



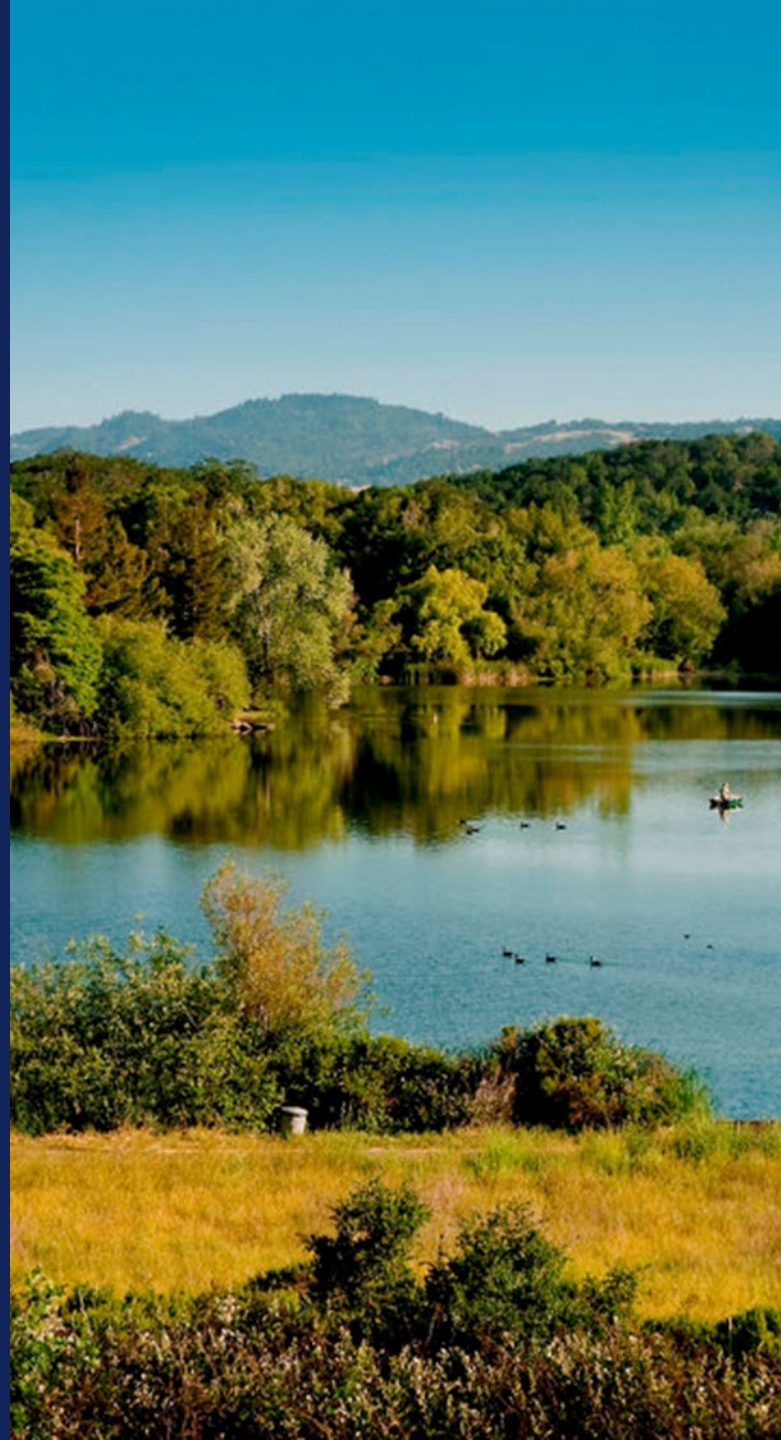
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Upper Petaluma Flood Control Feasibility Study

ZONE 2A UPDATE



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Agenda

- Project Background
 - Scoping Study
 - Model Update & Concept Screening
- Feasibility Study Update
 - Objectives & Approach
 - Analysis Results
- Next Steps
- Q&A





