Appendix B

Preliminary Drainage Analysis

This Page Intentionally Left Blank

Watershed Name	Area (acres)
SW.PP.02187	437.42
Rand Ave	47.38
Russell West	61.1
SW Corner Carson St	14.53
N Carson St	221.15
N Roop St	57.55
Rand Ave West	46.88
E William at E Russell	25.15
Stewart	12.62
Saliman	58.92

Golf Course
SW.PP.02187
N Carson St
N Roop St
Rand Ave
Rand Ave West
Russell West
E William at E Russell
Saliman
Stewart
SW Corner Carson St

Legend

Watersheds
- E William at E Russell
- N Carson St
- N Roop St
- Rand Ave
- Rand Ave West
- Russell West
- SW Corner Carson St
- SW.PP.02187
- Saliman
- Stewart
- Project Area

- Concentration Point

Time of Concentration
- Sheet
- Shallow
- Channel

- Existing Outfall
- Existing Manhole
- Existing Junction
- Existing Catch Basin
- swPipe
- swChannel
- swBasin

Document Path: C:\Users\CDavis\OneDrive - Nichols Consulting Engineers, Chtd\CDavis GIS\East Williams - Carson\Cdavis\EWilliams - cdavis.aprx

East William Street Complete Streets Project

Watersheds

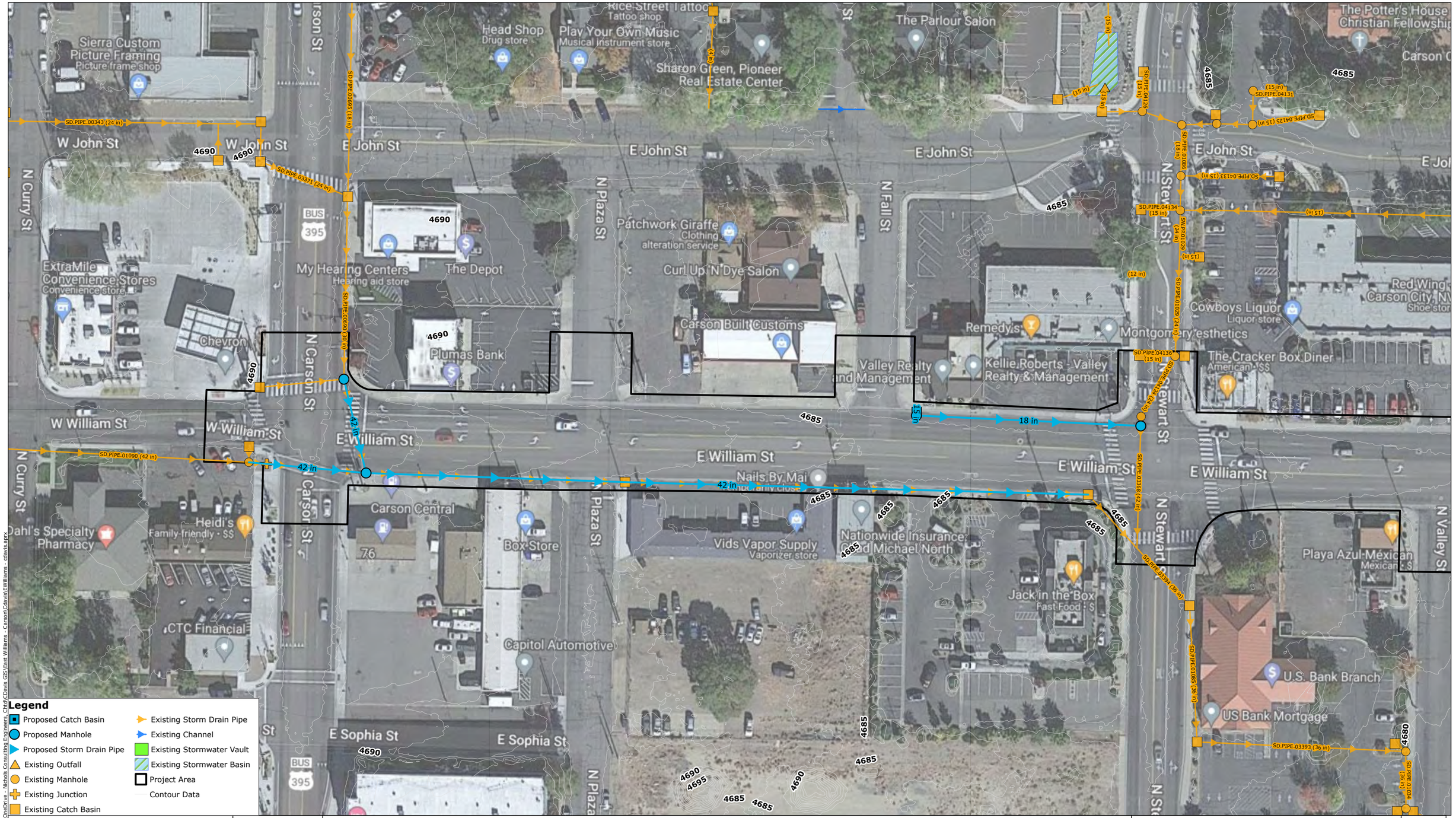
N

1 in. = 1,000 ft.

0 1,000 2,000 ft.

FIGURE B.1

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
Bing Aerial Basemap	953.10.25	cdavis	04/12/2022	-	MH



Legend

- Proposed Catch Basin
- Proposed Manhole
- Proposed Storm Drain Pipe
- Existing Outfall
- Existing Manhole
- Existing Junction
- Existing Catch Basin
- Existing Storm Drain Pipe
- Existing Channel
- Existing Stormwater Vault
- Existing Stormwater Basin
- Project Area
- Contour Data

