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MEMORANDUM

To: Larry Dotson, PE

From: Richard Moss, PE, Randy Hopkins, PE

Subject: Packwood and Cameron Creeks Pool and Basin Reconnaissance Study

Date: August 10, 2010

BACKGROUND

The Kaweah Delta Water Conservation District (KDWCD) is working with the City of Visalia, CalWater and Tulare Irrigation District to develop a groundwater recharge program in the Visalia region. As part of this effort the agencies are considering using Packwood and Cameron creeks to convey water from the Kaweah or St. Johns rivers (originating from either the Kaweah River or CVP Friant-Kern Canal) to one or more basins for groundwater recharge. In-channel check structures could also be used to store water in the creeks to increase recharge.

A hydraulics and capacity analysis was previously performed on both Packwood and Cameron creeks along their alignments near and through the City of Visalia. A HEC-RAS model was developed for each creek to determine anticipated water surface elevations at various flow rates. In conjunction with the HEC-RAS models, profiles of each creek were developed to show potential capacity and freeboard issues at various flow rates.

PURPOSE AND SCOPE

KDWCD and the City of Visalia are considering the use of these two creeks for groundwater recharge and/or conveying surface water to recharge basins located along the creek alignments. By using existing check structures or constructing new ones at strategic locations along the creeks, pools could be developed to temporarily store water and to allow it to percolate into the aquifer or to allow the water to be diverted into adjacent basins for recharge.

A pool capacity analysis was performed for several pool alternatives along each creek alignment. Potential pool locations were identified that maximize the pool depth and length of pool upstream of the check structure. For each pool alternative, a conceptual opinion of probable construction cost was developed to weigh the cost and benefit of each pool alternative. The data used for the analysis was based on work developed from the previous hydraulic capacity analysis. In addition, existing and new basins were considered for recharge outside of the creek channels, and estimates of recharge capacity were determined.

ANALYSES

The analyses utilized the profiles developed from the previous topographic survey and HEC-RAS modeling. In addition, all estimates of recharge rates assume, for the limited purposes of this study, a continuous percolation rate of one-half foot per day and that all percolation occurs at the floor of the channel or basin, not on the embankments. This percolation rate is only an estimate to provide a sense of relative benefits between alternatives studied and should not be used for any other purpose until verified through actual field tests and studies. The pools, check structures, and recharge basins considered for this study along each creek are shown in the attached creek plan and profile drawings.

Pool Location Selection

The portions of each creek modeled in HEC-RAS were reviewed for suitability for water storage pools. Check structures were assumed to be required to create the pools. For the purposes of this study, "check structures" could refer to new concrete structures, existing concrete structures, temporary earthen dams, or existing bridges or culverts with new or existing board guides. It was assumed that the check structures should be located in areas easily accessed by District or City staff for operations and maintenance purposes. Other considerations for locating the check structures were the available channel freeboard, high water levels determined from the HEC-RAS model, depth of channel upstream of the potential check structure and the proximity of the site to provide benefits to the City's groundwater.

To determine estimated pool volumes, channel cross sections from the HEC-RAS model were reviewed along with pool water surface elevations. Pool water surface elevations were selected to maintain at least one-foot of freeboard (when possible) in the channel. Channel cross-sectional areas were estimated every 1,000 feet along each pool, with most pools being approximately 6,000 to 8,000 feet long.

Seven potential pools were identified for Packwood Creek and four were identified for Cameron Creek. See the attached pool volume calculations for each creek. The pools identified in this study are summarized in the tables below:

Packwood Creek Pool Summary

Location of Check (station)	*Type of Check*	*Pool Water Surface Elev. (feet)*	*Length of Pool (feet)*	*Volume of Pool (acre-feet)*	*Est. Potential Monthly Recharge (acre-feet)*
6+00	(E) Check	306	6,400	11.9	37
56+00	(E) Check	313	8,300	19.0	34
143+00	New Check of Earthen Dam	321	5,200	7.7	20

208+00	New Check or Earthen Dam	330	7,500	13.2	27
280+00	New Check or Earthen Dam	336	5,500	9.7	20
300+00	New Check or Earthen Dam	340	7,000	15.2	24
376+00	New Check or Earthen Dam	348	6,500	15.0	26

Cameron Creek Pool Summary

Location of Check (station)	*Type of Check*	*Pool Water Surface Elev. (feet)*	*Length of Pool (feet)*	*Volume of Pool (acre-feet)*	*Est. Potential Monthly Recharge (acre-feet)*
142+00	New Check or Earthen Dam	328.5	3,800	5.8	21
203+00	New Check or Earthen Dam	336	6,900	11.3	50
280+00	New Check or Earthen Dam	344	7,000	12.2	44
325+00	New Check or Earthen Dam	349	4,500	13.1	24

