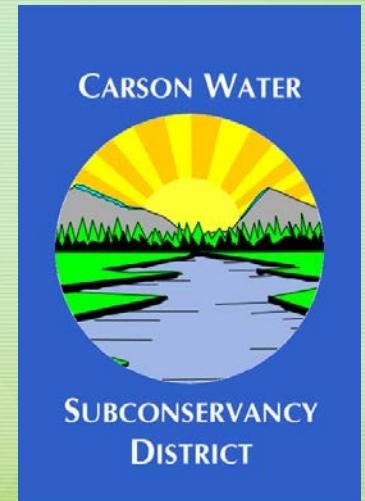




South Silver Springs Area Drainage Master Plan

Technical Briefing for Carson Water Subconservancy
District & Lyon County

Presented By James Springgate



Meeting Agenda

- Purpose of Study
- Existing and Future Conditions
- Methods of Study
- Recommendations and Results
- Q&A

Purpose of Study



PICTURE FROM 2020 FLASH FLOOD EVENT



ANALYZE EXISTING FLOODING CONDITIONS IN SILVER SPRINGS.



MODEL FUTURE FLOODING EVENTS.

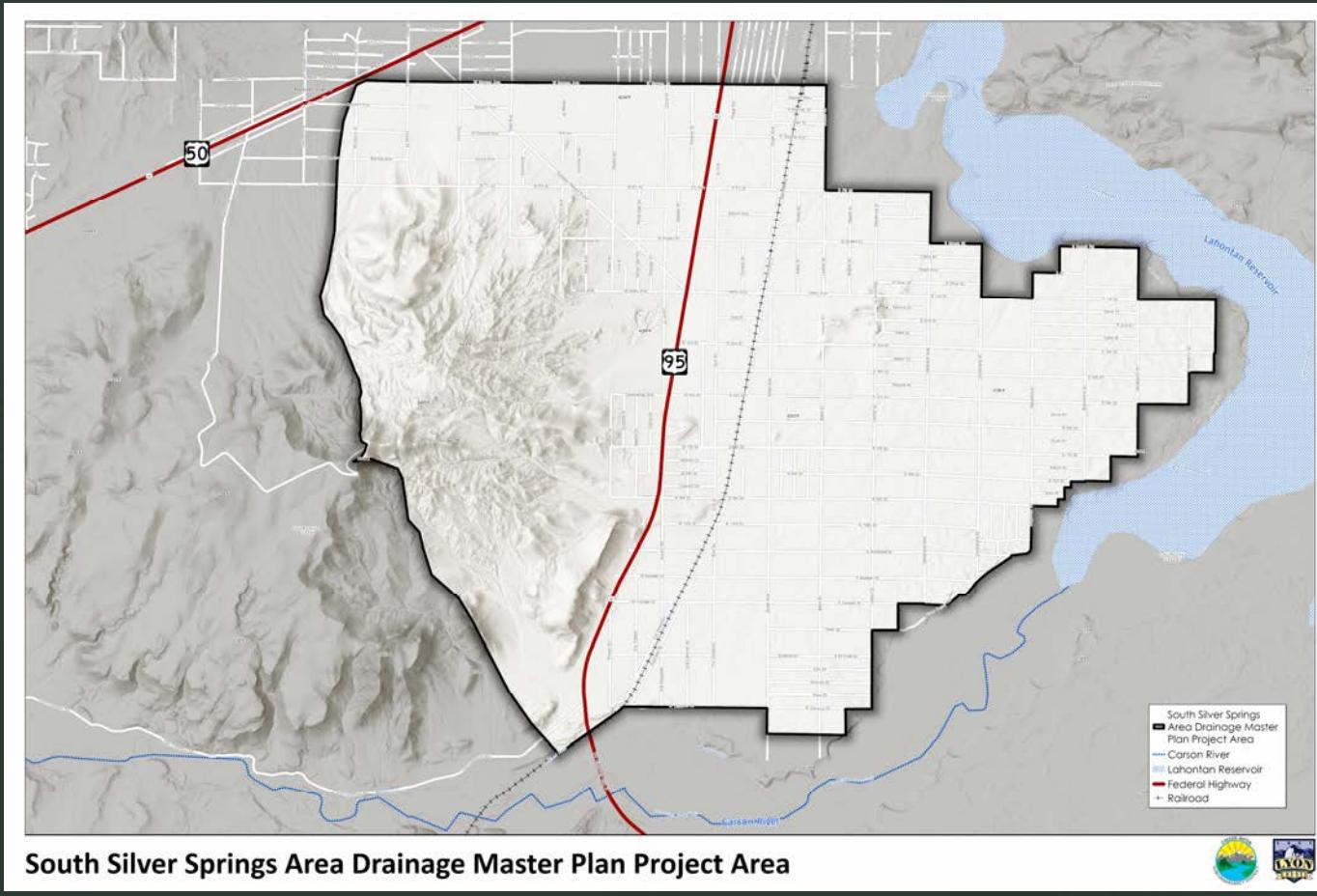


ASSESS PERFORMANCE OF EXISTING DRAINAGE INFRASTRUCTURE



IDENTIFY FEASIBLE MITIGATION STRATEGIES

Area of Analysis



Methods

- LiDar based DEM with Field-Verified Culverts
- HEC-RAS 2D, rain-on-grid, Hydrologic Model
- HEC-HMS Model Verification
- NEXRAD Radar Reflectivity for Historic Storm Validation (August 17, 2020 Flash Flood Event)
- Green & Ampt Infiltration Method using NDOT Soils
- 100-yr, 25-yr, 10-yr, 5-yr storms analyzed