East William Street Complete Streets Project

Proposed Drainage Improvements - North Carson to Stewart Street

N

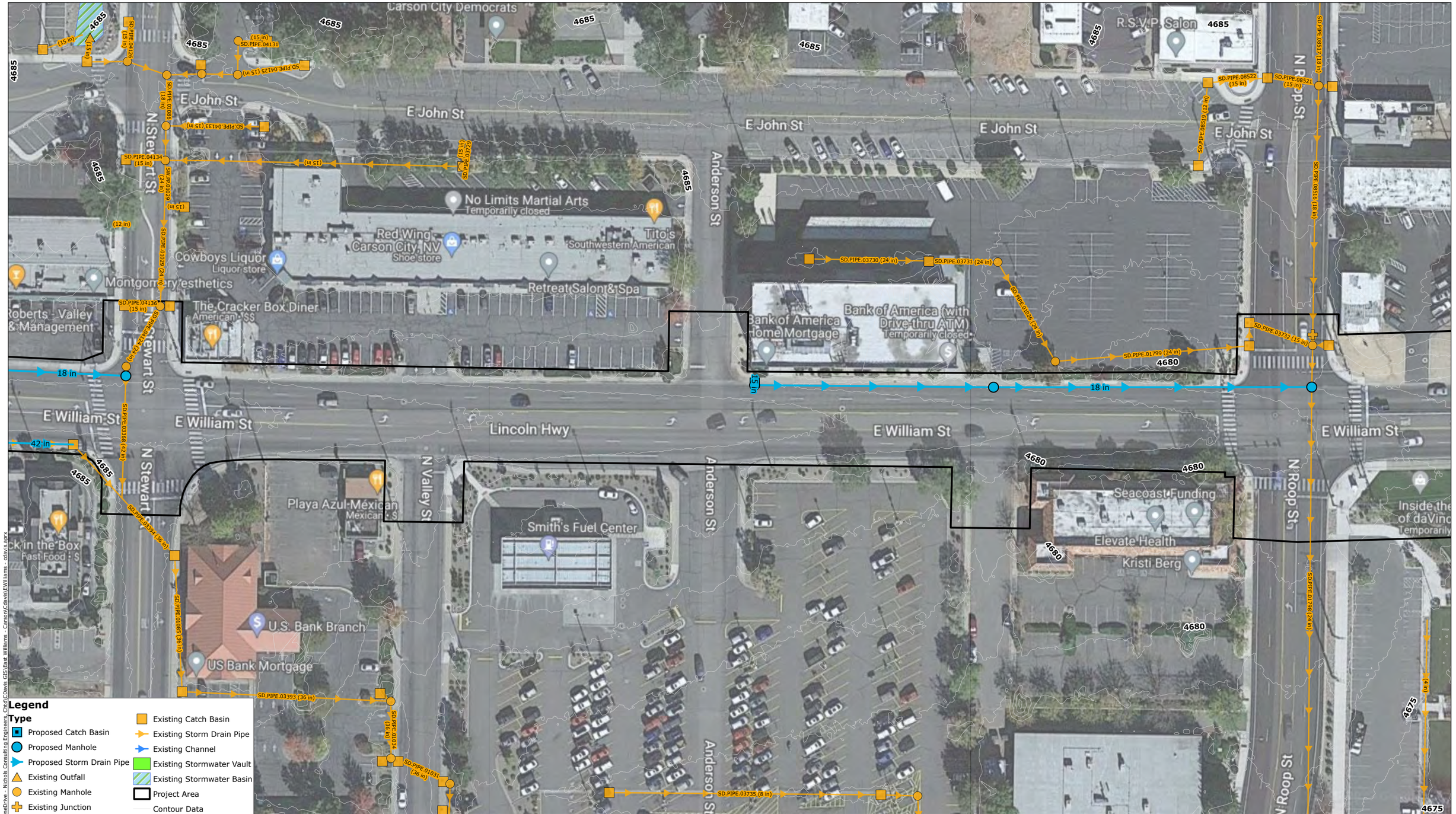
1 in. = 75 ft.

0 75 150 ft.

FIGURE B.2

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
Bing Aerial Basemap	953.10.25	cdavis	04/12/2022	6/14/2022	MH

Document Path: C:\Users\CDavis\OneDrive - Nichols Consulting Engineers, Chtd\CDavis GIS\East Williams - Carson\Cdavis\EWilliams - cdavis.aprx



Document Path: C:\Users\CDavis\OneDrive - Nichols Consulting Engineers, Chtd\CDavis GIS\East Williams - Carson\Cdavis\EWilliams - cdavis.aprx

East William Street Complete Streets Project

Proposed Drainage Improvements - Stewart Street to Roop Street

N

1 in. = 75 ft.

0 75 150 ft.

FIGURE B.3

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
Bing Aerial Basemap	953.10.25	cdavis	04/12/2022	6/14/2022	MH

Legend

Type

- Proposed Catch Basin
- Proposed Manhole
- Proposed Storm Drain Pipe
- Future Storm Drain By Others
- Existing Outfall
- Existing Manhole
- Existing Junction
- Existing Catch Basin
- Existing Storm Drain Pipe
- Existing Channel
- Existing Stormwater Vault
- Existing Stormwater Basin
- Project Area
- Contour Data

East William Street Complete Streets Project

Proposed Drainage Improvements - Roop Street to Saliman Road

N

1 in. = 200 ft.

0 100 200 ft.

