PRELIMINARY DRAINAGE STUDY REPORT

FOR

ARBOR VILLAS

CARSON CITY, NEVADA

Prepared for:

Capstone Communities
9441 Double Diamond Pkwy #14
Reno, Nevada 89521

Prepared by:

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Project: CCICCNV01 *Date:* 3/17/16

Table of Contents

Appendices

List of Figures

List of Tables

1 INTRODUCTION

1.1 Purpose of Analysis

This report presents the data, hydrologic and hydraulic analyses, and conclusions of a preliminary technical drainage study performed for Arbor Villas to support the proposed development in Carson City, Nevada. In addition, in the interest of brevity and clarity, this report will defer to figures, tables, and the data and calculations contained in the appendices, whenever possible.

1.2 Project Location and Description

The Arbor Villas development is approximately 10.3 acres in size and is located in the southern portion of Carson City and is east of South Stewart Street, south of East 5th Street, west of South Saliman Road Drive, and north of Little Lane5. Formally, this site is situated within Section 17, Township 15 North, and Range 20 East of the Mount Diablo Meridian (refer to Figure 1, Vicinity Map). The project site is within the existing parcels 004-02-113.

1.3 Project Description

The Arbor Villas development is a proposed subdivision which consists of 147 residential units single-family residential units on a 10.31 acre parcel. The project site is currently zoned within the GC zoning district and has an approved tentative map P.U.D. through Carson City.

According to Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community-Panel Number 3200010092F, effective date January 19, 2014 the subject property is located in Shaded Zone X, which is located with the 500-year floodplain (Appendix A).

The purpose of this report is to analyze the existing and proposed conditions of the subject property based on the 5-year and 100-year peak flow events. The report contains the following sections: (1) Methodologies and Assumptions, (2) Existing Hydrology, (3) Proposed Hydrology, and (4) Conclusion.

2 METHODOLOGIES AND ASSUMPTIONS

2.1 Hydrologic Modeling Methods

Hydrologic analyses were performed to determine the peak discharge for the 5-year and 100-year peak flow events. *Autodesk Sanitary and Storm Analysis* (SSA) was used to perform a *Rational Method* analysis to model the hydrologic basins that contribute in the existing and proposed conditions.

Parameters for peak storm flow and runoff volume estimates presented herein were determined using the data and methodologies presented in the *Carson City Municipal Code, Division 14 – Storm Drainage* section. In instances where the Carson City Municipal Code, Division 14 (CCMC-14) was lacking information or specificity, the *Truckee Meadows Regional Drainage Design Manual (2009)* and/or the other appropriate sources and software user manuals were referenced.

For the existing and proposed on-site hydrologic conditions, the Rational Method was utilized in accordance with the CCMC-14. A minimum time of concentration of 10-minutes was used for all sub-basins for a conservative analysis.

The rainfall characteristics were modeled using the NOAA database (http://dipper.nws.noaa.gov/hdsc/pfds/sa/nv_pfds.html) to determine site specific depth of precipitation (Appendix A).

Rational Formula: **Q=CiA**

Q=Peak Discharge (cfs)
C=Runoff Coefficient (dimensionless)
i=Precipitation Intensity (in/hr)
A=Watershed Area (Acres)

2.2 Hydraulic Modeling Methods

Hydraulic analyses were performed using the associated hydrologic data to provide the estimates of the elevation of floods for the selected recurrence intervals. Water-surface elevations were computed in SSA using hydrodynamic routing. Hydrodynamic routing solves the complete Saint Venant equations throughout the drainage network and includes modeling of backwater effects, flow reversal, surcharging, looped connections, and pressure flow. Hydrodyanmic routing provides a formulation for channels and pipes, including translation and attenuation effects.

3 EXISTING HYDROLOGIC CONDITIONS

3.1 Existing On-Site Drainage

The existing hydrologic analysis was based on the fact that the site was previously disturbed and the existing hydrologic sub-basin was delineated based on the property line.

For the existing catchment a time of concentration (Tc) and the Rational Method coefficients were selected, taking into consideration the catchment characteristics, which include catchment area and land cover. A 5-year intensity of 1.46 in/hr and 100-year intensity of 3.53 in/hr were used. Table 1 and Figure 2 summarize the characteristics of on-site catchment of the study area. Reference Appendix B for the existing conditions Rational Method analysis. Reference Figure 2 (Existing Hydrologic Conditions) in the map pocket for existing hydrology drainage map and the associated hydrologic sub-area.

Table 1 – Existing Conditions Rational Method Model Summary for the Arbor Villas, Carson City, Nevada.

Sub-Basin	Area (Ac.)	Rational Method Coefficient (C_5/C_{100})	Time of Concentration (min)	Rainfall Intensity (I_5/I_{100}) (in/hr)	5-Year Peak Flows (cfs)	100-Year Peak Flows (cfs)
X-01	10.31	0.30/0.50	15.00	1.46/3.53	2.54	14.95
TOTAL	**10.31**	**-----**	**-----**	**-----**	**2.54**	**14.95**

The 5-year and 100-year peak flows from on-site catchment in the existing condition are 2.54 cfs and 14.95cfs, respectively. The existing flow discharges in a southeasterly direction and ultimately is conveyed in an existing stormdrain system in Little Lane and routed in an easterly direction.

4 PROPOSED HYDROLOGIC CONDITIONS

4.1 Proposed On-Site Drainage

The sub-areas took into account the proposed on-site flows that affect the site. The associated calculated 5-year and 100-year peak flows can be found in Table 2 and Figure 3, the detention facility can be referenced in Tables 3 and Appendix C. Both pipe sizes and catch basins have been sized to accommodate the proposed flows. Reference Figure 3 in the map pocket for the associated hydrologic sub-areas and the proposed catch basins. A 5-year intensity of 1.46 in/hr and 100-year intensity of 3.53 in/hr were used. All drainage for the basins will be contained in swales and the roadway and will travel to the catch basins. From the catch basins, the flow will be routed through the proposed storm drain system. Refer to Appendix C, *Proposed Conditions Hydrologic Analysis* for all data and supporting calculations using the Rational Method.

Assumption:

Manhard Consulting made the assumption that the peak flows from Arbor Villas would be conveyed to the existing stormdrain system prior to the peak flows form the upstream basins; therefore, the hydraulic model was terminated at the point where the proposed system connects to the existing system.

Table 2 – Proposed Conditions Rational Method Model Summary for the Arbor Villas Project, Carson City, Nevada.

Sub-Basin	Area (Ac.)	Rational Method Coefficient (C_5/C_{100})	Time of Concentration (min)	Rainfall Intensity (I_5/I_{100}) (in/hr)	5-Year Peak Flows (cfs)	100-Year Peak Flows (cfs)
BASIN-01	0.73	0.60/0.78	10.00	1.46/3.53	0.64	2.01
BASIN-02	0.72	0.60/0.78	10.00	1.46/3.53	0.63	1.98
BASIN-03	0.85	0.60/0.78	10.00	1.46/3.53	0.74	2.34
BASIN-04	0.17	0.88/0.93	10.00	1.46/3.53	0.22	0.56
BASIN-05	0.53	0.88/0.93	10.00	1.46/3.53	0.68	1.74
BASIN-06	0.17	0.88/0.93	10.00	1.46/3.53	0.22	0.56
BASIN-07	0.55	0.88/0.93	10.00	1.46/3.53	0.70	1.81
BASIN-08	0.92	0.33/0.59	10.00	1.46/3.53	0.44	1.92
BASIN-09	0.73	0.60/0.78	10.00	1.46/3.53	0.64	2.01
BASIN-10	0.73	0.38/0.63	10.00	1.46/3.53	0.40	1.62
BASIN-11	0.23	0.88/0.93	10.00	1.46/3.53	0.27	0.76
BASIN-12	0.15	0.88/0.93	10.00	1.46/3.53	0.19	0.49
BASIN-13	0.67	0.36/0.61	10.00	1.46/3.53	0.35	1.44
BASIN-14	0.20	0.60/0.78	10.00	1.46/3.53	0.17	0.55
BASIN-15	0.54	0.74/0.85	10.00	1.46/3.53	0.58	1.62
BASIN-16	0.82	0.35/0.60	10.00	1.46/3.53	0.42	1.74
BASIN-17	0.22	0.60/0.78	10.00	1.46/3.53	0.19	0.61
BASIN-18	0.42	0.74/0.86	10.00	1.46/3.53	0.45	1.28
BASIN-19	0.51	0.74/0.86	10.00	1.46/3.53	0.55	1.55
BASIN-20	0.45	0.60/0.78	10.00	1.46/3.53	0.39	1.24
TOTAL	**10.31**	-----	-----	-----	**8.87**	**27.83**

5 HYDRAULIC ANALYSIS

5.1 Proposed Drainage Conditions

The hydraulic model utilized routing of the peak flows through proposed storm drain and the detention facilities. The runoff is collected in catch basins and detention facilities and routed toward the proposed storm drain system in Parkland and the existing storm drain system in Little Lane. All drainage from the sub-basins will be contained in the lot swales and the roadway and will travel to the catch basins or the detention basins.

5.2 Detention

According to the existing and proposed hydrologic analysis, the existing 5-year and 100-year condition flows are 2.54 cfs and 14.95 cfs, respectively. The proposed 5-year and 100-year condition flows are 8.87 cfs and 27.83 cfs. However, according to hydraulic analysis, the proposed 5-year and 100-year off-site discharges are 2.65 cfs and 11.35 cfs, respectively. Therefore, according to CCMC-14, the proposed civil improvements will create a decrease in

the 5-year peak flow runoff of 0.11 cfs increase and decrease in the 100-year peak flow runoff of 3.60 cfs. The 5-year peak flow increase is due to the basin located directly adjacent to Little Lane which are not routed to the proposed detention facilities.

6 CONCLUSION

6.1 Regulations and Master Plans

The proposed improvements and the analyses presented herein are in accordance with drainage regulations presented in *Carson City Municipal Code, Division 14 – Storm Drainage* section. In instances where the Carson City Municipal Code, Division 14 (CCMC-14) was lacking information or specificity, the *Truckee Meadows Regional Drainage Design Manual (2009)* and/or the other appropriate sources and software user manuals were referenced.

6.2 Impacts to Adjacent Properties

The performance of the proposed project improvements, roadways, detention/retention, and storm water conveyance facilities, once constructed, will not adversely impact upstream or downstream properties adjacent to this site. The development of this site for the uses proposed will significantly decrease downstream storm flow runoff rates, volumes, velocities, depths, and will not influence floodplain boundaries.

6.3 Standards of Practice

This study was prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable professional engineers practicing in this and similar localities.

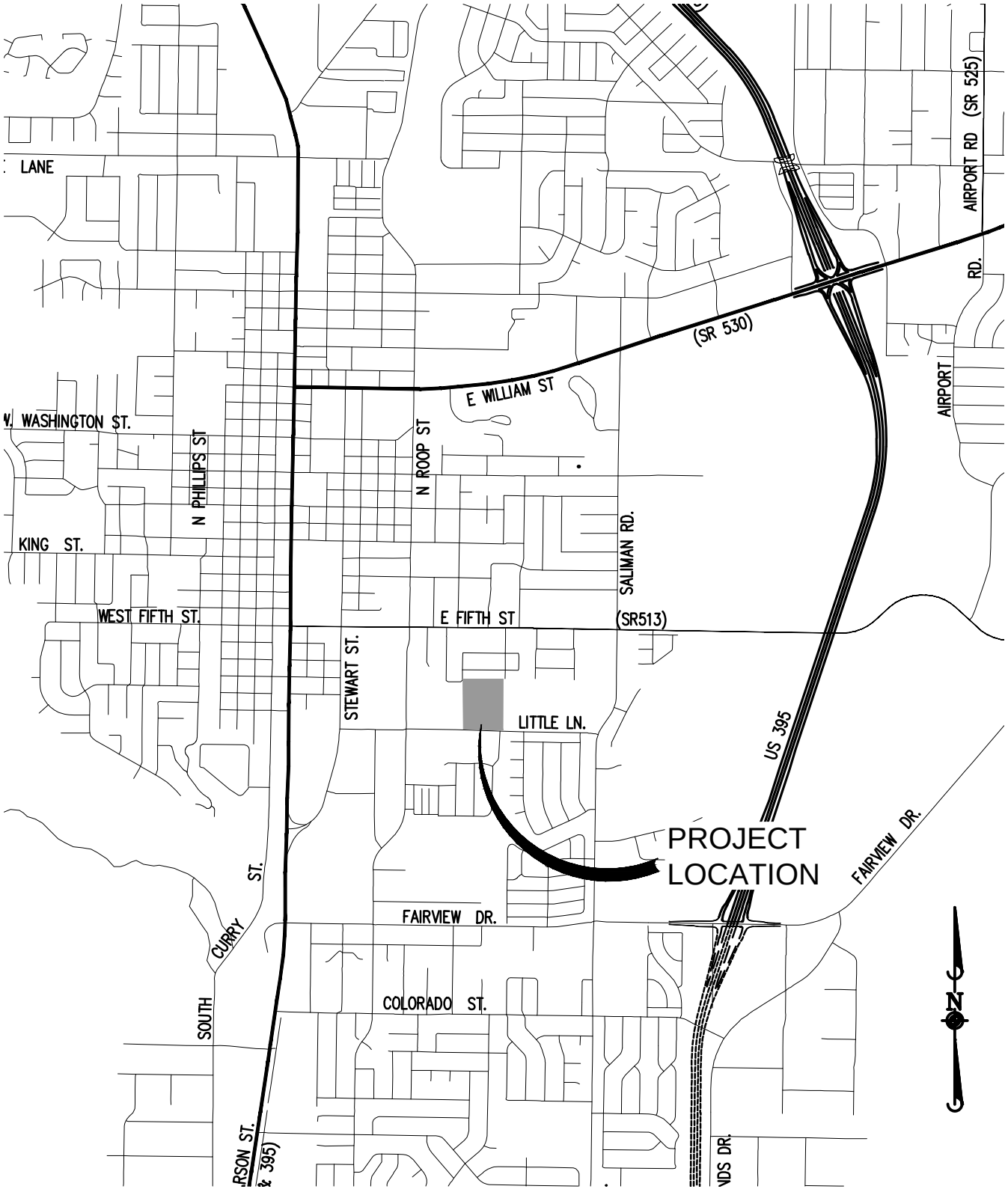


FIGURE 1

Manhard CONSULTING LTD
9850 Double R Blvd, Suite 101, Reno, NV 89521 tel: (775) 746-3500 fax: (775) 746-3520 www.manhard.com
Civil Engineers - Surveyors - Water Resources Engineers - Water & Wastewater Engineers
Construction Managers - Environmental Scientists - Landscape Architects - Planners