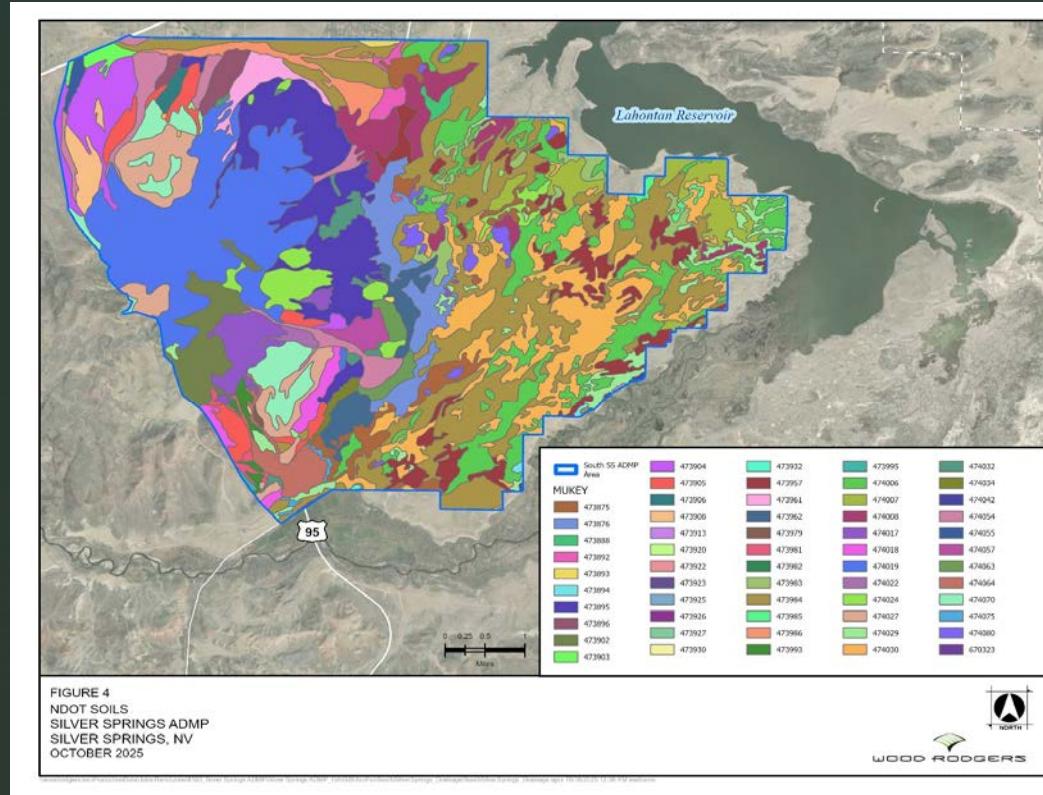
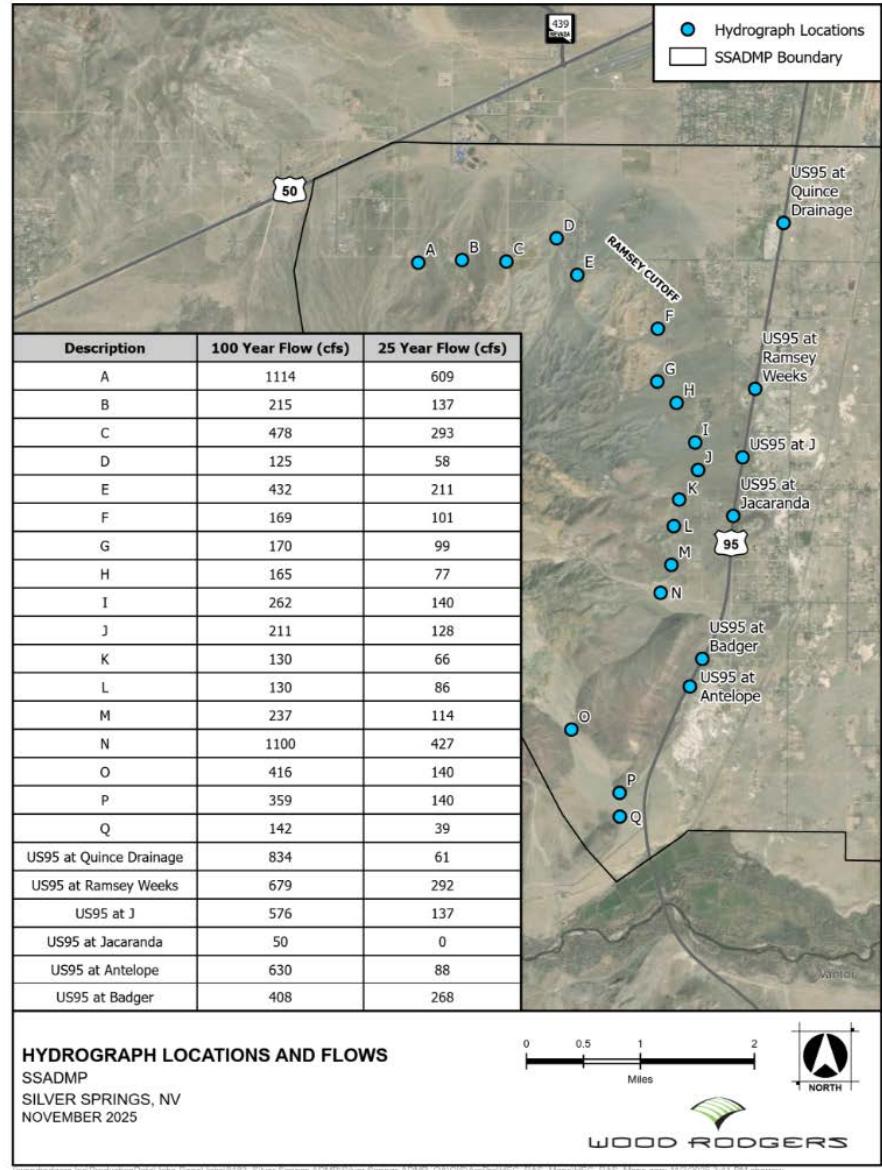