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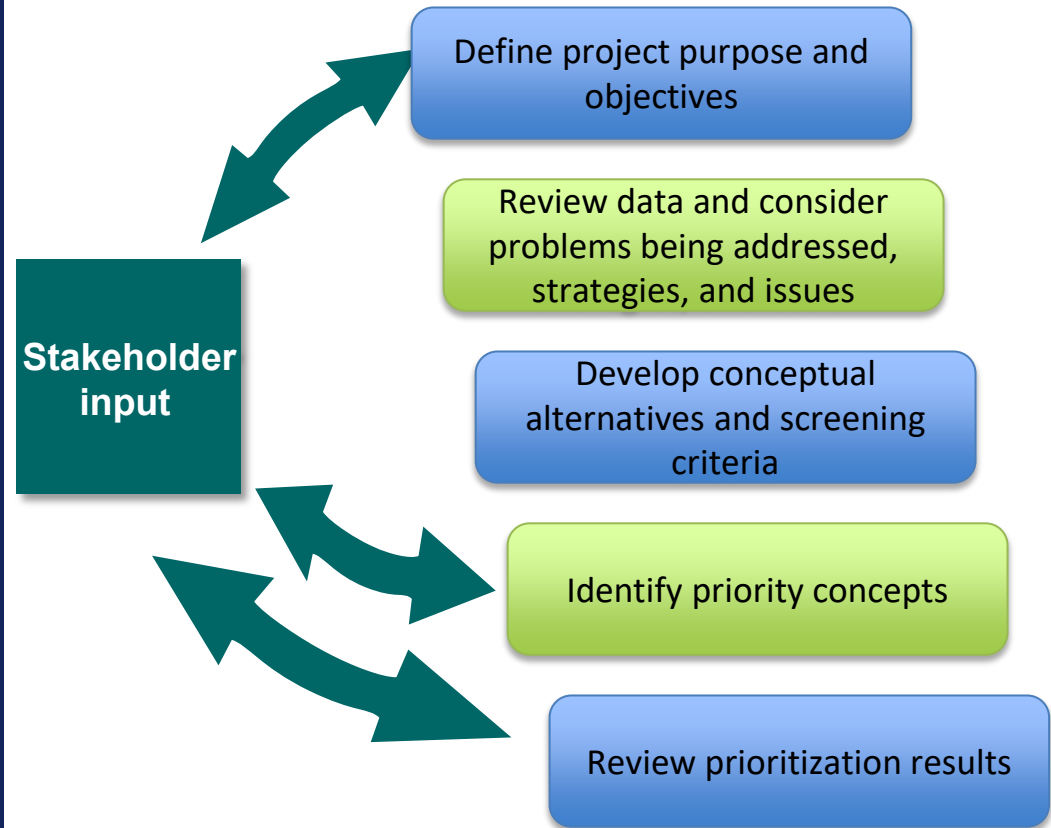
Project Background



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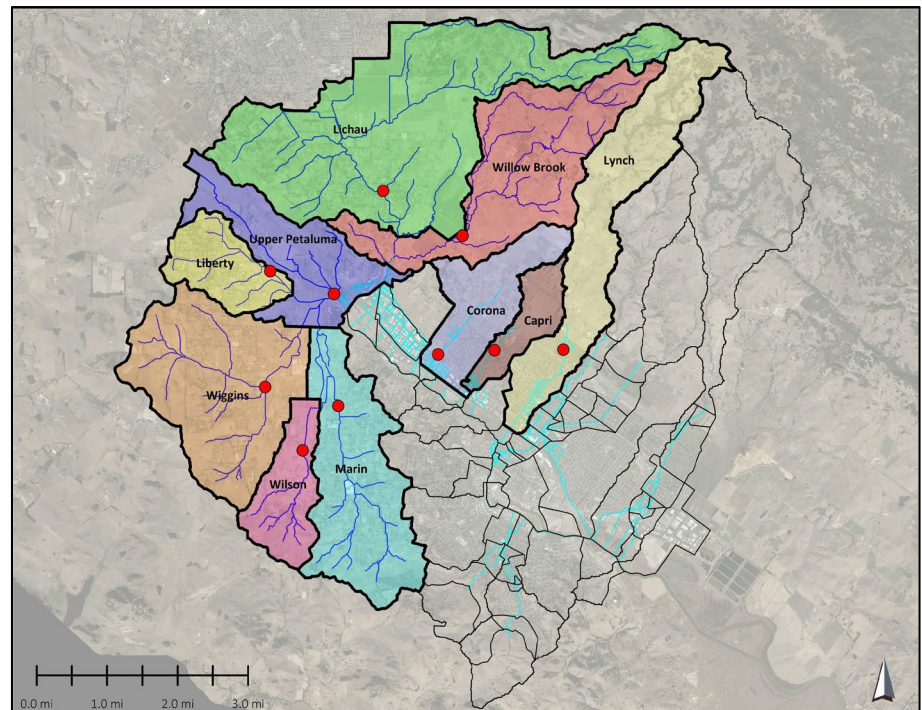
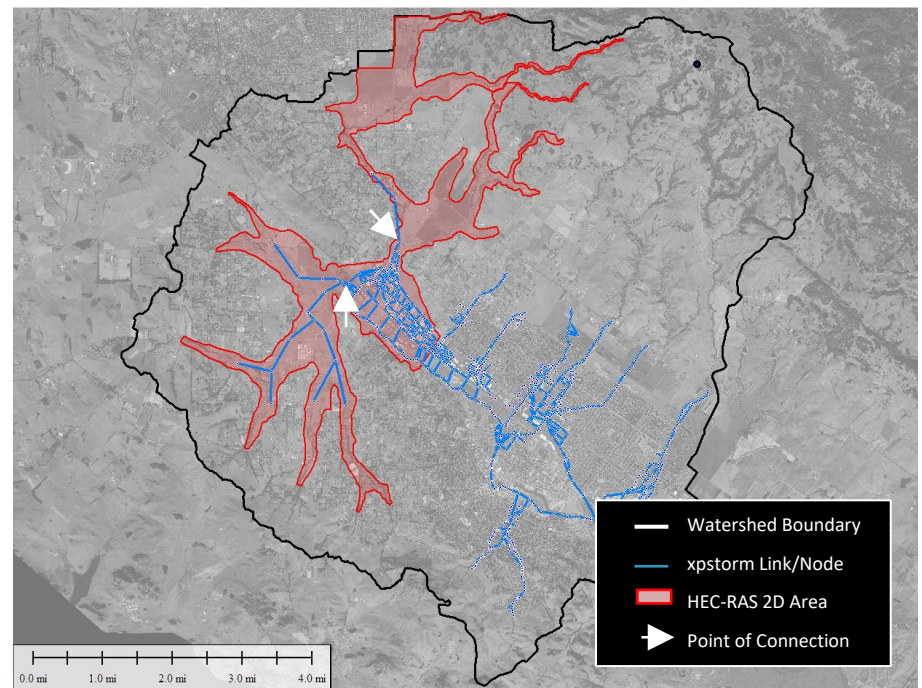
Project Background: Scoping Study Takeaways