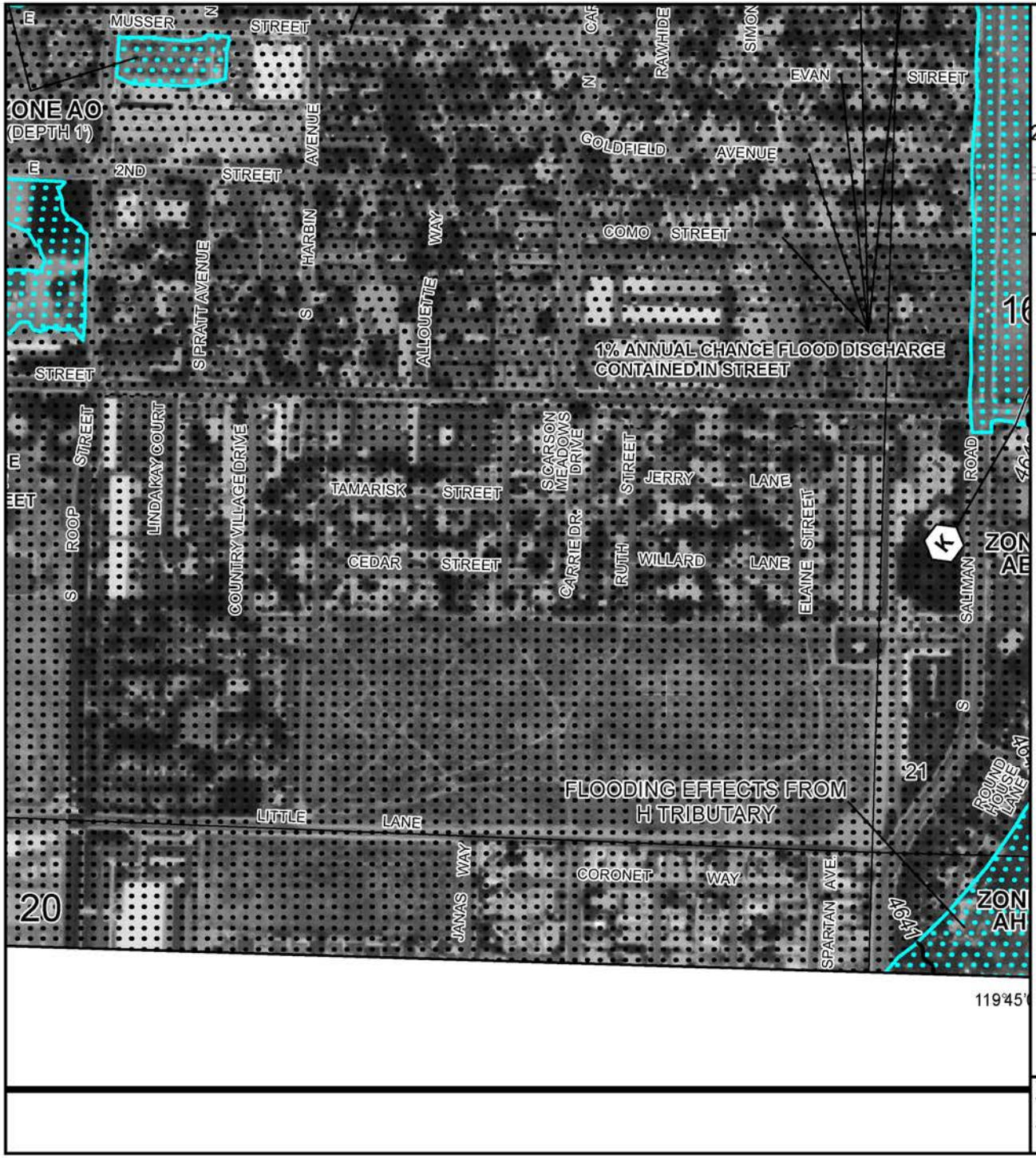
ARBOR VILLAS
CARSON CITY, NEVADA
VICINITY MAP

PROJ. MGR.:	AWM
DRAWN BY:	AWM
DATE:	3/16/2016
SCALE:	N.T.S.

SHEET 1 OF 1

Dwg Name: P:\Cciccnv01\dwg\Eng\Final Drawings\Tentative Map\1 - Title Sheet.dwg Updated By: SJividen 17:28

APPENDIX A
SUPPORTING DATA



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METE

PANEL 0092F

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CARSON CITY, NEVADA

INDEPENDENT CITY

PANEL 92 OF 275

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CARSON CITY	320001	0092	F

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
3200010092F

MAP REVISED
FEBRUARY 19, 2014

Federal Emergency Management Agency

NOAA Atlas 14, Volume 1, Version 5
Location name: Carson City, Nevada, US*
Latitude: 39.1584°, Longitude: -119.7568°
Elevation: 4645 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	**1.14** (0.984-1.36)	**1.43** (1.24-1.69)	**1.91** (1.63-2.26)	**2.36** (2.02-2.81)	**3.12** (2.57-3.71)	**3.80** (3.04-4.55)	**4.63** (3.58-5.59)	**5.62** (4.16-6.89)	**7.19** (5.02-8.99)	**8.59** (5.71-11.0)
10-min	**0.870** (0.750-1.03)	**1.09** (0.936-1.28)	**1.45** (1.24-1.72)	**1.80** (1.53-2.14)	**2.38** (1.96-2.82)	**2.90** (2.32-3.46)	**3.53** (2.72-4.25)	**4.28** (3.17-5.24)	**5.47** (3.82-6.85)	**6.54** (4.35-8.34)
15-min	**0.720** (0.620-0.852)	**0.900** (0.776-1.06)	**1.20** (1.03-1.42)	**1.49** (1.26-1.76)	**1.96** (1.62-2.33)	**2.40** (1.91-2.86)	**2.92** (2.25-3.52)	**3.54** (2.62-4.33)	**4.52** (3.16-5.66)	**5.40** (3.60-6.89)
30-min	**0.486** (0.418-0.574)	**0.604** (0.524-0.716)	**0.808** (0.692-0.958)	**1.00** (0.852-1.19)	**1.32** (1.09-1.57)	**1.61** (1.29-1.93)	**1.96** (1.52-2.37)	**2.38** (1.76-2.92)	**3.04** (2.13-3.81)	**3.64** (2.42-4.64)
60-min	**0.301** (0.259-0.355)	**0.374** (0.324-0.443)	**0.500** (0.429-0.593)	**0.620** (0.528-0.735)	**0.818** (0.674-0.971)	**0.998** (0.798-1.19)	**1.22** (0.938-1.47)	**1.47** (1.09-1.81)	**1.88** (1.32-2.36)	**2.25** (1.50-2.87)
2-hr	**0.204** (0.182-0.234)	**0.253** (0.225-0.290)	**0.322** (0.284-0.368)	**0.384** (0.336-0.438)	**0.478** (0.406-0.548)	**0.560** (0.466-0.650)	**0.654** (0.529-0.768)	**0.768** (0.600-0.914)	**0.964** (0.720-1.19)	**1.15** (0.826-1.45)
3-hr	**0.163** (0.146-0.183)	**0.202** (0.182-0.228)	**0.254** (0.227-0.286)	**0.296** (0.262-0.333)	**0.356** (0.310-0.403)	**0.408** (0.348-0.465)	**0.465** (0.389-0.536)	**0.539** (0.441-0.631)	**0.658** (0.522-0.801)	**0.773** (0.597-0.975)
6-hr	**0.113** (0.102-0.126)	**0.141** (0.127-0.158)	**0.175** (0.157-0.196)	**0.202** (0.180-0.226)	**0.239** (0.210-0.269)	**0.268** (0.232-0.303)	**0.297** (0.253-0.340)	**0.331** (0.276-0.383)	**0.381** (0.309-0.448)	**0.424** (0.337-0.508)
12-hr	**0.074** (0.066-0.083)	**0.093** (0.083-0.105)	**0.117** (0.104-0.132)	**0.136** (0.120-0.153)	**0.162** (0.141-0.183)	**0.181** (0.156-0.207)	**0.201** (0.171-0.232)	**0.222** (0.185-0.259)	**0.250** (0.202-0.297)	**0.271** (0.216-0.328)
24-hr	**0.049** (0.045-0.054)	**0.062** (0.056-0.068)	**0.078** (0.071-0.085)	**0.091** (0.083-0.100)	**0.109** (0.099-0.120)	**0.124** (0.111-0.136)	**0.139** (0.124-0.153)	**0.155** (0.136-0.171)	**0.176** (0.153-0.197)	**0.193** (0.166-0.218)
2-day	**0.029** (0.026-0.033)	**0.037** (0.033-0.041)	**0.047** (0.042-0.053)	**0.055** (0.050-0.062)	**0.067** (0.059-0.075)	**0.076** (0.067-0.086)	**0.086** (0.075-0.097)	**0.096** (0.083-0.109)	**0.110** (0.094-0.126)	**0.121** (0.102-0.140)
3-day	**0.022** (0.019-0.024)	**0.027** (0.024-0.031)	**0.035** (0.031-0.039)	**0.041** (0.037-0.046)	**0.050** (0.044-0.056)	**0.057** (0.050-0.064)	**0.064** (0.056-0.073)	**0.072** (0.062-0.082)	**0.083** (0.070-0.096)	**0.092** (0.077-0.107)
4-day	**0.018** (0.016-0.020)	**0.022** (0.020-0.025)	**0.029** (0.026-0.032)	**0.034** (0.030-0.038)	**0.041** (0.036-0.047)	**0.047** (0.041-0.054)	**0.054** (0.046-0.061)	**0.060** (0.052-0.069)	**0.070** (0.059-0.081)	**0.077** (0.064-0.090)
7-day	**0.012** (0.010-0.013)	**0.015** (0.013-0.017)	**0.019** (0.017-0.022)	**0.023** (0.020-0.026)	**0.028** (0.024-0.031)	**0.031** (0.028-0.036)	**0.036** (0.031-0.040)	**0.040** (0.034-0.045)	**0.046** (0.039-0.053)	**0.051** (0.042-0.059)
10-day	**0.009** (0.008-0.010)	**0.011** (0.010-0.013)	**0.015** (0.013-0.017)	**0.018** (0.016-0.020)	**0.021** (0.019-0.024)	**0.024** (0.021-0.027)	**0.027** (0.023-0.030)	**0.030** (0.026-0.034)	**0.034** (0.029-0.039)	**0.037** (0.031-0.043)
20-day	**0.006** (0.005-0.006)	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.011** (0.009-0.012)	**0.013** (0.011-0.014)	**0.014** (0.013-0.016)	**0.016** (0.014-0.018)	**0.017** (0.015-0.020)	**0.019** (0.017-0.022)	**0.021** (0.018-0.024)
30-day	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.011** (0.009-0.012)	**0.012** (0.010-0.013)	**0.013** (0.011-0.015)	**0.014** (0.012-0.016)	**0.016** (0.013-0.018)
45-day	**0.003** (0.003-0.004)	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.006-0.007)	**0.007** (0.007-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.009-0.011)	**0.011** (0.009-0.012)	**0.011** (0.010-0.013)
60-day	**0.003** (0.003-0.003)	**0.004** (0.003-0.004)	**0.005** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.006-0.007)	**0.007** (0.006-0.008)	**0.007** (0.007-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.009** (0.008-0.010)

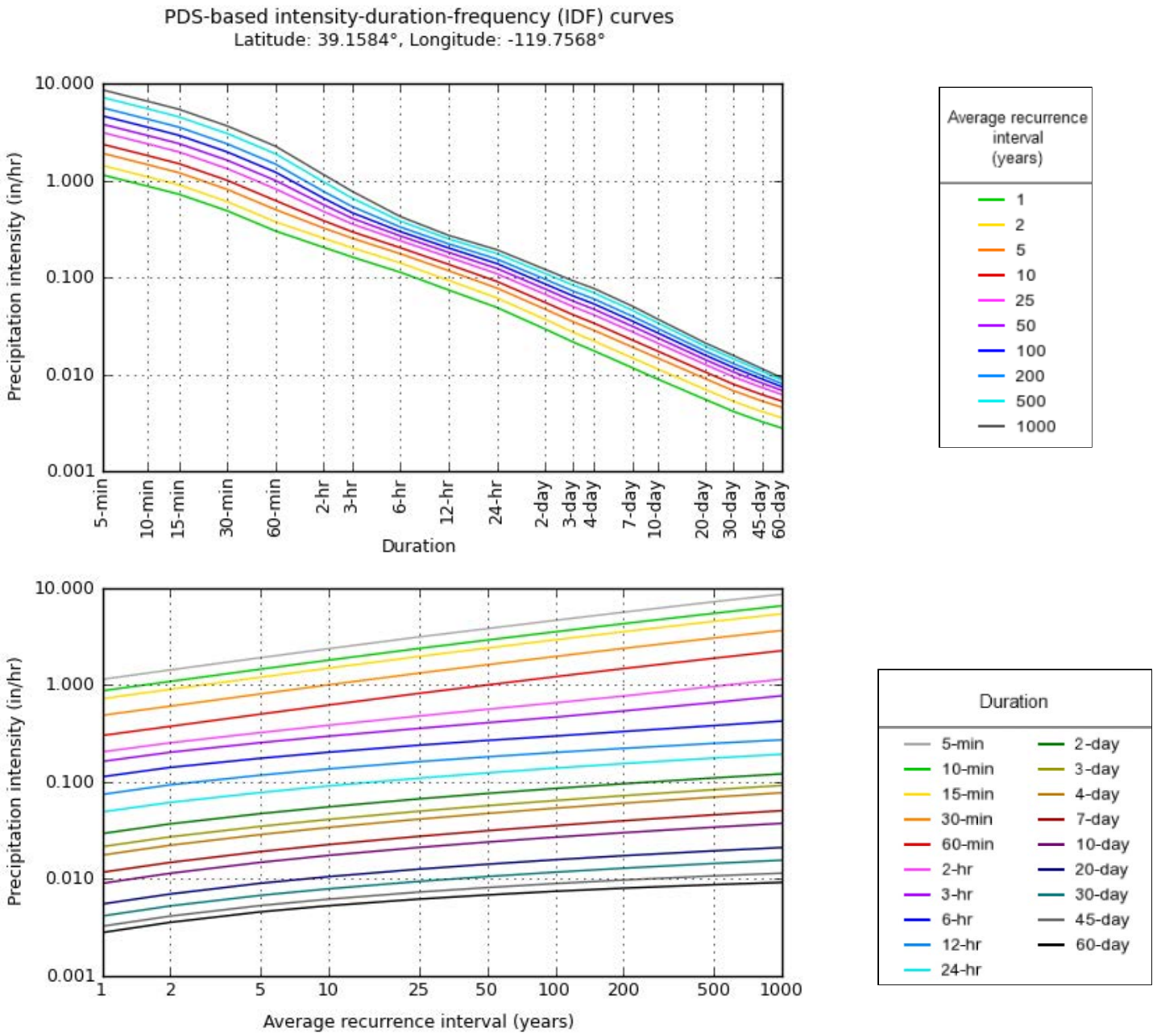
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