Table 7: Rainfall Estimation Validation

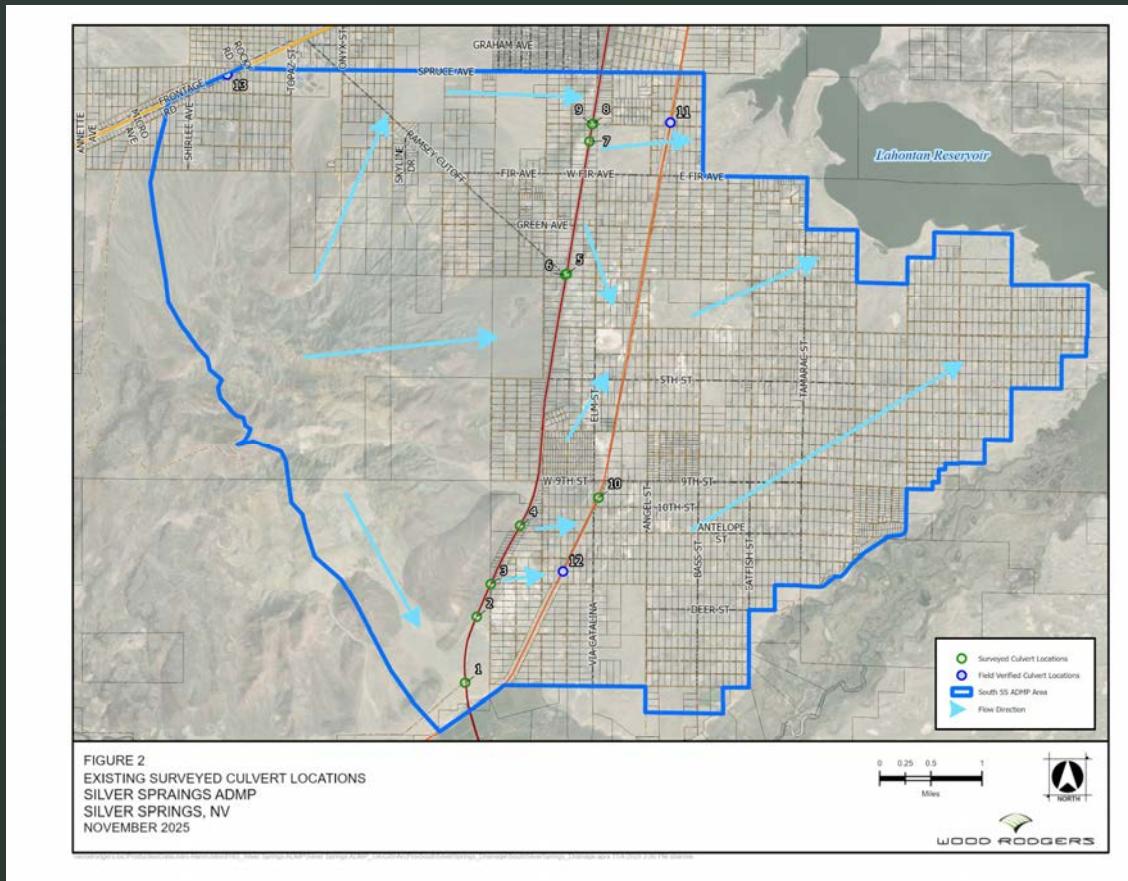
Model Software	Model Scenario	Peak Flow
HEC-RAS 6.5	Existing Conditions, 100-year	1,085 cfs
HEC-HMS 4.2.1	Existing Conditions, 100-year	1,129 cfs

Hydrologic Modeling Scenarios

- EXISTING CONDITIONS
- HISTORIC CONDITIONS
- INTERIM CONDITIONS
- PROPOSED CONDITIONS
- FUTURE BUILD-OUT CONDITIONS
- CLIMATE CHANGE ANALYSIS



Existing Conditions



- Alluvial fan draining from Churchill Butte toward Lahontan Reservoir
- Flash flooding driven by short-duration, high-intensity storms
- Low downstream slopes limit natural drainage
- Transportation embankments (US-95, US-50, UPRR) control conveyance

Table 9: Number of Innundated Structures, Existing Conditions

Structure Type	5-year storm	10-year storm	25-year storm	100-year storm
Residential	21	28	40	81
Commercial	0	0	0	0

Existing Conditions

Table 8: Summary of Existing Culvert Peak Flow Results

Culvert ID	Culvert Size	Flow Type	5-year storm (cfs)	10-year storm (cfs)	25-year storm (cfs)	100-year storm (cfs)
1	18" CMP	Culvert	1	2	2	4
		Overtopping	2	7	28	127
2	24" CMP	Culvert	26	31	37	43
		Overtopping	0	0	0	0
3	24" CMP	Culvert	13	13	14	14
		Overtopping	0	0	0	0
4	48" CMP	Culvert	67	136	150	165
		Overtopping	0	0	78	666
5	24" CMP	Culvert	4	9	14	18
		Overtopping	0	0	0	0
6	24" CMP	Culvert	Culvert Clogged			
		Overtopping	Culvert Clogged			
7	4'x3' Box	Culvert	73	102	126	135
		Overtopping	0	0	164	1156
8	18" CMP	Culvert	Culvert Clogged			
		Overtopping	Culvert Clogged			
9	18" CMP	Culvert	Culvert Clogged			
		Overtopping	Culvert Clogged			
10	44"x26" Elliptical CMP	Culvert	11	17	26	36
		Overtopping	0	0	0	0
11	36" CMP	Culvert	59	78	94	101
		Overtopping	0	0	0	0
12	36" CMP	Culvert	30	36	42	47
		Overtopping	0	0	0	0