FIGURE B.4

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
Bing Aerial Basemap	953.10.25	cdavis	04/12/2022	6/14/2022	MH

Document Path: C:\Users\CDavis\OneDrive - Nichols Consulting Engineers, Chtd\CDavis GIS\East Williams - Carson\Cdavis\EWilliams - cdavis.aprx

Legend

- Proposed Catch Basin
- Proposed Manhole
- Proposed Storm Drain Pipe
- Existing Outfall
- Existing Manhole
- Existing Junction
- Existing Catch Basin
- Existing Storm Drain Pipe
- Existing Channel
- Existing Stormwater Vault
- Existing Stormwater Basin
- Project Area
- Contour Data

Document Path: C:\Users\CDavis\OneDrive - Nichols Consulting Engineers, Chtd\CDavis GIS\East Williams - Carson\Cdavis\EWilliams - cdavis.aprx

East William Street Complete Streets Project

Proposed Drainage Improvements - Saliman Road to I-580

N

1 in. = 200 ft.

0 100 200 ft.

FIGURE B.5

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
Bing Aerial Basemap	953.10.25	cdavis	04/12/2022	6/14/2022	MH

Project: East William Street Complete Streets Project
Date: 5/3/2022
Done by: CMD
Subject: Time of Concentration Calculation

Watershed Name	Sheet Flow							Shallow Concentrated Flow						Channel Flow						Time of Concentration, T_t (min)
	Flow Length (ft)	$Elev_1$ (ft)	$Elev_2$ (ft)	Slope (ft/ft)	2-year, 24-hour Rainfall (in)	Manning's Roughness Coefficient (Table 3-1)	Travel Time, T_1 (min)	Flow Length (ft)	$Elev_1$ (ft)	$Elev_2$ (ft)	Slope (ft/ft)	Average Velocity (ft/s)	Travel Time, T_2 (min)	Flow Length (ft)	$Elev_1$ (ft)	$Elev_2$ (ft)	Slope (ft/ft)	Velocity (ft/s)	Travel Time, T_3 (min)	
E William at E Russell	48	4652	4651	0.021	1.48	0.011	0.97							2480	4651	4638	0.005	1.4	29.52	30.49
N Carson St	86	4818	4814	0.047	1.48	0.011	1.12	1148	4814	4784	0.026	2.6	7.36	6607	4784	4689	0.014	2.3	47.88	56.36
N Roop St	71	4715	4714	0.014	1.48	0.011	1.56							3423	4714	4677	0.011	2	28.53	30.09
Rand Ave	115	4695	4694	0.009	1.48	0.011	2.74							3441	4694	4647	0.014	2.2	26.07	28.81
Rand Ave West	25	4712	4711	0.04	1.48	0.011	0.45							5183	4711	4646	0.013	2.2	39.27	39.72
Russell West	111	4692	4690	0.018	1.48	0.011	2.02							5382	4690	4637	0.01	1.9	47.21	49.23
Saliman	174	4694	4691	0.017	1.48	0.011	2.96	445	4691	4685	0.013	2.3	3.22	2913	4685	4648	0.013	2.2	22.07	28.25
Stewart	96	4697	4691	0.063	1.48	0.24	12.83							969	4691	4683	0.008	1.7	9.5	22.33
SW Corner Carson St	121	4726	4724	0.017	1.48	0.011	2.21							2628	4724	4690	0.013	2.2	19.91	22.12
SW.PP.02187	50	4738	4737	0.02	1.48	0.24	12.05							9490	4737	4662	0.008	1.7	93.04	105.09

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1/]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2/]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3/]	
Light underbrush	0.40
Dense underbrush	0.80

[1/] The n values are a composite of information compiled by Engman (1986).
[2/] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3/] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Figure 3-1 (average velocities for estimating travel time for shallow concentrated flow):

Unpaved $V = 16.1345\ (s)^{0.5}$
Paved $V = 20.3282\ (s)^{0.5}$

where

V = average velocity (ft/s)
s = slope of hydraulic grade line (watercourse slope, ft/ft)

Note: Average velocity for Shallow Concentrated obtained through equation and/or Figure 3-1
Channel flow velocity assumes full gutter flow (Hydraflow Express)

Point precipitation frequency estimates (inches)
NOAA Atlas 14 Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Location name
(ESRI Maps): Nevada USA
Carson City
Station Name: -
Latitude: 39.1711°
Longitude: -119.7547°
Elevation (USGS): 4658.12 ft

