Stagecoach Area Drainage Master Plan

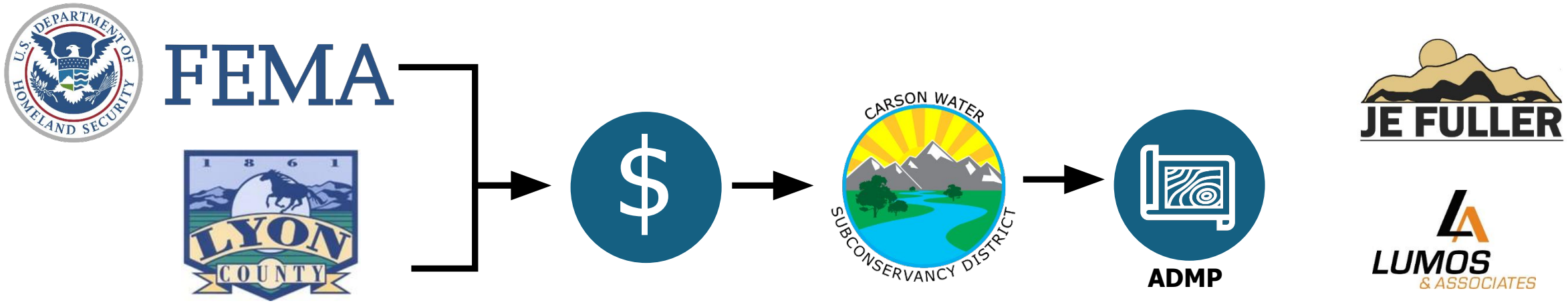
September 17, 2024

Project Purpose

- Planning-level study of flooding risk within the project watershed
- Goals
  - Develop a comprehensive understanding of the existing flood risk
  - Develop data to assist the community and Lyon County with future development
  - Develop regional and local flood mitigation alternative solutions
  - Develop a benefit-cost analysis for a selected mitigation alternative

Project Funding

- FEMA Cooperative Technical Partner (CTP Grant)
- Lyon County (In-Kind Support)



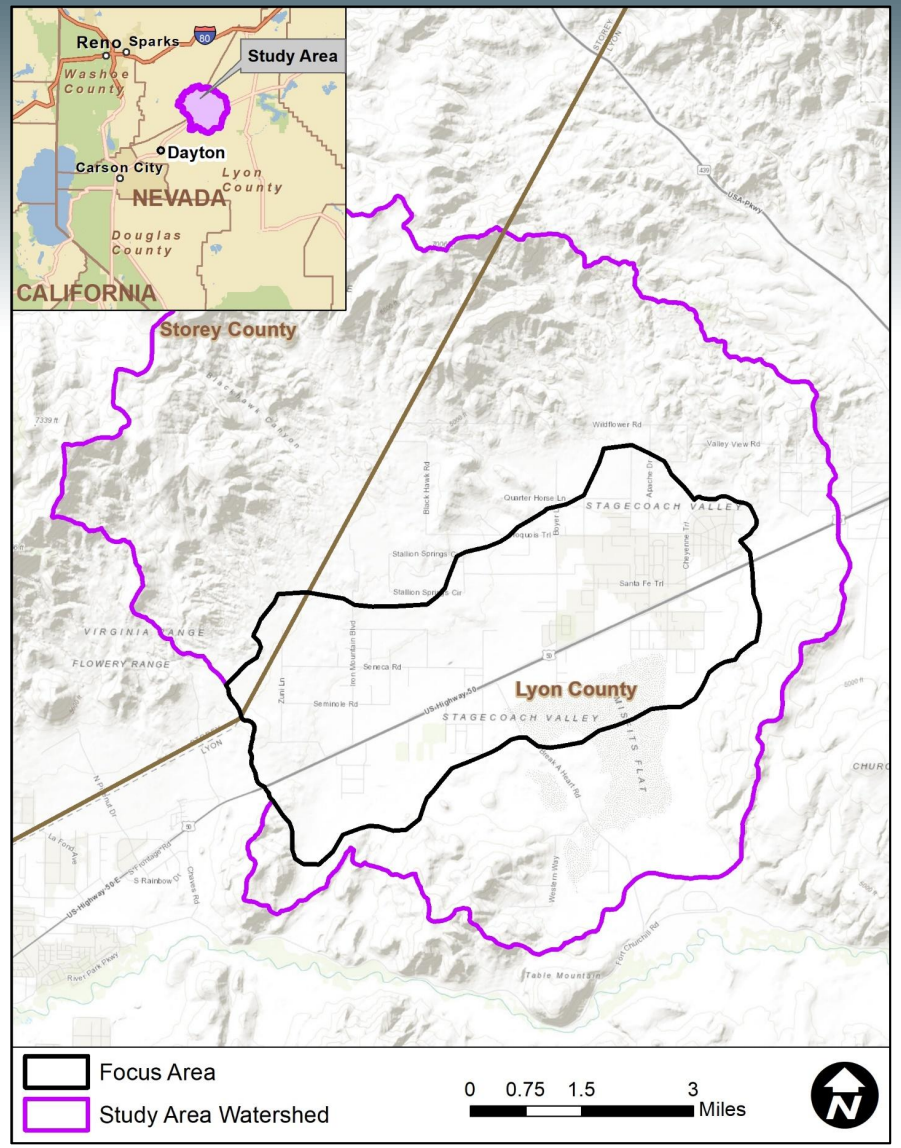
Project Elements

- Public Meetings
  - Meeting #1 – February 22, 2023
    - Introduced the project
    - Heard your experiences, received your input
  - Meeting #2 – Tonight
    - Present the Project Findings

Project Elements

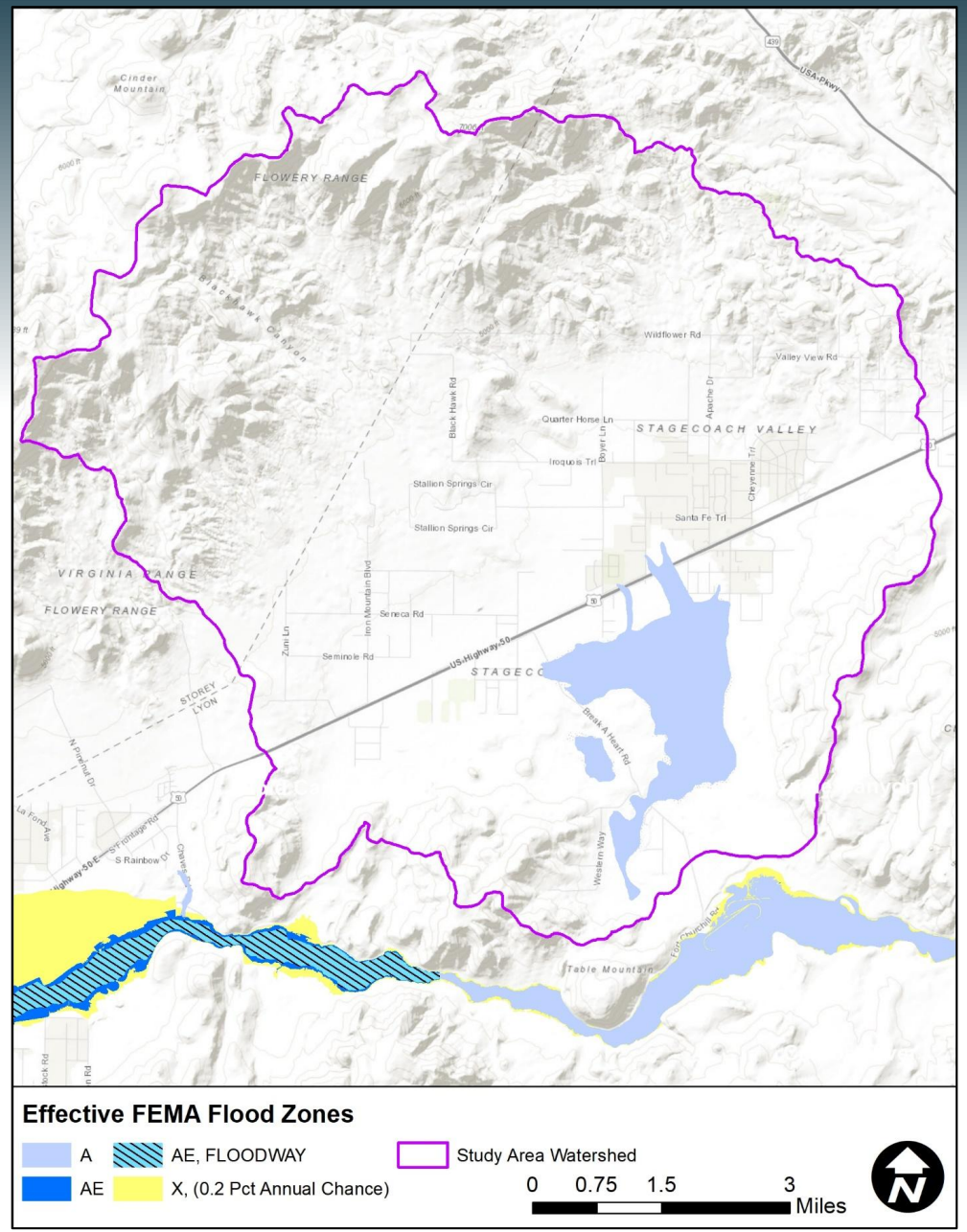
❖ Technical Project Elements

- Data Collection
- Topographic Mapping (LiDAR)
- Watershed Assessment (landforms)
- Flood Risk Assessment
  - Hydrologic Modeling
  - Hydraulic (2D) Modeling
- Flood Risk Classification (people, buildings, roads)
- Sediment Engineering
- Regional Alternatives
- Benefit-Cost Analysis