- Culverts 6, 7, and 8 clogged
- Culverts 1, 4, and 7 undersized

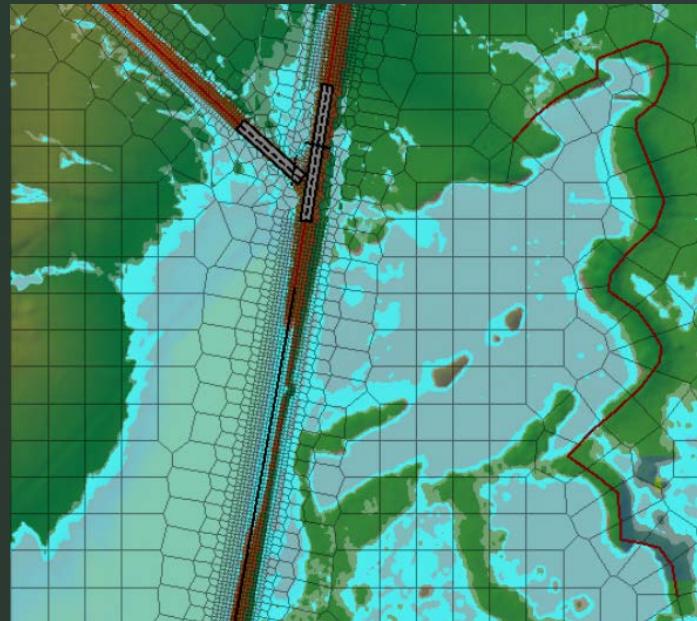
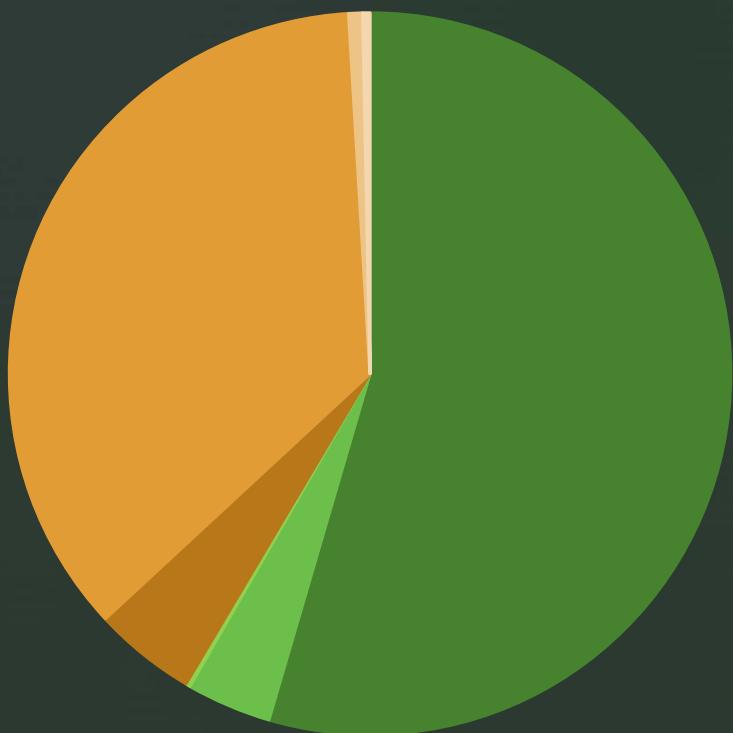