PRECIPITATION FREQUENCY ESTIMATES

by duration for ARI (years):	1	2	5	10	25	50	100	200	500	1000
5-min:	0.097	0.121	0.161	0.199	0.262	0.321	0.39	0.472	0.604	0.723
10-min:	0.147	0.183	0.244	0.303	0.4	0.488	0.593	0.719	0.919	1.1
15-min:	0.182	0.227	0.303	0.376	0.496	0.605	0.735	0.891	1.14	1.36
30-min:	0.245	0.306	0.408	0.507	0.667	0.815	0.991	1.2	1.53	1.84
60-min:	0.303	0.378	0.505	0.627	0.826	1.01	1.23	1.49	1.9	2.27
2-hr:	0.41	0.509	0.649	0.773	0.961	1.13	1.32	1.55	1.94	2.31
3-hr:	0.491	0.612	0.768	0.895	1.08	1.23	1.41	1.63	1.99	2.34
6-hr:	0.681	0.85	1.06	1.22	1.44	1.61	1.79	1.99	2.29	2.55
12-hr:	0.898	1.13	1.42	1.65	1.96	2.19	2.44	2.68	3.02	3.28
24-hr:	1.18	**1.48**	1.86	2.18	2.61	2.95	3.31	3.68	4.19	4.59
2-day:	1.41	1.77	2.25	2.64	3.19	3.62	4.07	4.55	5.21	5.74
3-day:	1.55	1.95	2.5	2.95	3.57	4.07	4.61	5.17	5.95	6.59
4-day:	1.69	2.13	2.75	3.25	3.96	4.53	5.14	5.79	6.7	7.43
7-day:	1.97	2.49	3.22	3.8	4.62	5.28	5.97	6.69	7.7	8.5
10-day:	2.17	2.75	3.57	4.21	5.09	5.78	6.5	7.23	8.24	9.03
20-day:	2.66	3.37	4.36	5.1	6.11	6.87	7.64	8.41	9.44	10.2
30-day:	3.01	3.83	4.93	5.77	6.88	7.72	8.57	9.42	10.5	11.4
45-day:	3.54	4.5	5.8	6.75	7.98	8.88	9.76	10.6	11.7	12.4
60-day:	4.07	5.19	6.67	7.72	9.04	9.99	10.9	11.7	12.7	13.4

Date/time (GMT): Thu Mar 3 01:13:04 2022
pyRunTime: 0.0243711471558

Project: East William Street Complete Streets Project
Date: 5/3/2022
Done by: CMD
Subject: TR-55 Curve Numbers

Curve numbers for Hydrologic Soil Group				
Cover Type	**A**	**B**	**C**	**D**
Open Space - Good	68	79	86	89
Open Space - Poor	39	61	74	80
Paved; Open Ditches	83	89	92	93
WDUA - Natural Desert Landscaping	63	77	85	88
Commercial and Business	89	92	94	95
Industrial	81	88	91	93
Residential - 1/8 acre or less	77	85	90	92
Residential - 1/4 acre	61	75	83	87
Residential - 1/3 acre	57	72	81	86
Residential - 1/2 acre	54	70	80	85
Residential - 1 acre	51	68	79	84
Residential - 2 acres	46	65	77	82