NOAA Atlas 14, Volume 1, Version 5 Created (GMT): Thu Mar 17 00:09:22 2016

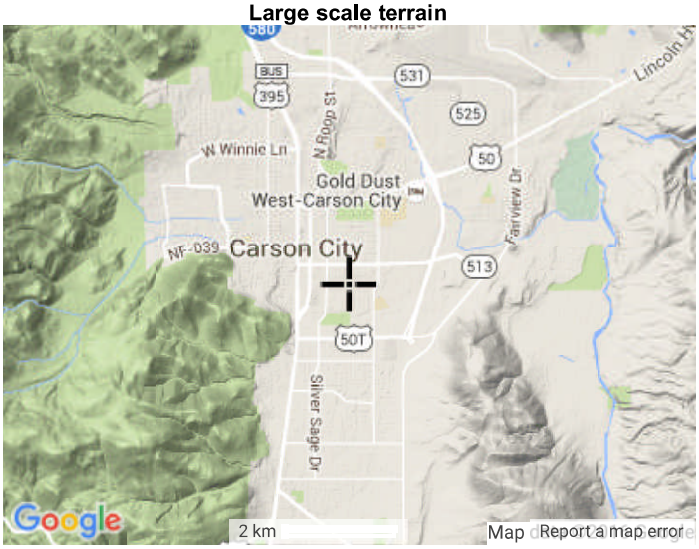
Back to Top

Maps & aerials

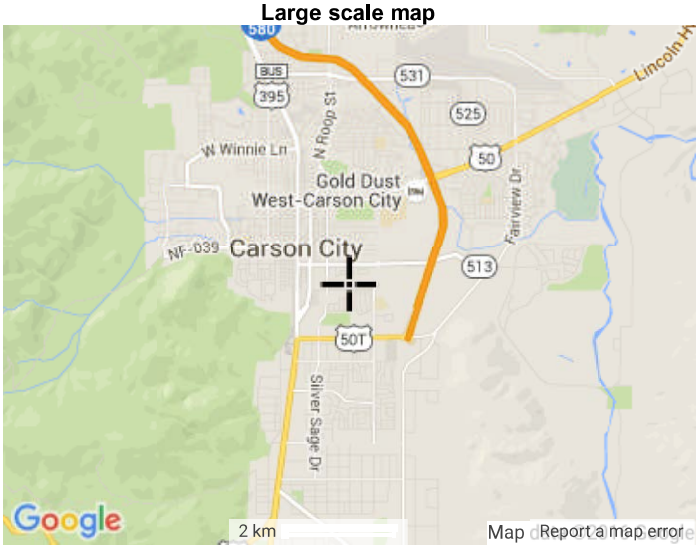
Small scale terrain

12

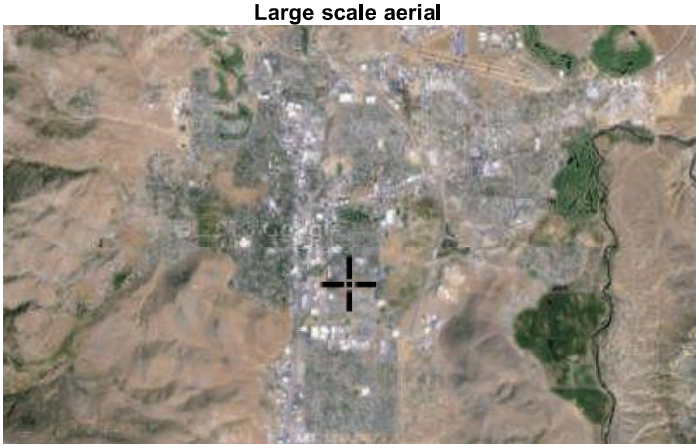
Large scale terrain



Large scale map



Large scale aerial



APPENDIX B
EXISTING CONDITIONS HYDROLOGICAL ANALYSIS
5-YEAR AND 100-YEAR OUTPUT DATA TABLES

Project Description

File Name	Ex-5Year.SPF
Description	
	Arbor Villas Development
	Carson City, Nevada
	Preliminary Drainage Study
	Existing 5-year Peak Event

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jan 22, 2016	00:00:00
End Analysis On	Jan 23, 2016	00:00:00
Start Reporting On	Jan 22, 2016	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	5 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01	10.31	0.2000	0.30	0.06	0.61	2.45	0 00:15:00

Project Description

File Name	Ex-100Year.SPF
Description	
	Arbor Villas Development
	Carson City, Nevada
	Preliminary Drainage Study
	Existing 100-year Peak Event

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jan 22, 2016	00:00:00
End Analysis On	Jan 23, 2016	00:00:00
Start Reporting On	Jan 22, 2016	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01	10.31	0.5000	0.73	0.36	3.73	14.95	0 00:15:00

APPENDIX C
PROPOSED CONDITIONS HYDROLOGICAL ANALYSIS
5-YEAR AND 100-YEAR OUTPUT DATA TABLES

Project Description

File Name	Prop-5Year.SPF
Description	Arbor Villas Development Carson City, Nevada Preliminary drainage Study proposed 100-year Peak Event

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 16, 2016	00:00:00
End Analysis On	Mar 17, 2016	00:00:00
Start Reporting On	Mar 16, 2016	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	20
Nodes	40
Junctions	19
Outfalls	1
Flow Diversions	0
Inlets	16
Storage Nodes	4
Links	39
Channels	0
Pipes	39
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	5 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BASIN-01	0.73	0.6000	0.24	0.15	0.11	0.64	0 00:10:00
2	BASIN-02	0.72	0.6000	0.24	0.15	0.10	0.63	0 00:10:00
3	BASIN-03	0.85	0.6000	0.24	0.15	0.12	0.74	0 00:10:00
4	BASIN-04	0.17	0.8800	0.24	0.21	0.04	0.22	0 00:10:00
5	BASIN-05	0.53	0.8800	0.24	0.21	0.11	0.68	0 00:10:00
6	BASIN-06	0.17	0.8800	0.24	0.21	0.04	0.22	0 00:10:00
7	BASIN-07	0.55	0.8800	0.24	0.21	0.12	0.70	0 00:10:00
8	BASIN-08	0.92	0.3300	0.24	0.08	0.07	0.44	0 00:10:00
9	BASIN-09	0.73	0.6000	0.24	0.15	0.11	0.64	0 00:10:00
10	BASIN-10	0.73	0.3800	0.24	0.09	0.07	0.40	0 00:10:00
11	BASIN-11	0.23	0.8000	0.24	0.19	0.04	0.27	0 00:10:00
12	BASIN-12	0.15	0.8800	0.24	0.21	0.03	0.19	0 00:10:00
13	BASIN-13	0.67	0.3600	0.24	0.09	0.06	0.35	0 00:10:00
14	BASIN-14	0.20	0.6000	0.24	0.15	0.03	0.17	0 00:10:00
15	BASIN-15	0.54	0.7400	0.24	0.18	0.10	0.58	0 00:10:00
16	BASIN-16	0.82	0.3500	0.24	0.09	0.07	0.42	0 00:10:00
17	BASIN-17	0.22	0.6000	0.24	0.15	0.03	0.19	0 00:10:00
18	BASIN-18	0.42	0.7400	0.24	0.18	0.08	0.45	0 00:10:00
19	BASIN-19	0.51	0.7400	0.24	0.18	0.09	0.55	0 00:10:00
20	BASIN-20	0.45	0.6000	0.24	0.15	0.07	0.39	0 00:10:00

Project Description

File Name	Prop-100Year.SPF
Description	
	Arbor Villas Development
	Carson City, Nevada
	Preliminary Drainage Study
	Proposed 100-year Peak Event

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 16, 2016	00:00:00
End Analysis On	Mar 17, 2016	00:00:00
Start Reporting On	Mar 16, 2016	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	20
Nodes	40
Junctions	19
Outfalls	1
Flow Diversions	0
Inlets	16
Storage Nodes	4
Links	39
Channels	0
Pipes	39
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BASIN-01	0.73	0.7800	0.59	0.46	0.34	2.01	0 00:10:00
2	BASIN-02	0.72	0.7800	0.59	0.46	0.33	1.98	0 00:10:00
3	BASIN-03	0.85	0.7800	0.59	0.46	0.39	2.34	0 00:10:00
4	BASIN-04	0.17	0.9300	0.59	0.55	0.09	0.56	0 00:10:00
5	BASIN-05	0.53	0.9300	0.59	0.55	0.29	1.74	0 00:10:00
6	BASIN-06	0.17	0.9300	0.59	0.55	0.09	0.56	0 00:10:00
7	BASIN-07	0.55	0.9300	0.59	0.55	0.30	1.81	0 00:10:00
8	BASIN-08	0.92	0.5900	0.59	0.35	0.32	1.92	0 00:10:00
9	BASIN-09	0.73	0.7800	0.59	0.46	0.34	2.01	0 00:10:00
10	BASIN-10	0.73	0.6300	0.59	0.37	0.27	1.62	0 00:10:00
11	BASIN-11	0.23	0.9300	0.59	0.55	0.13	0.76	0 00:10:00
12	BASIN-12	0.15	0.9300	0.59	0.55	0.08	0.49	0 00:10:00
13	BASIN-13	0.67	0.6100	0.59	0.36	0.24	1.44	0 00:10:00
14	BASIN-14	0.20	0.7800	0.59	0.46	0.09	0.55	0 00:10:00
15	BASIN-15	0.54	0.8500	0.59	0.50	0.27	1.62	0 00:10:00
16	BASIN-16	0.82	0.6000	0.59	0.35	0.29	1.74	0 00:10:00
17	BASIN-17	0.22	0.7800	0.59	0.46	0.10	0.61	0 00:10:00
18	BASIN-18	0.42	0.8600	0.59	0.51	0.21	1.28	0 00:10:00
19	BASIN-19	0.51	0.8600	0.59	0.51	0.26	1.55	0 00:10:00
20	BASIN-20	0.45	0.7800	0.59	0.46	0.21	1.24	0 00:10:00

APPENDIX D
HYDRAULIC ANALYSES
DETENTION CALCUALTIONS

Project Description

File Name	Prop-5Year.SPF
Description	Arbor Villas Development Carson City, Nevada Preliminary drainage Study proposed 100-year Peak Event

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 16, 2016	00:00:00
End Analysis On	Mar 17, 2016	00:00:00
Start Reporting On	Mar 16, 2016	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	20
Nodes	40
Junctions	19
Outfalls	1
Flow Diversions	0
Inlets	16
Storage Nodes	4
Links	39
Channels	0
Pipes	39
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	5 year(s)

Storage Nodes

Storage Node : POND-01

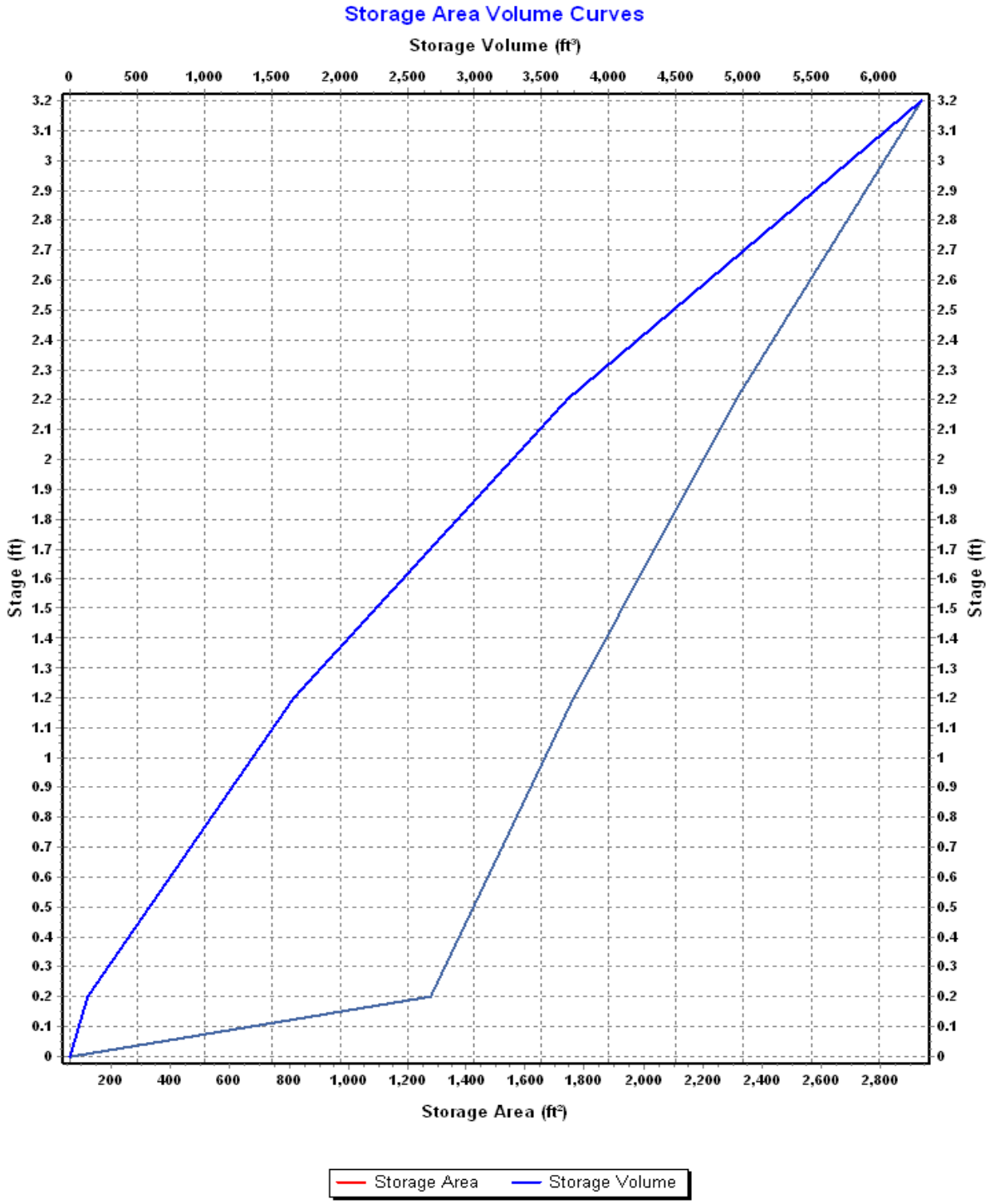
Input Data

Invert Elevation (ft)	4646.80
Max (Rim) Elevation (ft)	4650.00
Max (Rim) Offset (ft)	3.20
Initial Water Elevation (ft)	4646.80
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	2938.60
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-01

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	60	0.000
0.2	1280.6	134.06
1.2	1761.3	1655.01
2.2	2313.9	3692.61
3.2	2938.6	6318.86


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
Stage (ft)
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-01 (continued)

Output Summary Results

Peak Inflow (cfs)	0.63
Peak Lateral Inflow (cfs)	0.63
Peak Outflow (cfs)	0.00
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4647.19
Max HGL Depth Attained (ft)	0.39
Average HGL Elevation Attained (ft)	4647.18
Average HGL Depth Attained (ft)	0.38
Time of Max HGL Occurrence (days hh:mm)	0 00:20
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : POND-02