Figure 15: US-95 Overtopping near Ramsey Weeks

Development and Growth in Silver Springs, Nevada

Developed vs Undeveloped Parcels



■ Undeveloped Single Family Residential

■ Undeveloped Commercial

■ Undeveloped Others

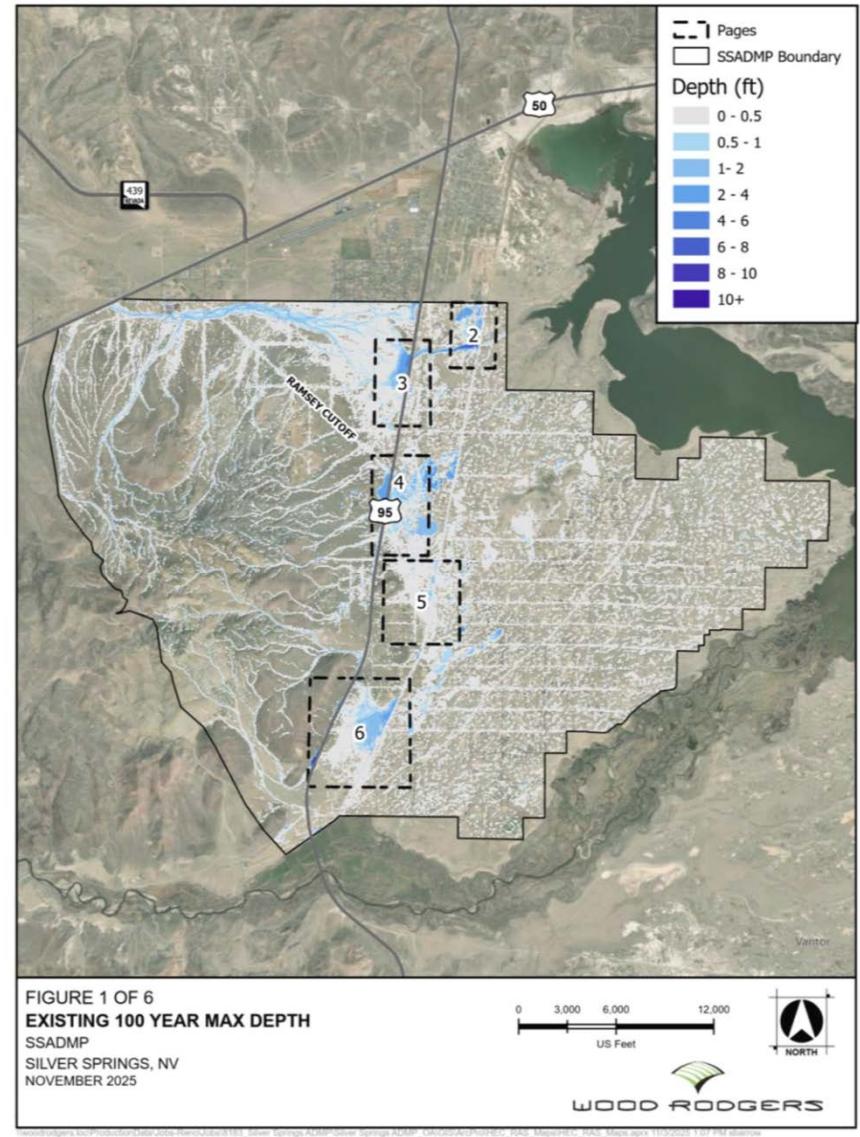
■ Developed Single Family Homes

■ Developed Manufactured Single Family Residence

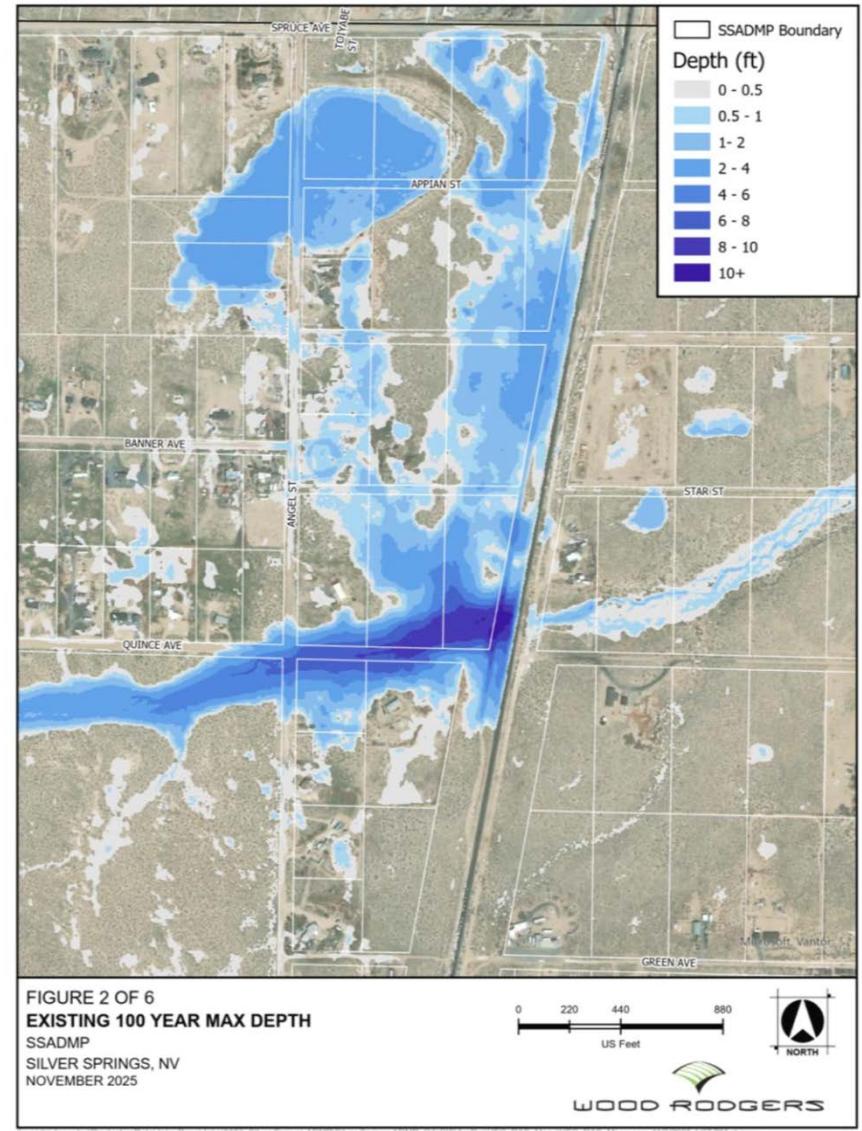
■ Developed Commercial

■ Developed Others

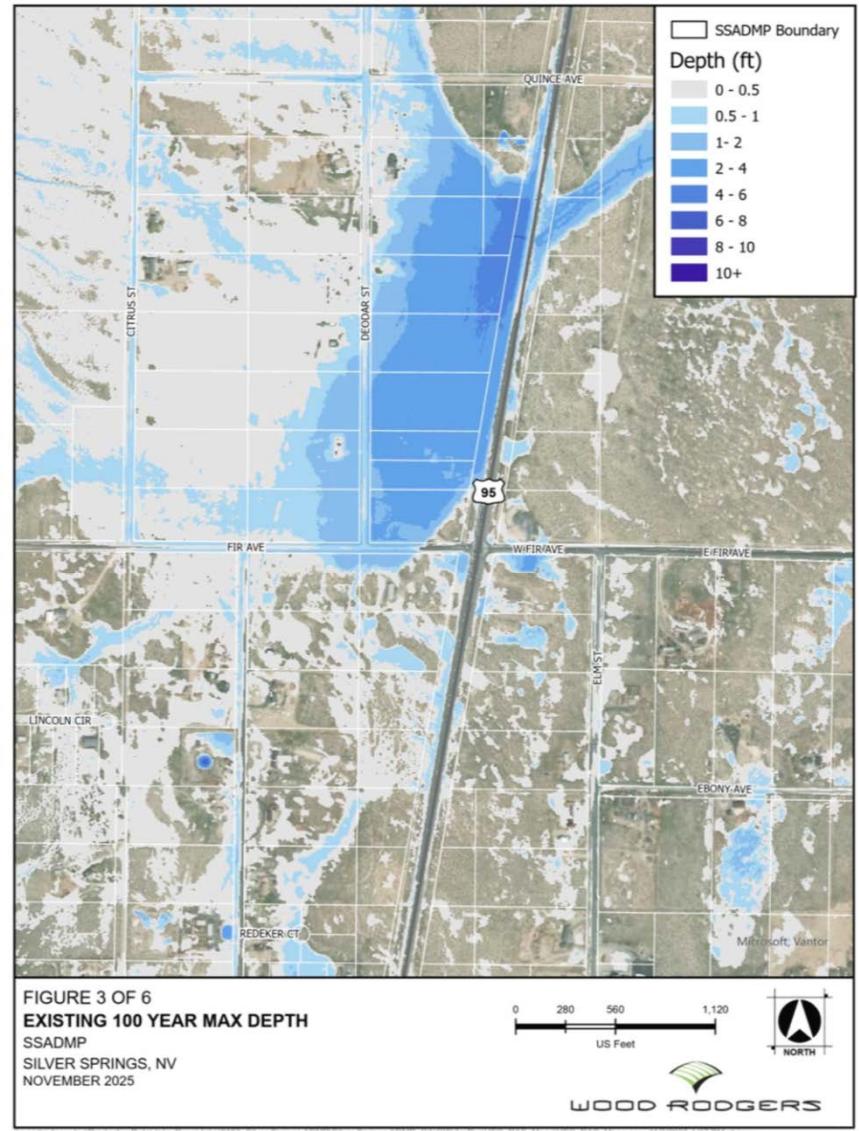
Existing Flood Conditions in South Silver Springs



