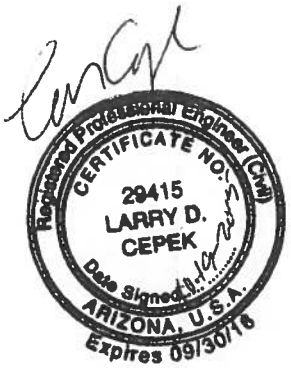
The City of Sedona Land Development Code Table 8.1 No.2:0 requires storm drains to handle the 2 year event. The 2 year stormwater runoff from the site is 1.13 cfs. The filter selected is the FloGard Model number FGP-RF30F with filter bypass capacity of 6.1 cfs. The filter size is adequate for a 2 year stormwater event.

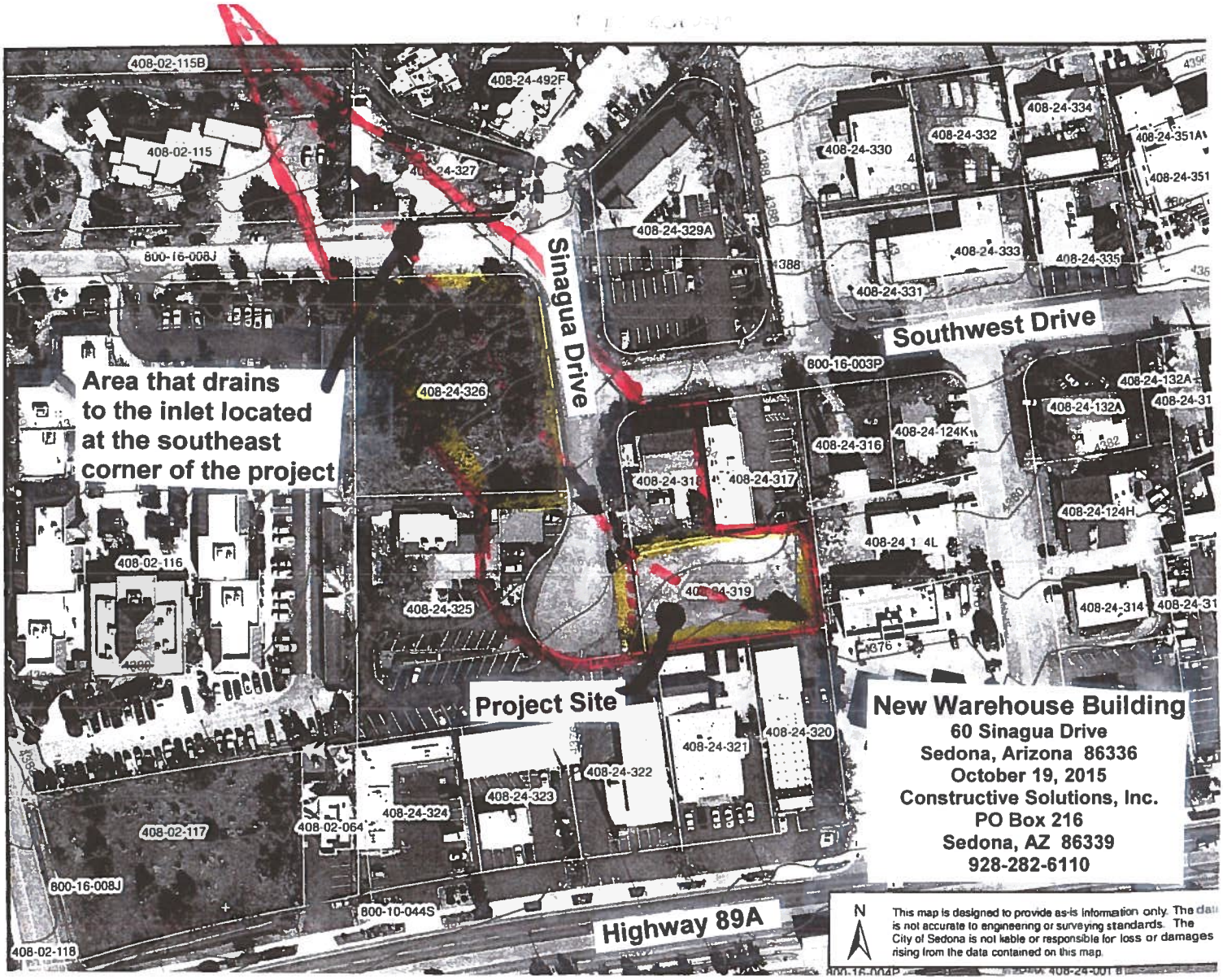
REFERENCES

The following references were used in the preparation of this report.