- Concepts considered included:
 - Managed Floodplain
 - Off-stream Detention
 - In-Stream Detention
 - Floodplain Modification
 - Levee/Floodwall
 - Channel Modification
 - Bypass Channel
 - Bridge Improvement & Debris Removal
 - Low-Impact Development
 - Policy Review & Development
 - Direct Recharge
- Flood Hazard Reduction & Groundwater Recharge were Identified as Core Objectives



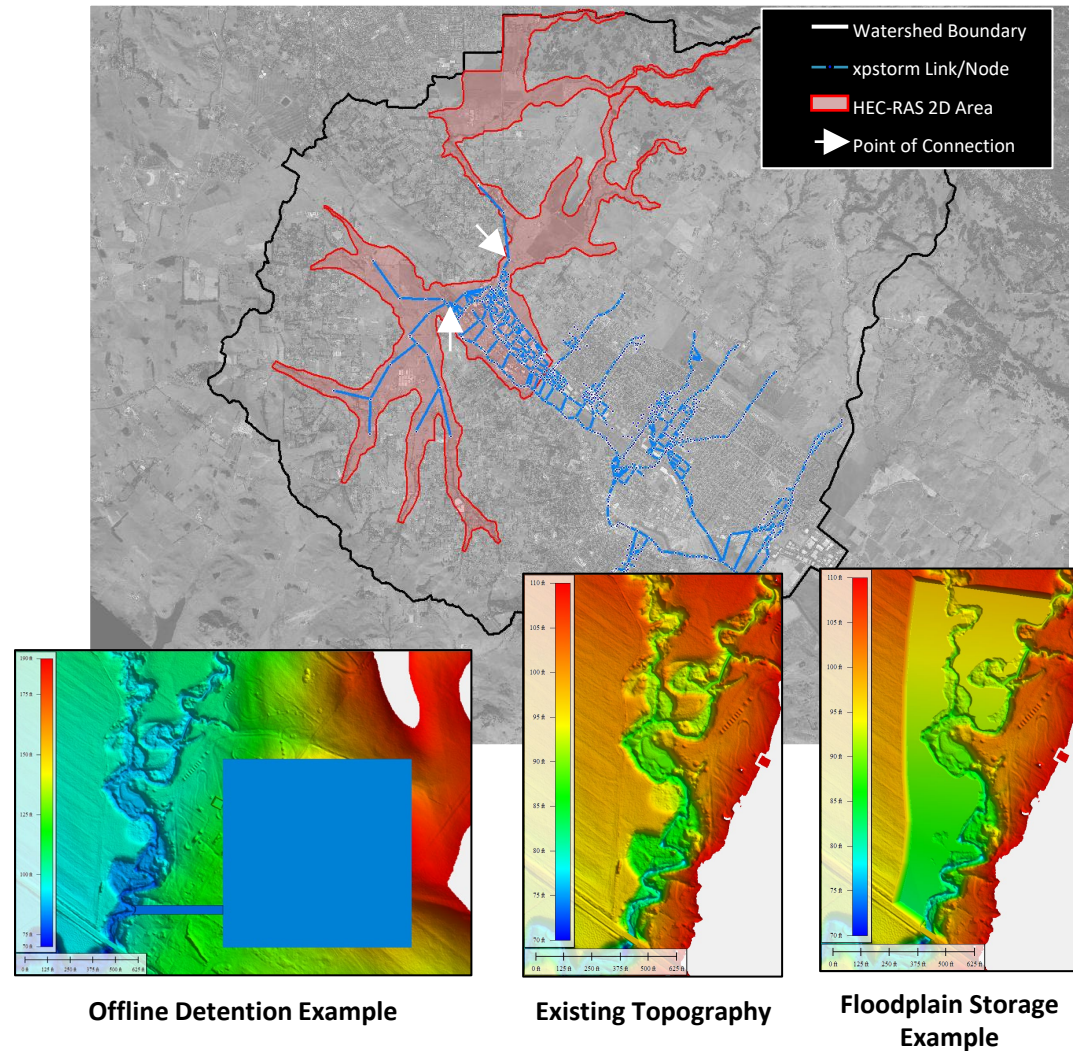
Project Background: Model Update Takeaways

- Existing XP model was supplemented with HEC-RAS 2D
- Modeling at consistent location in 5 tributaries revealed ranking:
 - Lichau
 - Willow Brook
 - Marin
 - Liberty
 - Lynch
- More benefits on Willow Brook & Lichau due to larger size & peaked hydrographs.
- Less benefit on Marin and Liberty due to existing attenuation at Denman Flats.
- Less benefit on Lynch due to inability to impact other tributaries, existing attenuation, timing of Lynch & Petaluma peaks.



