

County of Kern Caliente Creek – Conceptual Plan for Mitigation Project 500-acre Portion



60597765

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AECOM

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Introduction

This technical memorandum (TM) will serve as a supplement to the *Caliente Creek Habitat Mitigation and Groundwater Recharge Feasibility Study* (Feasibility Study) by AECOM dated June 2017. The purpose of the TM is to provide a conceptual plan that maximizes flood mitigation of a 500 acre portion of the original study area. The area and location of the study is shown graphically on Plates one and two and represent the two alternative scenarios being considered. The two alternatives are:

Alternative 1 – 267 acres will be farmed and the remaining 233 acres will be restored to native vegetation.

Alternative 2 – The entire 500 acres will be restored to native vegetation with no farming.

The conceptual plan will include permitting requirements (State, Federal and Local), an estimated project cost to include planning, construction and the three-year establishment period for each alternative. An estimate of the maximum flows (water and silt) that will occur with each alternative is shown on a chart and graphically using outputs generated by Flo 2D™. The recommended improvements are described for each alternative.

Permitting

From a regulatory and permitting perspective, both design alternatives explored in this report are consistent with the approach presented in the *Caliente Creek Habitat Mitigation and Groundwater Recharge Feasibility Study* (Feasibility Study) dated June, 2017. The analysis and conclusions regarding environmental resources and related permitting needs thus remain valid for the project actions currently being evaluated in this subsequent study. Permits required for the work presented in this report may include:

- Report of Waste Discharge from the Regional Water Quality Control Board
- Section 1600 Streambank Alteration Agreement from the California Department of Fish and Wildlife
- Determination of consistency with the Valley Floor Habitat Conservation Plan (VFHCP)
- California Environmental Quality Act (CEQA) review by the lead reviewing agency (presumably Kern County)
- National Environmental Policy Act (NEPA) review if the project is federally funded

Successful acquisition of these permits and approvals may require detailed site surveys for potentially occurring special status plant and animal species. See the Feasibility Study for the full discussion of permitting issues.

Habitat Restoration

While each alternative considered in this study is based on a different land use pattern and grading plan, the approach to establishment of habitat on this 500-acre phase of work would remain consistent overall with the approach detailed in the June 2017 Feasibility Study. The intent of grading under each alternative is to create the most natural landform and geomorphology possible, and to spread and slow flood flows as much as possible using landform and vegetation communities. The vegetation community targets and implementation methods proposed are unchanged from those proposed in the Feasibility Study, although the spatial extent of

the Riparian Scrub habitat and Upland/Saltbush Scrub habitat would shift to follow the channel patterns established for each alternative in this supplemental study.

Cost of Project Implementation

Estimated project costs are listed in Tables 1 and 2 for Alternatives 1 (Partial Agricultural) and 2 (Non-Agricultural) respectively. They do not include long-term maintenance monitoring 3 years after construction:

Table 1

Project Costs for Alternative 1- Partial Agricultural

	Project Feature	Unit	Quantity*	Rate	Total Cost Extension
Planning	Final Design				\$250,000
	Environmental Review				250,000
	Permitting				20,000
	Planning Total				\$520,000
Construction	Earthwork/Grading	CY	148,300	\$4.00**	\$593,000
	Seed mix	Acre	233	\$500	117,000
	Imprint/Hydro mulch labor and equipment	Day	8	\$1,200	10,000
	Construction Total				\$720,000
3-Year Establishment Period	Monitoring Habitat and Hydrology	Day	12	\$900	\$11,000
	Maintenance	Day	12	\$3,200	38,000
	Reporting	Each	3	\$8,500	26,000
	Establishment total				\$75,000
Totals	Project Subtotal				\$1,315,000
	Misc. Costs and Contingency (25%+/-)				\$329,000
	Total Project Implementation Cost				\$1,644,000
CY = cubic yards					
* Earthwork is balanced on the site. The earthwork called out is in cubic yards of in-place lightly compacted fill.					
** Source: Recent construction bids for large-scale restoration projects					

Table 2

Project Costs for Alternative 2- Non-Agricultural

	Project Feature	Unit	Quantity*	Rate	Total Cost Extension
Planning	Final Design				\$350,000
	Environmental Review				250,000
	Permitting				20,000
	Planning Total				\$620,000
Construction	Earthwork/Grading	CY	502,800	\$4.00**	\$2,011,000
	Seed mix	Acre	500	\$500	250,000
	Imprint/Hydro mulch labor and equipment	Day	15	\$1,200	18,000
	Construction Total				\$2,279,000
3-Year Establishment Period	Monitoring Habitat and Hydrology	Day	12	\$900	\$11,000
	Maintenance	Day	24	\$3,200	77,000
	Reporting	Each	3	\$8,500	26,000
	Establishment total				\$114,000
Totals	Project Subtotal				\$3,013,000
	Misc. Costs and Contingency (25%+/-)				\$753,000
	Total Project Implementation Cost				\$3,766,000
CY = cubic yards					
* Earthwork is balanced on the site. The earthwork called out is in cubic yards of in-place lightly compacted fill.					
** Source: Recent construction bids for large-scale restoration projects					

The earthwork quantities are relatively high with this project because within the site, the storm flow needs to be transitioned in to facilitate spreading; and transitioned out to return the flow pattern back to the existing flow regime. If the project was constructed as a single 3,000 acre site, grading to transition, spread and return to existing flow regime at the discharge point would be proportionally less. This logic also applies to planning and 3-year establishment activities.

The results from the two-dimensional hydraulic models serve as the basis to compare cost values of the alternatives. Please refer to Tables 3 and 4 for the hydraulic analysis results.

Environmental review costs for the alternatives on this portion would be proportionally higher per unit area than for the full project due to procedural costs that are necessary regardless of project size; however, overall level of effort for environmental site surveys would decrease, resulting in lower total review costs. Permitting costs would remain similar to those projected for the full project, given those costs are largely driven by permitting procedure and issues at play rather than project scale.

Two – Dimensional Hydrology and Hydraulic Modeling

1. *Reference Study* - Reference is made to the Caliente Creek Habitat Mitigation and Groundwater Recharge Project Report prepared by AECOM, dated June 2017.
2. *Hydrology* - Hydrology as developed by the reference study was utilized. The 5-year event as detailed in said study was the design storm for this 500-acre project study. Peak flow value for this event is estimated at 5,639 cubic feet per second (CFS) for confluence flows of Caliente Creek and Walker Basin Creek.
3. *Basis of Design* - Basis of Design follows the philosophy as outlined in Section 4.1.2 “Basis of Design” of the referenced report.
 - a. The two alternative approaches for the newly purchased 500 acres Phase 1 work are:
 - i. Alternative 1 - Allow Agriculture (AG Model): Per Section 4.2.2 “Retain Partial Agricultural Production” of the referenced report a portion of the project would be graded and planted in accordance with the study guidelines. The remainder would remain in agricultural production.
 - ii. Alternative 2 - No Agriculture (Non-AG Model): Per Section 4.2.4 “Full-Restoration” of the referenced report the whole 500-acre project would be restored as detailed in Chapter 5 of said report.
4. *H & H Modeling* - The Two-Dimensional H & H models (FLO-2d) developed within the referenced study were utilized for this analysis. Two-base models were developed in the referenced study; the north and south models. The north model consists of all proposed project lands north of Hwy 58. The south model consists of all proposed project lands south of Hwy 58. While the first phase 500 acres are located only in the north model, the south model was also run to show the total phase 1 project effects at the point of discharge at the south west corner of the ultimate project. The following modifications were made to reflect the impact of the two alternatives for the 500-acre project:
 - a. Alternative 1 (Please refer to the concept plan, Exhibit Plate 2):
 - i. The interior 233 acres of the 500-acre project were specifically modeled.
 - ii. A revised digital elevation model representing the AG Model design was input to the original existing north model. The terrain was modified to utilize the interior area reducing velocities and increasing the inundated area to affect sediment drop.
 - iii. Manning’s “N” values were increased for the planned native plantings.
 - iv. The berm planned along the southerly edge of the modeled 233 acres was included in the terrain.
 - b. Alternative 2 (Please refer to the concept plan, Exhibit Plate 1):
 - i. The entire 500 acres were modeled.
 - ii. A revised digital elevation model representing the Non-AG Model design was input to the original existing north model. The terrain was modified to utilize the interior area reducing velocities and increasing the inundated area to affect sediment drop.
 - iii. Additional channeling was utilized to take advantage of the northly and southerly bands not modeled in Alternative 1.
 - iv. Manning’s “N” values were increased for the planned native plantings.

- c. Both the Alternative 1 and 2 model outputs were routed to the existing south model. This provided comparable output information to information provided in the June 2017 Report.

Findings – Following are tables that summarize the results of the analyses. Table 3 summarizes the results of the two alternatives for the north model and compares them against the existing condition of the model area. Input values occur at the Walker Basin and Caliente Creek culverts on Bena Road. Output values are located at the two bridges on Hwy. 58. These are also the input values for the south model. Table 4 summarizes the results for the two alternatives and compares them against both the existing condition and the recommended design from the referenced study. Output values are located at the south west corner of the ultimate project.

Table 3

Summary of North Models								
Alternative	Input Water Volume, AF	Infiltration, AF	Inundated Area, AC	Output Water Volume, AF	Input Silt Volume, CF	Output Silt Volume, CF	Excavation, CY	Fill, CY
Existing	5860	3445	997.5	2310	581128	60647	-	-
Alt 1: AG	5860	3670	1054	2081	581126	21592	184600	148300
Alt 2: Non-AG	5860	3893	1115	1854	581126	18653	627800	502800

Table 4

Summary of South Models								
Alternative	Input Water Volume, AF	Infiltration, AF	Inundated Area, AC	Output Water Volume, AF	Overall % Reduction on Both Models	Input Silt Volume, CF	Output Silt Volume, CF	Overall % Reduction Both Models
Existing*	2326	1216	652	1110	81	47231	138050	76
AG	2082	1116	572	907	85	21600	102816	82
Non-AG	1854	1022	517	778	87	18653	91567	84
Original Design with Riprap	1811	1321	704	418	93	16897	2727	99.5

- a. The conceptual designs for each alternative yielded good results insofar as discharged water and silt significantly decreased. Resultant water discharge values and silt calculated to be less than that of the existing model. However, as noted above, when the output values from each alternative were routed to the southerly existing condition model, silt volume increased as velocities are high in the southerly model. This particularly is the case in the narrow-constructed channel along the easterly south model edge.
- b. Model surface was adjusted slightly to obtain earthwork balance. Earthwork volumes are high on a per acre basis as compared to the June 2017 Report. Total estimated earthwork volume for the

entire original 3,200-acre project is 800,000 cubic yards or 250 cubic yards per acre. The 500-acre Alternative 1 project excavation is estimated at 184,600 cubic yards for 233 acres or 792 cubic yards per acre. And, the 500-acre Alternative 2 project excavation is estimated at 627,800 cubic yards for 500 acres or 1,256 cubic yards per acre.