Basin Location Selection

In addition to utilizing pools within the creek channels, basins near the creeks were also considered for recharge. A check structure would again be required to back water up to be diverted into conveyance facilities leading to the basins. Several existing basins (shown in light blue) along the Packwood Creek alignment that may be utilized for recharge, while it appears Cameron Creek has no existing adjacent basins. For purposes of estimating costs, it was assumed that a new connection facility between a creek and basin would be required, even if there is an existing connection facility, due to capacity limitations or original intended use. Several existing basins currently used as parks (shown in green) within the City of Visalia are either adjacent to or near Packwood Creek. However, these were not considered for recharge in all cases because of their current use as parks.

Packwood Creek Basin Summary

Location of Basin (station)	*Type (Name) of Basin*	*Approx. Basin Size (acres)*	*Est. Potential Monthly Recharge (acre-feet)*
56+00	Existing ("Police Station Basin")	7.2	110
71+00	Existing ("Food-4-Less" or "State" Basin)	1.4	20
106+00	New ("Stonebrook Park")	5	75
208+00	New	Up to 17	Up to 255
280+00	Existing basin/orchard	14	210
320+00	Existing ("Dooley Basin")	5.7	85
380+00	Existing/New (including "Blain Basin")	7.5 (existing) up to 100	110 up to 1,400
440+00	Existing ("Oaks Basin")	28	Up to 420

Cameron Creek Basin Summary

Location of Basin (station)	*Type (Name) of Basin*	*Approx. Basin Size (acres)*	*Est. Potential Monthly Recharge (acre-feet)*
325+00	New	Up to 80	Up to 1,200

For the purposes of this study, it was assumed new basins would only be constructed on undeveloped land of "significant" size.

Packwood Creek

There is a storm drain line that leads from the Stonebrook Park drainage facilities to Packwood Creek. It should be fairly easy to tie into this line and divert water from Packwood Creek into Stonebrook Park. The park would need to be reconfigured to allow a significant portion of the park to be flooded in the summertime. Clearly an effort would need to be made to mitigate the loss of park land. Some mitigation could be as park improvements incorporating the regular presence of water as an added park feature.

The new potential Packwood Creek basin at station 208+00 listed above is located on a large parcel near an existing mobile home park and railroad tracks which was previously a site of an olive processing plan. The owner of this parcel already has plans to develop this property but may be willing to consider a sale alternative in this down development economy. He has not been contacted.

The potential to expand the existing Blain Basins up to 100 acres has greater potential given the City of Visalia already owns this property. It is slated to be developed into a regional sports park, but given its prime location from a groundwater recharge standpoint, consideration should be given to using it as a recharge site, at least for interim use. It is also well located for potential use for storm water layoff for either Packwood Creek or Mill Creek.

Cameron Creek

Data from the topographic survey indicates that Cameron Creek is shallower than Packwood Creek, often making it more difficult to form a pool of significant volume using a check structure. However, the portion of Cameron Creek considered for this study is primarily within rural agricultural areas, allowing flexibility in selecting locations for siting and sizing recharge basins. Ideally, the connection facility between the creek and any recharge basin would be immediately upstream of a check structure to maximize water depth in the basin. General areas to consider recharge basins along Cameron Creek include immediately east of Lovers Lane to near station 330+00 just downstream of the creek's headgate. Those areas would also allow for deeper pools when backed up with a new check structure.

A new basin location was selected near a new check structure (near station 325+00) that would put the additional recharge site in good proximity to the City's current urban boundary. No contact with the current landowner has been made.

SUMMARY

Based on the available data and information, conceptual opinions of construction costs were developed for each check structure and pool option considered in this study (see the attached cost breakdowns for further details). A summary of pool improvement alternatives are shown in the tables below for each creek.