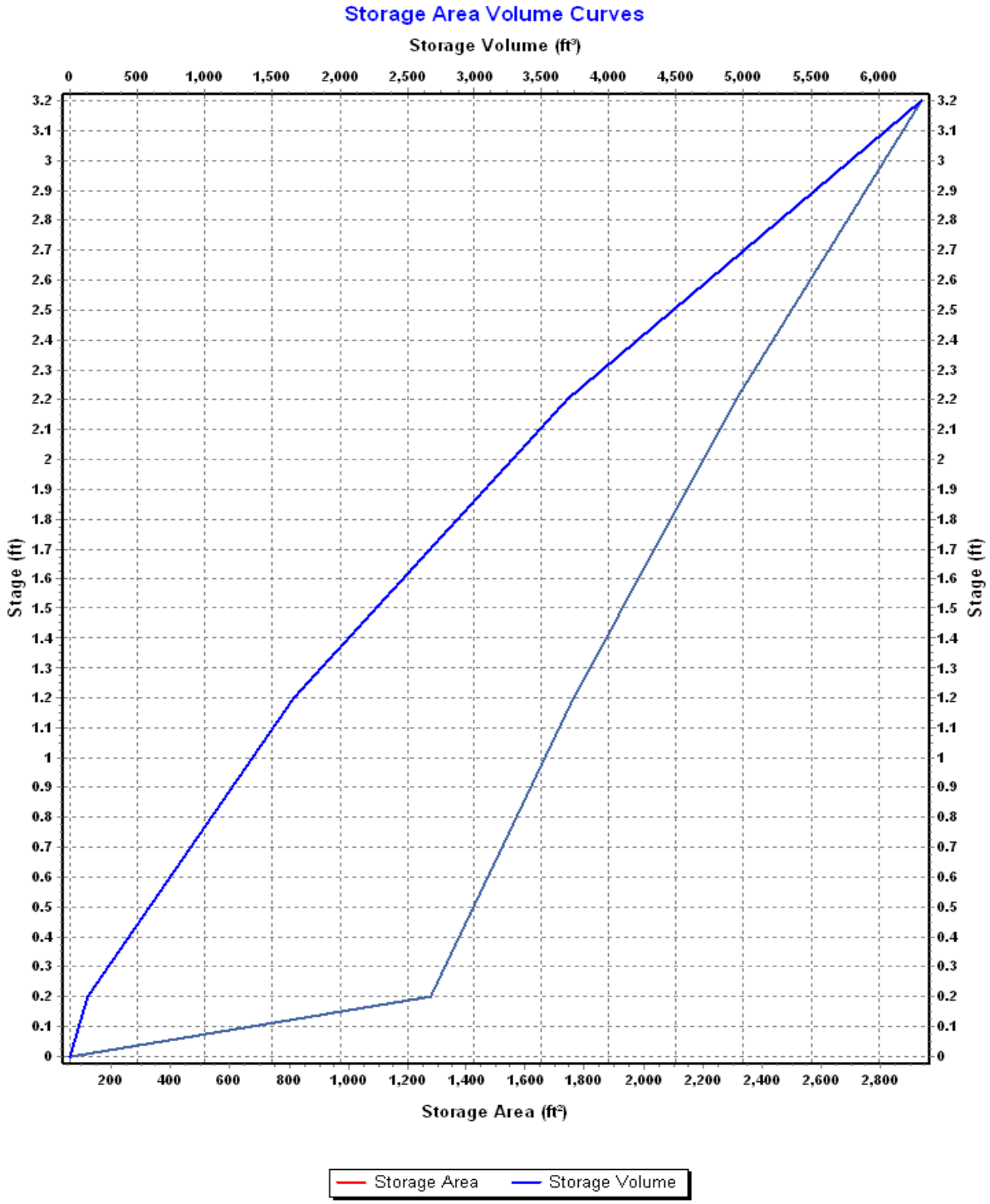
Input Data

Invert Elevation (ft) 4646.80
Max (Rim) Elevation (ft) 4650.00
Max (Rim) Offset (ft) 3.20
Initial Water Elevation (ft) 4646.80
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 2938.60
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : POND-02

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	60	0.000
0.2	1280.6	134.06
1.2	1761.3	1655.01
2.2	2313.9	3692.61
3.2	2938.6	6318.86


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
Stage (ft)
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-02 (continued)

Output Summary Results

Peak Inflow (cfs)	0.40
Peak Lateral Inflow (cfs)	0.40
Peak Outflow (cfs)	0.00
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4647.08
Max HGL Depth Attained (ft)	0.28
Average HGL Elevation Attained (ft)	4647.08
Average HGL Depth Attained (ft)	0.28
Time of Max HGL Occurrence (days hh:mm)	0 00:20
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : POND-03

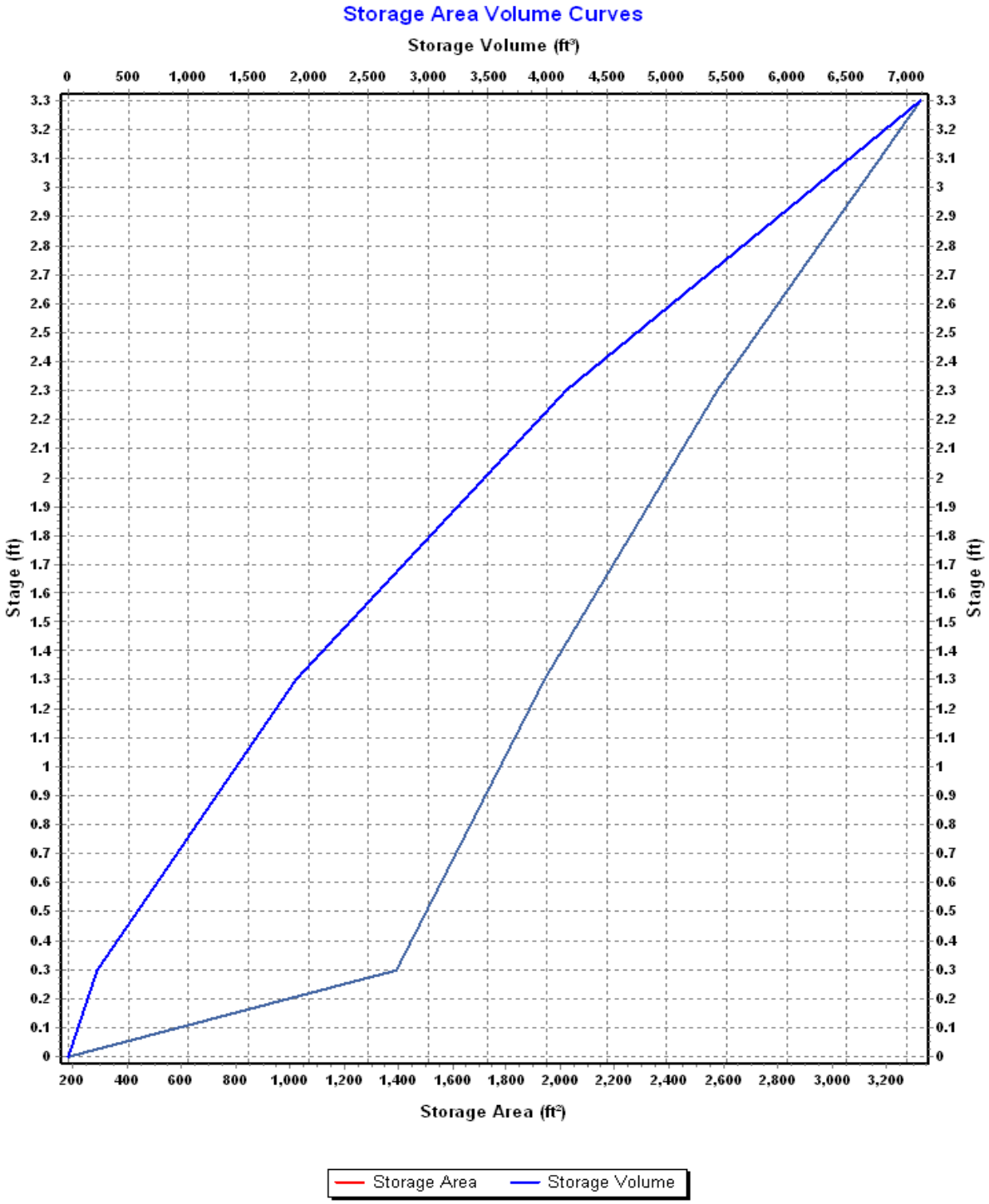
Input Data

Invert Elevation (ft)	4647.70
Max (Rim) Elevation (ft)	4651.00
Max (Rim) Offset (ft)	3.30
Initial Water Elevation (ft)	4647.70
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	3325.70
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-03

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	184.5	0.000
0.3	1393.9	236.76
1.3	1938.5	1902.96
2.3	2579.0	4161.71
3.3	3325.7	7114.06


Storage Area Volume Curves
Storage Volume (ft³)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000 5,500 6,000 6,500 7,000
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3
200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600 2,800 3,000 3,200
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-03 (continued)

Output Summary Results

Peak Inflow (cfs)	1.34
Peak Lateral Inflow (cfs)	0.35
Peak Outflow (cfs)	0.03
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4648.38
Max HGL Depth Attained (ft)	0.68
Average HGL Elevation Attained (ft)	4648.37
Average HGL Depth Attained (ft)	0.67
Time of Max HGL Occurrence (days hh:mm)	0 01:09
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : POND-04

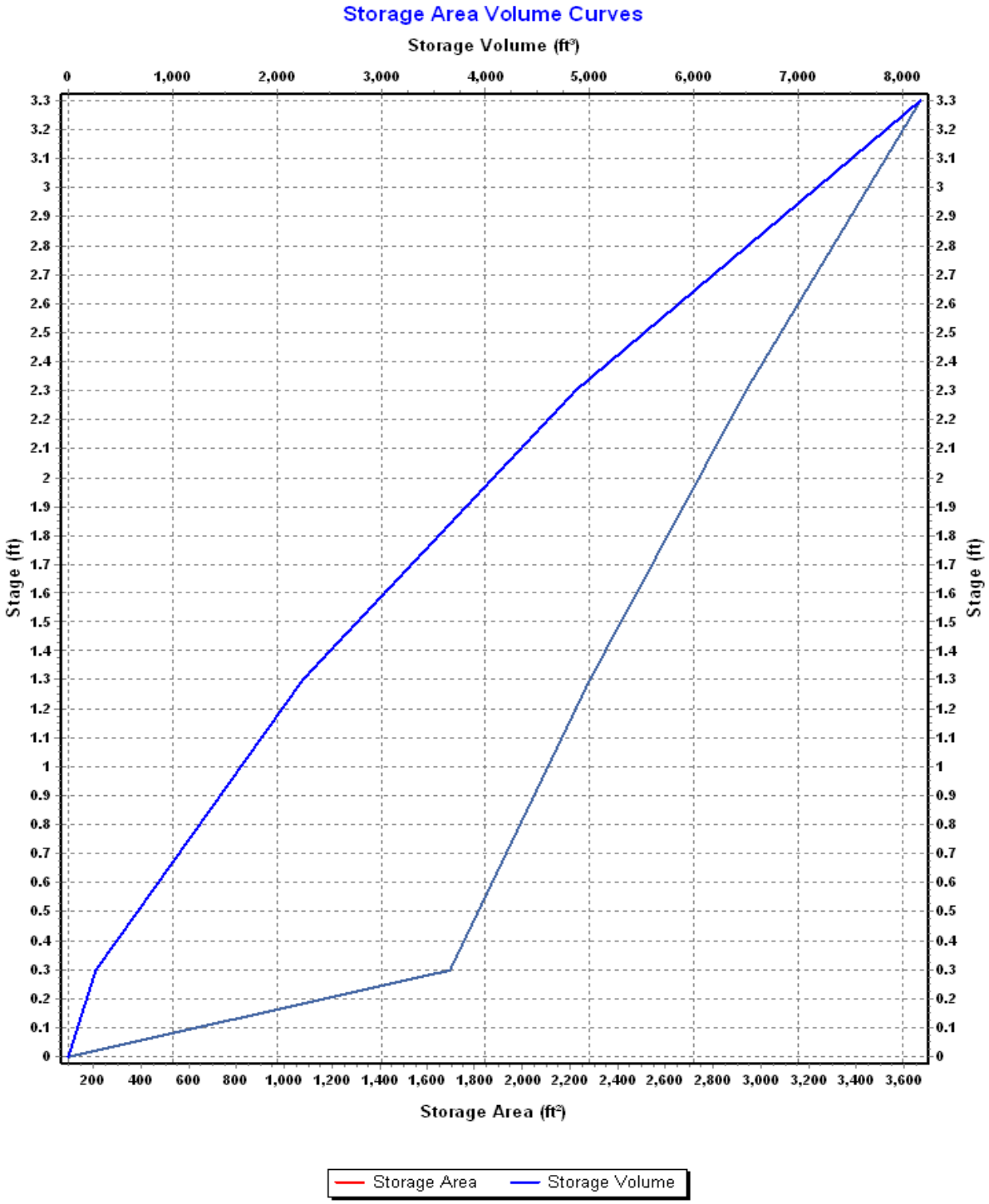
Input Data

Invert Elevation (ft)	4647.70
Max (Rim) Elevation (ft)	4651.00
Max (Rim) Offset (ft)	3.30
Initial Water Elevation (ft)	4647.70
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	3367.60
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-04

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	96.5	0.000
0.3	1692.7	268.38
1.3	2279.1	2254.28
2.3	2937.8	4862.73
3.3	3667.6	8165.43


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
Stage (ft)
Stage (ft)
3.3
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
3,600
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-04 (continued)

Output Summary Results

Peak Inflow (cfs)	1.93
Peak Lateral Inflow (cfs)	0.42
Peak Outflow (cfs)	0.13
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4648.41
Max HGL Depth Attained (ft)	0.71
Average HGL Elevation Attained (ft)	4648.41
Average HGL Depth Attained (ft)	0.71
Time of Max HGL Occurrence (days hh:mm)	0 00:32
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name	Prop-100Year.SPF
Description	
	Arbor Villas Development
	Carson City, Nevada
	Preliminary Drainage Study
	Proposed 100-year Peak Event

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 16, 2016	00:00:00
End Analysis On	Mar 17, 2016	00:00:00
Start Reporting On	Mar 16, 2016	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	20
Nodes	40
Junctions	19
Outfalls	1
Flow Diversions	0
Inlets	16
Storage Nodes	4
Links	39
Channels	0
Pipes	39
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BASIN-01	0.73	0.7800	0.59	0.46	0.34	2.01	0 00:10:00
2	BASIN-02	0.72	0.7800	0.59	0.46	0.33	1.98	0 00:10:00
3	BASIN-03	0.85	0.7800	0.59	0.46	0.39	2.34	0 00:10:00
4	BASIN-04	0.17	0.9300	0.59	0.55	0.09	0.56	0 00:10:00
5	BASIN-05	0.53	0.9300	0.59	0.55	0.29	1.74	0 00:10:00
6	BASIN-06	0.17	0.9300	0.59	0.55	0.09	0.56	0 00:10:00
7	BASIN-07	0.55	0.9300	0.59	0.55	0.30	1.81	0 00:10:00
8	BASIN-08	0.92	0.5900	0.59	0.35	0.32	1.92	0 00:10:00
9	BASIN-09	0.73	0.7800	0.59	0.46	0.34	2.01	0 00:10:00
10	BASIN-10	0.73	0.6300	0.59	0.37	0.27	1.62	0 00:10:00
11	BASIN-11	0.23	0.9300	0.59	0.55	0.13	0.76	0 00:10:00
12	BASIN-12	0.15	0.9300	0.59	0.55	0.08	0.49	0 00:10:00
13	BASIN-13	0.67	0.6100	0.59	0.36	0.24	1.44	0 00:10:00
14	BASIN-14	0.20	0.7800	0.59	0.46	0.09	0.55	0 00:10:00
15	BASIN-15	0.54	0.8500	0.59	0.50	0.27	1.62	0 00:10:00
16	BASIN-16	0.82	0.6000	0.59	0.35	0.29	1.74	0 00:10:00
17	BASIN-17	0.22	0.7800	0.59	0.46	0.10	0.61	0 00:10:00
18	BASIN-18	0.42	0.8600	0.59	0.51	0.21	1.28	0 00:10:00
19	BASIN-19	0.51	0.8600	0.59	0.51	0.26	1.55	0 00:10:00
20	BASIN-20	0.45	0.7800	0.59	0.46	0.21	1.24	0 00:10:00