- c. Graphs are provided for visual comparison of the results. These are as follows:
 - i. Figures 1-4, plots of the hydrographs, show the 5-year design flows. North models show the total inflow from Walker Basin Creek and Caliente Creek Culverts at Bena Road. The outflows are located at the two Hwy. 58 bridges. The split hydrographs are also shown for these two points. South models show the total inflow as posted from the north model at the two bridges on Hwy. 58. Outflows for the south model are located at the southwest corner of the ultimate project. Both graph sets illustrate the flows for each of the two alternatives.
 - ii. Figures 5-8 Plots of transported sediment follow the same format as the hydrographs. It is important to note that where the graphs drop below zero value additional sediment is being picked up from the floodplain.

Figure 1

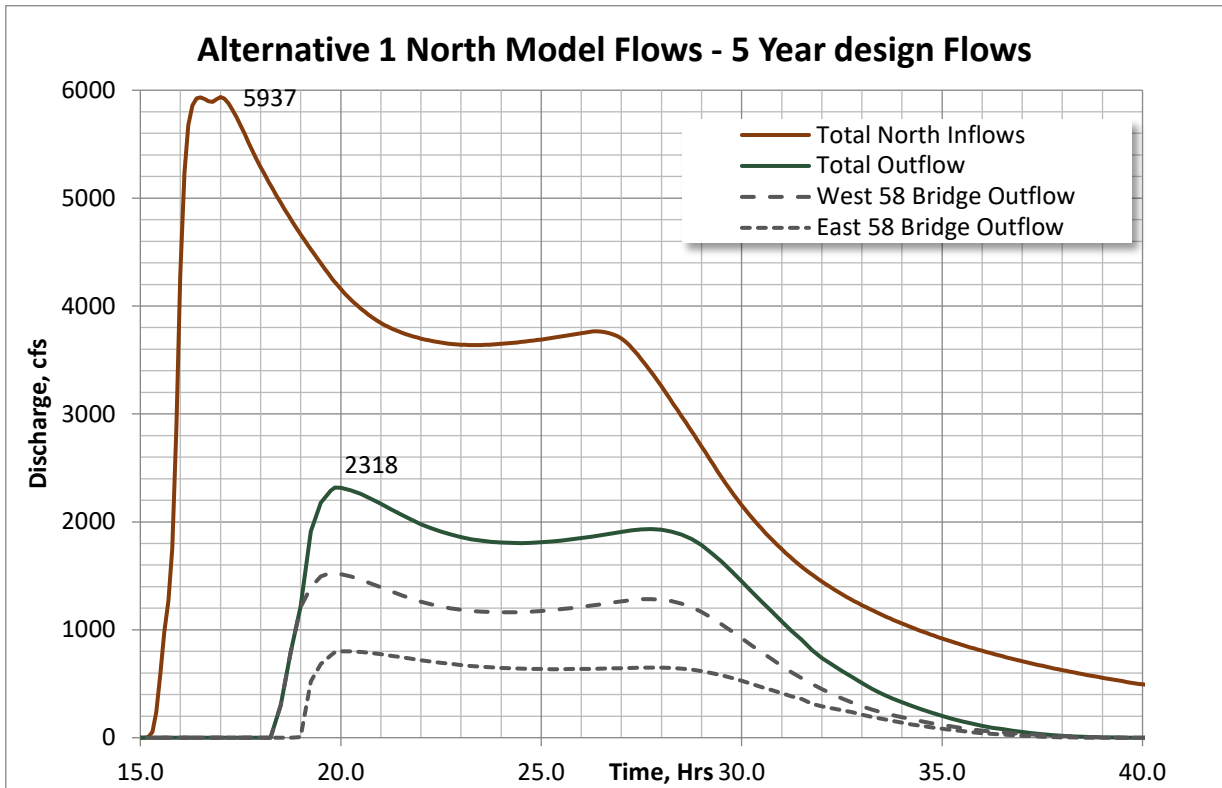


Figure 2

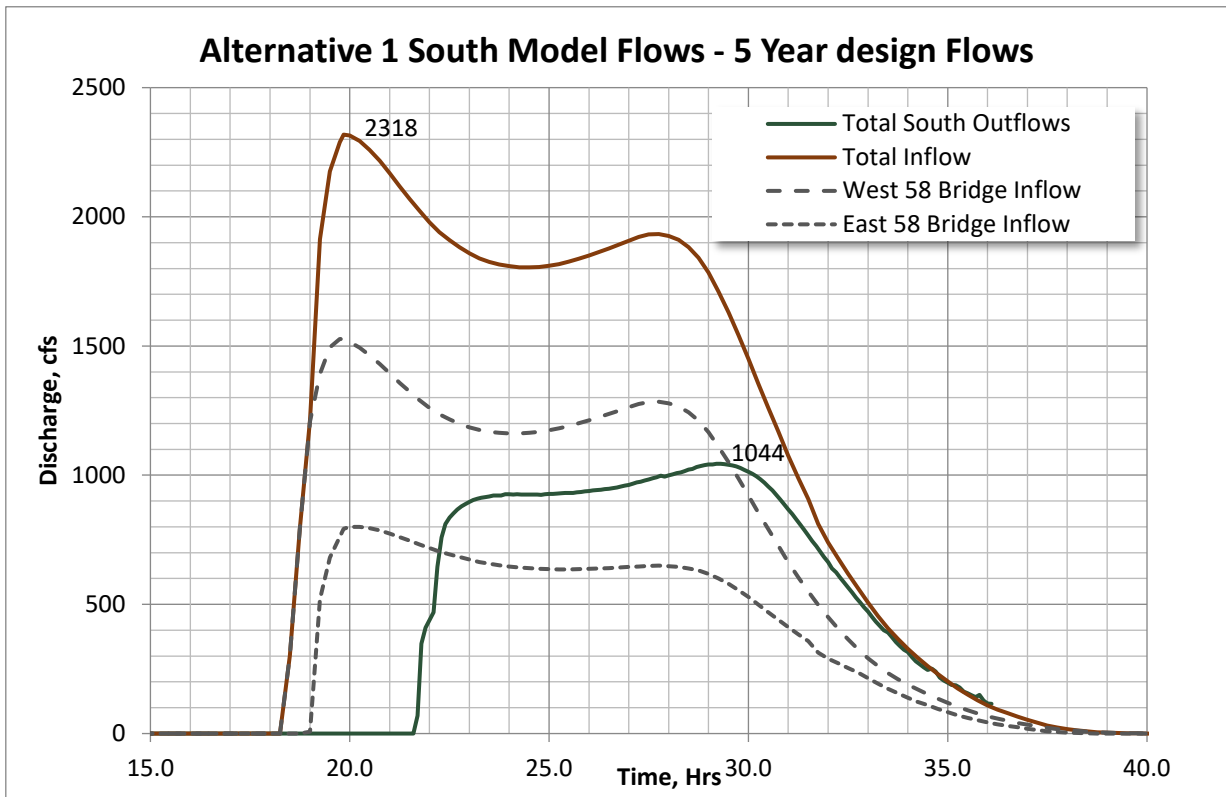


Figure 3

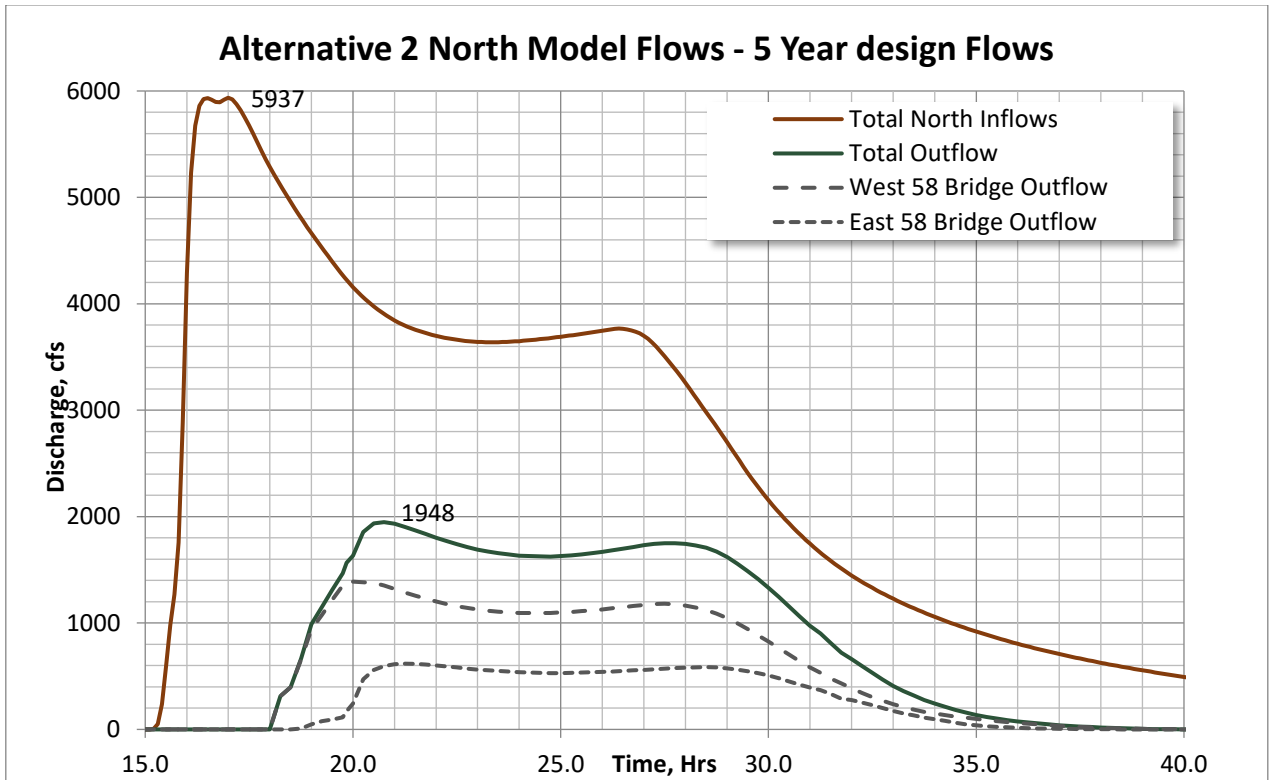


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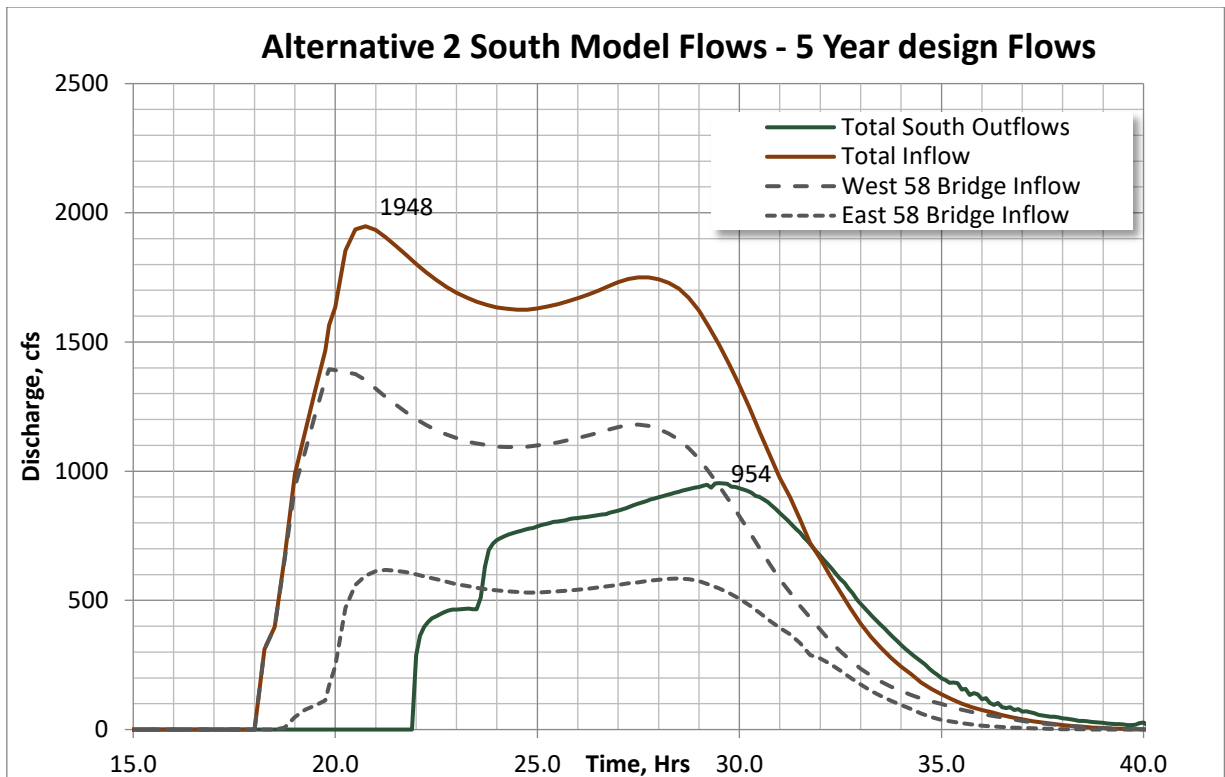


Figure 5

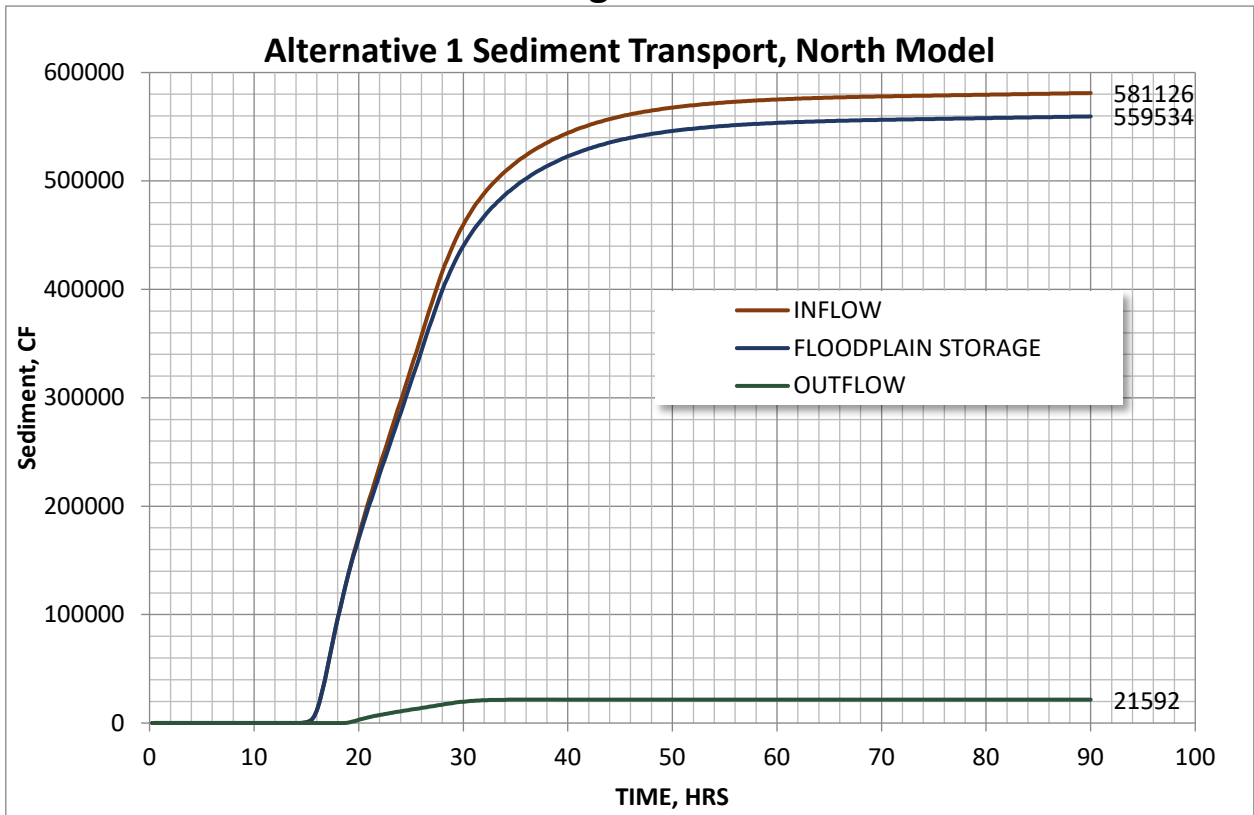


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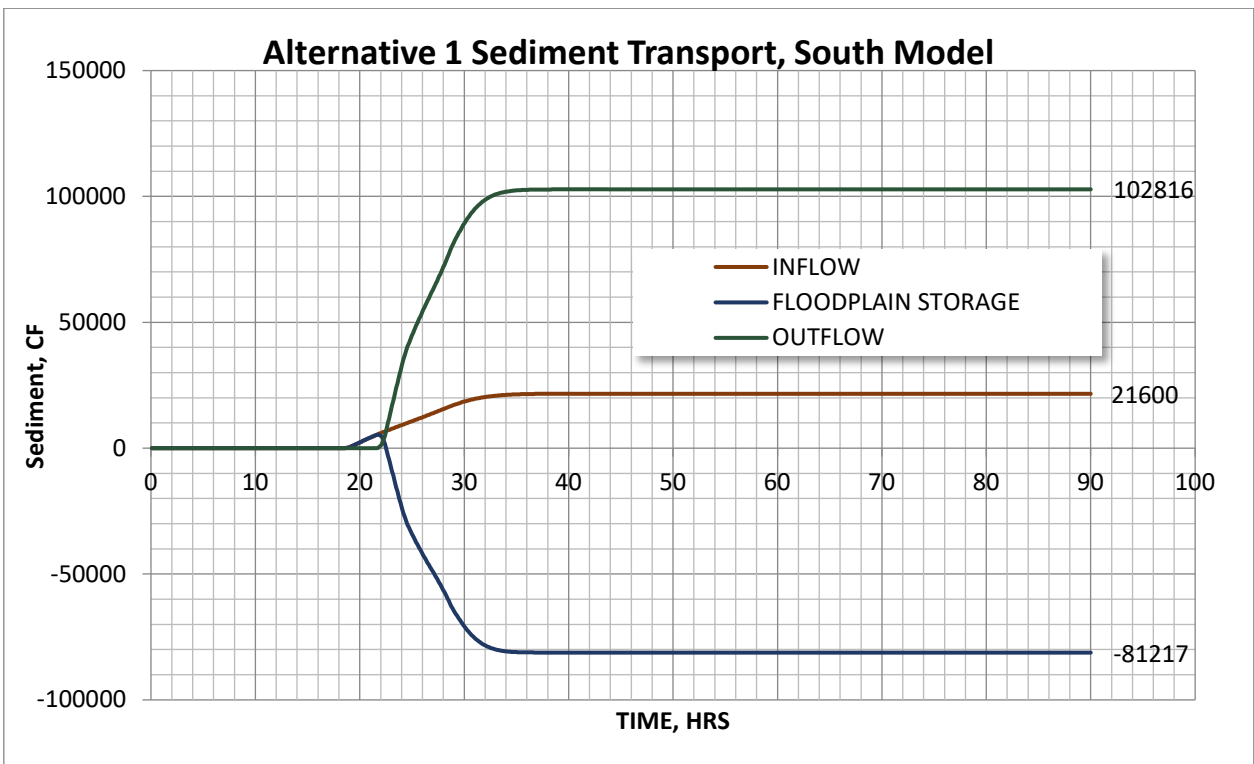