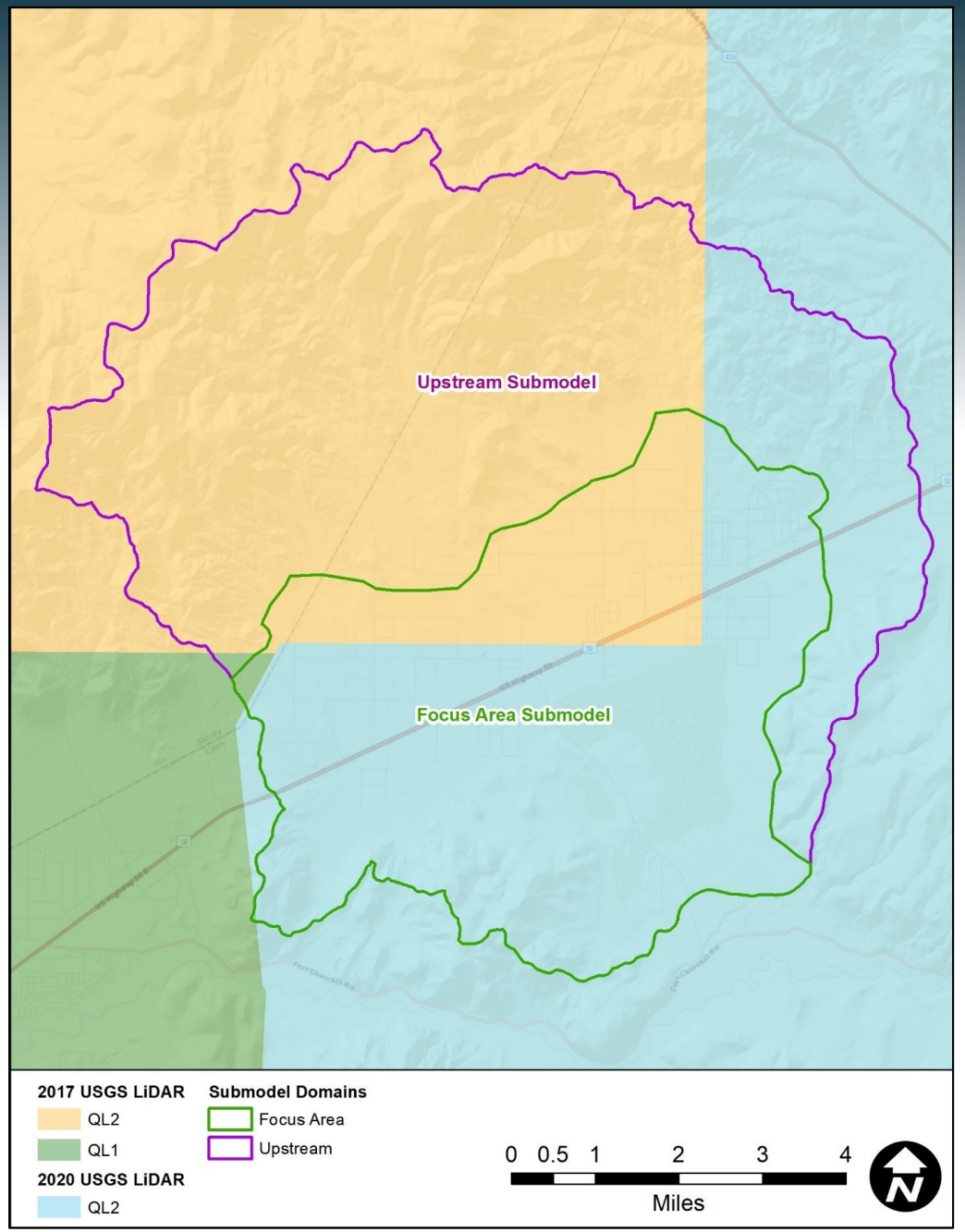
Project Elements

- Data Collection
  - Previous Studies
    - Flood Insurance Studies
    - FEMA Floodplain Mapping
    - County Layers
      - Land Use
      - Building Footprints
      - Assessor Parcels



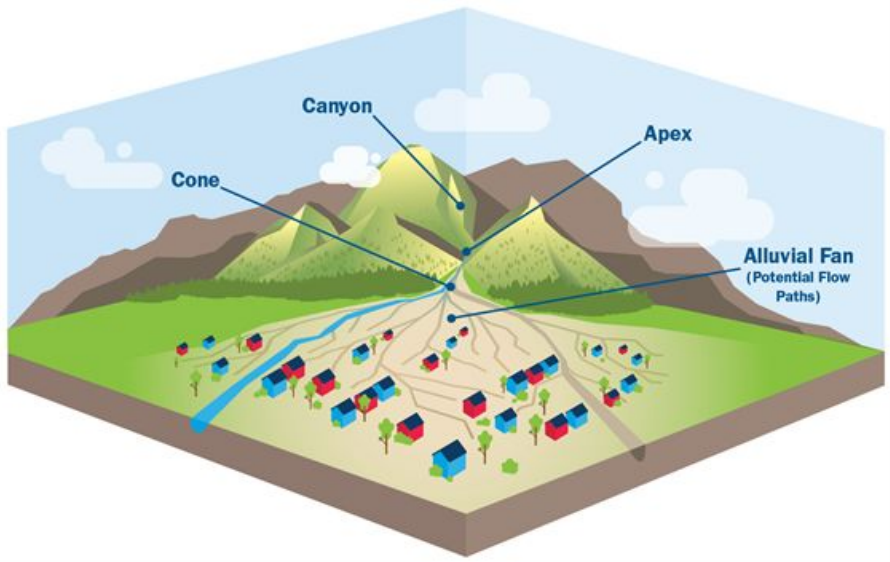
Project Elements

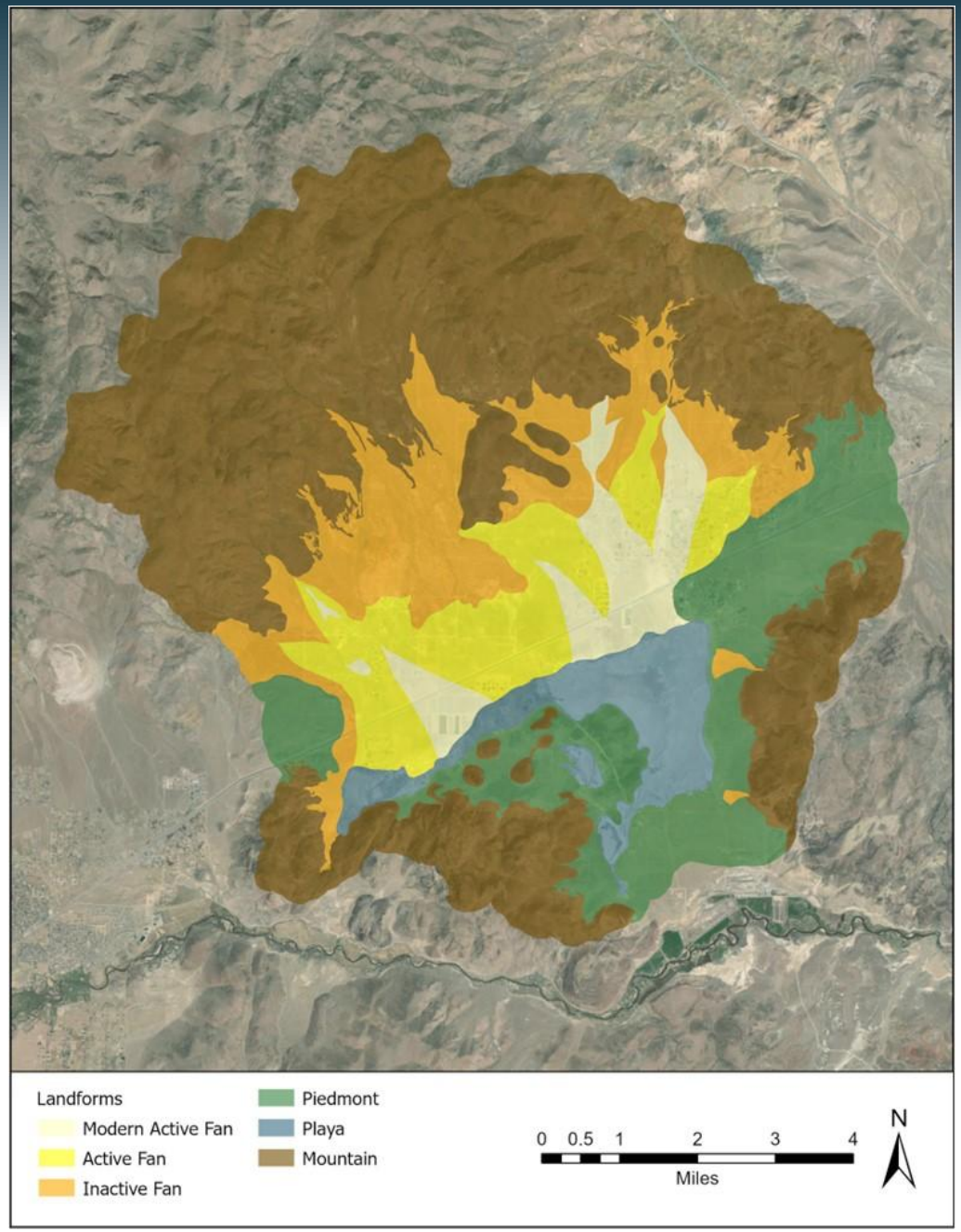
- Data Collection
  - Topographic Mapping
    - USGS LiDAR (2017, 2020)



Project Elements

- Data Collection
  - Landform Assessment
    - Alluvial Fans
    - Playas

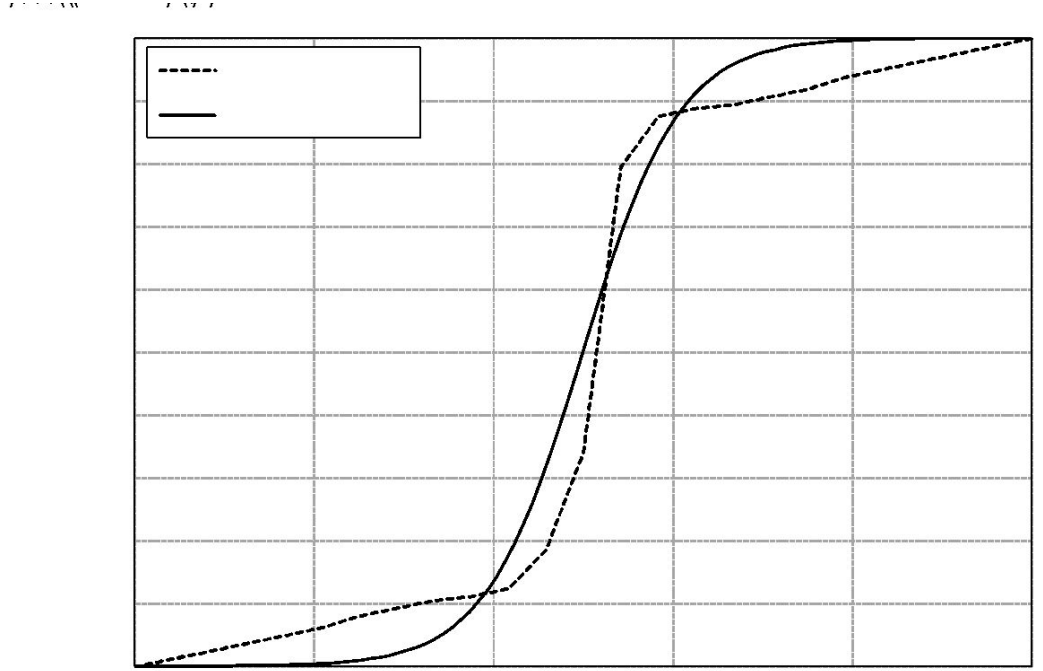




Project Elements

❖ Hydrologic Modeling

- New NDOT Method for Storm Shape
  - 5-year, 24-hour storm
  - 25-year, 24-hour storm
  - 100-year, 6-hour storm
  - 100-year, 24-hour storm
- NDOT Method for Soil Infiltration
  - Green and Ampt method