Storage Nodes

Storage Node : POND-01

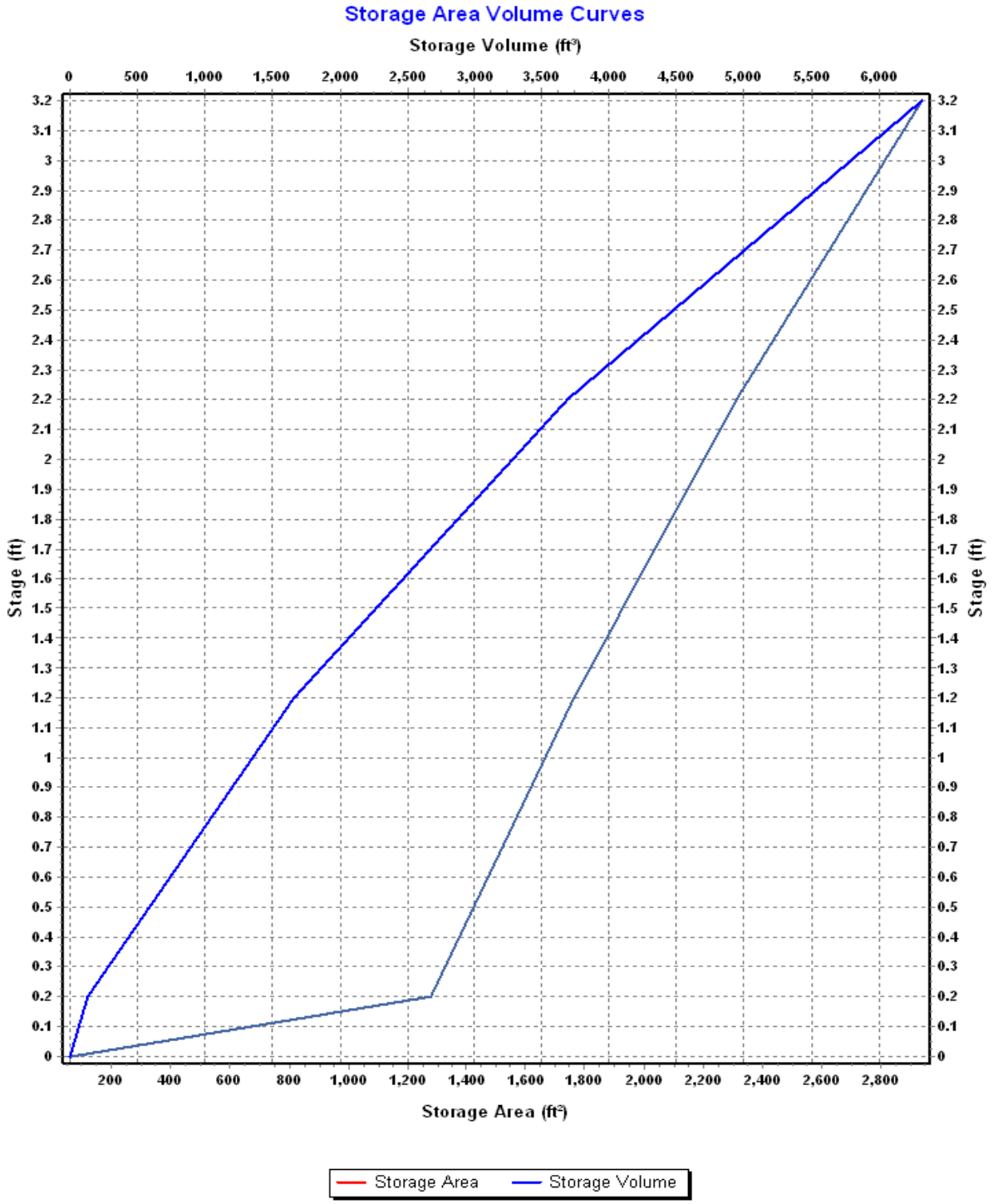
Input Data

Invert Elevation (ft)	4646.80
Max (Rim) Elevation (ft)	4650.00
Max (Rim) Offset (ft)	3.20
Initial Water Elevation (ft)	4646.80
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	2938.60
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-01

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	60	0.000
0.2	1280.6	134.06
1.2	1761.3	1655.01
2.2	2313.9	3692.61
3.2	2938.6	6318.86


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
Stage (ft)
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-01 (continued)

Output Summary Results

Peak Inflow (cfs)	2.00
Peak Lateral Inflow (cfs)	2.00
Peak Outflow (cfs)	0.00
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4647.73
Max HGL Depth Attained (ft)	0.93
Average HGL Elevation Attained (ft)	4647.73
Average HGL Depth Attained (ft)	0.93
Time of Max HGL Occurrence (days hh:mm)	0 00:20
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : POND-02

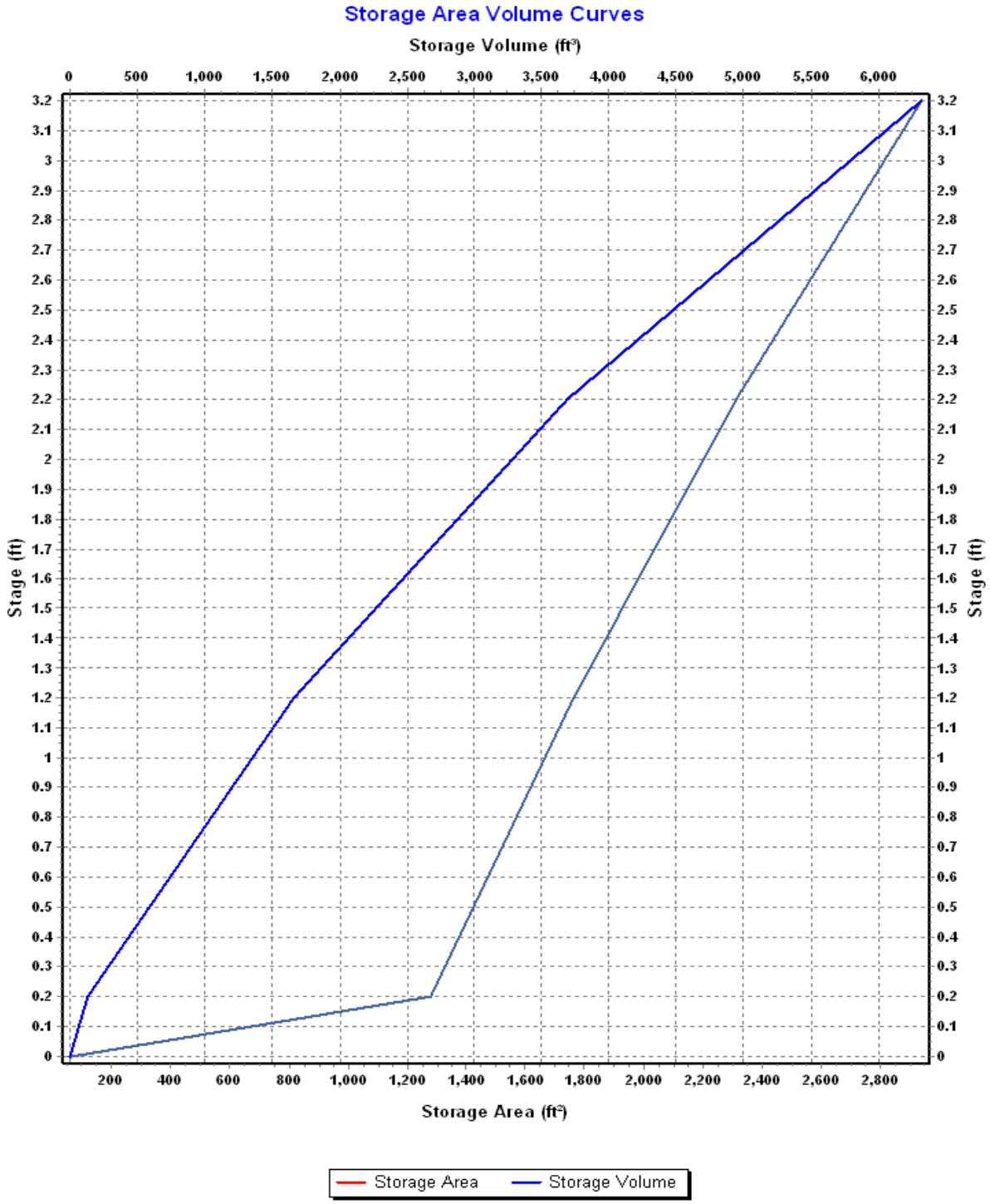
Input Data

Invert Elevation (ft)	4646.80
Max (Rim) Elevation (ft)	4650.00
Max (Rim) Offset (ft)	3.20
Initial Water Elevation (ft)	4646.80
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	2938.60
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-02

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	60	0.000
0.2	1280.6	134.06
1.2	1761.3	1655.01
2.2	2313.9	3692.61
3.2	2938.6	6318.86


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
Stage (ft)
Storage Area (ft²)
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
Storage Area
Storage Volume

Storage Node : POND-02 (continued)

Output Summary Results

Peak Inflow (cfs)	1.61
Peak Lateral Inflow (cfs)	1.61
Peak Outflow (cfs)	0.00
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4647.59
Max HGL Depth Attained (ft)	0.79
Average HGL Elevation Attained (ft)	4647.58
Average HGL Depth Attained (ft)	0.78
Time of Max HGL Occurrence (days hh:mm)	0 00:20
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : POND-03

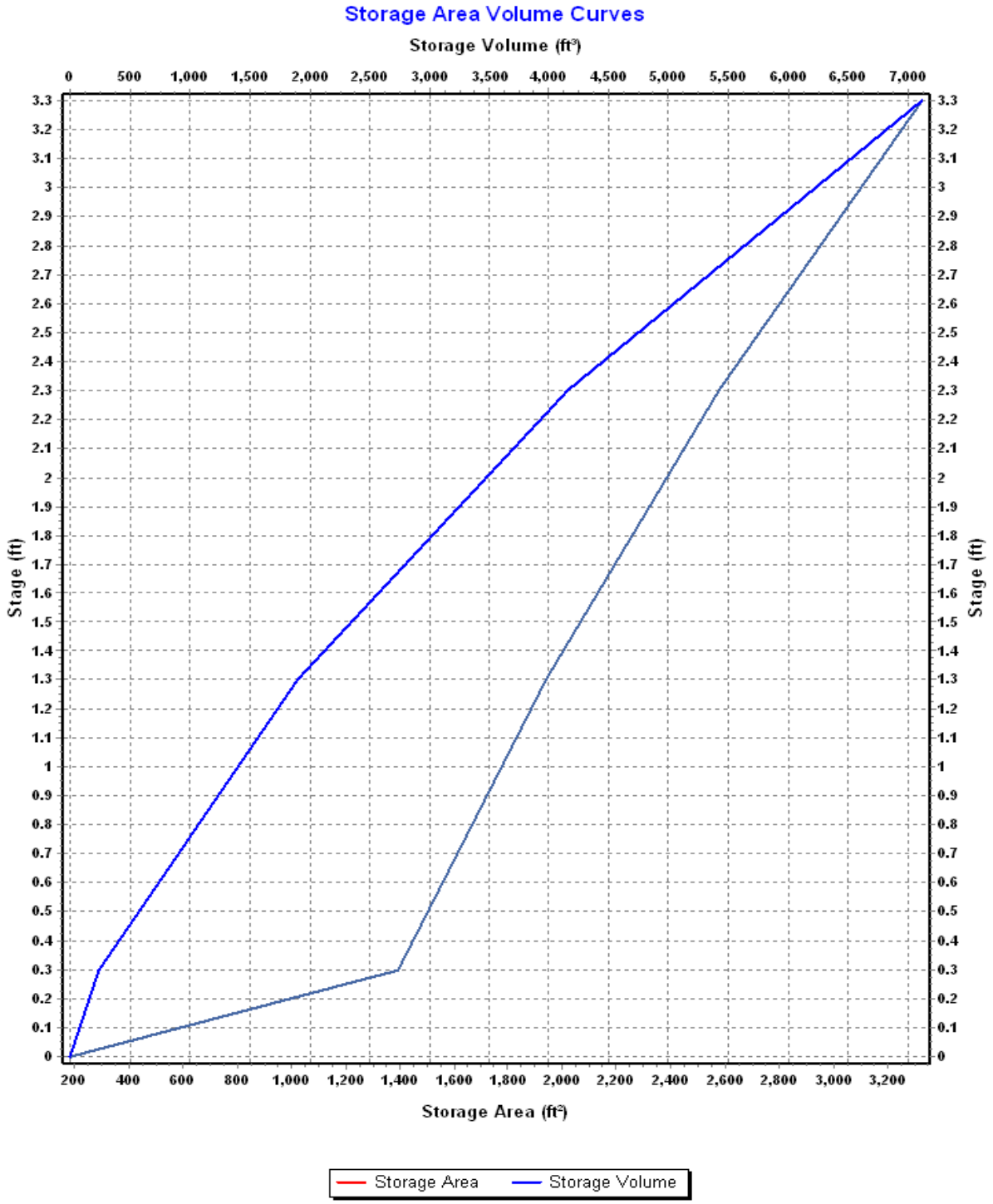
Input Data

Invert Elevation (ft)	4647.70
Max (Rim) Elevation (ft)	4651.00
Max (Rim) Offset (ft)	3.30
Initial Water Elevation (ft)	4647.70
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	3325.70
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-03

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	184.5	0.000
0.3	1393.9	236.76
1.3	1938.5	1902.96
2.3	2579.0	4161.71
3.3	3325.7	7114.06


Storage Area Volume Curves
Storage Volume (ft³)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000 4,500 5,000 5,500 6,000 6,500 7,000
Stage (ft)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3
200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600 2,800 3,000 3,200
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-03 (continued)

Output Summary Results

Peak Inflow (cfs)	4.13
Peak Lateral Inflow (cfs)	1.43
Peak Outflow (cfs)	0.29
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4649.16
Max HGL Depth Attained (ft)	1.46
Average HGL Elevation Attained (ft)	4649.01
Average HGL Depth Attained (ft)	1.31
Time of Max HGL Occurrence (days hh:mm)	0 00:19
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : POND-04