Figure 7

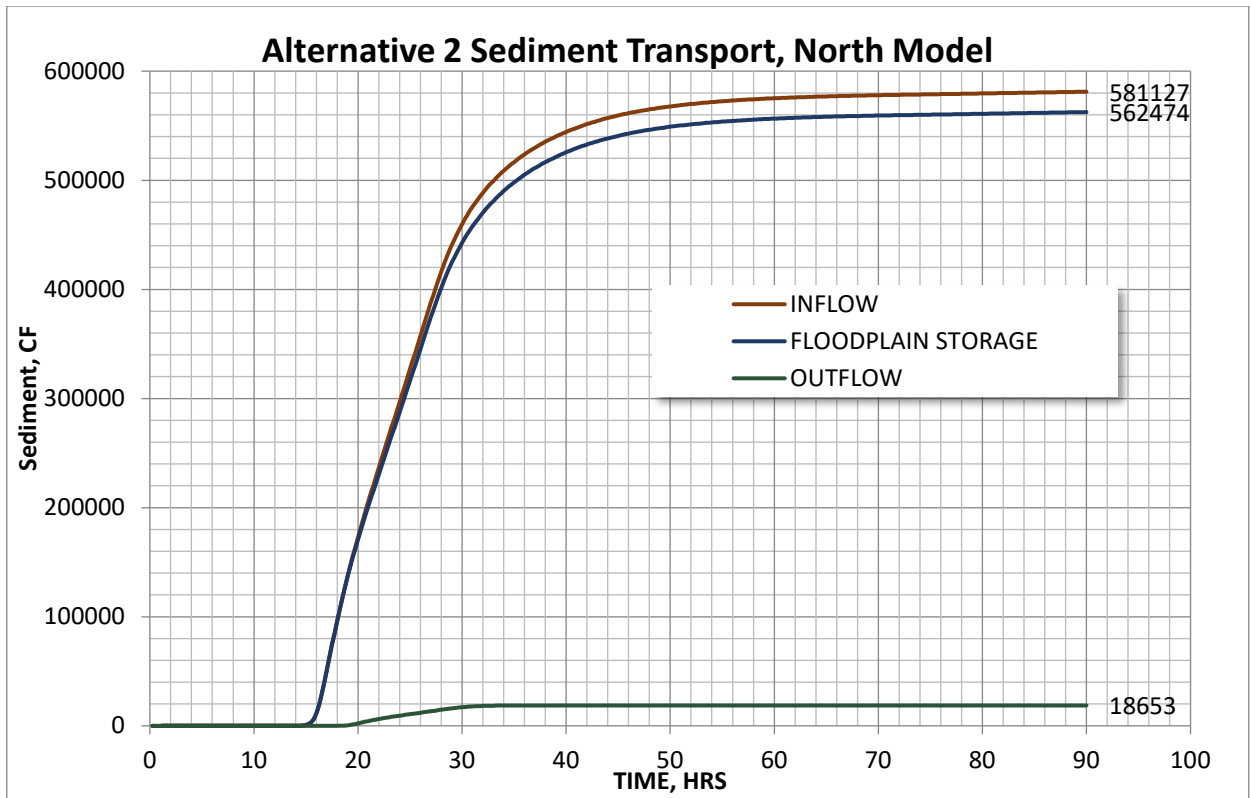
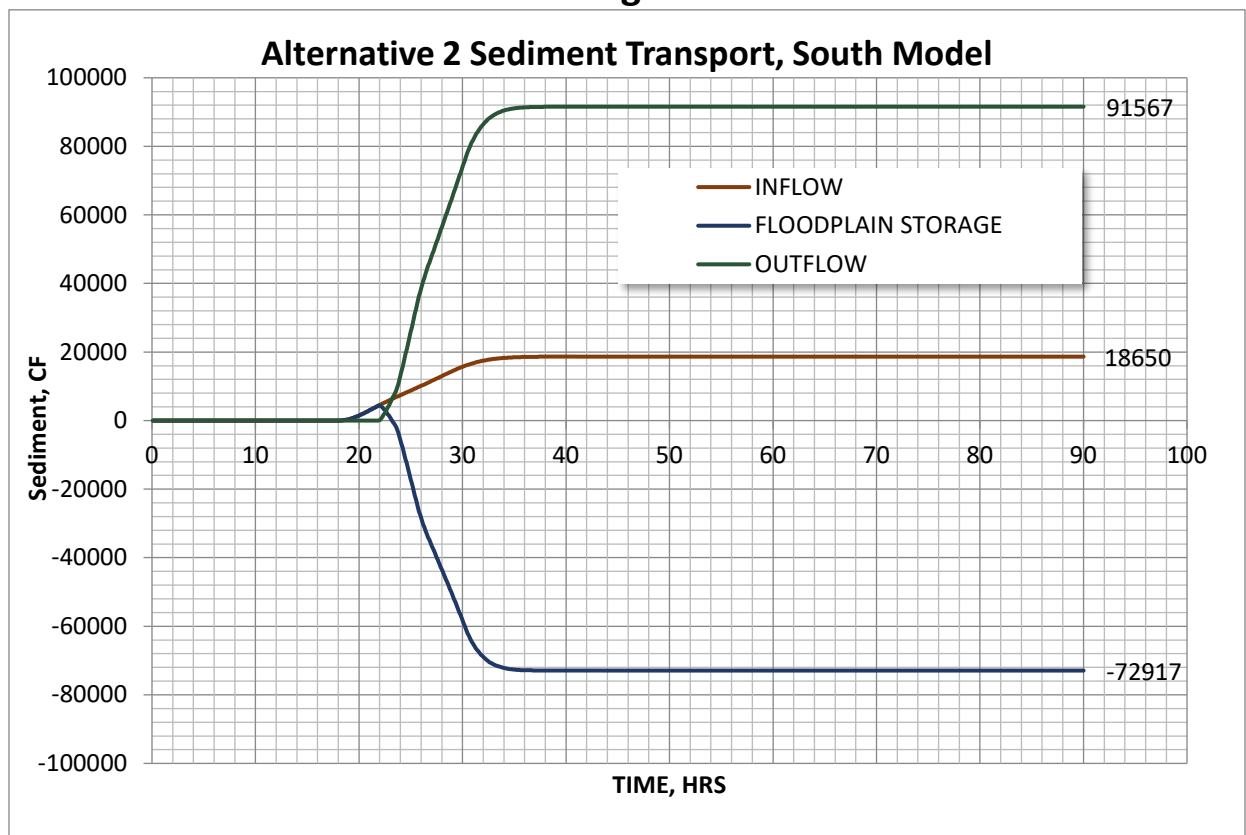
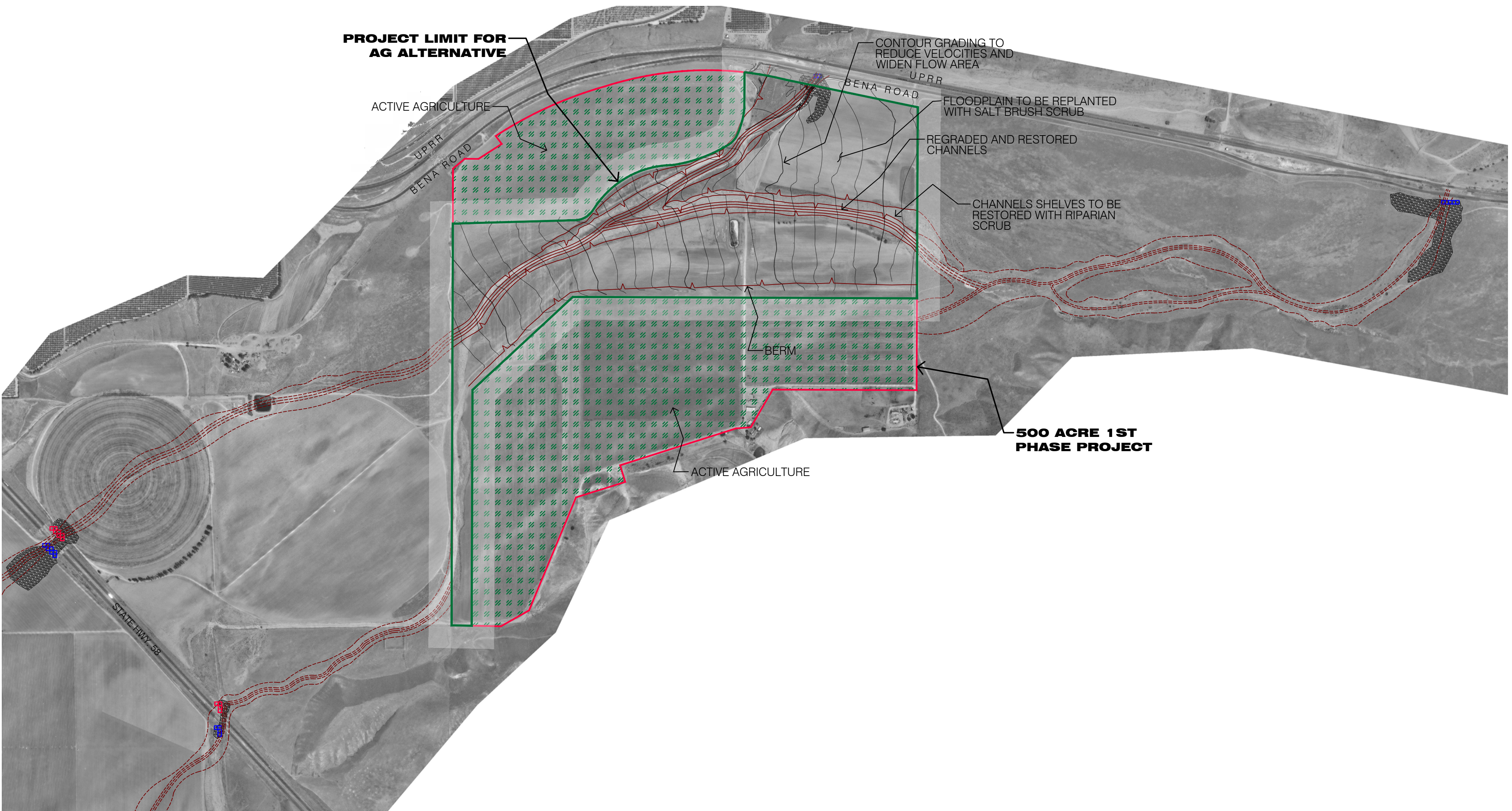


Figure 8



5. Graphic results are provided in the exhibit plates. Please refer to Plates 3 through 8.
 - a. Plates 3 and 6 illustrate the depths of flow over the project. The shaded color blue illustrates depths.
 - b. Plates 4 and 7 illustrate the magnitude of the water velocities over the project. Green shading indicates slower velocities where deposition can occur. Yellow shading indicates areas where sediment transport is in equilibrium. Red shaded areas show areas of erosion or scour.
 - c. Plates 5 and 8 illustrates areas where sediment will be deposited (shown in orange to brown tones) and where scour (shown in green to dark olive tones) will occur.