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Sw.pp.02187	0.68	62.39	03Mar2022, 14:00	0.84
N Carson St	0.35	42.58	03Mar2022, 13:05	0.76
SW Corner Carson St	0.02	10.66	03Mar2022, 12:25	1.56
Carson St	0.37	45.98	03Mar2022, 13:00	0.81
Rand Ave	0.07	22.32	03Mar2022, 12:35	1.16
Rand Ave West	0.07	18.43	03Mar2022, 12:45	1.17
Rand Ave Junction	0.15	39.67	03Mar2022, 12:35	1.17
E William at E Russell	0.04	15.06	03Mar2022, 12:35	1.53
Rand & EWill	0.19	54.73	03Mar2022, 12:35	1.24
Russell West	0.1	20.08	03Mar2022, 12:55	1.13
Russell Way	0.28	71.79	03Mar2022, 12:40	1.2
Saliman	0.09	36.38	03Mar2022, 12:30	1.51
N Roop St	0.09	33.68	03Mar2022, 12:35	1.48
Stewart	0.02	9.06	03Mar2022, 12:25	1.53

Project: East_William_Street_Complet
Simulation Run: 100YrPreliminary
Simulation Start: 2 March 2022, 24:00
Simulation End: 4 March 2022, 06:00

HMS Version: 4.9
Executed: 17 May 2022, 21:11

Global Parameter Summary - Subbasin

Location

Element Name	Longitude Degrees	Latitude Degrees
Sw.pp.02187	-119.77	39.18
N Carson St	-119.78	39.17
SW Corner Carson St	-119.77	39.17
Rand Ave	-119.75	39.18
Rand Ave West	-119.76	39.17
E William at E Russell	-119.75	39.17
Russell West	-119.75	39.18
Saliman	-119.76	39.17
N Roop St	-119.76	39.17
Stewart	-119.76	39.17

Area (MI^2)

Element Name	Area (MI^2)
Sw.pp.02187	0.68
N Carson St	0.35
SW Corner Carson St	0.02
Rand Ave	0.07
Rand Ave West	0.07
E William at E Russell	0.04
Russell West	0.1
Saliman	0.09
N Roop St	0.09
Stewart	0.02

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number
Sw.pp.02187	0	83.3
N Carson St	0	81.8
SW Corner Carson St	0	93.9
Rand Ave	0	88.7
Rand Ave West	0	88.9
E William at E Russell	0	93.6
Russell West	0	88.2
Saliman	0	93.3
N Roop St	0	93
Stewart	0	93.6

Transform: Scs

Element Name	Lag	Unitgraph Type
Sw.pp.02187	105.09	Standard
N Carson St	56.36	Standard
SW Corner Carson St	22.12	Standard
Rand Ave	28.81	Standard
Rand Ave West	39.72	Standard
E William at E Russell	30.49	Standard
Russell West	49.23	Standard
Saliman	28.25	Standard
N Roop St	30.09	Standard
Stewart	22.33	Standard

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Sw.pp.02187	0.68	148.23	03Mar2022, 13:50	1.72
N Carson St	0.35	114.79	03Mar2022, 13:00	1.61
SW Corner Carson St	0.02	22.54	03Mar2022, 12:25	2.64
Carson St	0.37	120.74	03Mar2022, 13:00	1.68
Rand Ave	0.07	52.49	03Mar2022, 12:30	2.16
Rand Ave West	0.07	42.51	03Mar2022, 12:45	2.17
Rand Ave Junction	0.15	92.55	03Mar2022, 12:35	2.16
E William at E Russell	0.04	31.81	03Mar2022, 12:35	2.61
Rand & EWill	0.19	124.35	03Mar2022, 12:35	2.26
Russell West	0.1	46.29	03Mar2022, 12:55	2.11
Russell Way	0.28	163.49	03Mar2022, 12:40	2.21
Saliman	0.09	77.48	03Mar2022, 12:30	2.58
N Roop St	0.09	72.04	03Mar2022, 12:35	2.55
Stewart	0.02	19.29	03Mar2022, 12:25	2.61

Project: East William Street Complete Streets Project
Date: 5/3/2022
Done by: CMD
Subject: Preliminary Hydraulic Analysis