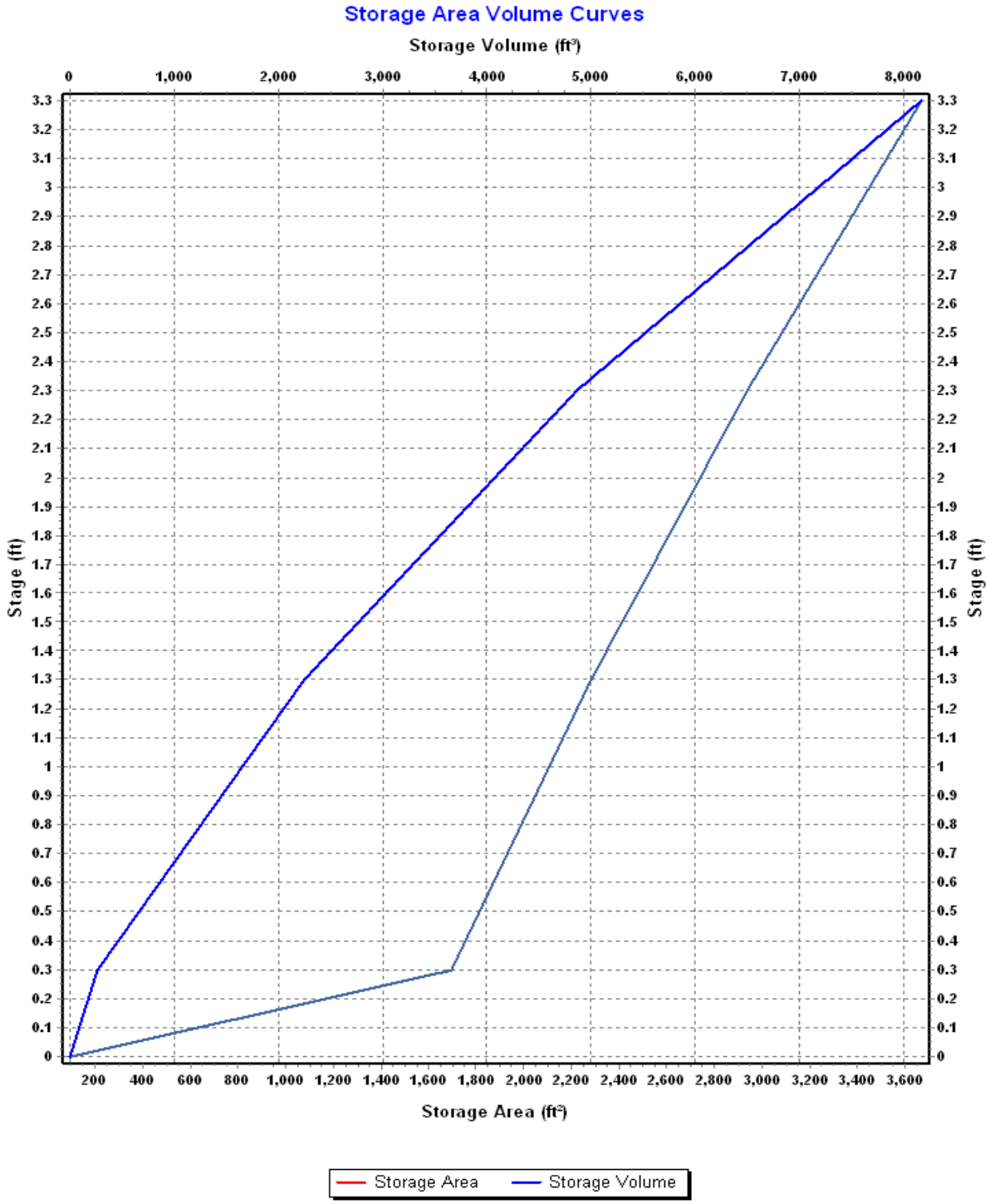
Input Data

Invert Elevation (ft)	4647.70
Max (Rim) Elevation (ft)	4651.00
Max (Rim) Offset (ft)	3.30
Initial Water Elevation (ft)	4647.70
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	3367.60
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : POND-04

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	96.5	0.000
0.3	1692.7	268.38
1.3	2279.1	2254.28
2.3	2937.8	4862.73
3.3	3667.6	8165.43


Storage Area Volume Curves
Storage Volume (ft³)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
Stage (ft)
Stage (ft)
3.3
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
3,600
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND-04 (continued)

Output Summary Results

Peak Inflow (cfs)	5.82
Peak Lateral Inflow (cfs)	1.73
Peak Outflow (cfs)	0.90
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	4649.31
Max HGL Depth Attained (ft)	1.61
Average HGL Elevation Attained (ft)	4649.01
Average HGL Depth Attained (ft)	1.31
Time of Max HGL Occurrence (days hh:mm)	0 00:18
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

PRELIMINARY SEWER REPORT

FOR

ARBOR VILLAS

CARSON CITY, NEVADA

Prepared for:

Capstone Communities
9441 Double Diamond Pkwy #14
Reno, Nevada 89521

Prepared by:

Manhard Consulting Ltd.
9850 Double R Boulevard
Suite 101
Reno, Nevada 89521

Project: CCICCNV01 *Date:* 3/17/16

Table of Contents

Appendices

1 INTRODUCTION

1.1 Purpose of Analysis

This report represents a detailed analysis of the proposed sanitary sewer system for the Arbor Villas. The purpose of this analysis is to establish peak flow rates and evaluate proposed sanitary sewer sizes for the subject property.

1.2 Project Location and Description

The Arbor Villas development is approximately 10.3 acres in size and is located in the southern portion of Carson City and is east of South Stewart Street, south of East 5th Street, west of South Saliman Road Drive, and north of Little Lane5. Formally, this site is situated within Section 17, Township 15 North, and Range 20 East of the Mount Diablo Meridian (refer to Figure 1, Vicinity Map). The project site is within the existing parcels 004-021-13.

Figure 2, the Sewer Main Layout, illustrates the location and orientation of the project and its proposed lots and roadway locations.

1.3 Project Description

The Arbor Villas Development is a proposed subdivision which consists of 147 single-family residential units. The project site is currently zoned within the GC zoning district and has an approved tentative map P.U.D. through Carson City.

2 PROPOSED ALIGNMENT AND QUANTITY OF SERVICE

2.1 Project Wastewater Collection System

Sewage flow from Arbor Villas will be conveyed via public 8" diameter PVC SDR-35 sewer mains to the collection point (manhole) located at the entrance of the development. The sanitary sewer main within the development flows south to the connection of the existing 15-inch sanitary sewer located in Little Lane. All of the mains within the proposed subdivision are located within the rights-of-way of the local roadways. The proposed sizes and locations of the sanitary sewers can be found on the *Sanitary Sewer Plan*, which is included in this report.

The minimum and maximum proposed slopes used within this development are 0.40% and 1.60%, respectively. These slopes have been checked to ensure that they are within the Carson City required velocity of 2 fps and 10 fps during the peak flow condition.

2.2 Estimated Peak Sewage Flows

Calculations for the design of the sewer system were performed in accordance with Chapter 10, Section 11.243 of the Recommended Standards for Wastewater Facilities, 2004 Edition and Division 15, Section 15.3.2 of the Carson City Development Standards and Carson City's Sewer Flow Monitoring Analysis (CCSFMA). According to CCSFMA, the actual per capita

flow ranges from 125 – 150 gal/cap/day with a peaking factor ranging from 3.5 – 3.8. For this analysis, the flow factors used in the calculations are 2.5 capita per dwelling unit for a single-family residential lot and 150 gal/cap/day to calculate average daily flow. A peaking factor of 3.8 is then applied to the daily average flow to compute the peak flow used in the design of the sanitary sewer. Complete peak flow calculations for Arbor Villas are included within this report. This analysis is considered to be conservative based on the CCSMA results. The following table summarizes the results of the calculations of the peak daily flows for the residential subdivision:

Units	Capita/DU	GPD/ Capita	Peaking Factor	Peak Flow (gpd)	Peak Flow (cfs)
41	2.5	150	3.80	209,475	0.32
			Total	**209,475**	**0.32**

2.3 Proposed Sewer Mains

Basic normal depth calculations for the proposed 8-inch and 10-inch sewer mains were done using open-channel pipe flow theory, the Manning's Formula, and *Bentley FlowMaster® V8i®* (*FlowMaster*) software. A Manning's Coefficient of 0.013 (assuming PVC pipe material) was used in all of these calculations. The *FlowMaster* worksheets that demonstrate these calculations are included within this report (Appendix A).

Per Carson City Development Standards, sewer mains are considered at capacity when peak flow is at d/D=0.75 (Div. 15, Section 15.3.2.a.). In addition, the minimum velocity of 2 fps and the maximum velocity of 10 fps are required design conditions (Div 15, Section 15.3.2.e.). The *FlowMaster* calculations included within this report demonstrate that the various velocities of PVC sewer pipe at a d/D of 75% at the minimum and maximum slopes mentioned above are within the requirements for Carson City. The velocity of an 8-inch sewer main is 2.48 fps for a minimum pipe slope of 0.40% and 2.77 fps for a maximum pipe slope of 0.50%. All of the calculated velocities described above are within the Carson City required ranged of 2 fps to 10 fps. These velocity calculations can be found in the *FlowMaster* calculations included within this report.

In addition to evaluating the sewer velocities within this development, this report also analyzes maximum capacity within the proposed sewer pipes. As described above, the peak flow within the sewer main must remain at or below a normal depth of 75%. As shown in the *FlowMaster* calculations included within this report, an 8-inch PVC sewer at 0.40% can convey 450,420 gpd (0.70 cfs) at a maximum depth of 75%. Therefore, each individual neighborhood can be served by an 8-inch sewer system because the maximum sewer loading for the largest neighborhood, Arbor Villas, is 209,475 gpd (0.32 cfs), which is less than the maximum allowed capacity of an 8-inch sewer. The size and locations of the proposed sanitary sewers mentioned above can be found on the *Sanitary Sewer Plan*, which is included in this report.

3 CONCLUSION

The 8-inch sanitary sewer mains proposed herein will adequately serve the project as planned. The attached *FlowMaster* worksheets calculates the maximum capacity of the proposed 8-inch sewer mains at a minimum slope of 0.40% in accordance with the

requirements of Carson City. The 8-inch sewers at 0.40% have a capacity of 450,420 gpd (0.70 cfs) at a maximum depth of 75%, which will be able to adequately serve Arbor Villas.

The proposed sanitary sewerage system within this report for the Arbor Villas development has adequate capacity to carry the subject property's peak sewage flow in conformance with the guidelines outlined in the Carson City Development Standards and the Recommended Standards for Wastewater Facilities.

SANITARY SEWER CALCULATIONS FOR ARBOR VILLAS

The following calculations were performed in accordance with Chapter 10, Section 11.243 of the Recommended Standards for Wastewater Facilities, 2004 ed. (Ten-States Standards), and the Carson City Development Standards:

2.5 capita/dwelling unit
150 gal/capita/day

The site will consist of 147 dwelling units; therefore the following equations are used:

Average flow = num. of dwellings * capita/dwelling * GPCD

Average flow = 147 * 2.5 * 150 = 55,125 gpd = 0.09 cfs

Peak flow = Average flow * peaking factor

Peaking Factor = $(18 + P^{1/2}) / (4+P^{1/2})$ where P = population in thousands (i.e. dwelling units x 3.5 divided by 1,000). Maximum peaking factor is 4.0. However, according CCSFMA a peaking factor of 3.8 is acceptable.

Calculated peaking factor = 3.80

Peak flow = 55,125 * 3.8 = 209,475 gpd = 0.32 cfs

The design shall be for the peak flow; therefore the design flow is 0.32 cfs.

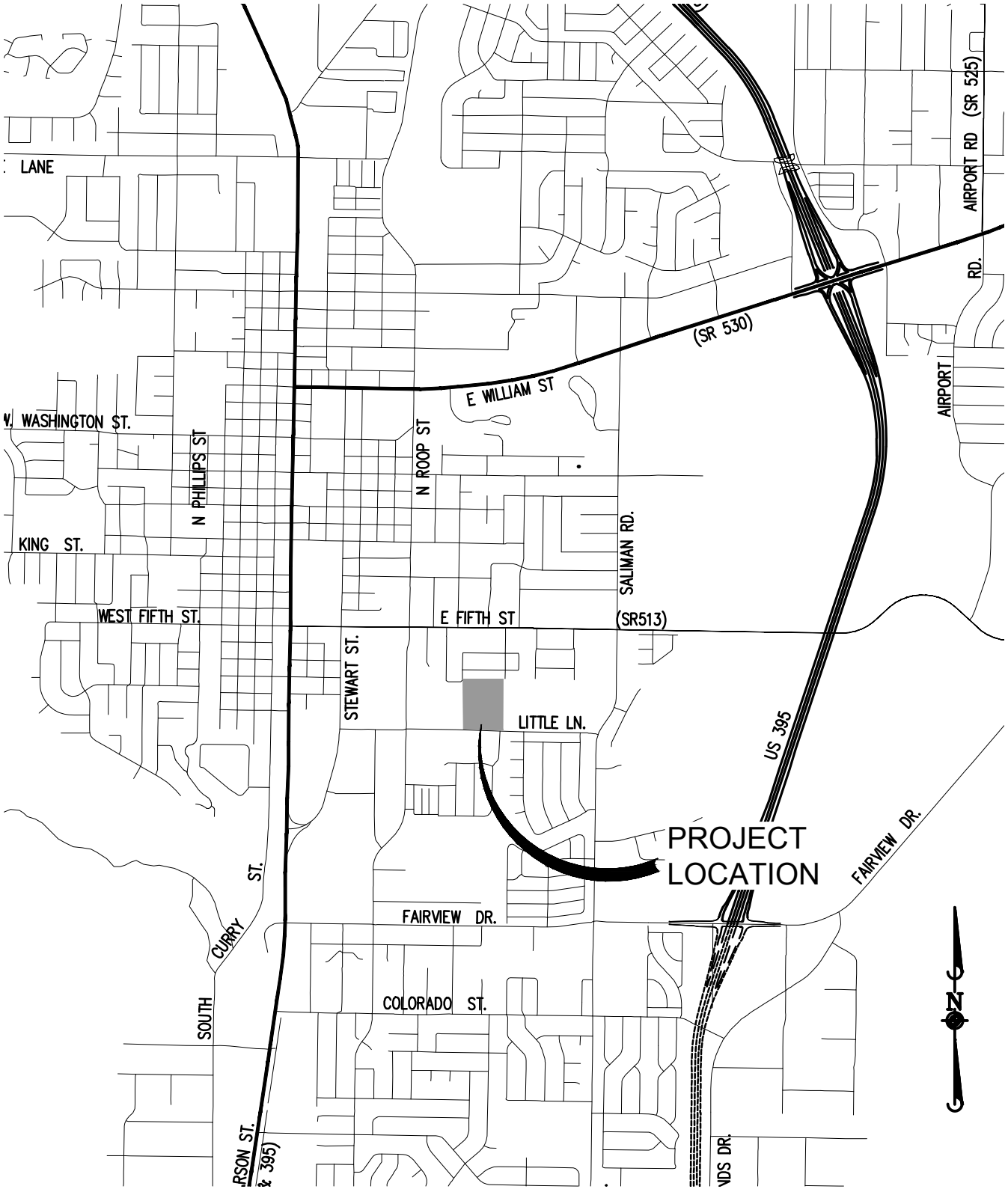


FIGURE 1

Manhard CONSULTING LTD
9850 Double R Blvd, Suite 101, Reno, NV 89521 tel: (775) 746-3500 fax: (775) 746-3520 www.manhard.com
Civil Engineers - Surveyors - Water Resources Engineers - Water & Wastewater Engineers
Construction Managers - Environmental Scientists - Landscape Architects - Planners

ARBOR VILLAS
CARSON CITY, NEVADA
VICINITY MAP

PROJ. MGR.:	AWM
DRAWN BY:	AWM
DATE:	3/16/2016
SCALE:	N.T.S.