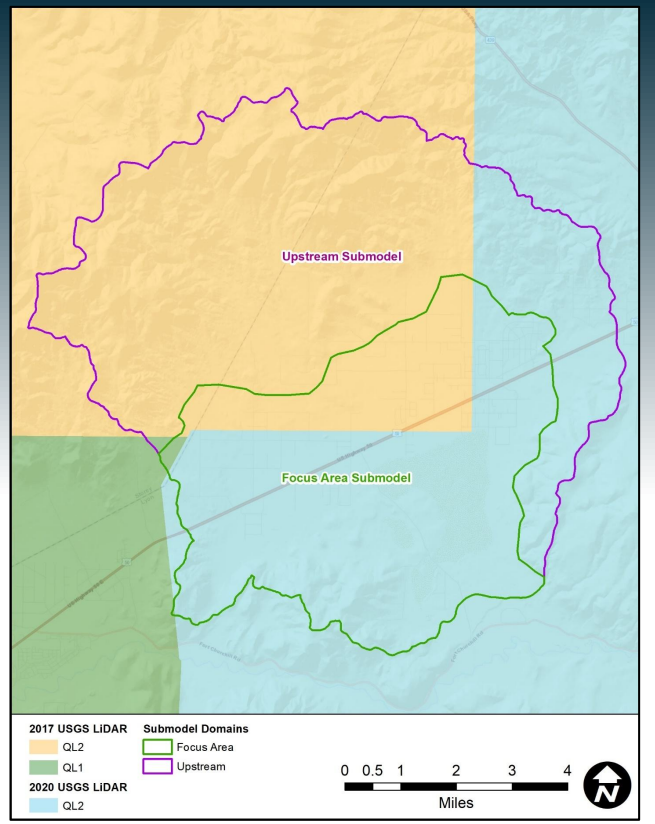


Comparison of 6-hour and 24-hour storm shapes

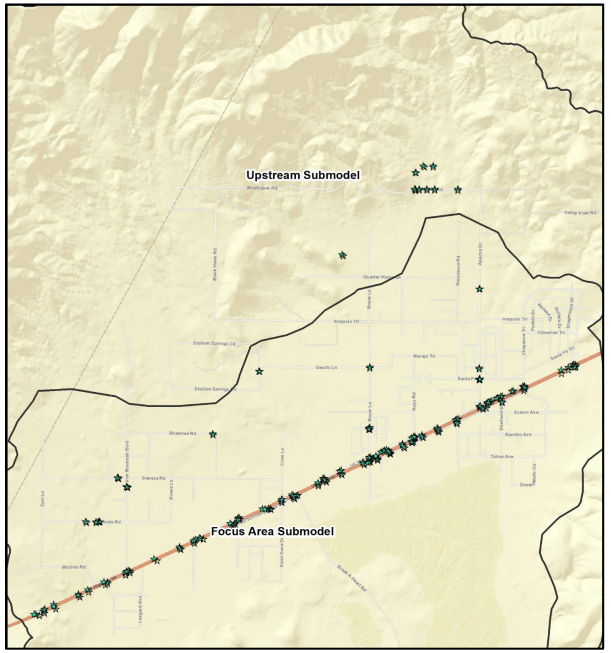
Project Elements

❖ Hydraulic Modeling

- Latest technology: 2-dimenstional (FLO-2D)
  - Two model areas (upper and lower)
  - Topography (LiDAR)
  - Land Use
  - Hydraulic structures (culverts)
  - Floodplain cross-sections
- Verification
  - Resident information
  - USGS Regression



Model boundaries

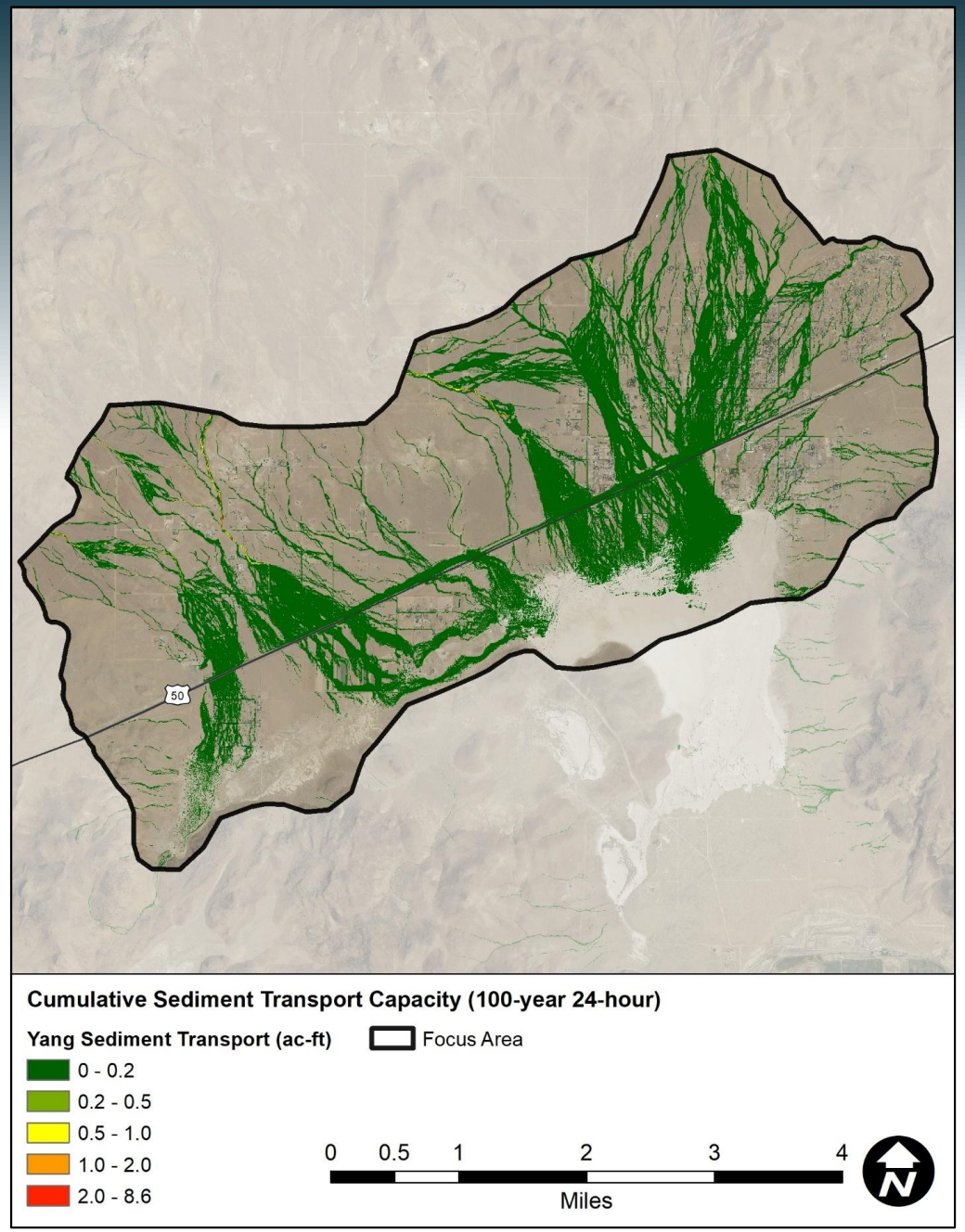


Existing culverts

Project Elements

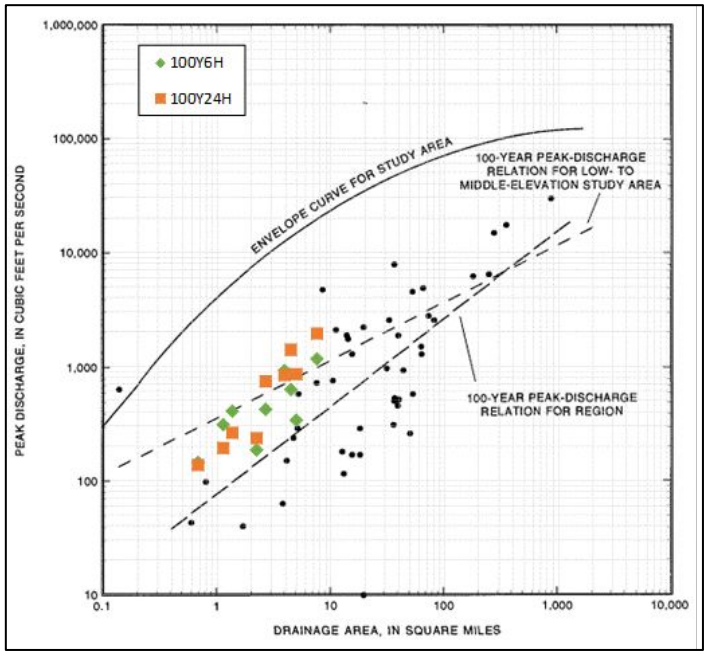
Project Elements

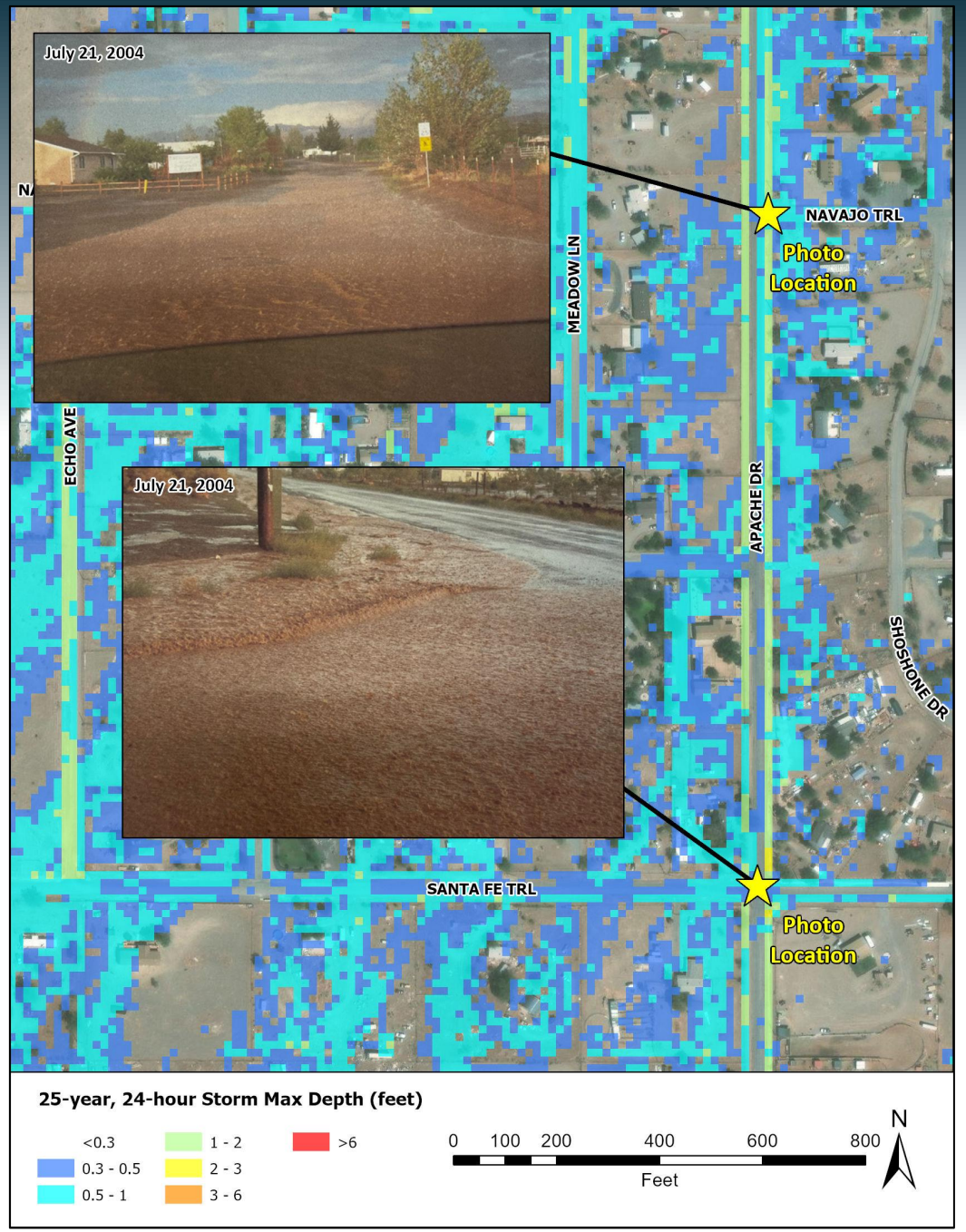
- Sediment Engineering
  - Collected Sediment Samples
  - Quantify sediment being transported during floods