LEGEND

-  FLO-2D MODEL INFLOW TILES
-  FLO-2D MODEL OUTFLOW TILES
-  PROPOSED GRADED CHANNELS
-  FUTURE GRADED CHANNELS
-  FUTURE ROCK PROTECTION



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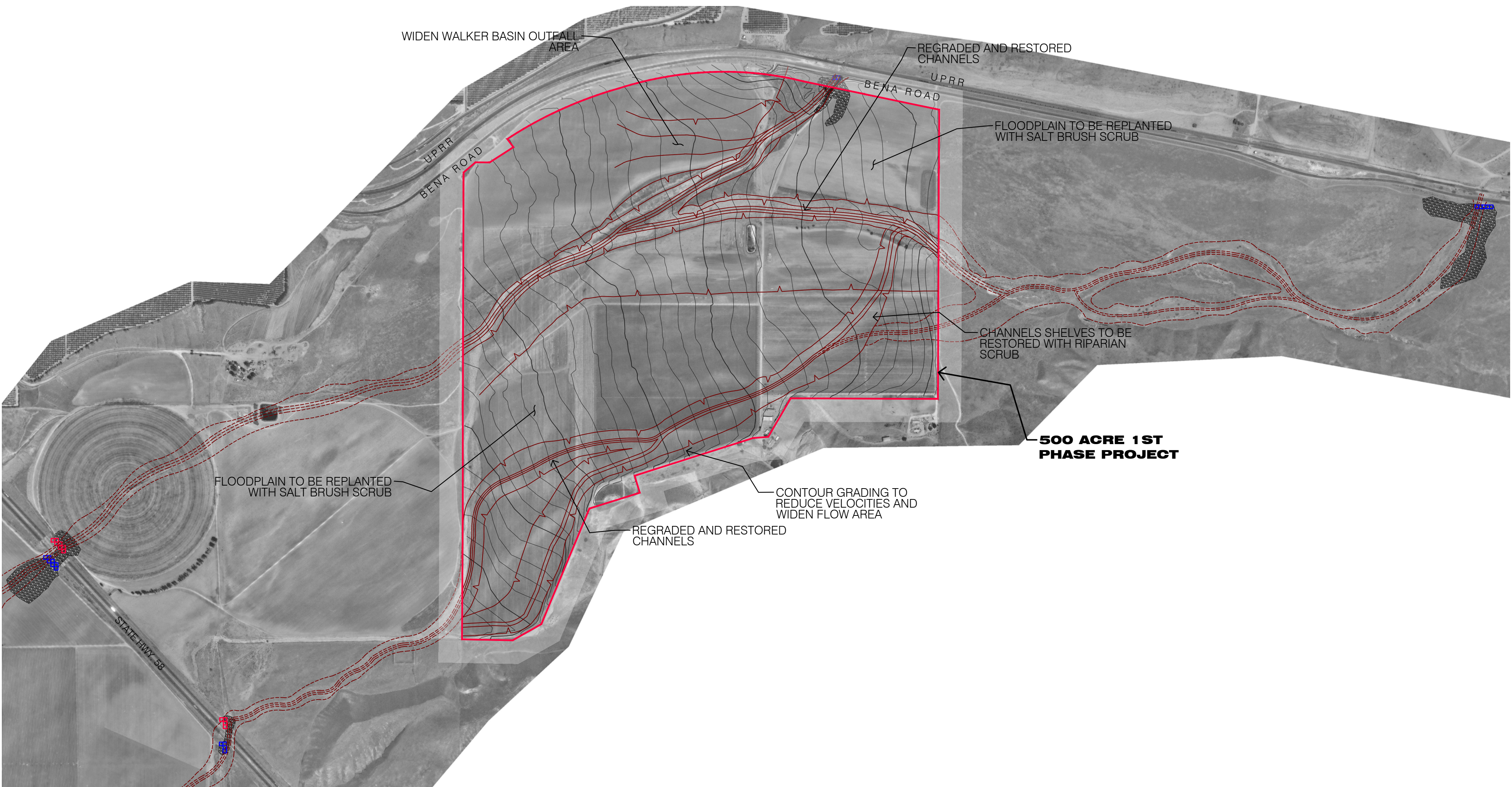
INDEX OF PLATES

PLATE NO.	TITLE
1	500 ACRE AG ALTERNATIVE 1, CONCEPT PLAN
2	500 ACRE Non-AG ALTERNATIVE 2, CONCEPT PLAN
3	500 ACRE AG ALTERNATIVE 1, 5YR WATER DEPTHS
4	500 ACRE AG ALTERNATIVE 1, 5YR VELOCITY PLOT
5	500 ACRE AG ALTERNATIVE 1, 5YR DEPOSITON-SCOUR PLOT
6	500 ACRE Non-AG ALTERNATIVE 2, 5YR WATER DEPTHS
7	500 ACRE Non-AG ALTERNATIVE 2, 5YR VELOCITY PLOT
8	500 ACRE Non-AG ALTERNATIVE 2, 5YR DEPOSITON-SCOUR PLOT

CALIENTE CREEK MODELING STUDY
500 ACRE AG ALTERNATIVE 1
CONCEPT PLAN

APRIL 25, 2019

PLATE 1 OF 8



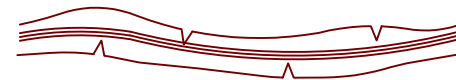
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FLO-2D MODEL INFLOW TILES

378

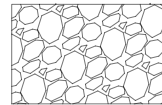
FLO-2D MODEL OUTFLOW TILES



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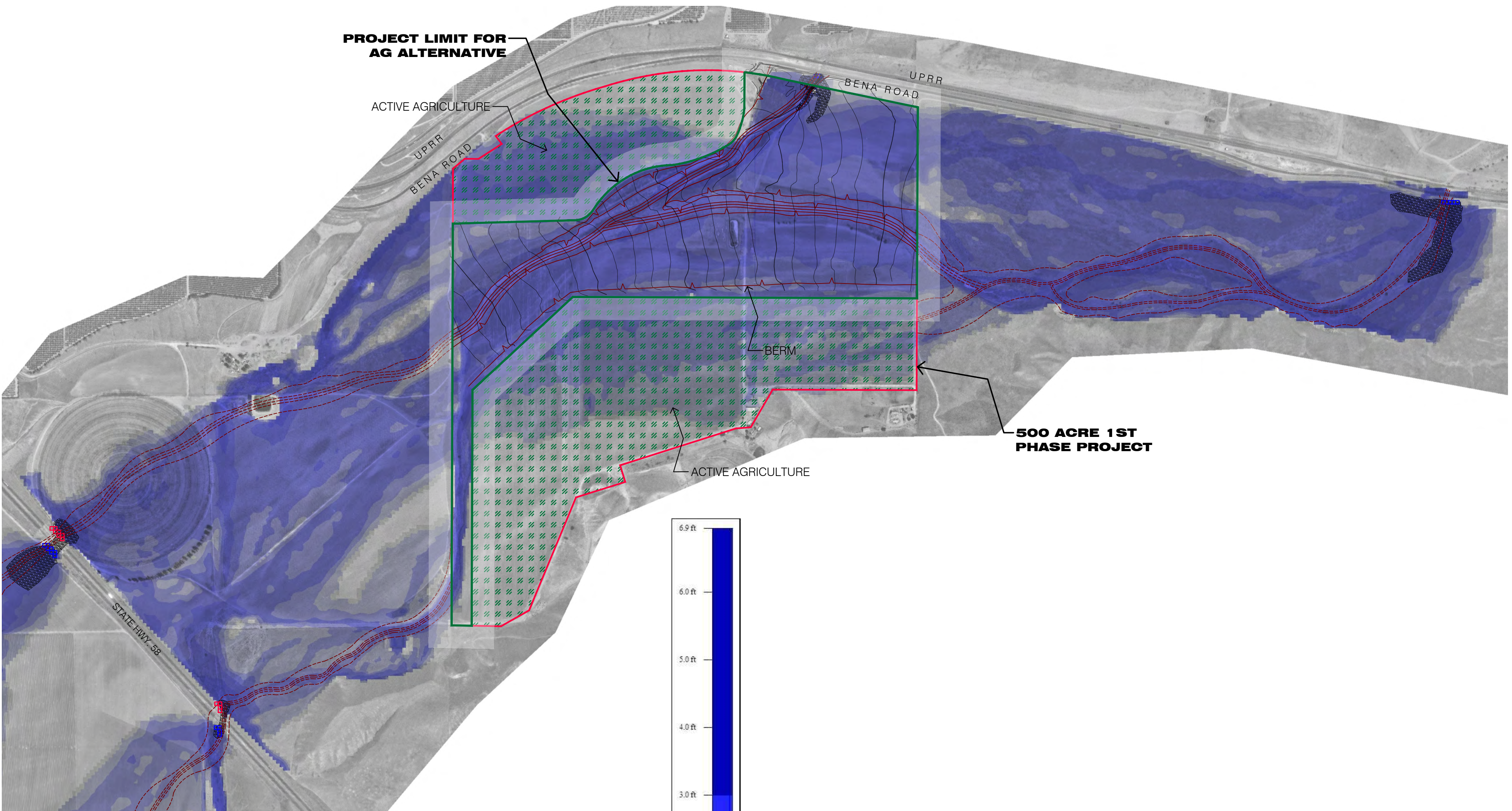