SHEET 1 OF 1

Dwg Name: P:\Cciccnv01\dwg\Eng\Final Drawings\Tentative Map\1 - Title Sheet.dwg Updated By: SJividen 17:28

APPENDIX A

FlowMaster Flow Data

Worksheet for 8" Sewer at 0.40%

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00400	ft/ft
Normal Depth	6.00	in
Diameter	8.00	in

Results

Discharge	0.70	ft³/s
Flow Area	0.28	ft²
Wetted Perimeter	1.40	ft
Hydraulic Radius	2.41	in
Top Width	0.58	ft
Critical Depth	4.73	in
Percent Full	75.0	%
Critical Slope	0.00773	ft/ft
Velocity	2.48	ft/s
Velocity Head	0.10	ft
Specific Energy	0.60	ft
Froude Number	0.63	
Maximum Discharge	0.82	ft³/s
Discharge Full	0.76	ft³/s
Slope Full	0.00333	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for 8" Sewer at 0.40%

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	6.00	in
Critical Depth	4.73	in
Channel Slope	0.00400	ft/ft
Critical Slope	0.00773	ft/ft

Worksheet for 8" Sewer at 0.50%

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	6.00	in
Diameter	8.00	in

Results

Discharge	0.78	ft³/s
Flow Area	0.28	ft²
Wetted Perimeter	1.40	ft
Hydraulic Radius	2.41	in
Top Width	0.58	ft
Critical Depth	5.01	in
Percent Full	75.0	%
Critical Slope	0.00810	ft/ft
Velocity	2.77	ft/s
Velocity Head	0.12	ft
Specific Energy	0.62	ft
Froude Number	0.70	
Maximum Discharge	0.92	ft³/s
Discharge Full	0.85	ft³/s
Slope Full	0.00416	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for 8" Sewer at 0.50%

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	6.00	in
Critical Depth	5.01	in
Channel Slope	0.00500	ft/ft
Critical Slope	0.00810	ft/ft

PRELIMINARY WATER MAIN ANALYSIS REPORT

FOR

ARBOR VILLAS

CARSON CITY, NEVADA

Prepared for:

Capstone Communities
9441 Double Diamond Pkwy #14
Reno, Nevada 89521

Prepared by:

Manhard Consulting Ltd.
9850 Double R Boulevard
Suite 101
Reno, Nevada 89521

Project: CCICCNV01 *Date:* 3/17/16

Table of Contents

Appendices
Appendix A

List of Figures

List of Tables

1 INTRODUCTION

1.1 Purpose of Analysis

This report represents a detailed analysis of the proposed water main system for the Arbor Villas. The report describes the water system and the criteria used for design. The purpose of this analysis is to establish the adequacy of the proposed water main pipe diameters and layout to meet the needs of the development.

1.2 Project Location and Description

The Arbor Villas development is approximately 10.3 acres in size and is located in the southern portion of Carson City and is east of South Stewart Street, south of East 5th Street, west of South Saliman Road Drive, and north of Little Lane5. Formally, this site is situated within Section 17, Township 15 North, and Range 20 East of the Mount Diablo Meridian (refer to Figure 1, Vicinity Map). The project site is within the existing parcels 004-021-13.

Figure 2, the Water Main Layout, illustrates the location and orientation of the project and its proposed lots and roadway locations.

1.3 Project Description

The Arbor Villas Development is a proposed subdivision which consists of 147 single-family residential units. The project site is currently zoned within the GC zoning district and has an approved tentative map P.U.D. through Carson City. For purposes of this water main analysis the average lot size for this development is taken to be approximately 1,200 sf.

1.4 Methodologies

The Arbor Villas water main analysis was analyzed using WaterGEMS, which employs the Hazen-Williams Method to determine headloss. The Hazen-Williams formula uses a pipe carrying capacity factor (C) based on piping materials. For the Arbor Villas analysis a C-value of 150 was used to model the proposed water main system.

2 PROPOSED ALIGNMENT AND QUANTITY OF SERVICE

2.1 Project Water Main System

Two connection points to the existing water system are being utilized for this project. One connection point occurs on Little Lane to the south of the project site and the other occurs on Parkland Avenue. At these points, a proposed 8" water main will connect to an existing stub and looped around the subject property and eventually connecting to the other existing 8" water main. The Arbor Villas development will be served by 8" water main that creates a water system loop for the project (refer to Figure 2, *Water Main Layout*).

2.2 Water Main Analysis

The average per lot demand (1.0 gpm/unit) used in the analysis of the water main system.and NAC 445A.66735. A maximum day demand factor of 2.0 was applied to the average day demand to obtain the maximum day demand (per *Tentative Addendum*). The peak hour demand was calculated by applying a 1.5 global demand multiplier to the maximum day demands. In a separate analysis, a 1500 gpm fire flow requirement was applied to the farthest hydrant in the system from the connection points. This 1500 gpm fire flow requirement was obtained from Section B105 and Table B105.1 of the 2012 International Fire Code. As a conservative analysis, it was assumed that all of the irrigation zones were active at the same time.

The following table provides the high and low pressures that were calculated using WaterGEMS (refer to Appendix B for WaterGEMS output) for each demand condition:

Table 1: Arbor Villas Pressure Summary

Condition	High Pressure (psi)	Low Pressure (psi)
Max Day	103	101
Peak Hour	102	101
Fire Flow (farthest hydrant)	100	83

The maximum day demand low pressure of 103 psi is above the NAC minimum of 40 psi. The peak hour demand low pressure is above the minimum of 64 psi listed in the *Carson City Development Standards.* The pressure for the various scenarios can be found in the WaterGEMS output included in Appendix B of this report. The fire flow low pressures indicated in the table above are well above the NAC minimum requirement of 20 psi. The pressure at the hydrant H-2 can be found in the WaterGEMS output included in Appendix B of this report.

3 CONCLUSION

The analysis of the water system shows that the pipe sizes and layouts within the Arbor Villas Development are adequately designed to meet the demands of the development. The WaterGEMS analysis shows that the pressures are greater than the minimum requirement and below the maximum requirement for Carson City and the NAC requirements. The Arbor Villas Development is in compliance and meets the minimum pressures per NAC 445A.6711 during maximum day, peak hour, and fire flow conditions.

WATER DEMAND CALCULATIONS FOR ARBOR VILLAS

Number of units = 41
Average per lot demand = 1.0 gpm/lot
Maximum day demand factor = 2.0
Peak hour global demand multiplier = 1.5

Average demand = 147*1.0 = 147.0 gpm
Maximum day demand = 147*2.0 = 294.0 gpm
Peak hour demand = 294*1.5 = 441.0 gpm

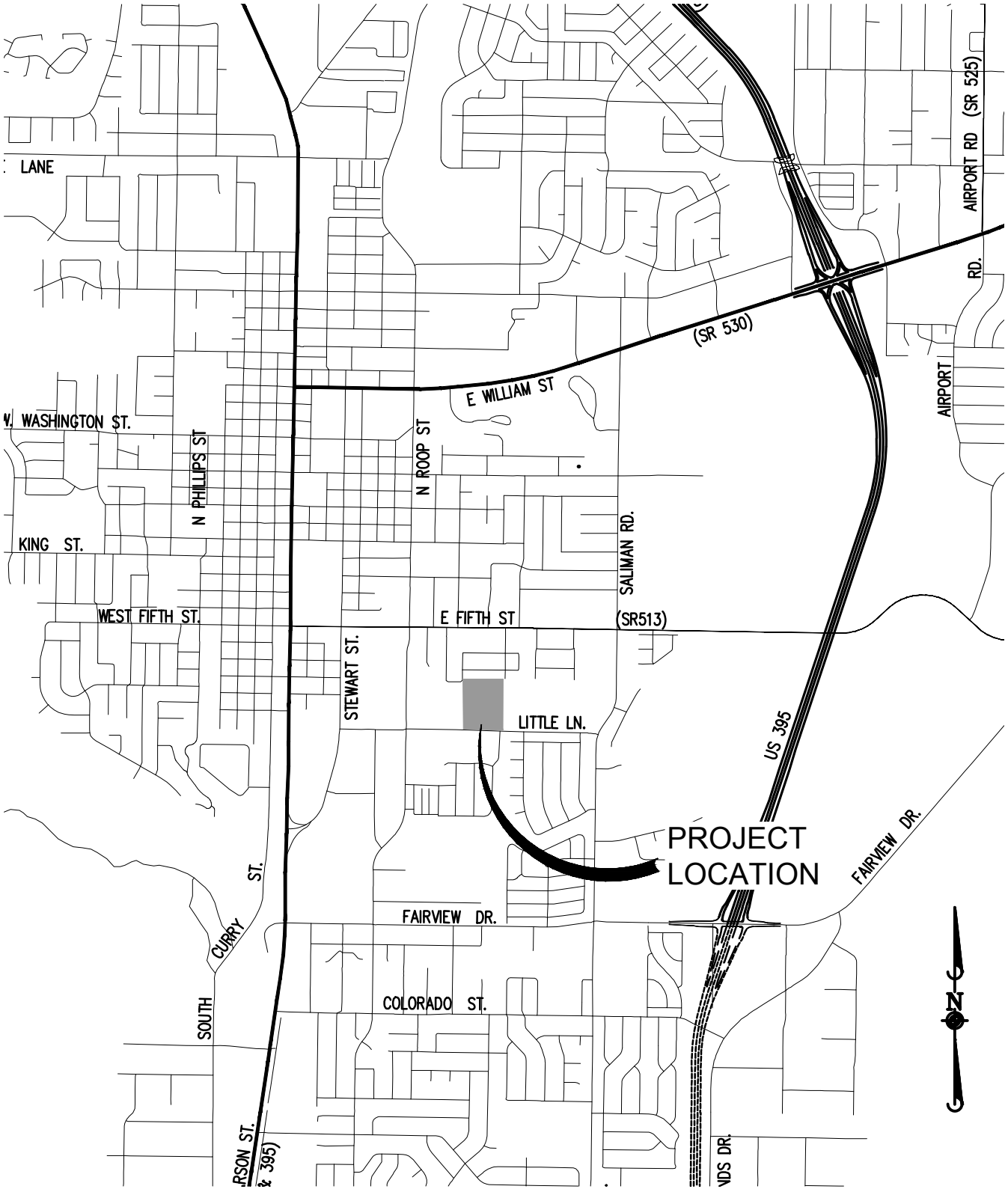


FIGURE 1

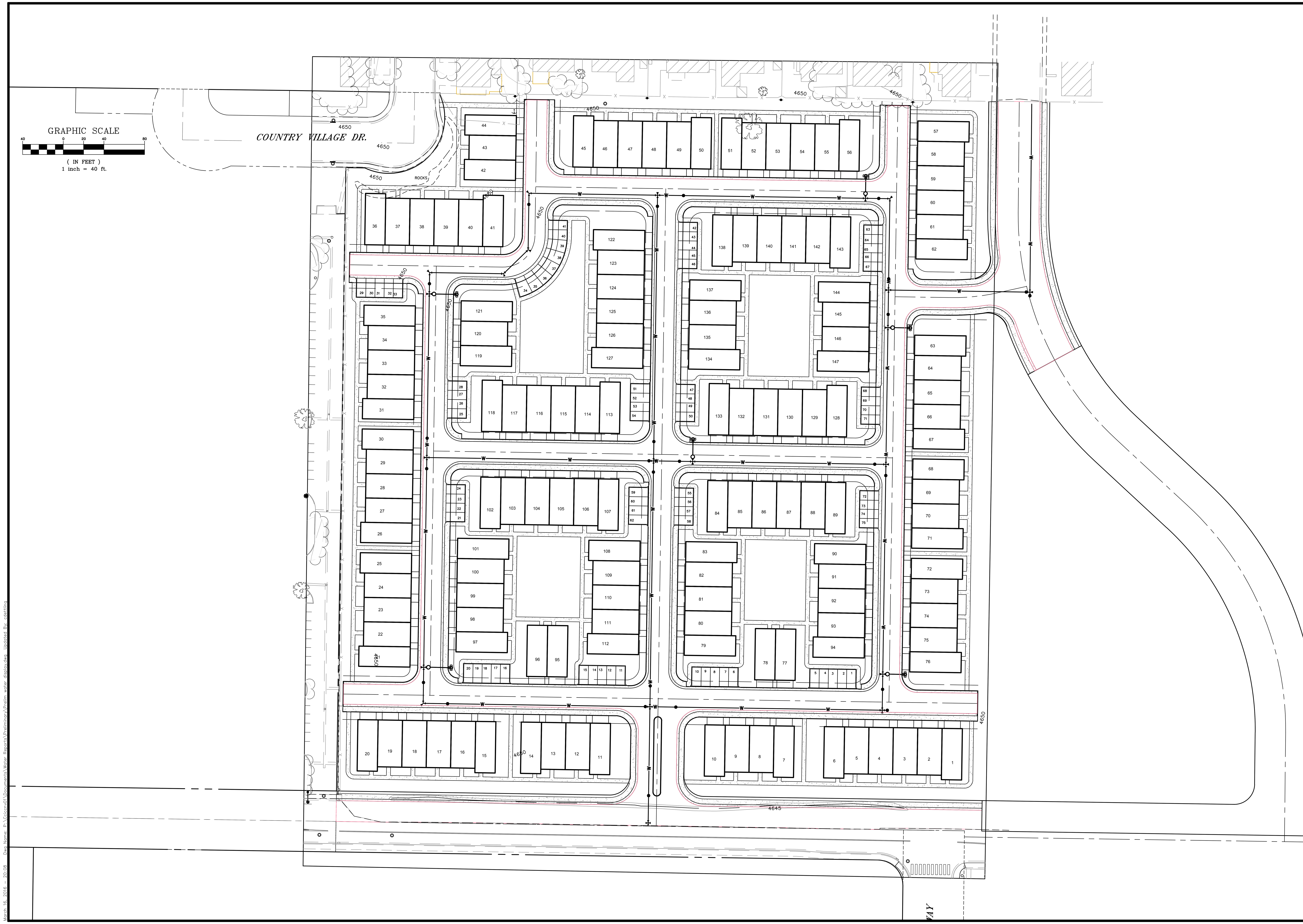
Manhard CONSULTING LTD
9850 Double R Blvd, Suite 101, Reno, NV 89521 tel: (775) 746-3500 fax: (775) 746-3520 www.manhard.com
Civil Engineers - Surveyors - Water Resources Engineers - Water & Wastewater Engineers
Construction Managers - Environmental Scientists - Landscape Architects - Planners

ARBOR VILLAS
CARSON CITY, NEVADA
VICINITY MAP

PROJ. MGR.:	AWM
DRAWN BY:	AWM
DATE:	3/16/2016
SCALE:	N.T.S.