Existing Conditions Hydraulic Analysis								Preliminary Proposed Drainage Improvements (May 2022)							
Facility Identifier	Pipe Size	Pipe Type	Manning's n	Flow Capacity (cfs)	Watershed	10-Yr Peak Flow (cfs)	100-Yr Peak Flow (cfs)	Pipe Size	Pipe Type	Flow Capacity (cfs)	Approx. Length of Pipe (ft)	Catch Basins	Manholes	Comment	Option
SW.PP.00694	30	RCP	0.012	31	N Carson St	42.6	114.8	42	RCP	72	80		2 (Replace)	Limited by d/s pipe size of 42 inch	
SW.PP.03365	42	CMP	0.024	41	SW Corner Carson St	10.7	22.5								
SW.PP.03366	42	CMP	0.024	41	Carson St	46	120.7								
								15	RCP	6	3	1	1	Lateral	
								18	RCP	8	187		1	New SD Line	
SW.PP.03368	42	RCP	0.012	82	Stewart	9.1	19.3								
								15	RCP	6	3	1	1	Lateral	
								18	RCP	8	200		1	New SD Line	
								18	RCP	8	265			New SD Line	
SW.PP.00346 & SW.PP.01798	24	RCP	0.012	17	N Roop St	33.7	72	36	RCP	51	544		2 (Replace)	Extends outside of project limits	
SW.PP.00700	42	RCP	0.012	82	SW.PP.02187	62.4	148.2								
								18	RCP	8	5	1	1	Lateral	
								18	RCP	8	343		1	New SD line	
								18	RCP	8	343		1	New SD line	
								18	RCP	8	73	1		Lateral	
								18	RCP	8	66	1		Lateral	
								15	RCP	5	8	1	1	Lateral	
								18	RCP	8	344		1	New SD line	
								24	RCP	8	352		1	New SD line	
								15	RCP	5	8	1		Lateral	1
								24	RCP	8	317		1	New SD line	
								15	RCP	5	8	1 (Replace)		Lateral (Replace)	
								24	RCP	17	103		1 (Replace)	New SD line (MH Replace)	
								12	CMP		110			Remove/Abandon Ex SD	
								24	RCP	17	91			Replace along S. Williams	
SW.PP.01727	18	CMP	0.024	4	Saliman	36.4	77.5	36	RCP	51	91		1 (Replace)	Would need to upsize all d/s pipes to do this. (length = 2474 ft)	
								36	RCP	51	355		1	Replacement of SD from Saliman to Outfall at I-580	
								42	RCP	72	106		1 (Replace)		
								42	RCP	72	864		4 (Replace)	Replacement of SD from Saliman to Outfall at I-581	
								42	RCP	72	1150		4 (Replace)	Replacement of SD from Saliman to Outfall at I-581	
SW.PP.03716	18	RCP	0.012	8	Rand Ave West	18.4	42.5	24	RCP	17	40	2	1	New lateral from prop inlet to SD along Rand Ave.	
Prelim Pipes	18	RCP	0.012	8	Rand Ave	22.3	52.5	30	RCP	31	420		4 (Replace)	Replacement of SD along Rand Ave to E. William	
SW.PP.01726	18	RCP	0.012	8	Rand Ave Junction	39.7	92.5								
	48	RCP	0.012	110	Pipe upsizes near Humbolt Ln										
SW.PP.03694	60	RCP	0.012	199	Rand & Ewill	54.7	124.4								
SW.PP.00150	48	RCP	0.012	110	Russell West	20.1	46.3								
SW.PP.00058	66	RCP	0.012	275	Russell Way	71.8	163.5								
								18	RCP	8	73	1		Lateral under Williams	
								18	RCP	17	66	1		Lateral under Williams	
								15	RCP	5	8	1	1	Lateral	
								18	RCP	8	345		1	New SD Line	2
								15	RCP	5	18	1		Lateral	
								24	RCP	17	223			New SD Line	
								15	RCP	5	8	1 (Replace)		Lateral (Replace)	

Notes:
These sections are only part of Option 1
All pipe slopes were assumed to be 0.005 ft/ft
Red font indicates lack of capacity