Project Background: Concept Screening Takeaways

- Detention projects have greater flood reduction benefits.
- Offline detention is less likely to result in adverse downstream impacts due to flow not reentering the creeks along the tail end of the hydrograph.
- Floodplain modification projects provide a greater benefit when combined with a downstream constriction such as a culvert under an elevated roadway.





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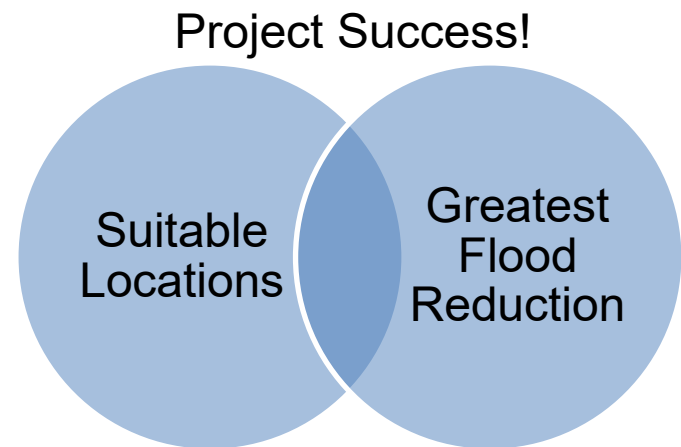
Feasibility Study Update



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Feasibility Study Update: Objectives & Approach

- Leverage Tools & Results from Prior Phases to Hone in on Feasible Project Concepts
 - Expand Concept & Tributary Screening to All Tributaries
 - Screen Project Locations Watershed-Wide
 - Assessed Hydraulic Impacts in More Detail at More Locations
 - Ranking of Potential Project Locations



Feasibility Study Update: Task 1

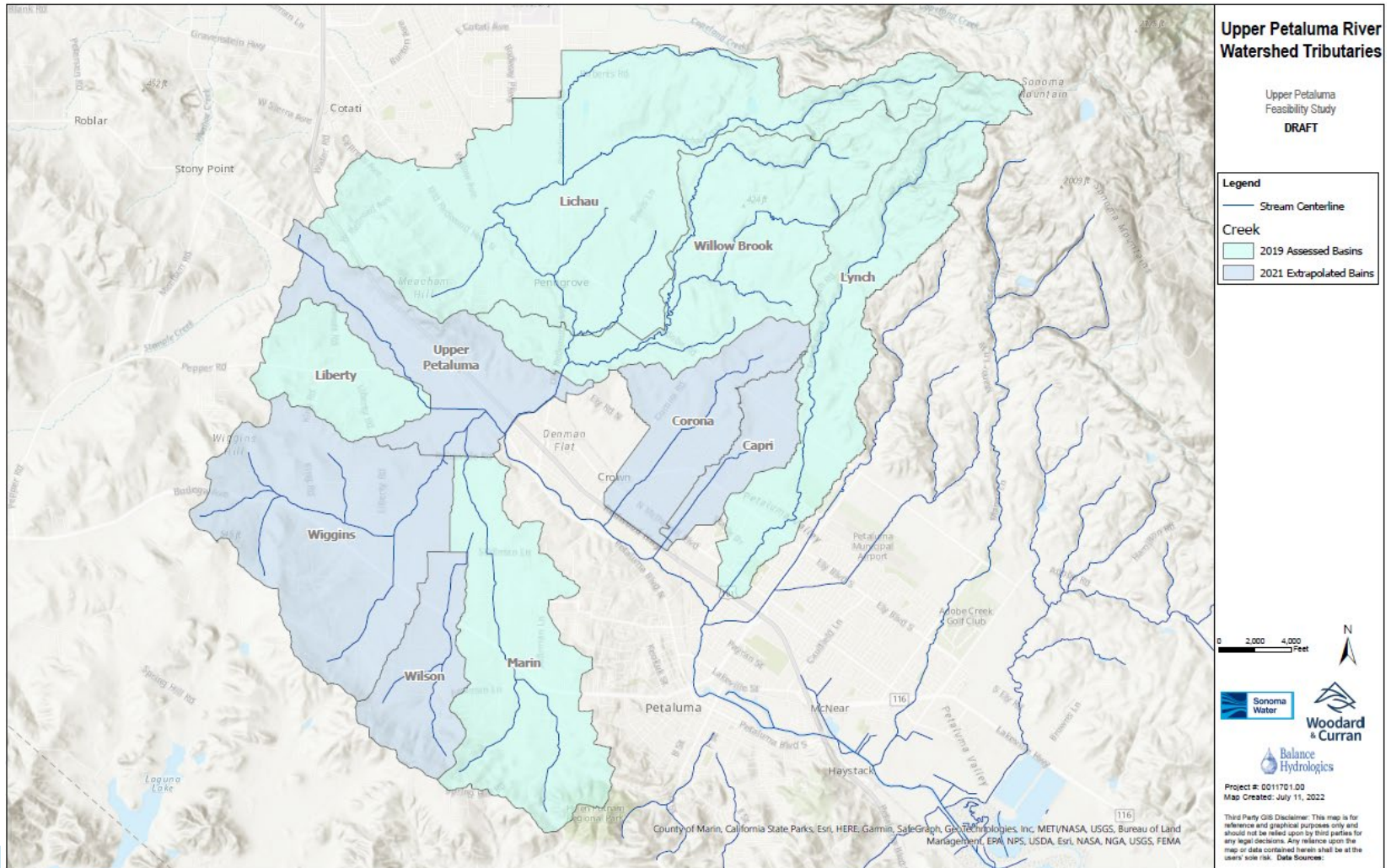
- Extend Ranking Results
- Provide More Consistent Context for Decision-Making