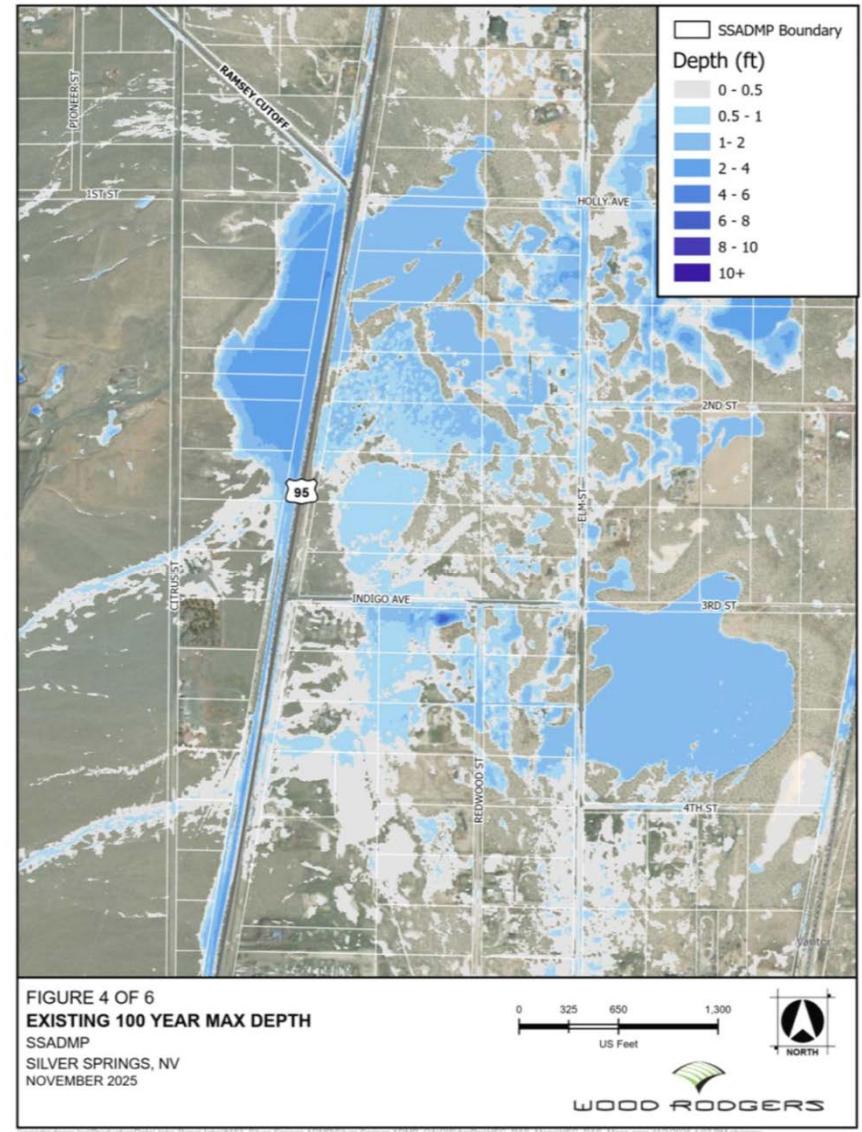
Existing Flood Conditions in South Silver Springs



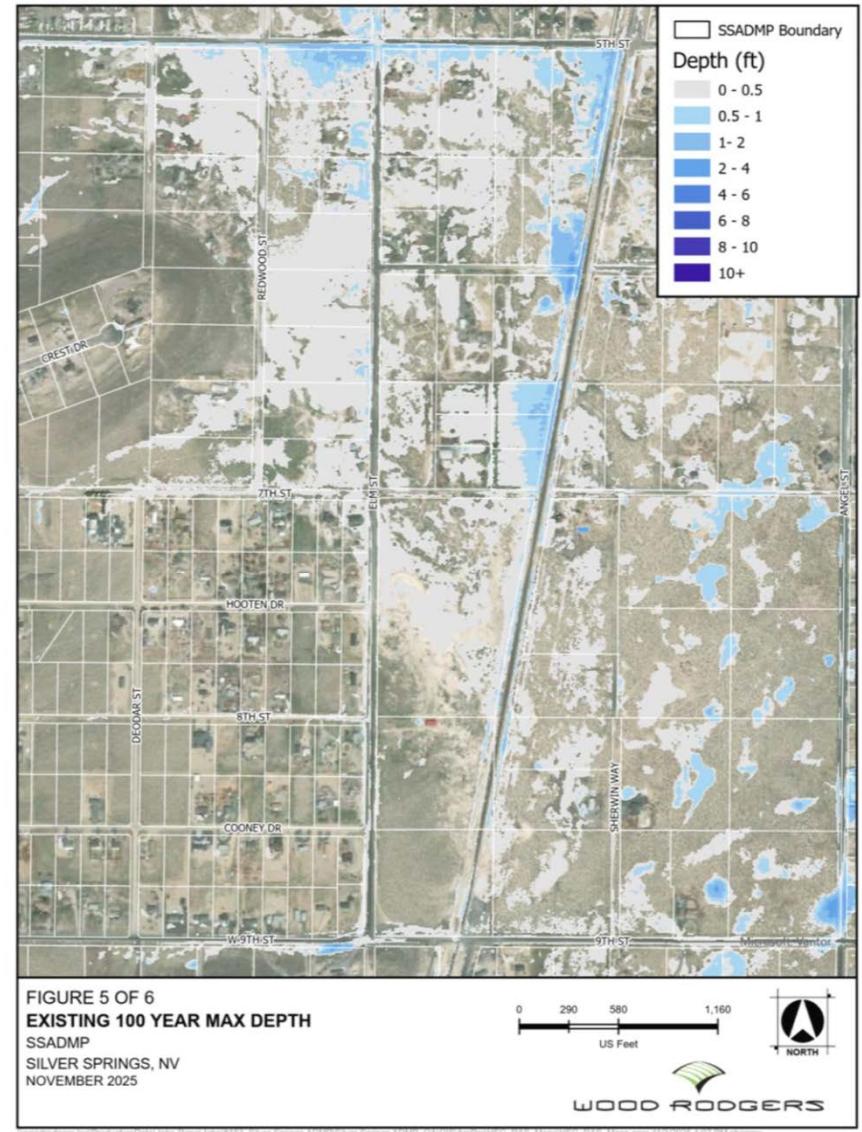
Existing Flood Conditions in South Silver Springs