1. The City of Sedona Land Development Code
2. The HydroCad Stormwater Modeling System Owners Manual Version 9.10 published in 2010 by HydroCad Software Solutions LLC.

Prepared by: Larry Cepek, P.E.




Area that drains to the inlet located at the southeast corner of the project
Project Site
Sinagua Drive
Southwest Drive
Highway 89A
New Warehouse Building
60 Sinagua Drive
Sedona, Arizona 86336
October 19, 2015
Constructive Solutions, Inc.
PO Box 216
Sedona, AZ 86339
928-282-6110
N
This map is designed to provide as-is information only. The data is not accurate to engineering or surveying standards. The City of Sedona is not liable or responsible for loss or damages rising from the data contained on this map.
408-02-115B
408-02-115
408-24-492F
408-24-327
800-16-008J
408-24-329A
408-24-326
408-24-330
408-24-332
408-24-334
408-24-351A
408-24-351
408-24-333
408-24-335
408-24-331
800-16-003P
408-24-132A
408-24-316
408-24-124K
408-24-317
408-24-124H
408-24-314
408-02-116
408-24-325
408-24-319
408-24-321
408-24-320
408-24-322
408-24-323
408-24-324
408-02-064
408-02-117
800-16-008J
800-10-044S
408-02-118

Summary for Pond 27P: Catch Basin with FloGard+Plus Insert Filter

Inflow Area = 2.313 ac, 64.26% Impervious, Inflow Depth = 1.36" for 2 year event
Inflow = 4.39 cfs @ 11.99 hrs, Volume= 0.263 af
Outflow = 4.39 cfs @ 11.99 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.0 min
Primary = 4.39 cfs @ 11.99 hrs, Volume= 0.263 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 10.86' @ 11.99 hrs
Flood Elev= 14.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.00'	**36.0" Round Culvert** L= 5.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.00' / 9.80' S= 0.0400 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior

Primary OutFlow Max=4.39 cfs @ 11.99 hrs HW=10.86' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 4.39 cfs @ 3.95 fps)

Summary for Subcatchment 23S: Off Site

Runoff = 3.91 cfs @ 12.01 hrs, Volume= 0.211 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.14"

Area (sf)	CN	Description
26,037	85	Natural western desert, HSG C
59,773	94	Urban commercial, 85% imp, HSG C
85,810	91	Weighted Average
35,003		40.79% Pervious Area
50,807		59.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	784	0.0330	1.35		**Lag/CN Method,**

Summary for Subcatchment 24S: Post-Construction - Garnello Site

Runoff = 1.13 cfs @ 11.92 hrs, Volume= 0.052 af, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.14"

Area (sf)	CN	Description
1,000	86	<50% Grass cover, Poor, HSG C
13,923	98	Paved parking, HSG C
14,923	97	Weighted Average
1,000		6.70% Pervious Area
13,923		93.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	163	0.0330	1.32		**Lag/CN Method,**

Summary for Subcatchment 6S: Pre-Construction - Garnello Site

Runoff = 0.87 cfs @ 11.93 hrs, Volume= 0.037 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.14"

Area (sf)	CN	Description
14,923	91	Newly graded area, HSG C
14,923		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	163	0.0330	0.98		**Lag/CN Method,**

Summary for Pond 27P: Catch Basin with FloGard+Plus Insert Filter

Inflow Area = 2.313 ac, 64.26% Impervious, Inflow Depth = 2.23" for 10 year event
Inflow = 7.11 cfs @ 11.99 hrs, Volume= 0.430 af
Outflow = 7.11 cfs @ 11.99 hrs, Volume= 0.430 af, Atten= 0%, Lag= 0.0 min
Primary = 7.11 cfs @ 11.99 hrs, Volume= 0.430 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 11.13' @ 11.99 hrs
Flood Elev= 14.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.00'	**36.0" Round Culvert** L= 5.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.00' / 9.80' S= 0.0400 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior

Primary OutFlow Max=7.11 cfs @ 11.99 hrs HW=11.13' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 7.11 cfs @ 4.34 fps)

Summary for Subcatchment 23S: Off Site

Runoff = 6.39 cfs @ 12.01 hrs, Volume= 0.352 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.08"

Area (sf)	CN	Description
26,037	85	Natural western desert, HSG C
59,773	94	Urban commercial, 85% imp, HSG C
85,810	91	Weighted Average
35,003		40.79% Pervious Area
50,807		59.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	784	0.0330	1.35		**Lag/CN Method,**

Summary for Subcatchment 24S: Post-Construction - Garnello Site

Runoff = 1.66 cfs @ 11.92 hrs, Volume= 0.078 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.08"