Detention Basin Scenario											
Design Event		Willow Brook	Lichau	Marin	Liberty	Lynch	Upper				
							Wilson	Wiggins	Petaluma	Corona	Capri
10-Year	Score	54	56	43	43	33	43	43	43	33	33
	Rank	2	1	4	4	13	8	4	4	13	13
	Notes	Unmodeled tributaries mapped to modeled tributaries based on flow rates.					Marin	Marin	Liberty	Lynch	Lynch
100-Year	Score	59	61	53	51	39	53	53	51	39	39
	Rank	2	1	3	6	10	5	3	6	10	10
	Notes	Unmodeled tributaries mapped to modeled tributaries based on flow rates.					Marin	Marin	Liberty	Lynch	Lynch
Overall	Score	113	117	96	94	72	96	96	94	72	72
	Rank	2	1	3	6	10	5	3	6	10	10

Floodplain Modification Scenario											
Design Event		Willow Brook	Lichau	Marin	Liberty	Lynch	Upper				
							Wilson	Wiggins	Petaluma	Corona	Capri
10-Year		35	47	34	33	29	34	34	33	29	29
		9	3	10	13	18	12	10	13	18	18
	Notes	Unmodeled tributaries mapped to modeled tributaries based on flow rates.					Marin	Marin	Liberty	Lynch	Lynch
100-Year		43	40	34	39	30	34	34	39	30	30
		8	9	15	10	18	17	15	10	18	18
	Notes	Unmodeled tributaries mapped to modeled tributaries based on flow rates.					Marin	Marin	Liberty	Lynch	Lynch
Overall		78	87	68	72	59	68	68	72	59	59
		9	8	15	10	18	17	15	10	18	18