FUTURE GRADED CHANNELS



FUTURE ROCK PROTECTION





LEGEND

34247

FLO-2D MODEL INFLOW TILES

378

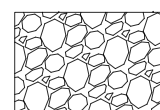
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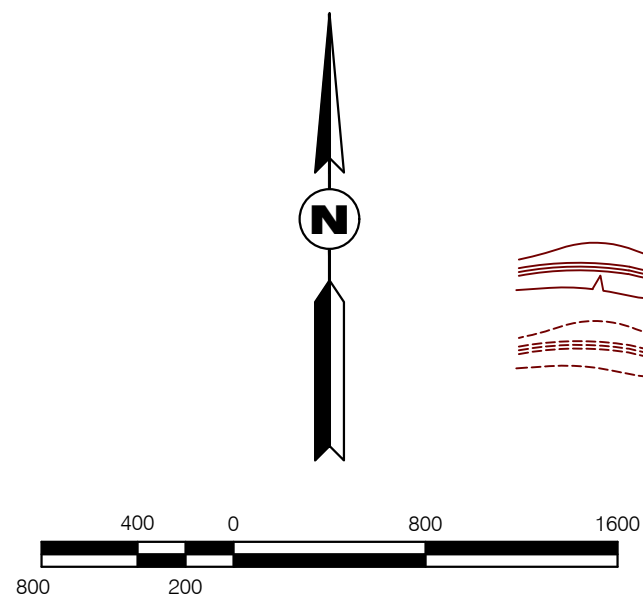
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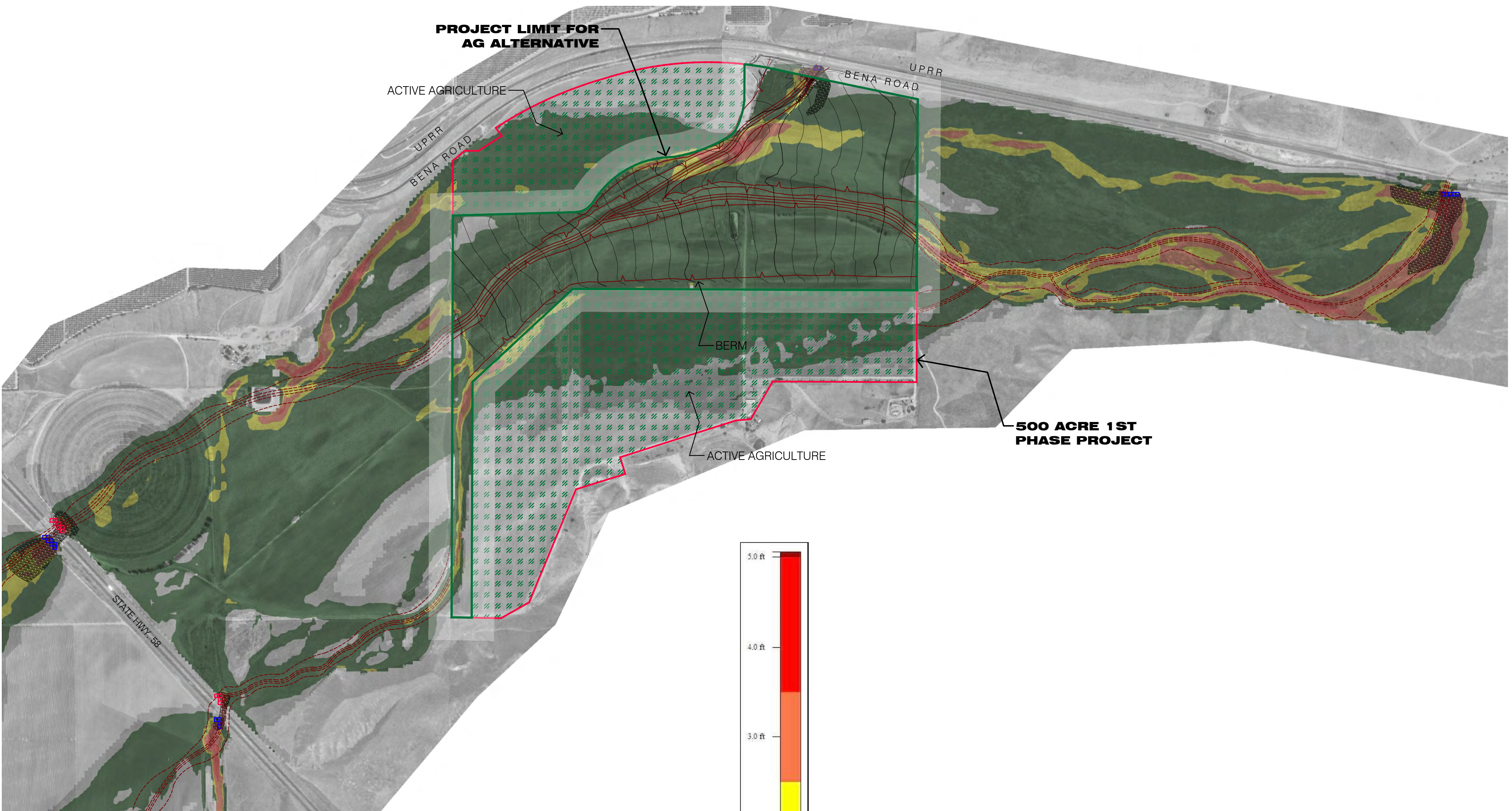


FUTURE GRADED CHANNELS



FUTURE ROCK PROTECTION





**PROJECT LIMIT FOR
AG ALTERNATIVE**

ACTIVE AGRICULTURE

UPRR

BENA ROAD

BENA ROAD

UPRR

BERM

ACTIVE AGRICULTURE

**500 ACRE 1ST
PHASE PROJECT**

STATE HWY 58

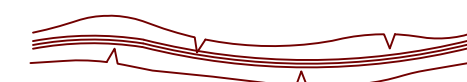
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34247

FLO-2D MODEL INFLOW TILES

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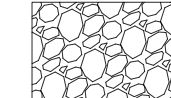
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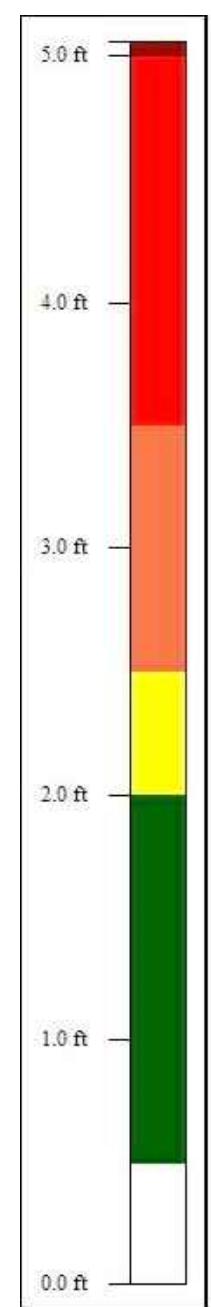
PROPOSED GRADED CHANNELS



FUTURE GRADED CHANNELS



FUTURE ROCK PROTECTION



WATER VELOCITY

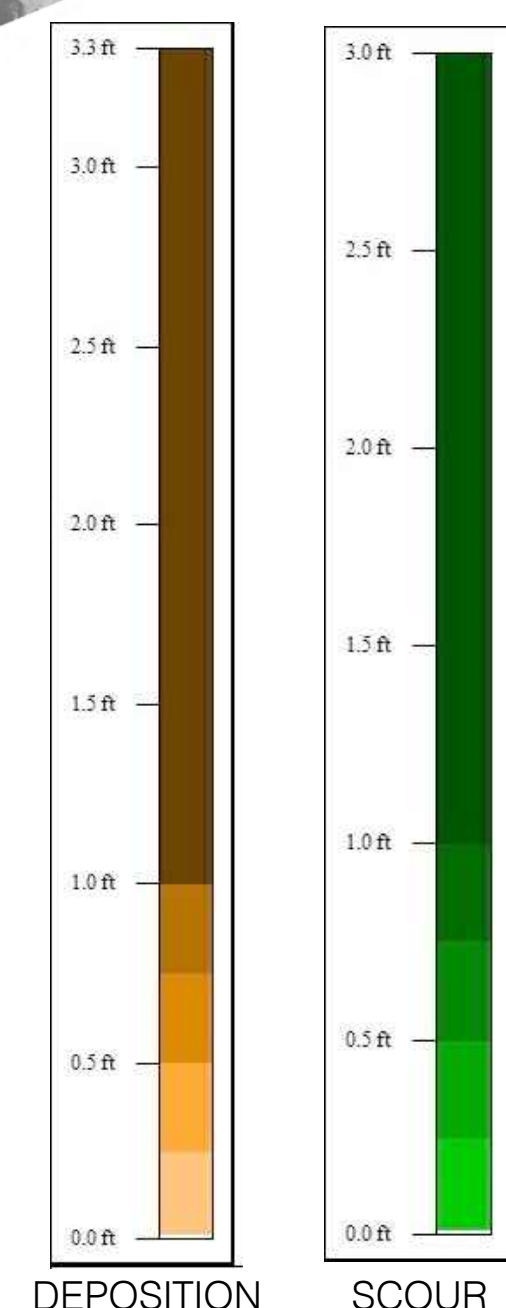
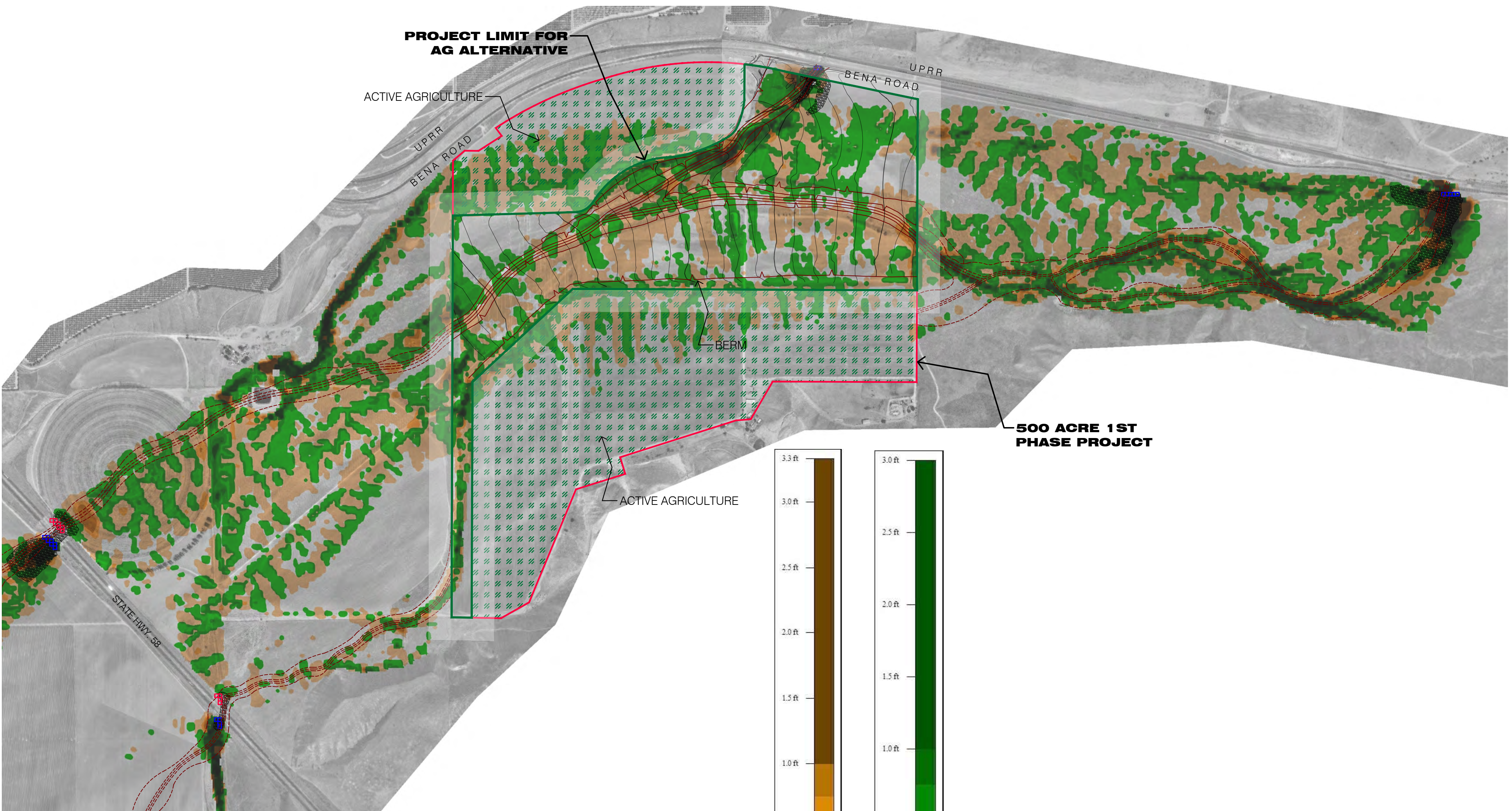