Project Elements

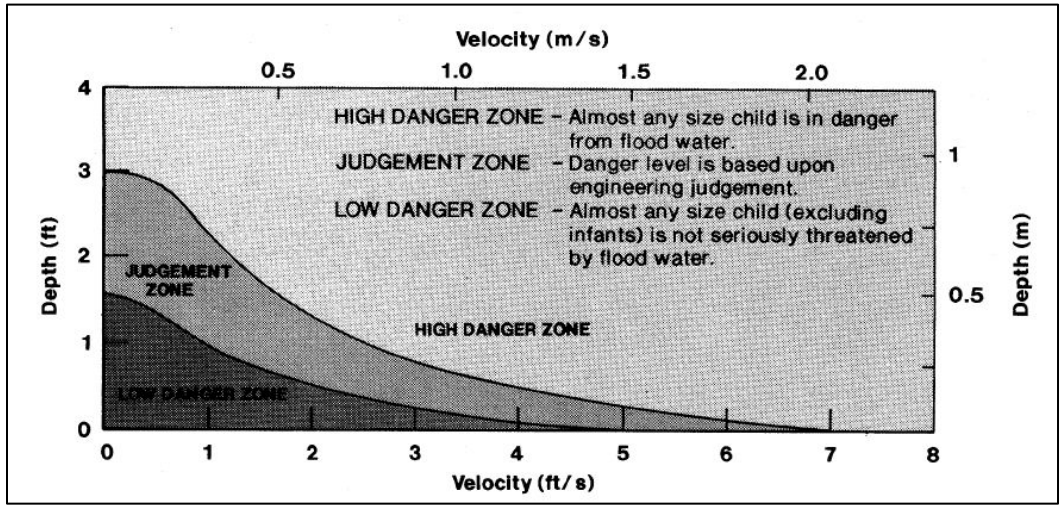
- Verification of Results
  - USGS Regression Data
  - Resident flooding experience

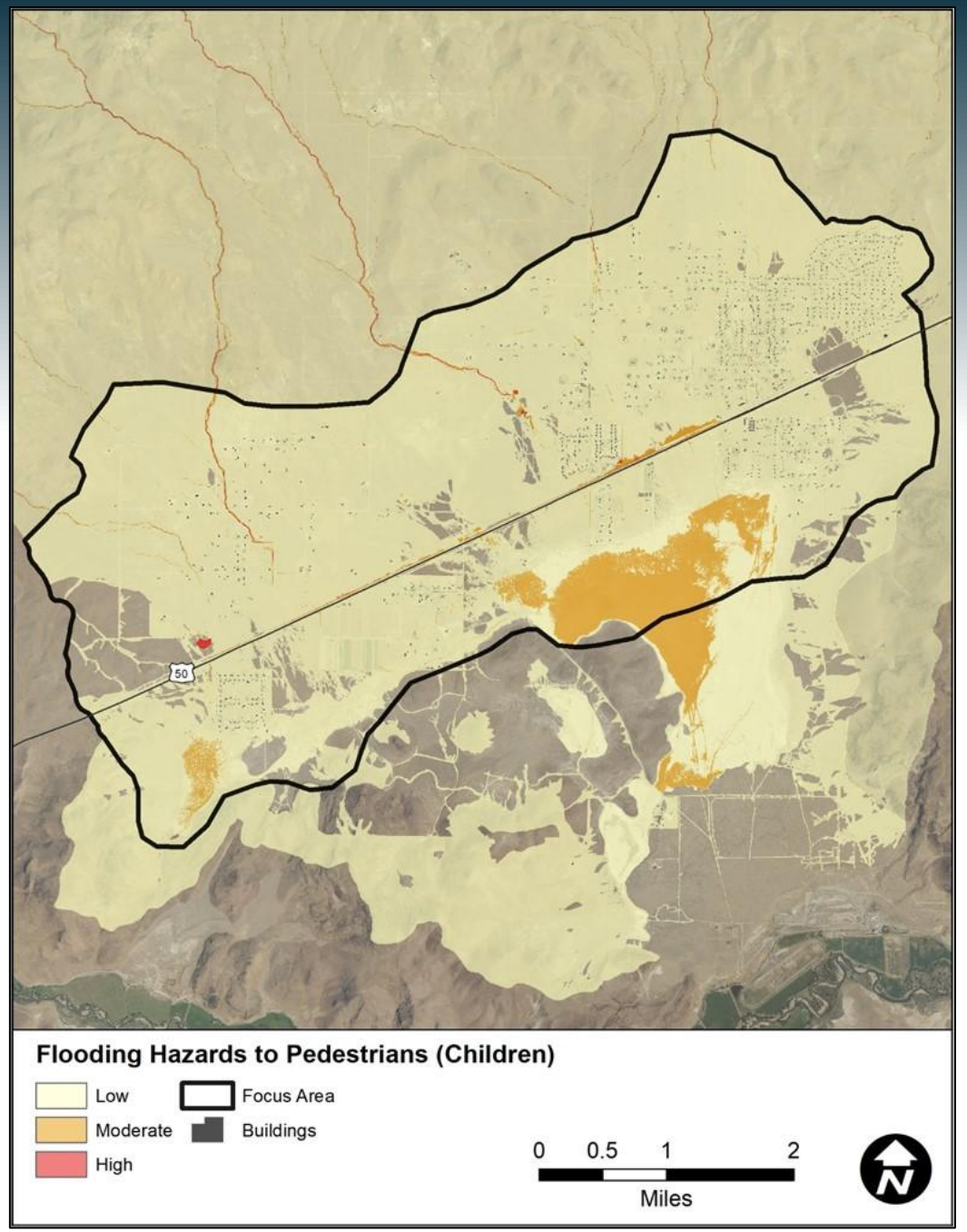




Project Elements

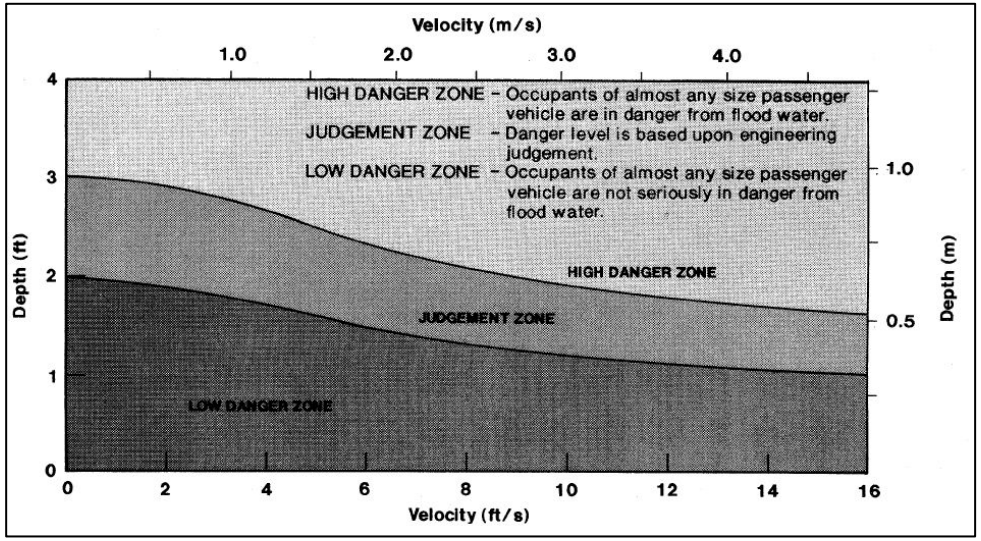
- Flood Risk Classification
  - **Pedestrians**
  - Vehicles
  - Buildings