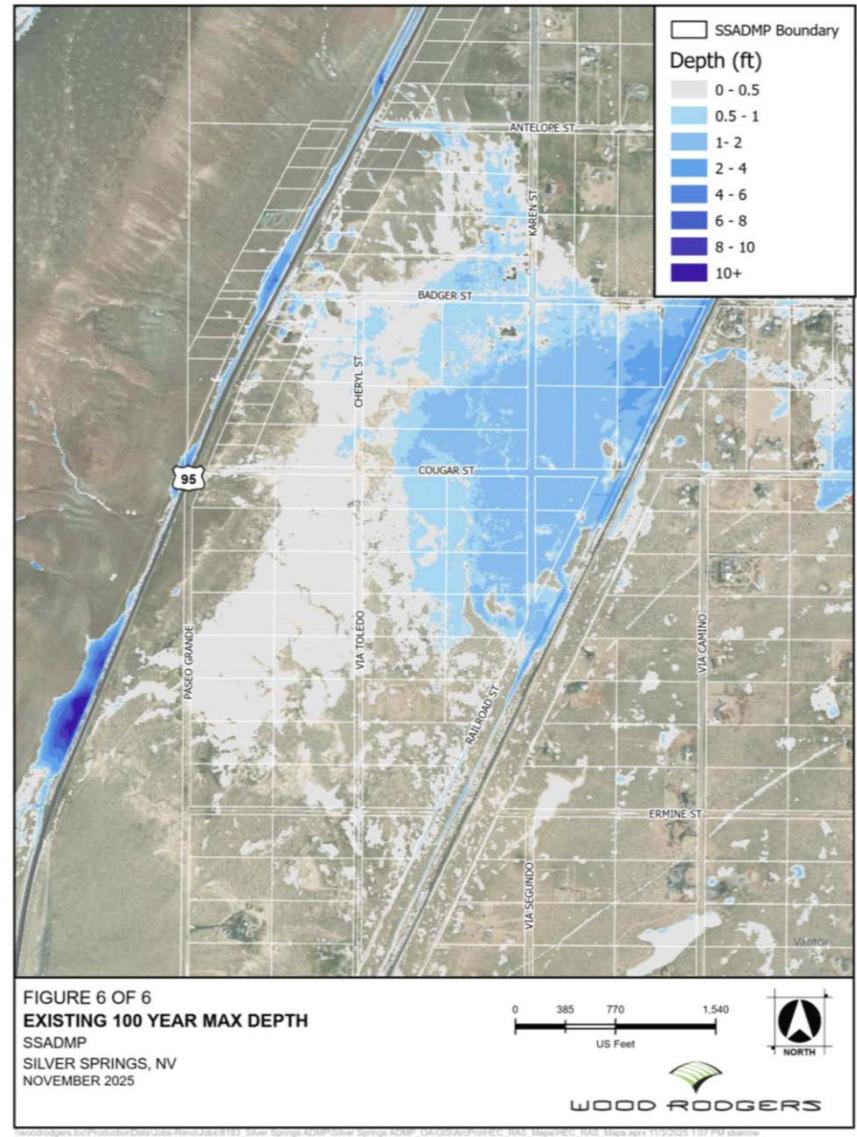
Existing Flood Conditions in South Silver Springs



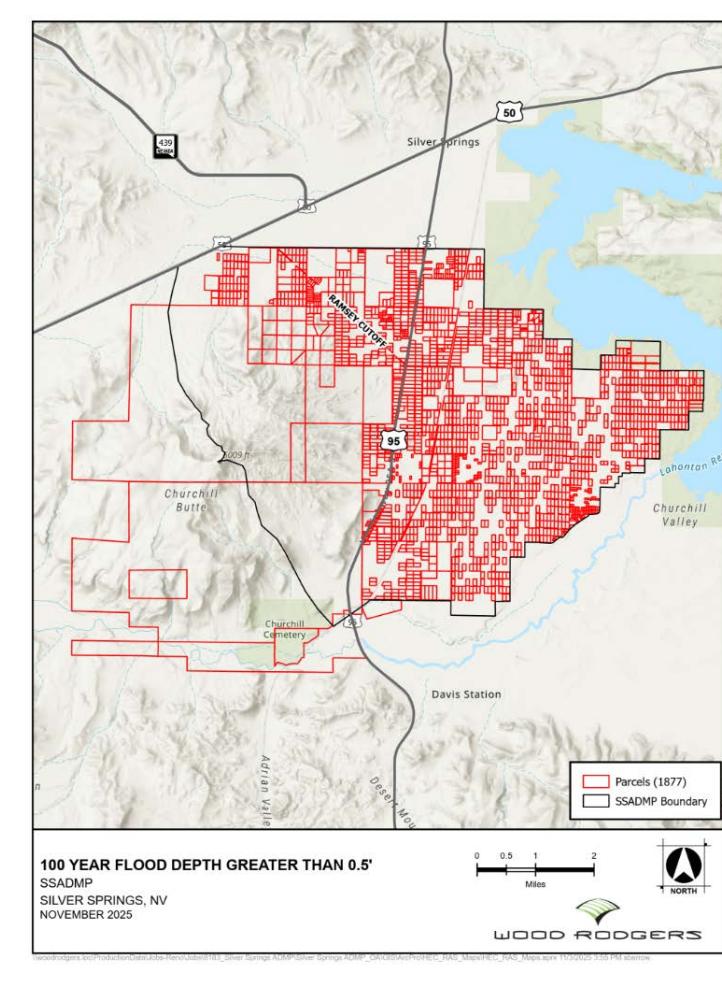
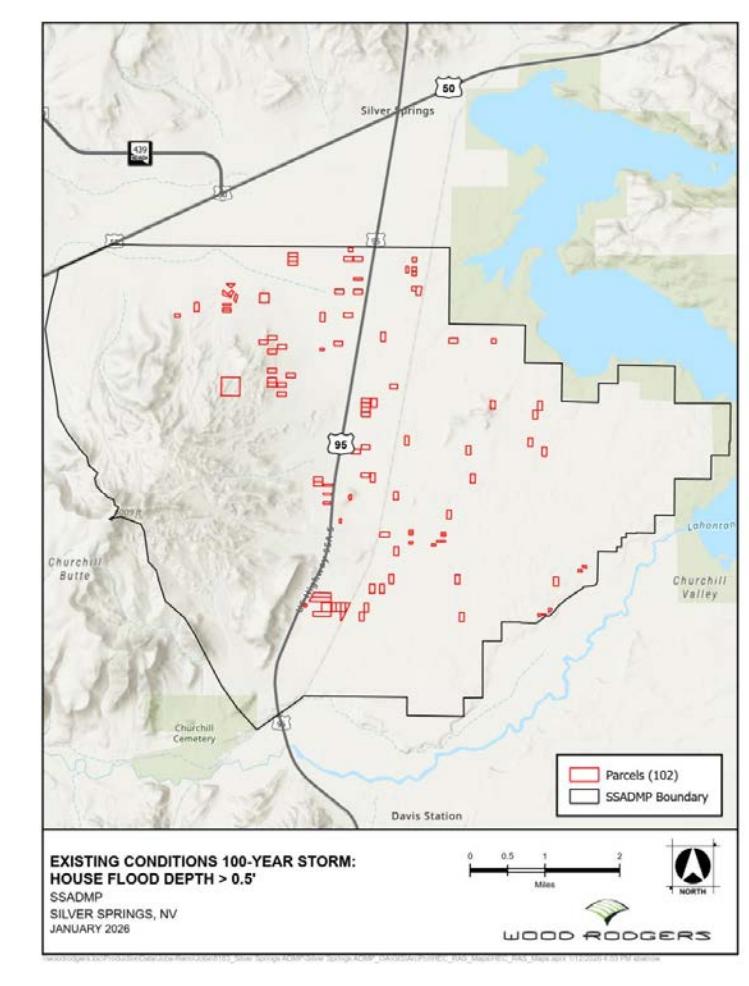
Existing Flood Conditions in South Silver Springs