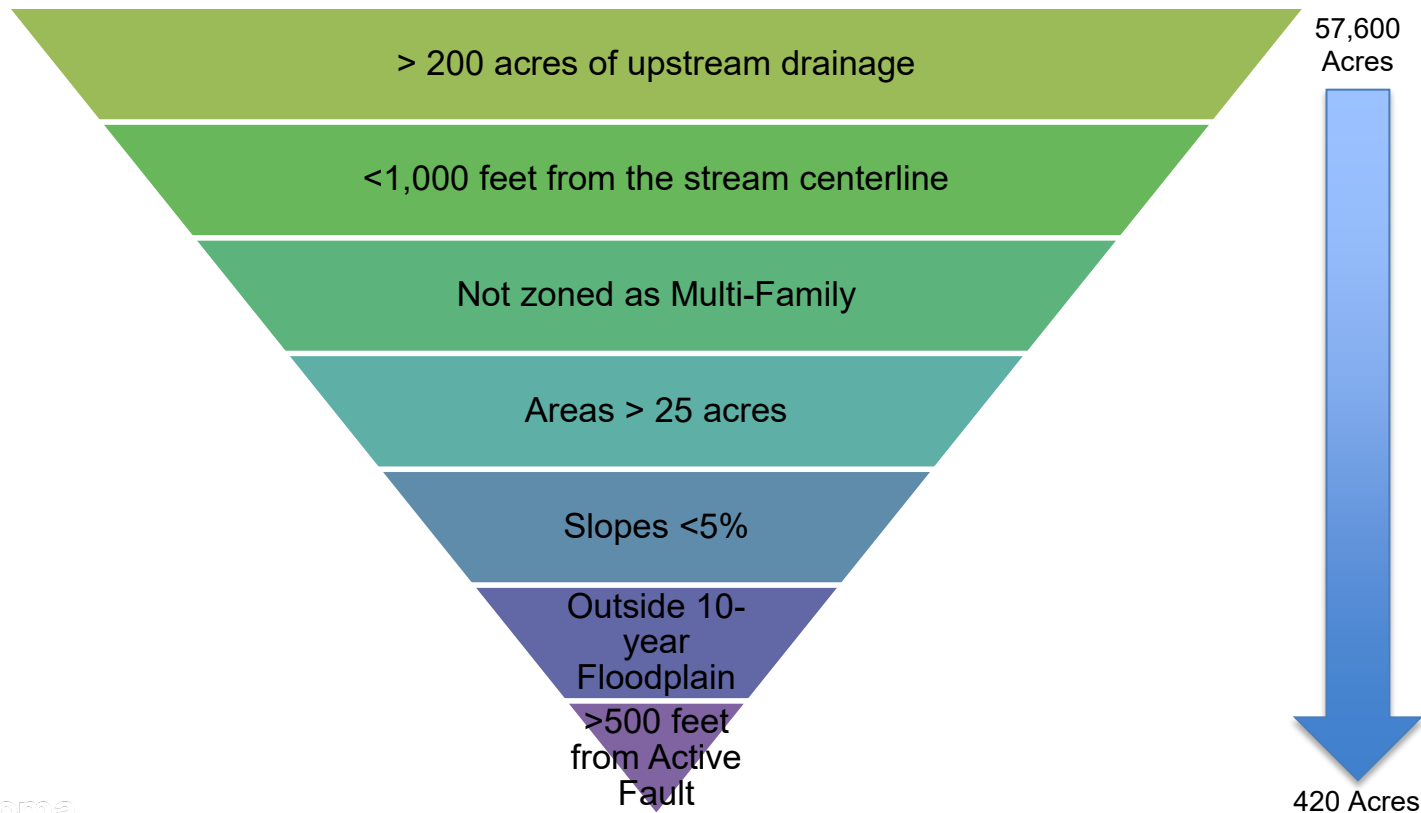
Feasibility Study Update: Task 1



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Feasibility Study Update: Task 2

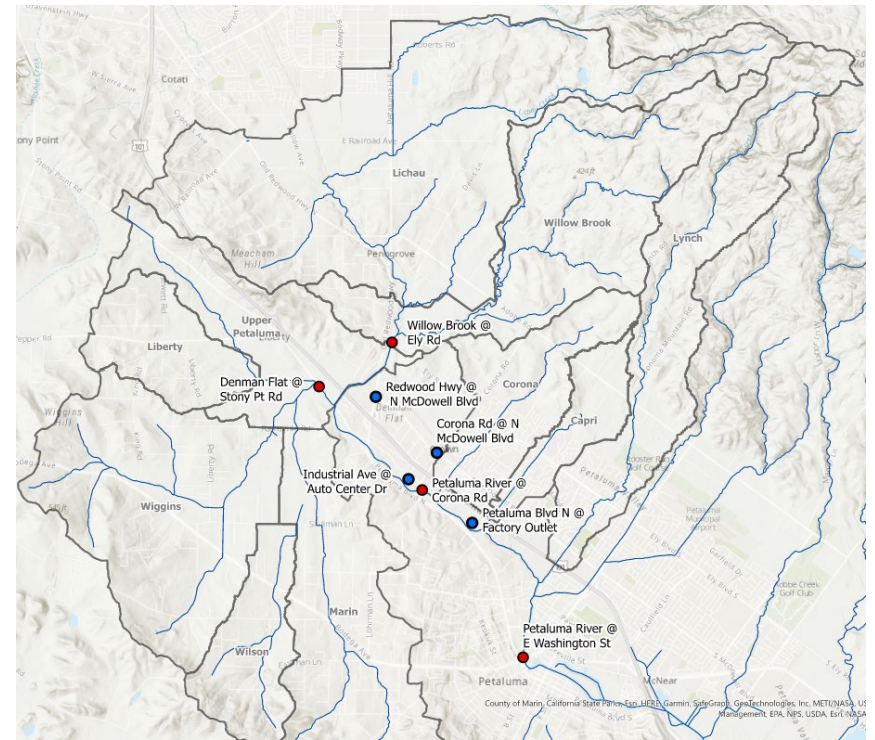
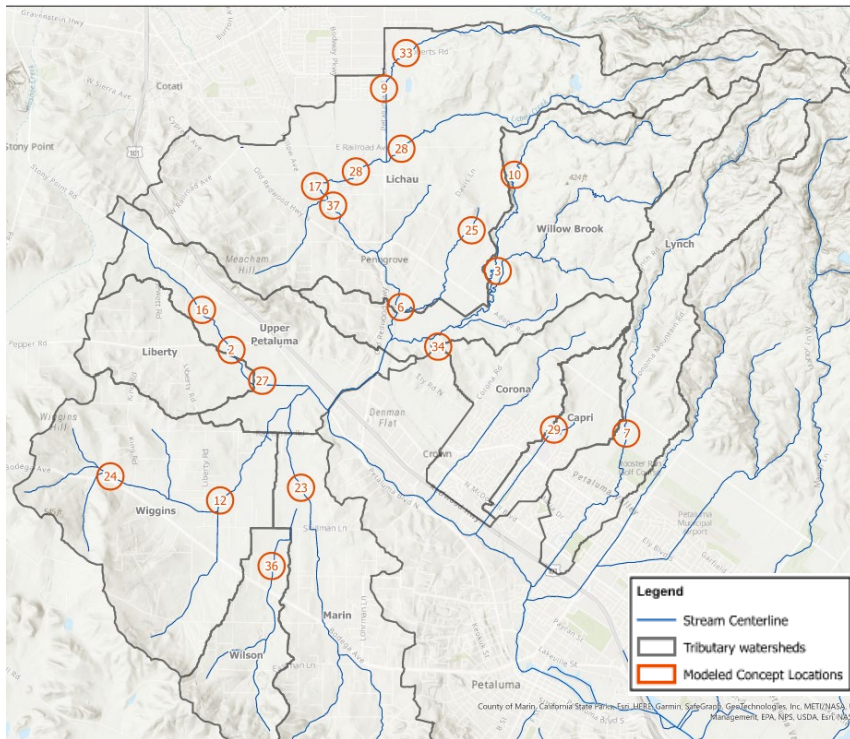
- Location Screening