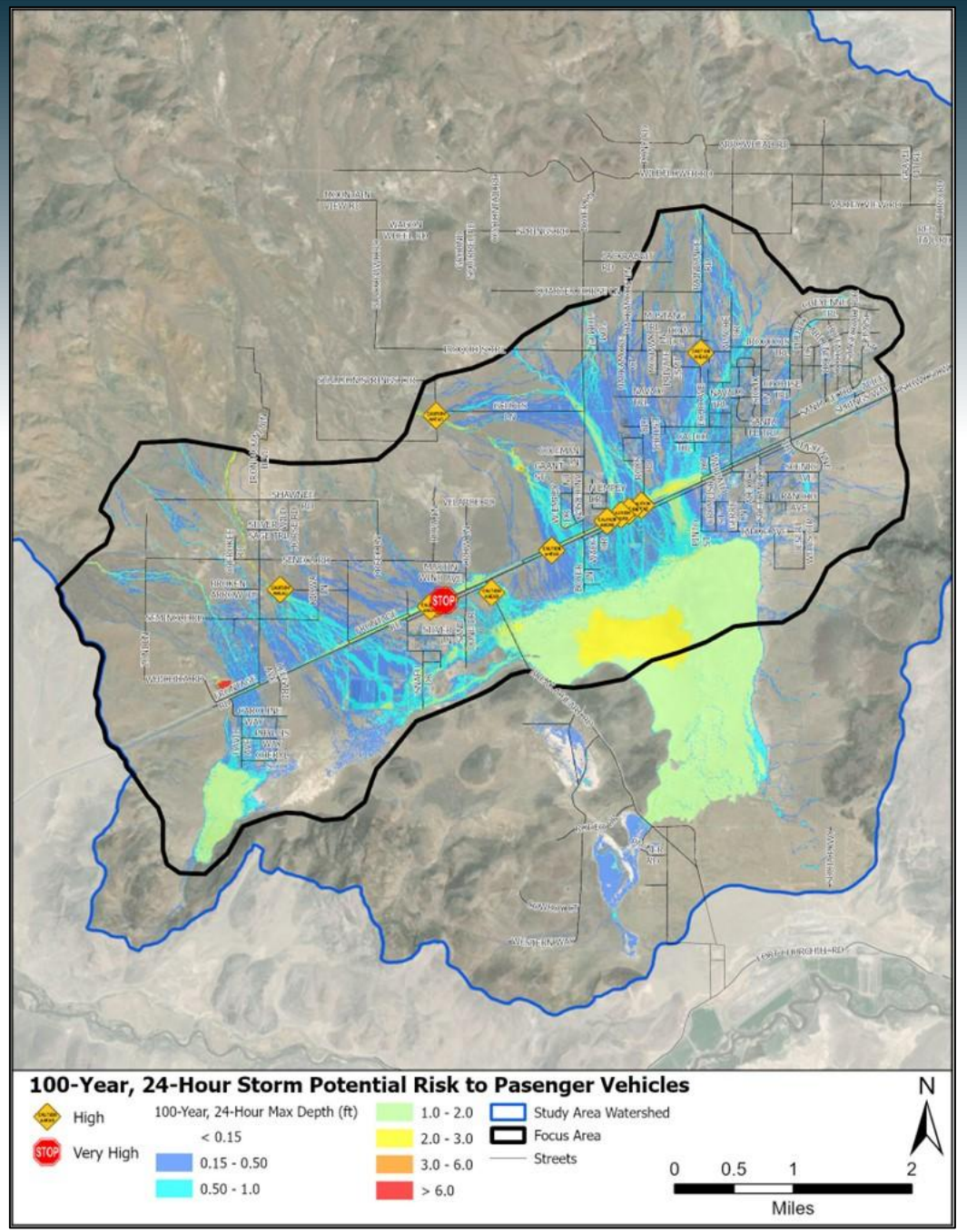




Project Elements

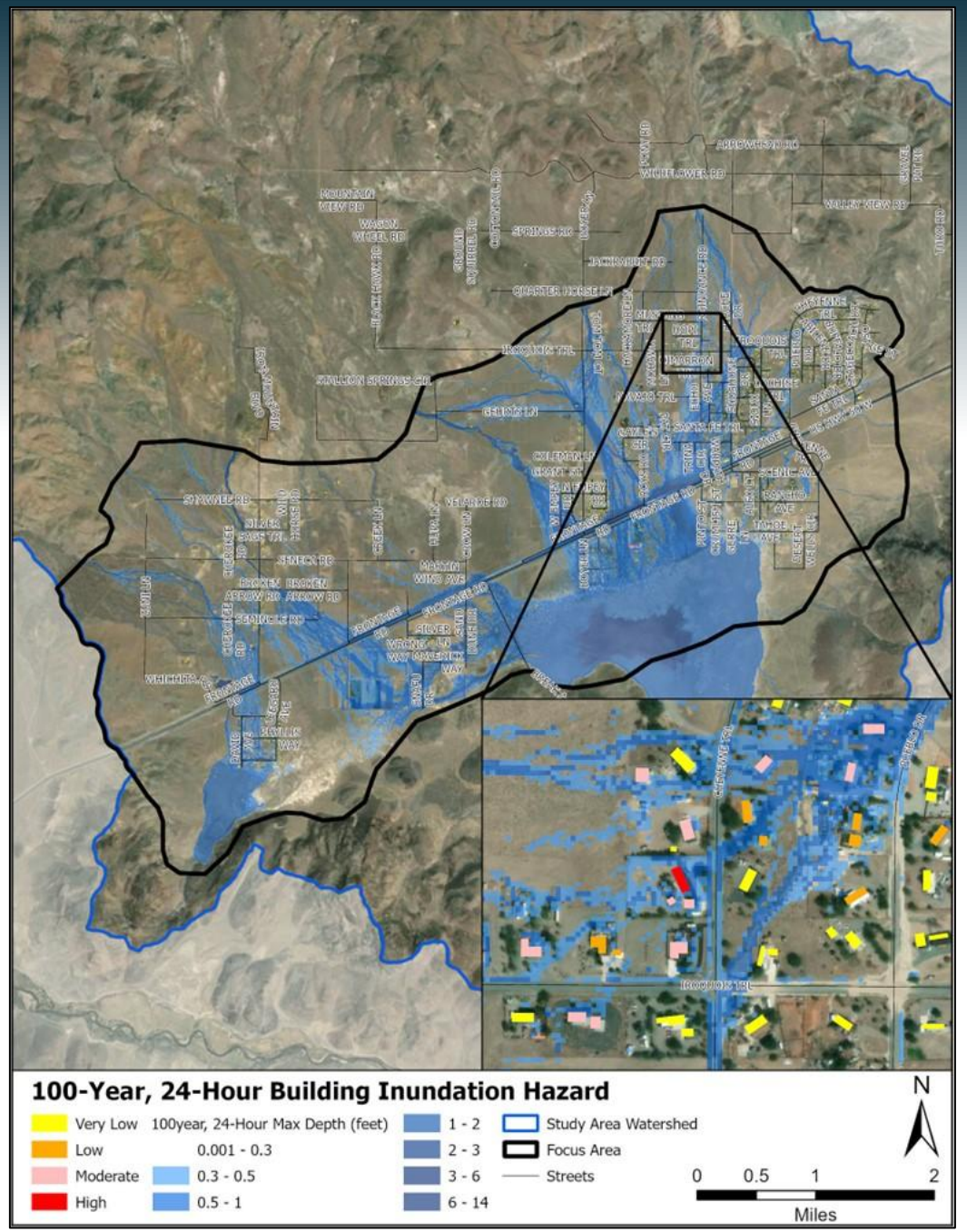
- Flood Risk Classification
  - Pedestrians
  - **Vehicles**
  - Buildings





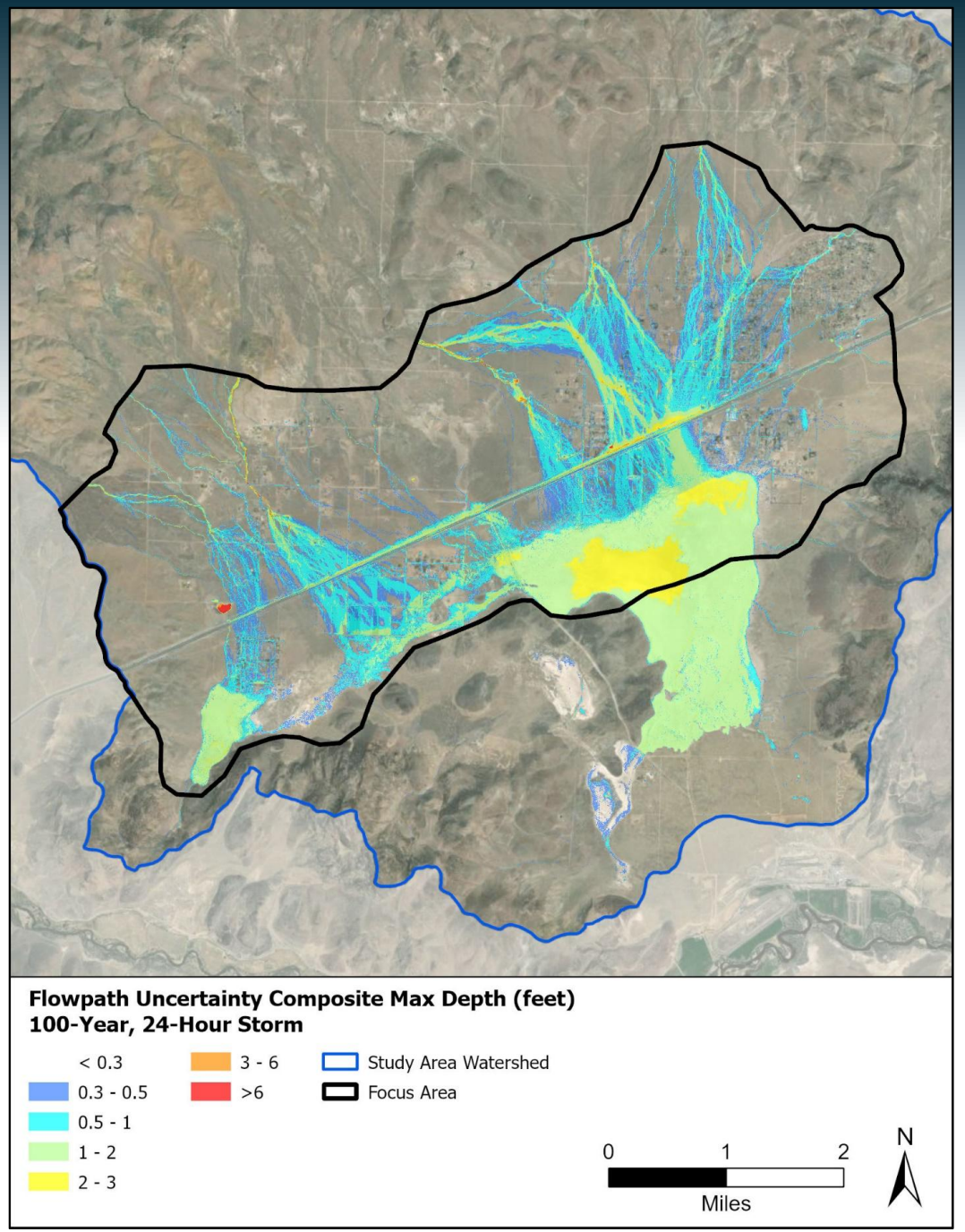
Project Elements

- Flood Risk Classification
  - Pedestrians
  - Vehicles
  - **Buildings**
    - **Low: depth < 6 inches**
    - **Moderate: 6 in > depth < 1 foot**
    - **High: depth > 1 foot**



Project Elements

- Mitigation Alternatives
  - Stagecoach Unique Challenges
    - Minimal drainage infrastructure
    - Alluvial fans, distributary flow
    - Closed basin watershed
  - Develop both Regional and Local mitigation alternatives