Existing Flood Conditions in South Silver Springs



Flood Damage Areas

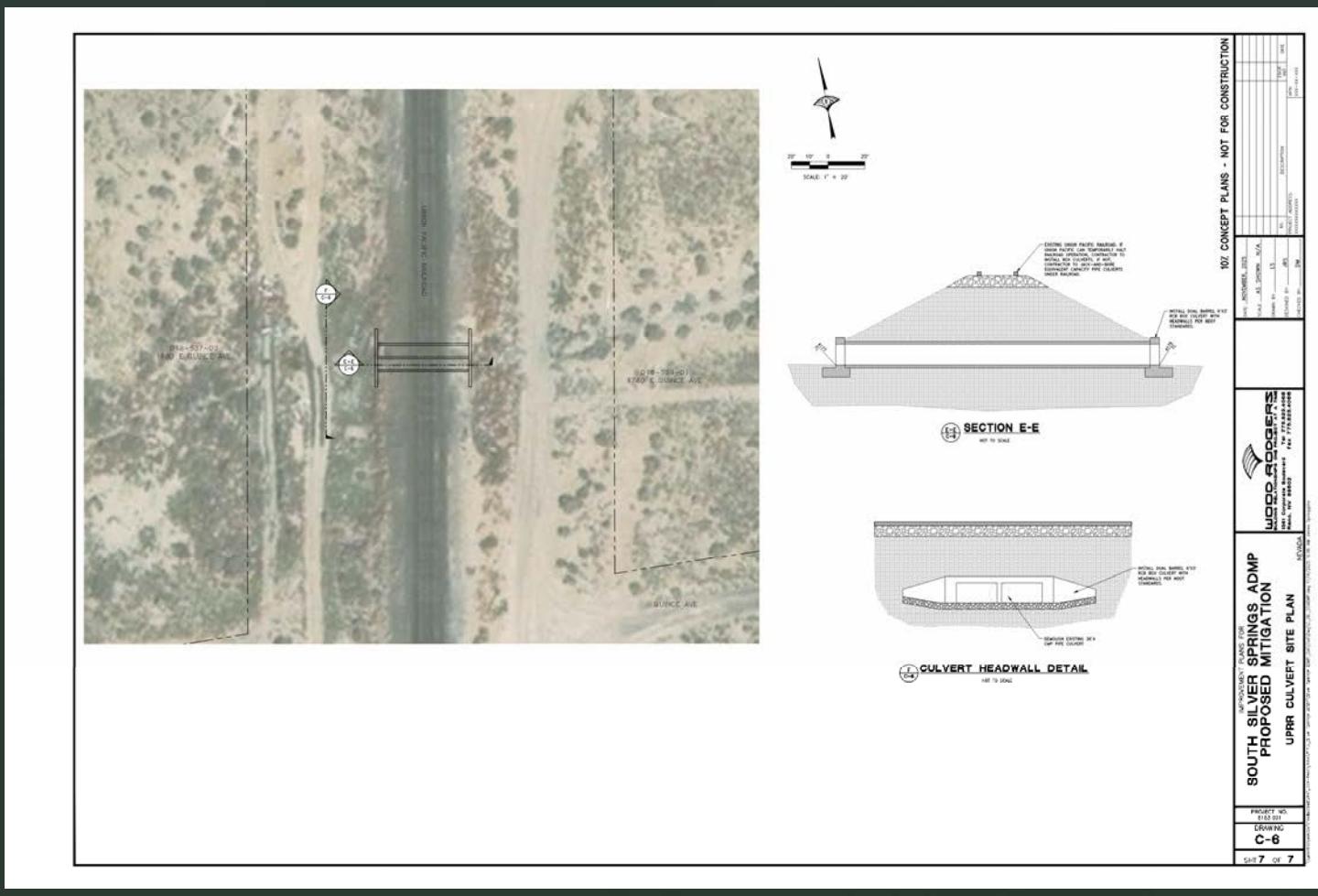


Recommendations

- Adoption of South Silver Springs ADMP
- Structure raising to a minimum of two feet above the Base Flood Elevation demonstrates strongest benefit-cost performance
- Additional standard details, such as cut-off ditches
- Culvert upgrades provide significant emergency access benefits
- Detention ponds improve resilience but depend on future growth



Plan Set



Costs & Benefits

South Silver Springs ADMP

Table 22

Unmitigated Storm Damage



WOOD RODGERS

Storm Event	Direct Costs	Indirect Costs	Total Cost
100-Year	\$49,539,000	\$85,080,000	\$134,619,000
25-Year	\$27,325,000	\$52,211,000	\$79,536,000
10-Year	\$17,831,000	\$21,328,000	\$39,159,000
5-Year	\$15,237,000	\$11,261,000	\$26,498,000

South Silver Springs ADMP

Table 15

Interim Culvert BCR Estimate



WOOD RODGERS

Silver Springs Mitigation FEMA Benefit-Cost Calculator Results

Item Description	Total Benefits [B]	Total Costs [C]	BCR [B/C]	Project Design Life [Years]
Interim Culverts Only	\$391,362	\$1,711,747	0.23	50

South Silver Springs ADMP

Table 20

Raising Structures BCR Estimate



WOOD RODGERS

Silver Springs Mitigation FEMA Benefit-Cost Calculator Results

Item Description	Total Benefits [B]	Total Costs [C]	BCR [B/C]	Project Design Life [Years]
Raise 28 Structures	\$4,182,095	\$1,400,000	2.99	50

Questions?