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Feasibility Study Update: Task 3

- Model 20 basins with *similar parameters* to provide a comparison
- Depth reduction results for 100-year & 10-year extracted at 8 locations



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Feasibility Study Update: Task 3

- Depth Reduction Results for 10-year event

Result Point Name	2	3	6	7	9	10	12	16	17	23
Willow Brook @ Ely Rd	0.00	-0.18	-0.23	0.00	-0.16	-0.08	0.00	0.00	-0.19	0.00
Denman Flat @ Stony Pt Rd	-0.08	-0.01	-0.01	0.00	-0.03	-0.01	-0.12	-0.05	-0.02	-0.03
Petaluma River @ Corona Rd	-0.05	-0.07	-0.06	0.00	-0.12	-0.04	-0.10	-0.03	-0.06	-0.04
Redwood Hwy @ N McDowell Blvd	0.00	-0.02	-0.02	0.00	-0.02	-0.01	0.00	0.00	-0.02	0.00
Corona Rd @ N McDowell Blvd	-0.01	-0.21	-0.21	0.00	-0.21	-0.21	0.00	-0.01	-0.21	-0.01
Industrial Ave @ Auto Center Dr	-0.06	-0.04	-0.04	0.00	-0.07	-0.02	-0.11	-0.04	-0.05	-0.04
Petaluma Blvd N @ Factory Outlet	-0.17	-0.22	-0.22	0.00	-0.40	-0.12	-0.33	-0.11	-0.22	-0.12
Petaluma River @ E Washington St	0.00	0.00	0.00	-0.03	-0.01	0.00	0.00	0.00	0.00	-0.01
Sum of WSE Reductions at all Locations	-0.37	-0.75	-0.79	-0.03	-1.01	-0.49	-0.67	-0.23	-0.77	-0.23

Result Point Name	24	25	27	28	29	33	34	36	37	38
Willow Brook @ Ely Rd	0.00	-0.11	0.00	-0.04	0.00	-0.15	-0.31	0.00	-0.19	-0.03
Denman Flat @ Stony Pt Rd	-0.03	-0.02	-0.22	-0.02	0.00	-0.02	-0.01	-0.02	-0.02	-0.01
Petaluma River @ Corona Rd	-0.02	-0.06	-0.29	-0.07	0.00	-0.09	-0.05	-0.01	-0.06	-0.04
Redwood Hwy @ N McDowell Blvd	0.00	-0.01	0.00	-0.01	0.00	-0.01	-0.03	0.00	-0.02	-0.01
Corona Rd @ N McDowell Blvd	0.00	-0.21	-0.01	-0.21	0.00	-0.21	-0.21	0.00	-0.21	-0.19
Industrial Ave @ Auto Center Dr	-0.02	-0.04	-0.24	-0.05	0.00	-0.05	-0.03	-0.01	-0.05	-0.03
Petaluma Blvd N @ Factory Outlet	-0.07	-0.20	-0.81	-0.23	-0.07	-0.30	-0.16	-0.03	-0.22	-0.12
Petaluma River @ E Washington St	0.00	-0.03	-0.01	0.00	-0.04	-0.01	0.00	0.00	0.00	0.00
Sum of WSE Reductions at all Locations	-0.13	-0.68	-1.57	-0.62	-0.11	-0.85	-0.80	-0.07	-0.77	-0.42



Feasibility Study Update: Task 3

- Depth Reduction Results for 100-year event

Result Point Name	2	3	6	7	9	10	12	16	17	23
Willow Brook @ Ely Rd	0.00	-0.12	-0.31	0.00	-0.11	-0.07	0.00	0.00	-0.20	0.00
Denman Flat @ Stony Pt Rd	-0.10	-0.01	-0.02	0.00	-0.02	-0.01	-0.08	-0.07	-0.01	-0.02
Petaluma River @ Corona Rd	-0.11	-0.03	-0.03	0.00	-0.03	-0.02	-0.10	-0.07	-0.02	-0.03
Redwood Hwy @ N McDowell Blvd	0.00	-0.03	-0.04	0.00	-0.03	-0.02	0.00	0.00	-0.04	0.00
Corona Rd @ N McDowell Blvd	0.00	-0.10	-0.11	0.00	-0.09	-0.07	0.00	0.00	-0.08	0.00
Industrial Ave @ Auto Center Dr	-0.11	-0.02	-0.02	0.00	-0.02	-0.01	-0.09	-0.07	-0.02	-0.03
Petaluma Blvd N @ Factory Outlet	-0.14	-0.15	-0.15	0.00	-0.12	-0.10	-0.15	-0.09	-0.12	-0.05
Petaluma River @ E Washington St	-0.18	-0.20	-0.21	-0.12	-0.17	-0.13	-0.20	-0.12	-0.17	-0.08
Sum of WSE Reductions at all Locations	-0.65	-0.65	-0.88	-0.12	-0.59	-0.43	-0.62	-0.43	-0.66	-0.21