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**CALIENTE CREEK MODELING STUDY
 500 ACRE AG ALTERNATIVE 1
 5 YR VELOCITY PLOT**

APRIL 25, 2019

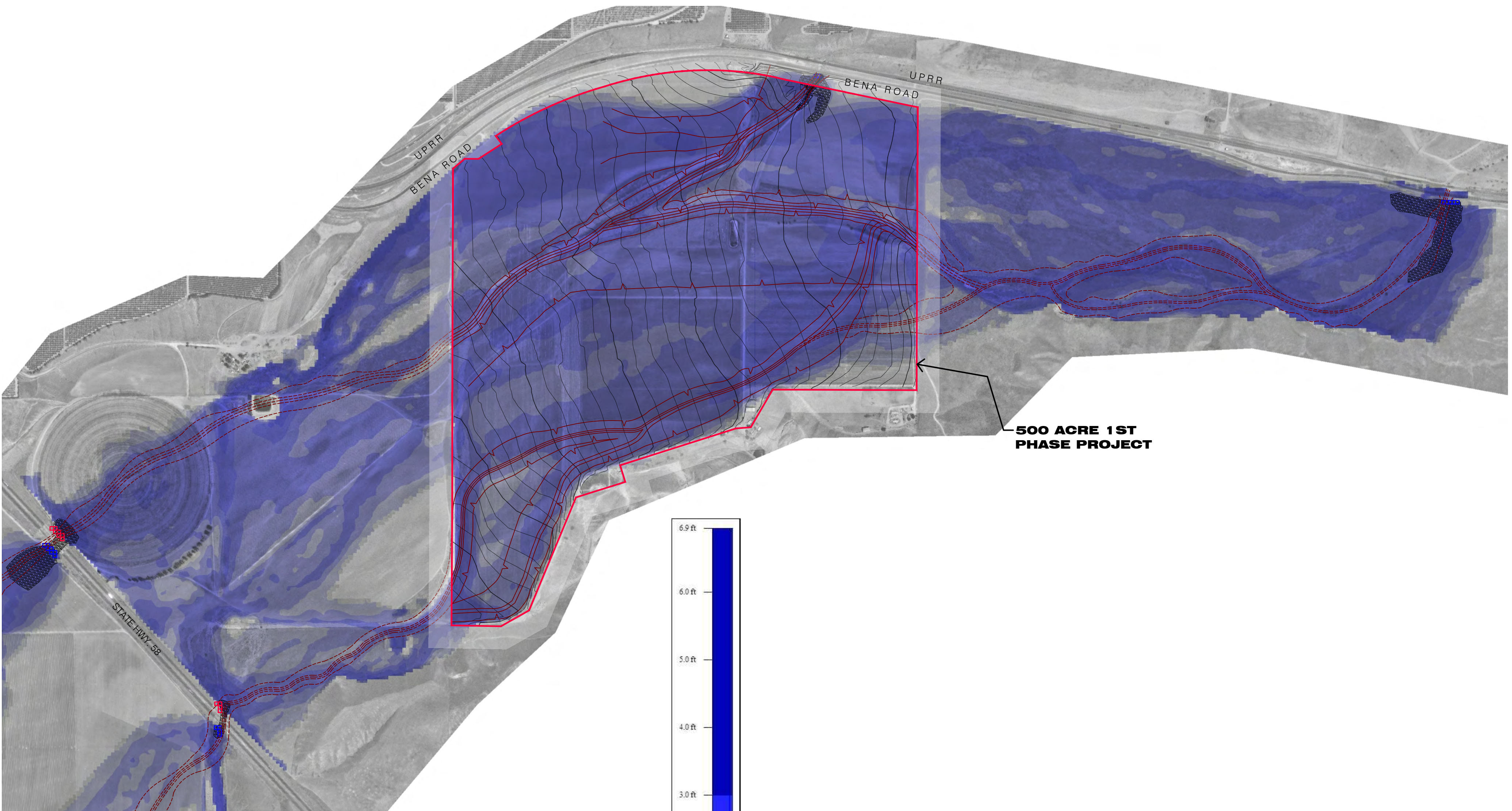
PLATE 4 OF 8



LEGEND

- 34247 FLO-2D MODEL INFLOW TILES
- 378 FLO-2D MODEL OUTFLOW TILES
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- FUTURE GRADED CHANNELS
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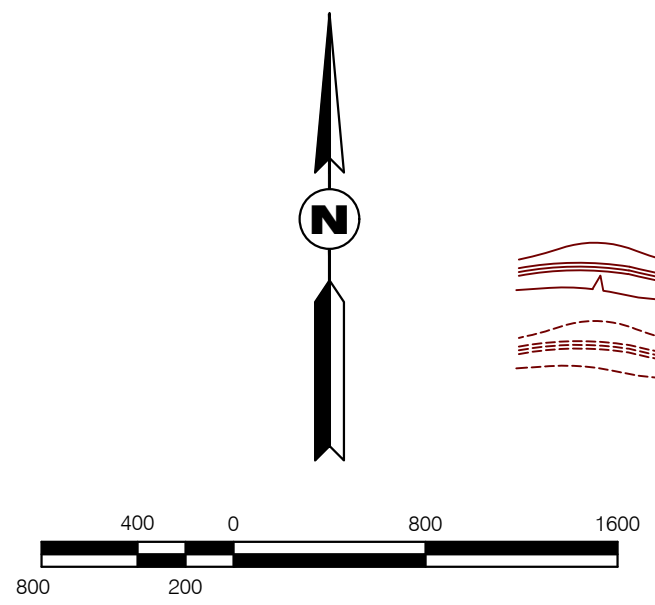
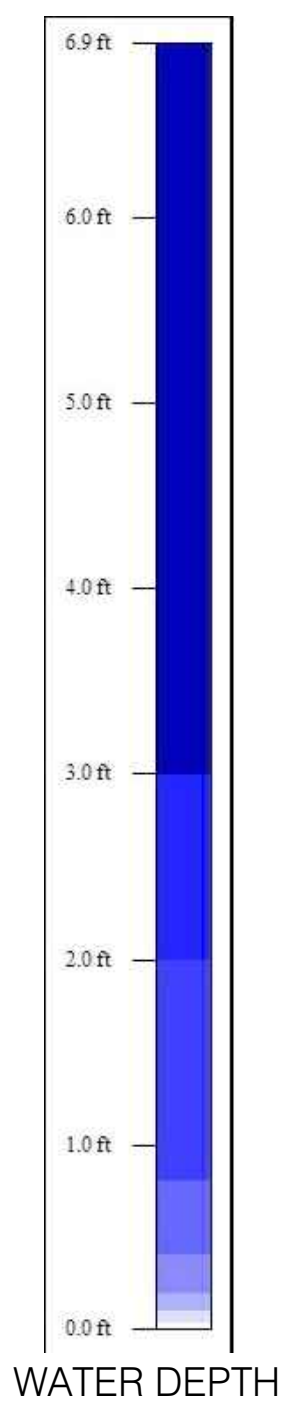