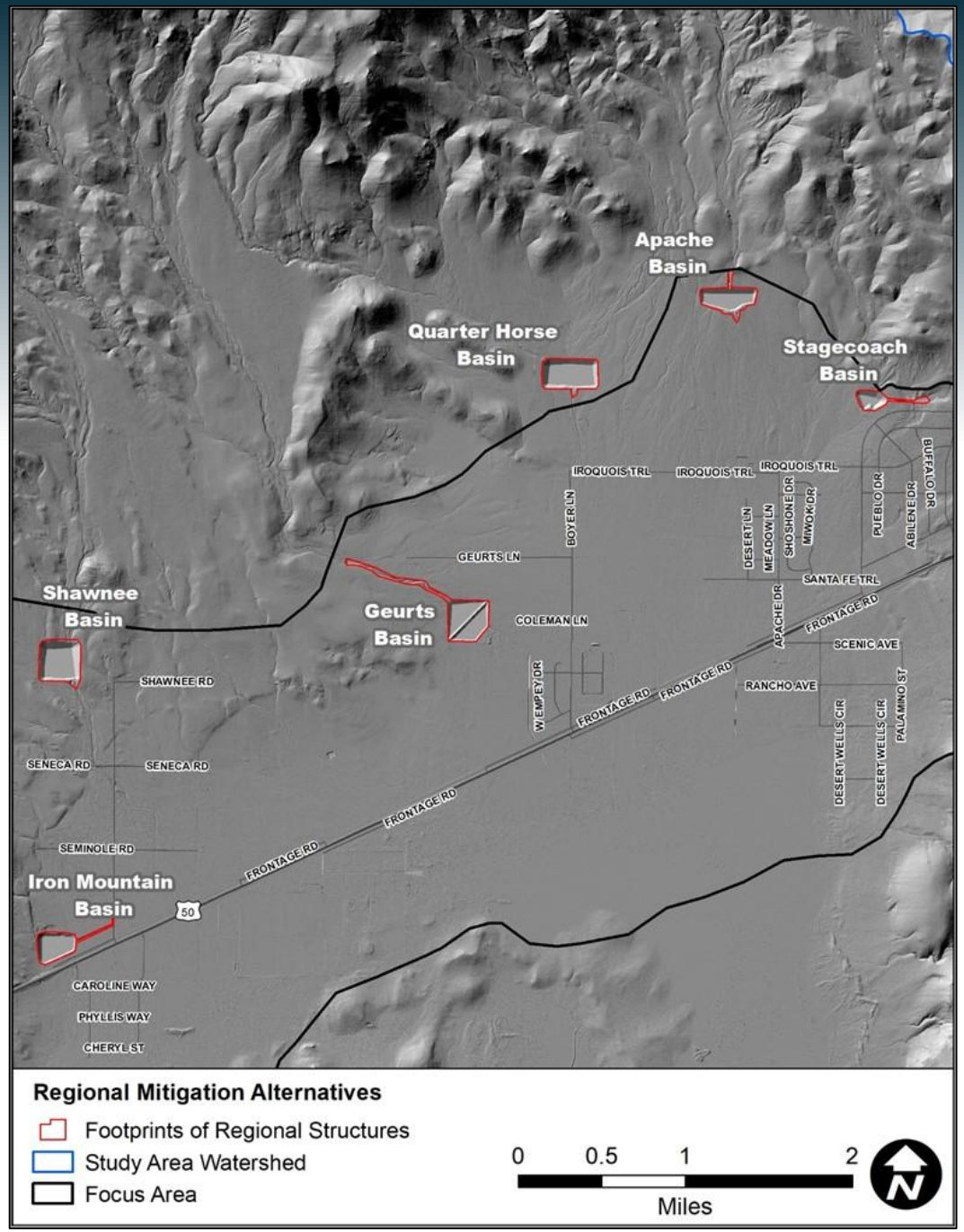


Project Elements

- Regional Alternatives
  - Six regional basins with collector and conveyance channels
  - Mitigation challenges

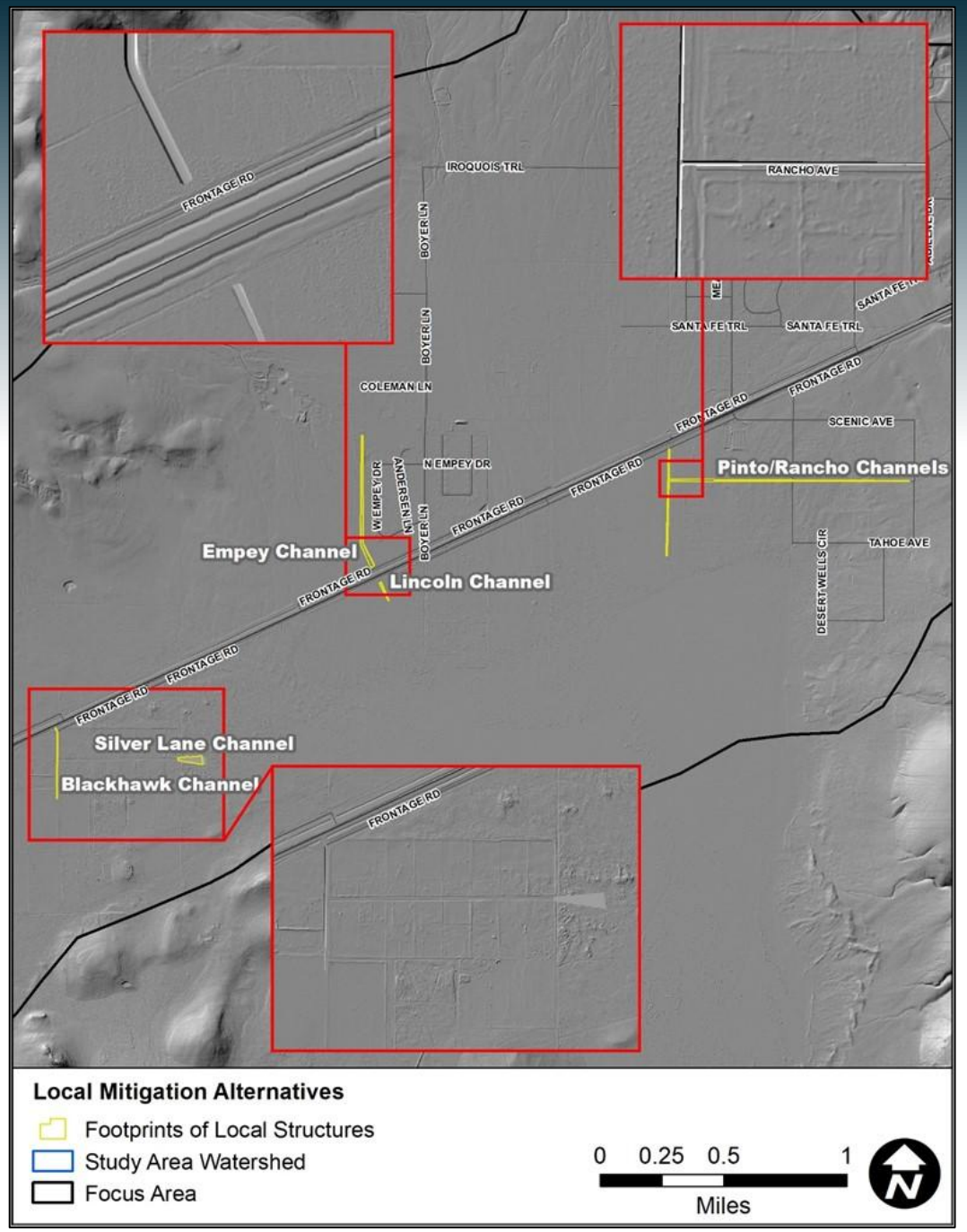
Large Storm Volumes + Large Sediment Volumes = Large Basins

Large Basins + High Gradient Topography = Large Costs



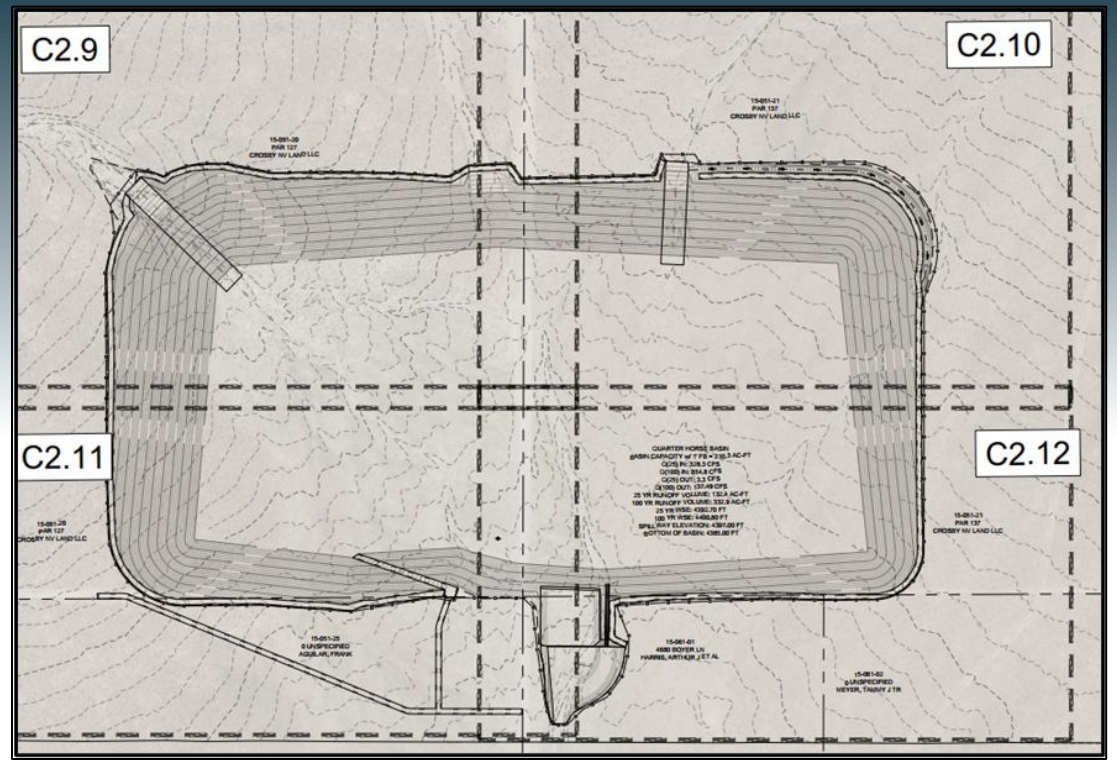
Project Elements

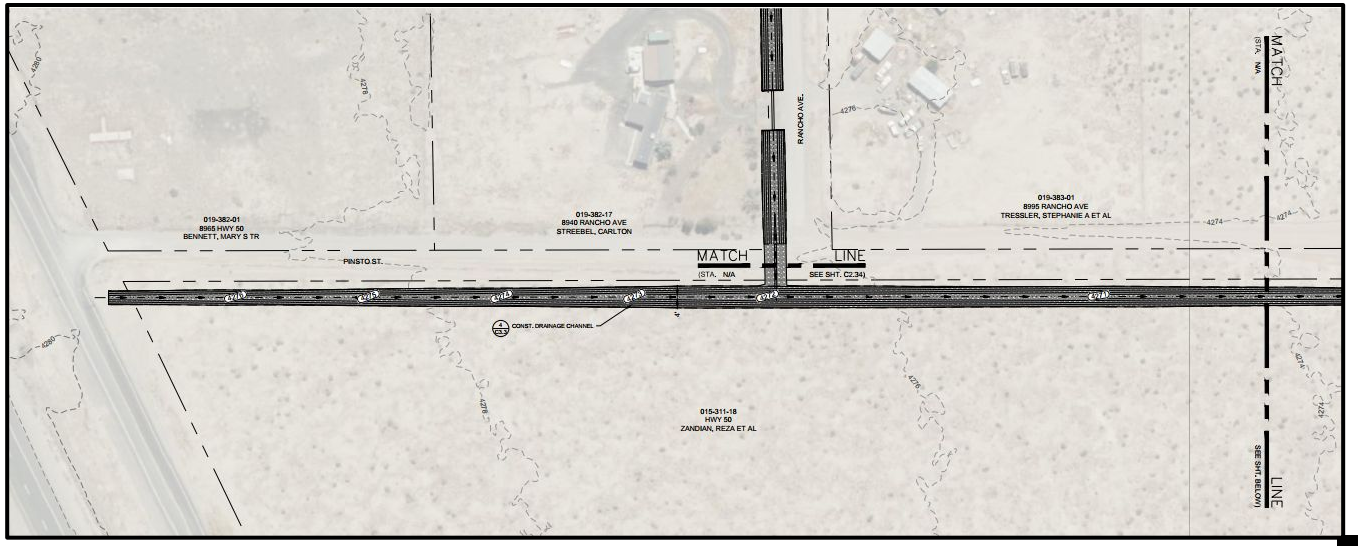
- Local Alternatives
  - Four areas where local alternatives would be beneficial
    - Empey Channel – collects and drains flow from west of Empey Drive
    - Help with roadway drainage and sediment