SHEET 1 OF 1

Dwg Name: P:\Cciccnv01\dwg\Eng\Final Drawings\Tentative Map\1 - Title Sheet.dwg Updated By: SJividen 17:28



DRAWN BY | CHECK BY
REVISIONS
DATE

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ARBOR VILLAS
CARSON CITY, NEVADA
PROPOSED WATER DISPLAY

PROJ. MGR.: AWM
PROJ. ASSOC.: CRD
DRAWN BY: CRD
DATE: 3/16/16
SCALE: 1" = 40'

SHEET 2 OF 2

APPENDIX A

Scenario Summary Report
Scenario: ADD

Scenario Summary	
ID	94
Label	ADD
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	ADD
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	<I> AVERAGE DAY
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary			
Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Hydraulics Only

FlexTable: Junction Table

Label	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)	Zone	Elevation (ft)
J-1	0	101	4,879.97	ARBOR VILLAS	4,646.00
J-2	10	101	4,879.90	ARBOR VILLAS	4,646.50
J-3	10	101	4,879.89	ARBOR VILLAS	4,646.50
J-4	16	101	4,879.88	ARBOR VILLAS	4,645.56
J-5	14	102	4,879.87	ARBOR VILLAS	4,645.17
J-6	0	101	4,879.87	ARBOR VILLAS	4,646.26
J-7	5	101	4,879.87	ARBOR VILLAS	4,645.45
J-8	5	102	4,879.87	ARBOR VILLAS	4,644.98
J-9	5	101	4,879.87	ARBOR VILLAS	4,645.56
J-10	9	101	4,879.87	ARBOR VILLAS	4,646.74
J-11	5	102	4,879.87	ARBOR VILLAS	4,645.18
J-12	10	101	4,879.88	ARBOR VILLAS	4,645.56
J-13	10	101	4,879.89	ARBOR VILLAS	4,645.74
J-14	8	101	4,879.89	ARBOR VILLAS	4,646.03
J-15	10	101	4,879.89	ARBOR VILLAS	4,645.87
J-16	0	101	4,879.90	ARBOR VILLAS	4,645.41
J-17	6	101	4,879.91	ARBOR VILLAS	4,645.63
J-18	10	102	4,879.89	ARBOR VILLAS	4,645.29
J-19	8	101	4,879.89	ARBOR VILLAS	4,645.87
J-20	0	101	4,879.98	ARBOR VILLAS	4,645.71
J-21	6	103	4,879.89	ARBOR VILLAS	4,642.23

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	40	6.0	Ductile Iron	130.0	77	0.87	0.03
P-2	117	6.0	Ductile Iron	130.0	77	0.87	0.07
P-3	241	6.0	Ductile Iron	130.0	20	0.23	0.01
P-4	263	6.0	Ductile Iron	130.0	18	0.20	0.01
P-5	127	6.0	Ductile Iron	130.0	23	0.26	0.01
P-6	56	6.0	Ductile Iron	130.0	9	0.10	0.00
P-7	33	6.0	Ductile Iron	130.0	9	0.10	0.00
P-8	74	6.0	Ductile Iron	130.0	4	0.04	0.00
P-9	21	6.0	Ductile Iron	130.0	-1	0.01	0.00
P-10	161	6.0	Ductile Iron	130.0	-6	0.07	0.00
P-11	205	6.0	Ductile Iron	130.0	-15	0.17	0.01
P-12	37	6.0	Ductile Iron	130.0	-20	0.23	0.00
P-13	223	6.0	Ductile Iron	130.0	-30	0.34	0.02
P-14	229	6.0	Ductile Iron	130.0	16	0.18	0.01
P-15	36	6.0	Ductile Iron	130.0	6	0.07	0.00
P-16	207	6.0	Ductile Iron	130.0	-2	0.02	0.00
P-17	133	6.0	Ductile Iron	130.0	-25	0.29	0.01
P-18	37	6.0	Ductile Iron	130.0	-25	0.29	0.00
P-19	89	6.0	Ductile Iron	130.0	39	0.44	0.02
P-20	24	6.0	Ductile Iron	130.0	29	0.33	0.00
P-21	204	6.0	Ductile Iron	130.0	21	0.24	0.01
P-22	138	6.0	Ductile Iron	130.0	-70	0.80	0.08
P-23	33	6.0	Ductile Iron	130.0	-70	0.80	0.02
P-24	39	6.0	Ductile Iron	130.0	-7	0.08	0.00
P-25	190	6.0	Ductile Iron	130.0	-13	0.15	0.00

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-26	28	6.0	Ductile Iron	130.0	0	0.00	0.00
P-27	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-29	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-30	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-31	26	6.0	Ductile Iron	130.0	0	0.00	0.00

Scenario Summary Report
Scenario: MDD

Scenario Summary	
ID	95
Label	MDD
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	MDD
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	MAX DAY
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary			
Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Hydraulics Only

FlexTable: Junction Table

Label	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)	Zone	Elevation (ft)
J-1	0	101	4,879.91	ARBOR VILLAS	4,646.00
J-2	20	101	4,879.64	ARBOR VILLAS	4,646.50
J-3	20	101	4,879.59	ARBOR VILLAS	4,646.50
J-4	32	101	4,879.55	ARBOR VILLAS	4,645.56
J-5	28	101	4,879.52	ARBOR VILLAS	4,645.17
J-6	0	101	4,879.52	ARBOR VILLAS	4,646.26
J-7	10	101	4,879.52	ARBOR VILLAS	4,645.45
J-8	10	101	4,879.52	ARBOR VILLAS	4,644.98
J-9	10	101	4,879.52	ARBOR VILLAS	4,645.56
J-10	18	101	4,879.52	ARBOR VILLAS	4,646.74
J-11	10	101	4,879.54	ARBOR VILLAS	4,645.18
J-12	20	101	4,879.55	ARBOR VILLAS	4,645.56
J-13	20	101	4,879.61	ARBOR VILLAS	4,645.74
J-14	16	101	4,879.61	ARBOR VILLAS	4,646.03
J-15	20	101	4,879.61	ARBOR VILLAS	4,645.87
J-16	0	101	4,879.65	ARBOR VILLAS	4,645.41
J-17	12	101	4,879.66	ARBOR VILLAS	4,645.63
J-18	20	101	4,879.60	ARBOR VILLAS	4,645.29
J-19	16	101	4,879.59	ARBOR VILLAS	4,645.87
J-20	0	101	4,879.93	ARBOR VILLAS	4,645.71
J-21	12	103	4,879.59	ARBOR VILLAS	4,642.23

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	40	6.0	Ductile Iron	130.0	153	1.74	0.09
P-2	117	6.0	Ductile Iron	130.0	153	1.74	0.27
P-3	241	6.0	Ductile Iron	130.0	41	0.46	0.05
P-4	263	6.0	Ductile Iron	130.0	36	0.41	0.04
P-5	127	6.0	Ductile Iron	130.0	46	0.52	0.03
P-6	56	6.0	Ductile Iron	130.0	18	0.20	0.00
P-7	33	6.0	Ductile Iron	130.0	18	0.20	0.00
P-8	74	6.0	Ductile Iron	130.0	8	0.09	0.00
P-9	21	6.0	Ductile Iron	130.0	-2	0.02	0.00
P-10	161	6.0	Ductile Iron	130.0	-12	0.14	0.00
P-11	205	6.0	Ductile Iron	130.0	-30	0.34	0.02
P-12	37	6.0	Ductile Iron	130.0	-40	0.46	0.01
P-13	223	6.0	Ductile Iron	130.0	-60	0.68	0.09
P-14	229	6.0	Ductile Iron	130.0	32	0.36	0.03
P-15	36	6.0	Ductile Iron	130.0	12	0.14	0.00
P-16	207	6.0	Ductile Iron	130.0	-4	0.04	0.00
P-17	133	6.0	Ductile Iron	130.0	-51	0.58	0.04
P-18	37	6.0	Ductile Iron	130.0	-51	0.58	0.01
P-19	89	6.0	Ductile Iron	130.0	78	0.89	0.06
P-20	24	6.0	Ductile Iron	130.0	58	0.66	0.01
P-21	204	6.0	Ductile Iron	130.0	42	0.48	0.04
P-22	138	6.0	Ductile Iron	130.0	-141	1.60	0.27
P-23	33	6.0	Ductile Iron	130.0	-141	1.60	0.07
P-24	39	6.0	Ductile Iron	130.0	-15	0.17	0.00
P-25	190	6.0	Ductile Iron	130.0	-27	0.31	0.02

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-26	28	6.0	Ductile Iron	130.0	0	0.00	0.00
P-27	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-29	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-30	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-31	26	6.0	Ductile Iron	130.0	0	0.00	0.00

Scenario Summary Report
Scenario: MDD PLUS FF

Scenario Summary	
ID	96
Label	MDD PLUS FF
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	MDD PLUS FF
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	MAX DAY
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary			
Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Hydraulics Only

FlexTable: Junction Table

Label	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)	Zone	Elevation (ft)
J-1	0	100	4,877.31	ARBOR VILLAS	4,646.00
J-2	20	96	4,869.39	ARBOR VILLAS	4,646.50
J-3	20	96	4,868.25	ARBOR VILLAS	4,646.50
J-4	32	95	4,864.13	ARBOR VILLAS	4,645.56
J-5	28	91	4,856.48	ARBOR VILLAS	4,645.17
J-6	0	90	4,853.29	ARBOR VILLAS	4,646.26
J-7	10	89	4,851.42	ARBOR VILLAS	4,645.45
J-8	10	88	4,847.29	ARBOR VILLAS	4,644.98
J-9	10	87	4,846.12	ARBOR VILLAS	4,645.56
J-10	18	89	4,851.70	ARBOR VILLAS	4,646.74
J-11	10	93	4,859.19	ARBOR VILLAS	4,645.18
J-12	20	93	4,860.57	ARBOR VILLAS	4,645.56
J-13	20	97	4,869.39	ARBOR VILLAS	4,645.74
J-14	16	97	4,869.39	ARBOR VILLAS	4,646.03
J-15	20	97	4,869.43	ARBOR VILLAS	4,645.87
J-16	0	97	4,870.49	ARBOR VILLAS	4,645.41
J-17	12	97	4,870.78	ARBOR VILLAS	4,645.63
J-18	20	97	4,868.74	ARBOR VILLAS	4,645.29
J-19	16	96	4,868.22	ARBOR VILLAS	4,645.87
J-20	0	101	4,878.20	ARBOR VILLAS	4,645.71
J-21	12	98	4,868.44	ARBOR VILLAS	4,642.23

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	40	6.0	Ductile Iron	130.0	953	10.81	2.69
P-2	117	6.0	Ductile Iron	130.0	953	10.81	7.92
P-3	241	6.0	Ductile Iron	130.0	225	2.56	1.13
P-4	263	6.0	Ductile Iron	130.0	432	4.91	4.12
P-5	127	6.0	Ductile Iron	130.0	894	10.15	7.65
P-6	56	6.0	Ductile Iron	130.0	866	9.83	3.18
P-7	33	6.0	Ductile Iron	130.0	866	9.83	1.87
P-8	74	6.0	Ductile Iron	130.0	856	9.72	4.13
P-9	21	6.0	Ductile Iron	130.0	846	9.60	1.17
P-10	161	6.0	Ductile Iron	130.0	-664	7.53	5.58
P-11	205	6.0	Ductile Iron	130.0	-682	7.73	7.49
P-12	37	6.0	Ductile Iron	130.0	-692	7.85	1.38
P-13	223	6.0	Ductile Iron	130.0	-712	8.07	8.82
P-14	229	6.0	Ductile Iron	130.0	-4	0.05	0.00
P-15	36	6.0	Ductile Iron	130.0	-24	0.27	0.00
P-16	207	6.0	Ductile Iron	130.0	-40	0.45	0.04
P-17	133	6.0	Ductile Iron	130.0	-299	3.39	1.06
P-18	37	6.0	Ductile Iron	130.0	-299	3.39	0.30
P-19	89	6.0	Ductile Iron	130.0	530	6.01	2.04
P-20	24	6.0	Ductile Iron	130.0	510	5.79	0.52
P-21	204	6.0	Ductile Iron	130.0	494	5.61	4.09
P-22	138	6.0	Ductile Iron	130.0	-841	9.54	7.42
P-23	33	6.0	Ductile Iron	130.0	-841	9.54	1.80
P-24	39	6.0	Ductile Iron	130.0	-227	2.57	0.18
P-25	190	6.0	Ductile Iron	130.0	-239	2.71	0.99

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-26	28	6.0	Ductile Iron	130.0	0	0.00	0.00
P-27	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-29	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-30	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-31	26	6.0	Ductile Iron	130.0	-1,500	17.02	4.05

FlexTable: Hydrant Table

Label	Lateral Length (ft)	Elevation (ft)	Zone	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
H-1	20	4,651.12	ARBOR VILLAS	0	4,859.19	90
H-3	20	4,651.02	ARBOR VILLAS	0	4,869.39	94
H-4	20	4,650.83	ARBOR VILLAS	0	4,870.49	95
H-5	20	4,650.41	ARBOR VILLAS	0	4,868.22	94
H-6	20	4,650.17	ARBOR VILLAS	0	4,868.44	94
H-7	20	4,650.75	ARBOR VILLAS	1,500	4,842.07	83

Scenario Summary Report
Scenario: PHD

Scenario Summary	
ID	97
Label	PHD
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	PHD
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	PEAK HOUR
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary			
Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Hydraulics Only

FlexTable: Junction Table

Label	Demand (gpm)	Pressure (psi)	Hydraulic Grade (ft)	Zone	Elevation (ft)
J-1	0	101	4,879.81	ARBOR VILLAS	4,646.00
J-2	30	101	4,879.24	ARBOR VILLAS	4,646.50
J-3	30	101	4,879.14	ARBOR VILLAS	4,646.50
J-4	48	101	4,879.05	ARBOR VILLAS	4,645.56
J-5	42	101	4,878.98	ARBOR VILLAS	4,645.17
J-6	0	101	4,878.98	ARBOR VILLAS	4,646.26
J-7	15	101	4,878.98	ARBOR VILLAS	4,645.45
J-8	15	101	4,878.98	ARBOR VILLAS	4,644.98
J-9	15	101	4,878.98	ARBOR VILLAS	4,645.56
J-10	27	100	4,878.98	ARBOR VILLAS	4,646.74
J-11	15	101	4,879.03	ARBOR VILLAS	4,645.18
J-12	30	101	4,879.05	ARBOR VILLAS	4,645.56
J-13	30	101	4,879.18	ARBOR VILLAS	4,645.74
J-14	24	101	4,879.18	ARBOR VILLAS	4,646.03
J-15	30	101	4,879.18	ARBOR VILLAS	4,645.87
J-16	0	101	4,879.26	ARBOR VILLAS	4,645.41
J-17	18	101	4,879.29	ARBOR VILLAS	4,645.63
J-18	30	101	4,879.16	ARBOR VILLAS	4,645.29
J-19	24	101	4,879.14	ARBOR VILLAS	4,645.87
J-20	0	101	4,879.86	ARBOR VILLAS	4,645.71
J-21	18	102	4,879.14	ARBOR VILLAS	4,642.23

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	40	6.0	Ductile Iron	130.0	230	2.61	0.19
P-2	117	6.0	Ductile Iron	130.0	230	2.61	0.57
P-3	241	6.0	Ductile Iron	130.0	61	0.70	0.10
P-4	263	6.0	Ductile Iron	130.0	54	0.61	0.09
P-5	127	6.0	Ductile Iron	130.0	69	0.78	0.07
P-6	56	6.0	Ductile Iron	130.0	27	0.30	0.00
P-7	33	6.0	Ductile Iron	130.0	27	0.30	0.00
P-8	74	6.0	Ductile Iron	130.0	12	0.13	0.00
P-9	21	6.0	Ductile Iron	130.0	-3	0.04	0.00
P-10	161	6.0	Ductile Iron	130.0	-18	0.21	0.01
P-11	205	6.0	Ductile Iron	130.0	-45	0.51	0.05
P-12	37	6.0	Ductile Iron	130.0	-60	0.68	0.01
P-13	223	6.0	Ductile Iron	130.0	-90	1.02	0.19
P-14	229	6.0	Ductile Iron	130.0	48	0.55	0.06
P-15	36	6.0	Ductile Iron	130.0	18	0.21	0.00
P-16	207	6.0	Ductile Iron	130.0	-6	0.07	0.00
P-17	133	6.0	Ductile Iron	130.0	-76	0.87	0.08
P-18	37	6.0	Ductile Iron	130.0	-76	0.87	0.02
P-19	89	6.0	Ductile Iron	130.0	117	1.33	0.12
P-20	24	6.0	Ductile Iron	130.0	87	0.99	0.02
P-21	204	6.0	Ductile Iron	130.0	63	0.72	0.09
P-22	138	6.0	Ductile Iron	130.0	-211	2.40	0.57
P-23	33	6.0	Ductile Iron	130.0	-211	2.40	0.14
P-24	39	6.0	Ductile Iron	130.0	-22	0.25	0.00
P-25	190	6.0	Ductile Iron	130.0	-40	0.46	0.04

FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P-26	28	6.0	Ductile Iron	130.0	0	0.00	0.00
P-27	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-28	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-29	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-30	22	6.0	Ductile Iron	130.0	0	0.00	0.00
P-31	26	6.0	Ductile Iron	130.0	0	0.00	0.00