Area (sf)	CN	Description
1,000	86	<50% Grass cover, Poor, HSG C
13,923	98	Paved parking, HSG C
14,923	97	Weighted Average
1,000		6.70% Pervious Area
13,923		93.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	163	0.0330	1.32		**Lag/CN Method,**

Summary for Subcatchment 6S: Pre-Construction - Garnello Site

Runoff = 1.40 cfs @ 11.93 hrs, Volume= 0.061 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.08"

Area (sf)	CN	Description
14,923	91	Newly graded area, HSG C
14,923		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	163	0.0330	0.98		**Lag/CN Method,**

Summary for Pond 27P: Catch Basin with FloGard+Plus Insert Filter

Inflow Area = 2.313 ac, 64.26% Impervious, Inflow Depth = 2.79" for 25 year event
Inflow = 8.83 cfs @ 11.99 hrs, Volume= 0.539 af
Outflow = 8.83 cfs @ 11.99 hrs, Volume= 0.539 af, Atten= 0%, Lag= 0.0 min
Primary = 8.83 cfs @ 11.99 hrs, Volume= 0.539 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 11.28' @ 11.99 hrs
Flood Elev= 14.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.00'	**36.0" Round Culvert** L= 5.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.00' / 9.80' S= 0.0400 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior

Primary OutFlow Max=8.82 cfs @ 11.99 hrs HW=11.28' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 8.82 cfs @ 4.53 fps)

Summary for Subcatchment 23S: Off Site

Runoff = 7.95 cfs @ 12.01 hrs, Volume= 0.444 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=3.67"

Area (sf)	CN	Description
26,037	85	Natural western desert, HSG C
59,773	94	Urban commercial, 85% imp, HSG C
85,810	91	Weighted Average
35,003		40.79% Pervious Area
50,807		59.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	784	0.0330	1.35		**Lag/CN Method,**

Summary for Subcatchment 24S: Post-Construction - Garnello Site

Runoff = 1.99 cfs @ 11.92 hrs, Volume= 0.095 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=3.67"

Area (sf)	CN	Description
1,000	86	<50% Grass cover, Poor, HSG C
13,923	98	Paved parking, HSG C
14,923	97	Weighted Average
1,000		6.70% Pervious Area
13,923		93.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	163	0.0330	1.32		**Lag/CN Method,**

Summary for Subcatchment 6S: Pre-Construction - Garnello Site

Runoff = 1.74 cfs @ 11.93 hrs, Volume= 0.077 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=3.67"

Area (sf)	CN	Description
14,923	91	Newly graded area, HSG C
14,923		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	163	0.0330	0.98		**Lag/CN Method,**

Summary for Pond 27P: Catch Basin with FloGard+Plus Insert Filter

Inflow Area = 2.313 ac, 64.26% Impervious, Inflow Depth = 3.70" for 100 year event
Inflow = 11.55 cfs @ 11.99 hrs, Volume= 0.713 af
Outflow = 11.55 cfs @ 11.99 hrs, Volume= 0.713 af, Atten= 0%, Lag= 0.0 min
Primary = 11.55 cfs @ 11.99 hrs, Volume= 0.713 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 11.50' @ 11.99 hrs
Flood Elev= 14.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.00'	**36.0" Round Culvert** L= 5.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.00' / 9.80' S= 0.0400 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior

Primary OutFlow Max=11.54 cfs @ 11.99 hrs HW=11.50' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 11.54 cfs @ 4.79 fps)

Summary for Subcatchment 23S: Off Site

Runoff = 10.43 cfs @ 12.01 hrs, Volume= 0.592 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=4.61"

Area (sf)	CN	Description
26,037	85	Natural western desert, HSG C
59,773	94	Urban commercial, 85% imp, HSG C
85,810	91	Weighted Average
35,003		40.79% Pervious Area
50,807		59.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	784	0.0330	1.35		**Lag/CN Method,**

Summary for Subcatchment 24S: Post-Construction - Garnello Site

Runoff = 2.52 cfs @ 11.92 hrs, Volume= 0.122 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=4.61"

Area (sf)	CN	Description
1,000	86	<50% Grass cover, Poor, HSG C
13,923	98	Paved parking, HSG C
14,923	97	Weighted Average
1,000		6.70% Pervious Area
13,923		93.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	163	0.0330	1.32		**Lag/CN Method,**

Summary for Subcatchment 6S: Pre-Construction - Garnello Site

Runoff = 2.27 cfs @ 11.93 hrs, Volume= 0.103 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=4.61"

Area (sf)	CN	Description
14,923	91	Newly graded area, HSG C
14,923		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	163	0.0330	0.98		**Lag/CN Method,**