Project Elements

- Concept Design Plans
  - Plans were developed for each alternative
  - Integrated into the FLO-2D model for verification





Project Elements

- Mitigation Alternative Costs

Mitigation Alternative	Project Cost	O&M Cost (over 20 years)	20-year Net Present Values
Regional Structures			
Iron Mountain Basin	$ 16,713,000	$ 8,943,100	$ 25,656,100
Shawnee Basin	$ 51,500,500	$ 9,669,400	$ 61,169,900
Geurts Basin	$ 28,234,800	$ 9,835,900	$ 38,070,700
Quarter Horse Basin	$ 45,108,800	$ 9,731,200	$ 54,840,000
Apache Basin	$ 28,753,500	$ 9,123,400	$ 37,876,900
Stagecoach Basin	$ 30,178,300	$ 8,453,800	$ 38,632,100
Regional Subtotal	**$ 200,488,900**	**$ 55,756,800**	**$ 256,245,700**
Local Structures			
Empey Channel	$ 4,206,700	$ 1,110,800	$ 5,317,500
Black Hawk Channel	$ 409,400	$ 769,200	$ 1,178,600
Silver Lane Channel	$ 208,200	$ 769,200	$ 977,400
Rancho/Pinto Channels	$ 2,108,000	$ 769,200	$ 2,877,200
Local Subtotal	**$ 6,932,300**	**$ 3,418,400**	**$ 10,350,700**
Total	**$ 207,421,200**	**$ 59,175,200**	**$ 266,596,400**

Project Elements

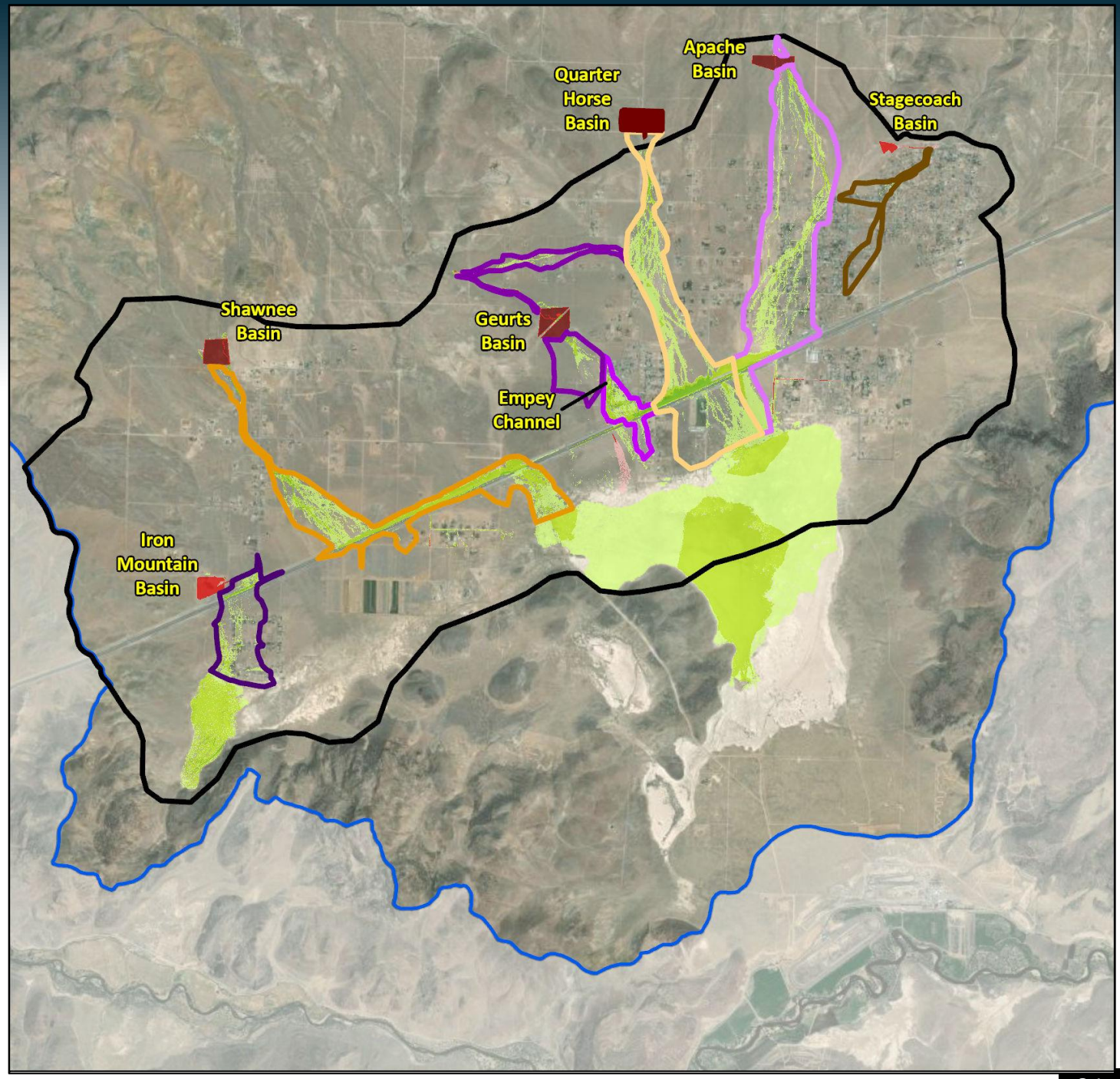
Benefits Summary - Buildings

Regional Alternative Project	25-Year, 24-Hour Storm Existing Conditions			25-Year, 24-Hour Storm With Mitigation Alternatives			Total Buildings Removed
	Number of High Hazard Buildings[1]	Number of Moderate Hazard Buildings[2]	Number of Low Hazard Buildings[3]	Number of High Hazard Buildings[1]	Number of Moderate Hazard Buildings[2]	Number of Low Hazard Buildings[3]	
Apache Basin	2	51	75	0	4	32	**92**
Empey Channel	5	17	14	0	0	1	**35**
Geurts Basin	0	2	3	0	0	1	**4**
Iron Mountain Basin	2	8	15	1	2	4	**18**
Quarter Horse Basin	3	22	20	0	2	12	**31**
Shawnee Basin	1	3	1	0	0	2	**3**
Stagecoach Basin	0	10	13	0	0	8	**15**
Regional Alternative Project	**100-Year, 24-Hour Storm Existing Conditions**			**100-Year, 24-Hour Storm With Mitigation Alternatives**			**Total Buildings Removed**
	Number of High Hazard Buildings[1]	Number of Moderate Hazard Buildings[2]	Number of Low Hazard Buildings[3]	Number of High Hazard Buildings[1]	Number of Moderate Hazard Buildings[2]	Number of Low Hazard Buildings[3]	
Apache Basin	12	96	50	2	49	71	**36**
Empey Channel	15	37	20	0	3	14	**55**
Geurts Basin	1	13	11	0	2	8	**15**
Iron Mountain Basin	7	34	16	1	4	7	**45**
Quarter Horse Basin	13	33	13	1	12	24	**22**
Shawnee Basin	2	5	2	1	4	3	**1**
Stagecoach Basin	1	9	6	1	8	3	**4**

1. Depth: > 1'
2. Depth: 0.5'< h ≤ 1'
3. Depth: 0.25' < h ≤ 0.5'

Benefits Summary

Depth Reduction
25-year, 24-hour Storm



Depth Change with Alternatives (25-year, 24-hour storm)

- <-6.0
- -6.0 - -1.0
- -1.0 - -0.5
- -0.5 - -0.25
- -0.25 - 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 6.0
- >6.0

Mitigation Project Affected Areas
- Apache Basin
- Empey Channel
- Geurts Basin
- Iron Mountain Basin
- Quarter Horse Basin
- Shawnee Basin
- Stagecoach Basin

- Focus Area
- Study Area Watershed

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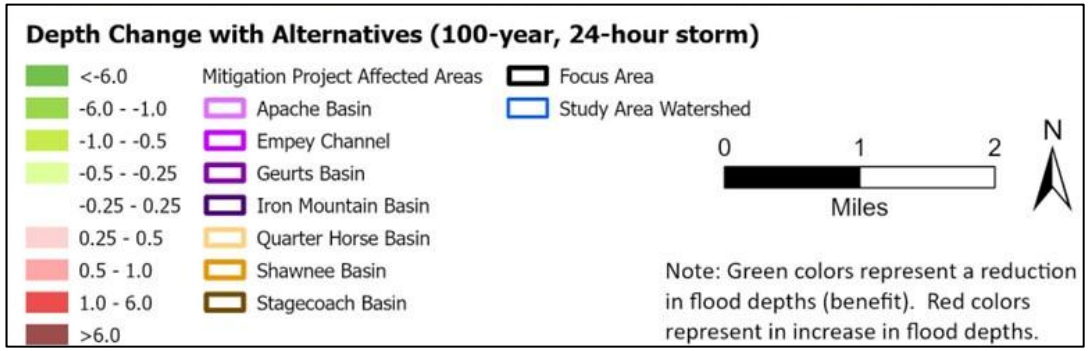
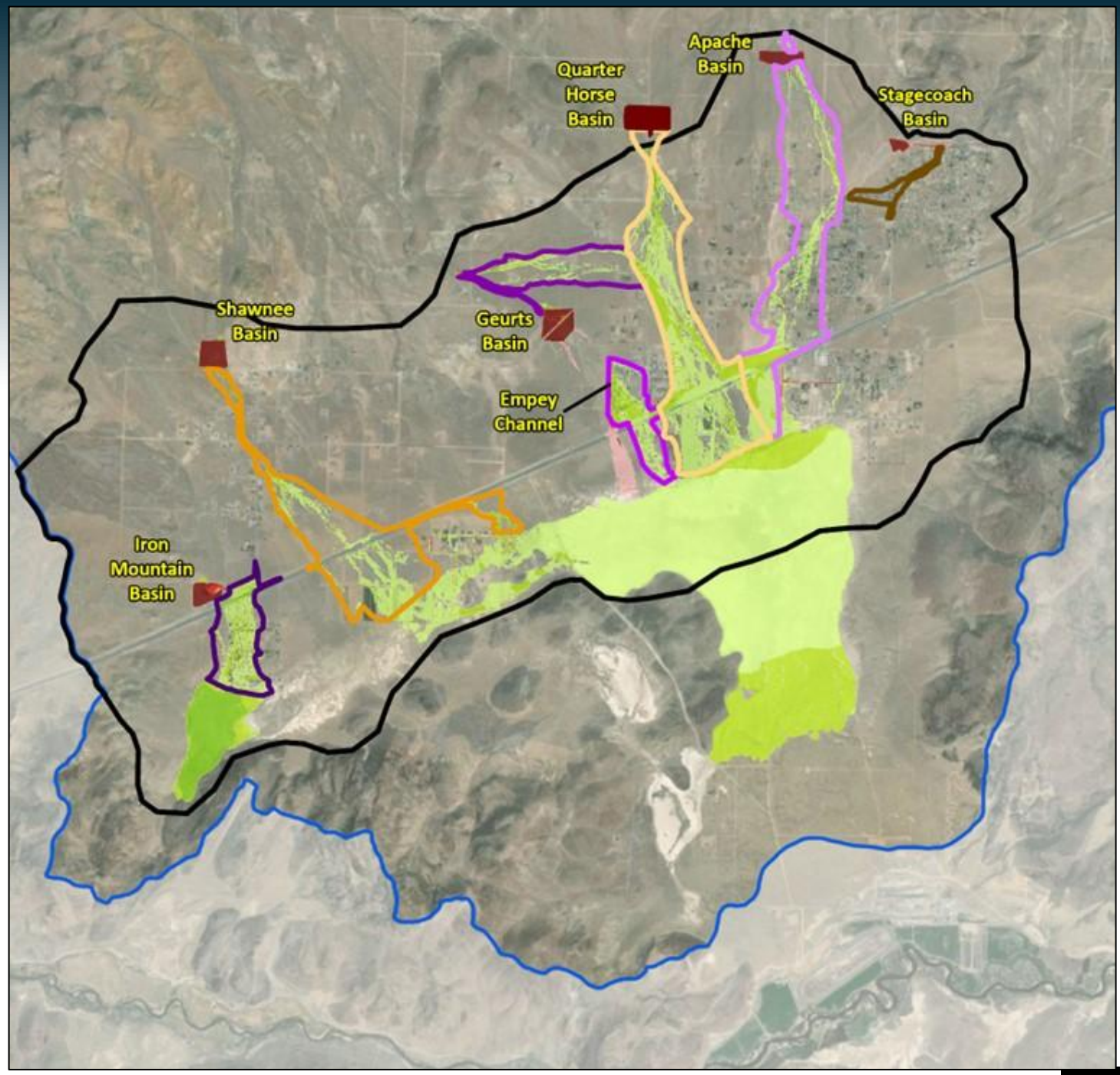
Note: Green colors represent a reduction in flood depths (benefit). Red colors represent in increase in flood depths.