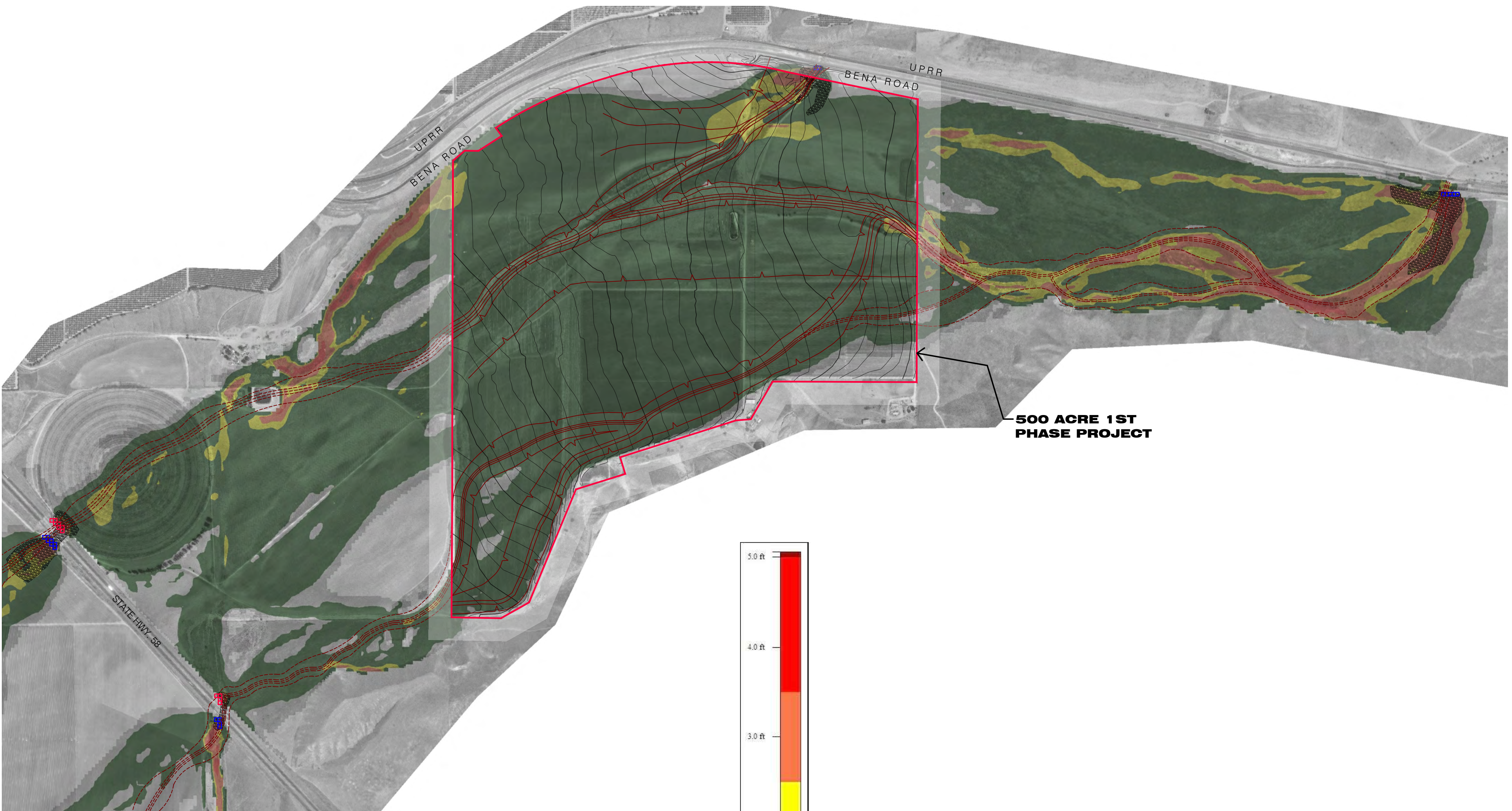


**500 ACRE 1ST
PHASE PROJECT**

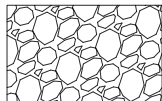
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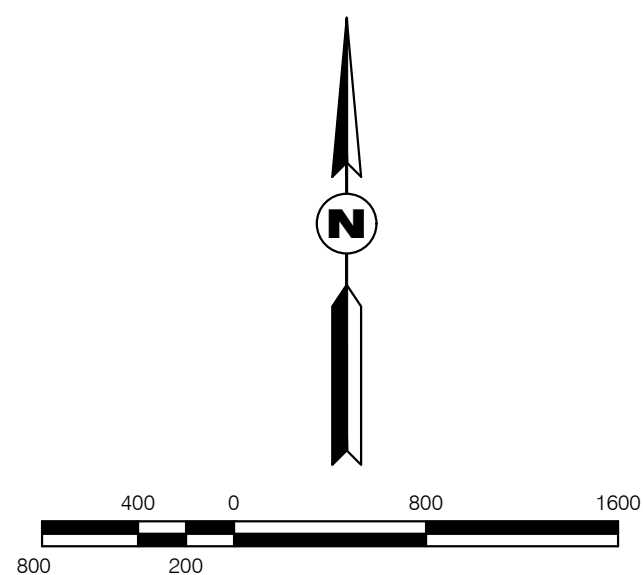
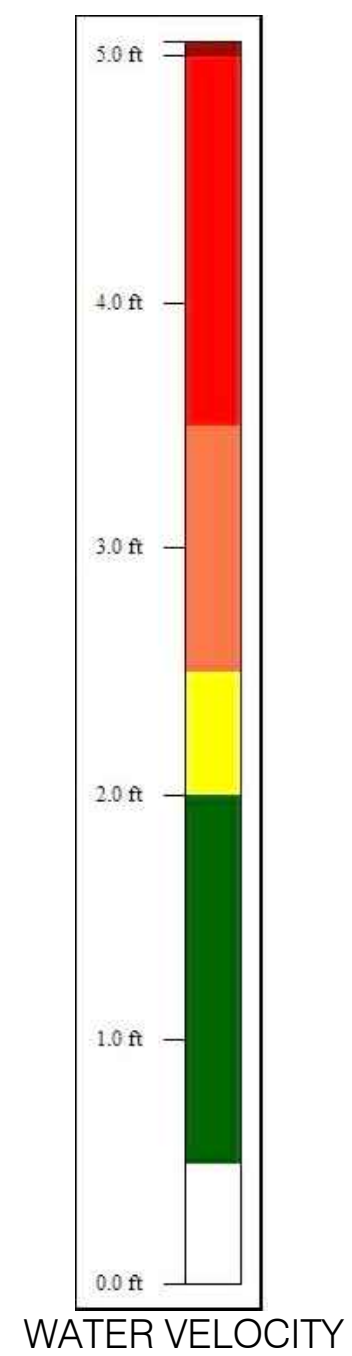
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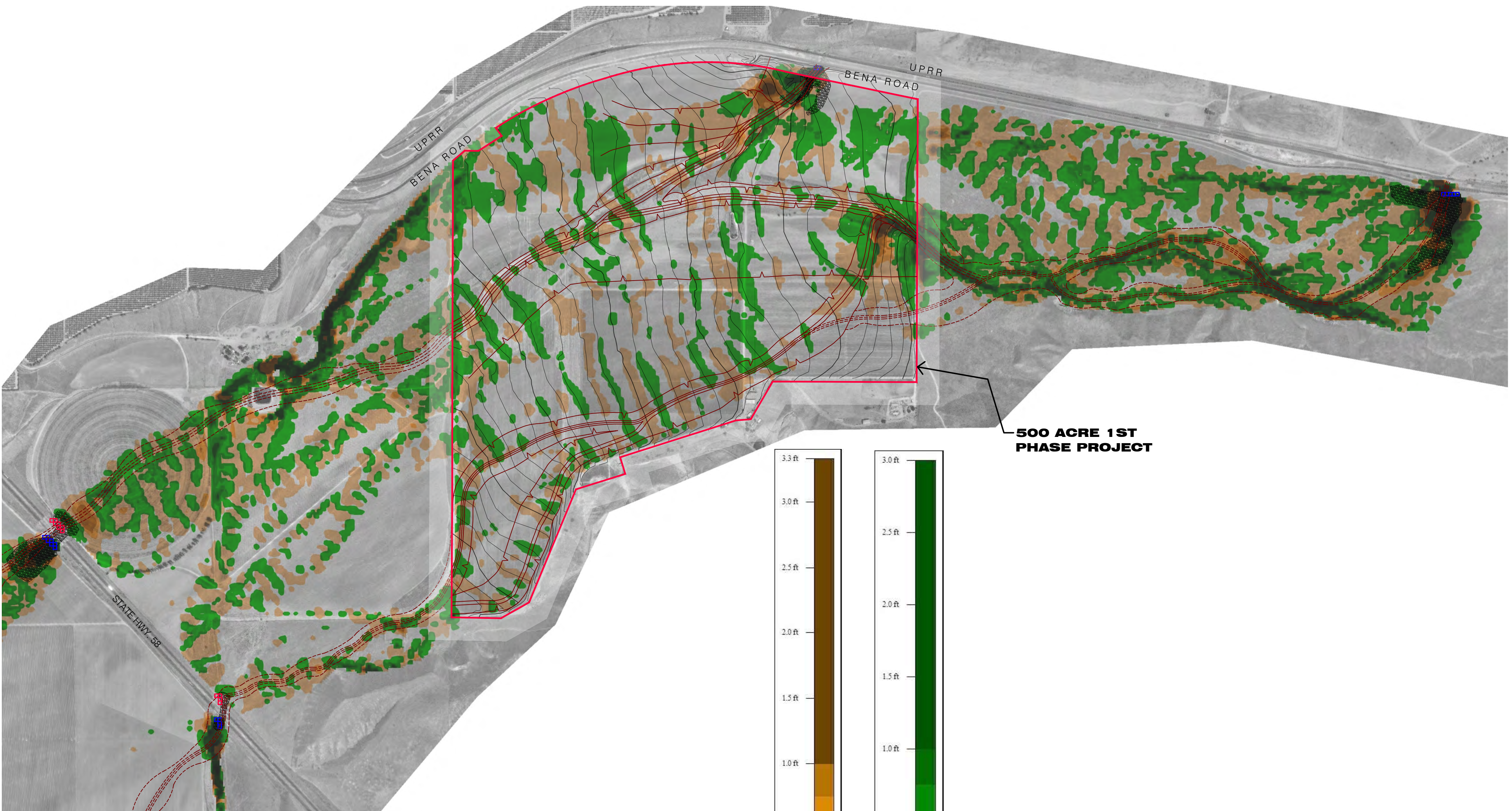




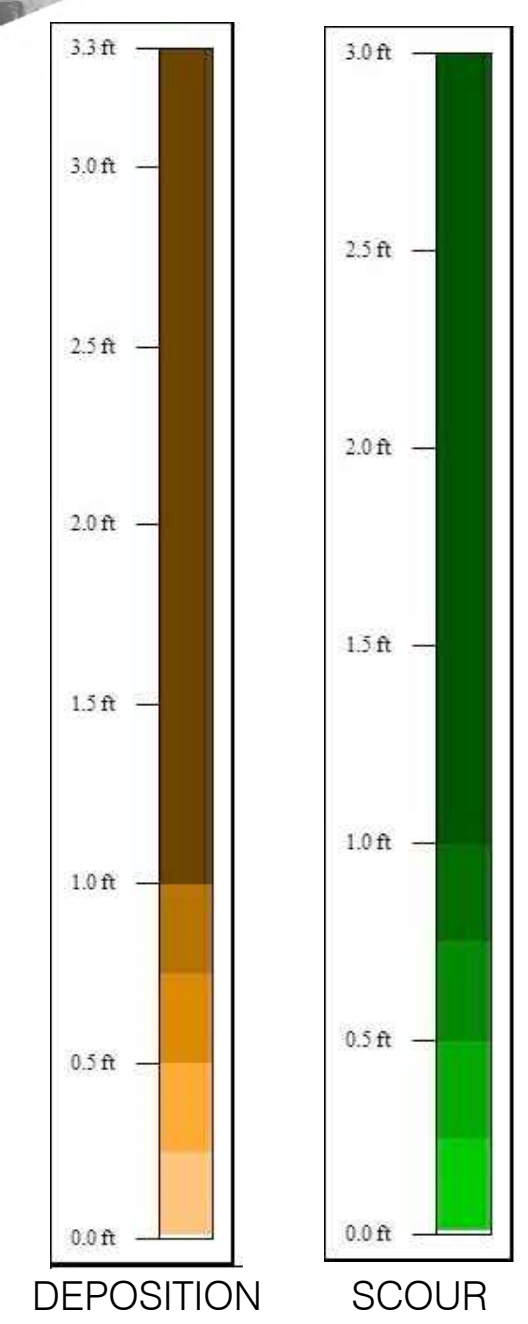
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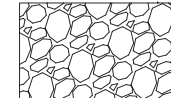




**500 ACRE 1ST
PHASE PROJECT**



LEGEND

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