Result Point Name	24	25	27	28	29	33	34	36	37	38
Willow Brook @ Ely Rd	0.00	-0.15	0.00	-0.10	0.00	-0.05	-0.44	0.00	-0.13	-0.08
Denman Flat @ Stony Pt Rd	-0.04	-0.01	-0.18	-0.01	0.00	-0.02	-0.01	-0.02	-0.01	-0.01
Petaluma River @ Corona Rd	-0.04	-0.02	-0.24	-0.03	0.00	-0.02	-0.02	-0.02	0.00	-0.02
Redwood Hwy @ N McDowell Blvd	0.00	-0.02	0.00	-0.03	0.00	-0.02	-0.08	0.00	-0.02	-0.02
Corona Rd @ N McDowell Blvd	0.00	-0.06	-0.01	-0.12	0.00	-0.07	-0.20	0.00	-0.05	-0.08
Industrial Ave @ Auto Center Dr	-0.04	-0.02	-0.22	-0.02	0.00	-0.02	-0.02	-0.02	0.00	-0.01
Petaluma Blvd N @ Factory Outlet	-0.04	-0.11	-0.41	-0.17	-0.06	-0.09	-0.18	-0.02	-0.02	-0.12
Petaluma River @ E Washington St	-0.06	-0.15	-0.44	-0.22	-0.10	-0.14	-0.27	-0.03	-0.05	-0.16
Sum of WSE Reductions at all Locations	-0.21	-0.55	-1.49	-0.70	-0.16	-0.43	-1.22	-0.12	-0.29	-0.50



Feasibility Study Update: Task 4

Location Scoring & Ranking Considerations

- Variability of Potential Hydraulic Impacts
 - Depth Reduction
 - Floodplain Storage & Uncontrolled Inflow/Outflow
 - Footprint Considerations
 - Increased Depth Opportunity
- Other Considerations
 - Adjacent Parcel Opportunities
 - Recharge Potential
 - Easements
 - Cut Volume Unit Benefit
 - Footprint Unit Benefit



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Feasibility Study Update: Task 4

Workshop Discussion

- Factors impacting ranking:
 - Depth Reduction at single Locations
 - Total depth reduction
 - Depth reduction per storage provided
 - Inflow and outflow controls
 - Available grade for positive outflow
 - Excavation
 - Easements

Location Number	Subwatershed	Basin Area (Acres)	Rank
37	Lichau	14	1
9	Lichau	24	2
6	Lichau	24	3
17	Lichau	22	5
33	Lichau	25	5
34	Willow Brook	26	4
10	Willow Brook	14	8
3	Lichau	24	7
38	Lichau	14	9
27	Liberty	35	10
12	Wiggins	20	13
25	Lichau	25	12
28	Lichau	24	11
23	Marin	8	14
2	Liberty	26	15
16	Upper Petaluma	23	17
24	Wiggins	15	16
36	Wilson	9	18
29	Capri	25	19
7	Lynch	25	20



Feasibility Study Update: Analysis Results

- Results confirm ideal locations for offline storage on Lichau, Willow Brook and Liberty Creek
- Consistent w/ previous effort
- Narrowed locations and project type within sub-watersheds

		Detention Basin Scenario									
		Sub-Watershed									
Design Event		Willow Brook	Lichau	Marin	Liberty	Lynch	Wilson	Wiggins	Upper Metcaluma	Corona	Capri
10-Year	Score	54	56	43	43	33	43	43	43	33	33
	Rank	2	1	4	4	13	8	4	4	13	13
	Notes	Unmodeled tributaries mapped to modeled tributaries based on flow rates.					Marin	Marin	Liberty	Lynch	Lynch
100-Year	Score	59	61	53	51	39	53	53	51	39	39
	Rank	2	1	3	6	10	5	3	6	10	10
	Notes	Unmodeled tributaries mapped to modeled tributaries based on flow rates.					Marin	Marin	Liberty	Lynch	Lynch
Overall	Score	113	117	96	94	72	96	96	94	72	72
	Rank	2	1	3	6	10	5	3	6	10	10





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Next Steps



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Next Steps

- Landowner buy-In
- Local land-owner benefit
 - Recharge
 - Local floodplain reductions
- Detailed study for possible projects
- Optimization for flood frequency and depth benefit
- Regional benefit opportunities
 - Flood reduction (frequency & elevation)
 - Watershed enhancement
 - Recreational benefits
 - Water quality improvement
- Multi-benefit projects more likely to attract funding and stakeholder support
- Multiple basins multiply our impact





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Q&A



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