Benefits Summary

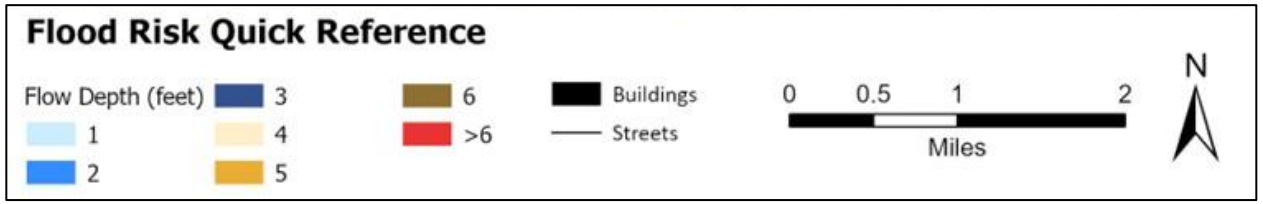
Depth Reduction
100-year, 24-hour Storm

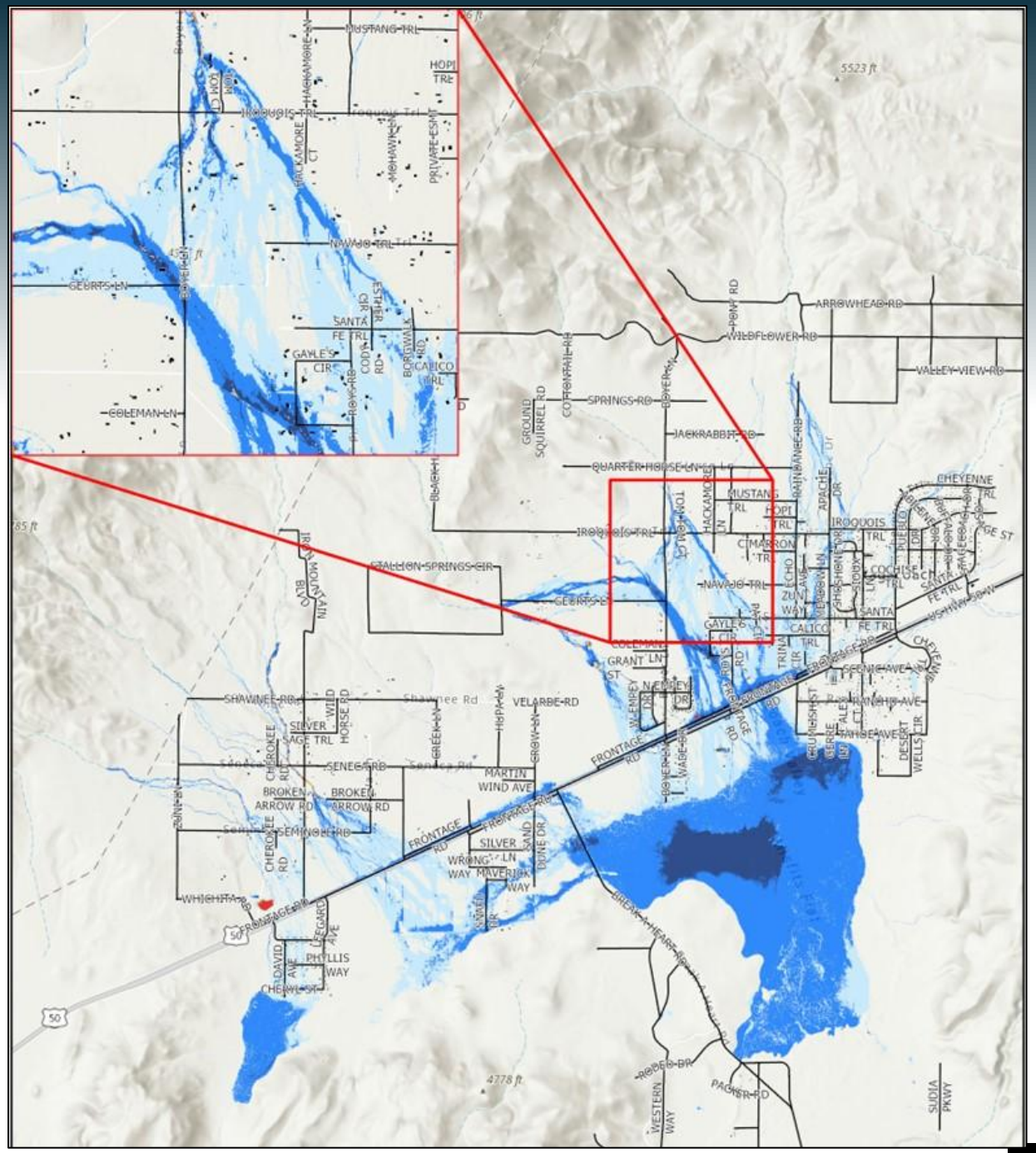




Benefits Summary

Flood Risk Quick Reference

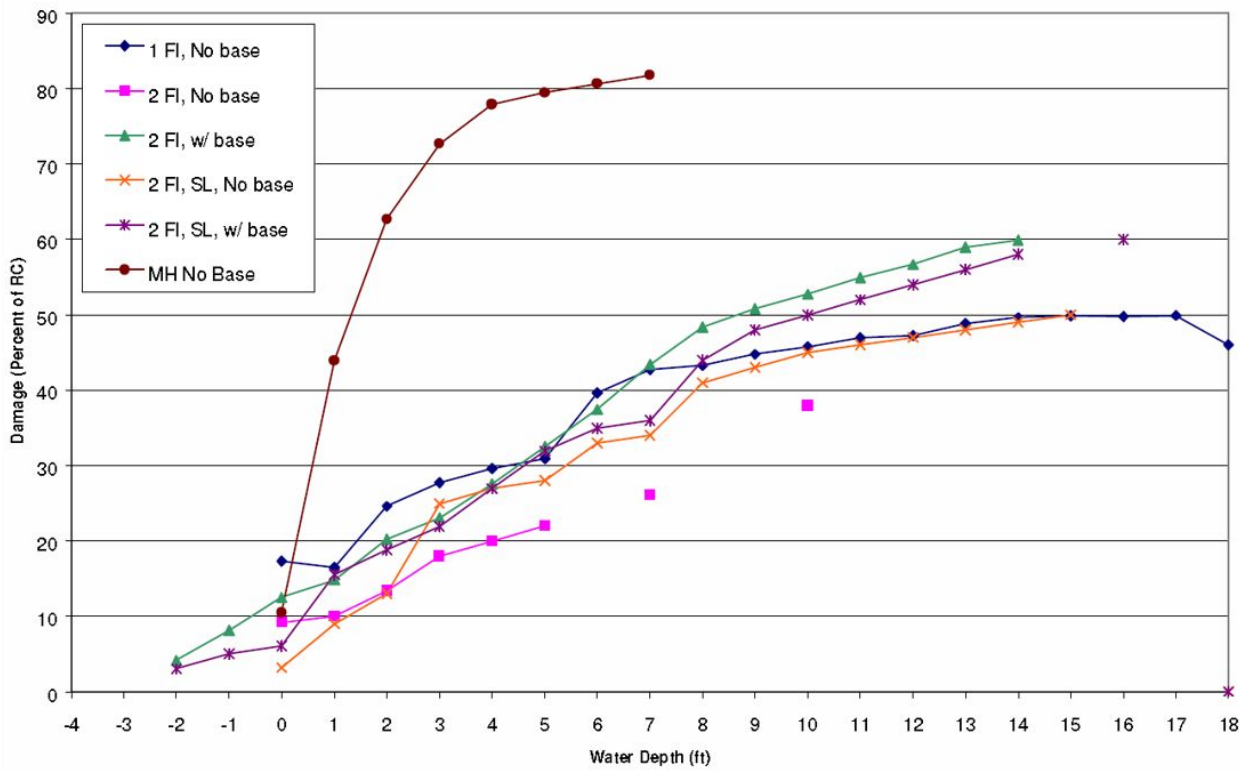




Benefits Summary

Benefit-Cost Analysis

- FEMA procedures
  - Building Damages
  - Content Damages
  - Displacement Costs
- Needed to apply for federal grant opportunities for mitigation construction projects
- Benefit-Cost Ratio > 1 = Good



FEMA Damage Curves

Benefits Summary

Benefit-Cost Analysis

- Project Team selected Empey Channel

Structure and Displacement Loss Estimates and Project Benefits

	10 -Year Storm	25 -Year Storm	50 -Year Storm	100 -Year Storm	500-year Storm	Annual
Structure Losses (Existing)	$3,174,996	$4,050,623	$4,881,785	$5,763,126	$7,514,410	$427,456
Structure Losses (Post-Project)	$2,468,289	$2,803,620	$3,053,810	$3,352,412	$4,576,283	$289,630
Structure Loss Benefit	$706,707	$1,247,003	$1,827,975	$2,410,714	$2,938,127	$137,826
Displacement (Existing)	$2,430,000	$2,940,000	$3,150,000	$3,360,000	$3,960,000	$291,750
Displacement (Post-Project)	$2,140,000	$2,630,000	$2,740,000	$2,810,000	$3,170,000	$254,810
Displacement Benefit	$290,000	$310,000	$410,000	$550,000	$790,000	$36,940
Total Benefit	$996,707	$1,557,003	$2,237,975	$2,960,714	$3,728,127	$174,766

Final Benefit Cost Ratio

Type	NPV	BCR
Empey Channel (Construction and O&M for 50-years)	$5,840,263	-
Benefits (50-year life)	$7,789,295	**1.334**

Project Elements