Packwood Creek Pool Costs

Location of Check (station)	*Volume of Pool (acre-feet)*	*Est. Check & Pool Improvement Costs (Permanent)*	*Est. Check & Pool Improvement Costs (Temporary)*
6+00	11.9	$3,000	n/a
56+00	19.0	$3,000	n/a
143+00	7.7	$58,000	$25,000
208+00	13.2	$187,000	$24,000
280+00	9.7	$203,000	$24,000
300+00	15.2	$178,000	$18,000
376+00	15.0	$173,000	$10,000

Cameron Creek Pool Costs

Location of Check (station)	*Volume of Pool (acre-feet)*	*Est. Check & Pool Improvement Costs (Permanent)*	*Est. Check & Pool Improvement Costs (Temporary)*
142+00	5.8	$9,000	n/a
208+00	11.3	$55,000	$22,000
280+00	12.2	$48,000	$14,000
325+00	13.1	$145,000	$7,000

"Permanent" check and pool improvements include the construction of a permanent standalone concrete check structure with provisions for board guides. "Temporary" check and pool improvements include the construction of an earthen dam with a corrugated metal pipe (CMP) water control structure located within the dam. This control structure would likely consist of a large diameter CMP vertical riser half pipe with board guides, with a horizontal outlet pipe that would have the capability to convey nominal creeks flows without removing the dam. An example of such a structure is shown in **Figure 1** below.

Figure 1 – CMP Half Pipe Structure

In addition, it is estimated that most tie-in facilities used for connecting a creek to an adjacent basin would likely have construction costs in the range of $100,000 to $150,000, depending on size and capacity requirements.

NEXT STEPS

Additional work to further investigate the feasibility of creek and/or basin recharge activities includes:

- Performing geotechnical, insitu seepage, and/or flow measurement tests to verify the percolation rates within the creek channels and basins considered in this study in order to refine estimates of the amount of potential recharge capacity of the creeks and basins considered in this study;

- Refine construction estimates for check structures and basin tie-ins and prioritize projects to pursue and construct.

Additional topics to be explored include the need to meet the future conveyance demands of Tulare Irrigation District for these creeks and to assist the City of Visalia in utilizing these creeks as storm water control facilities:

- Reviewing how these creeks can best be used to allow Tulare Irrigation District to meet their future conveyance demands and identify necessary improvements. Some of this is expected to be accomplished as part of the Tulare Irrigation District's System Optimization Review Study currently underway;

- Reviewing how these creeks can best be integrated in the City of Visalia's storm water master plan.

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Kaweah Delta Water Conservation District
Packwood and Cameron Creeks Reconaissance Study
Creek Pool Volume Estimates

JOB #: 1225 0901
COMP. BY: ASC
CHKD. BY:
DATE: 8/11/2010

Packwood Creek

Check Sta: 6+00

Water surface elev: 306 ft

	Sta	Floor Elev	Area	Volume (CF)	Volume (AF)
	639	300	184		
	1,000	300.4	185	73696	1.7
	2,000	300.6	105	145174	3.3
	3,000	301.4	106	105788	2.4
	4,000	302.5	69	87349	2.0
	5,000	303	58	63500	1.5
	6,000	304.8	15	36783	0.8
End	7,000			7548	0.2
			Total	519838	**11.9**

Check Sta: 56+00

Water surface elev: 313 ft

	Sta	Floor Elev	Area	Volume (CF)	Volume (AF)
	5,500	304.3	353		
	6,000	304.8	230	116518	2.7
	7,000	305.8	177	203517	4.7
	8,000	306.7	146	161615	3.7
	9,000	307.6	102	124153	2.9
	10,000	308.9	74	88164	2.0
	11,000	309.8	49	61541	1.4
	12,000	310.5	29	39159	0.9
	13,000	311.4	21	24979	0.6
End	13,800			8278	0.2
			Total	827924	**19.0**

Check Sta: 143+00

Water surface elev: 321 ft

	Sta	Floor Elev	Area	Volume (CF)	Volume (AF)
	14,500	314.3	120		
	15,000	315.6	105	78830	1.8
	16,000	317.3	93	98950	2.3
	17,000	316.9	77	85139	2.0
	18,000	318.9	25	51204	1.2
	19,000	320.1	12	18341	0.4
End	19,700			4089	0.1
			Total	336553	**7.7**

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Packwood and Cameron Creeks Reconaissance Study
Creek Pool Volume Estimates

JOB #: 1225 0901
COMP. BY: ASC
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DATE: 8/11/2010

Check Sta:	**208+00**					
	Water surface elev:		330	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	20,501	321.65	194			
	21,000	322	199	39375	0.9	
	22,000	322.5	157	178374	4.1	
	23,000	324.1	129	143137	3.3	
	24,000	326.5	49	89144	2.0	
	25,000	327	46	47666	1.1	
	26,000	328.3	40	42753	1.0	
	27,000	328.9	15	27092	0.6	
End	28,000			7304	0.2	
			Total	574844	**13.2**	
Check Sta:	**280+00**					
	Water surface elev:		336	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	28,000	330	164			
	29,000	330.4	135	149779	3.4	
	30,000	331.4	91	112817	2.6	
	31,000	331.8	65	77803	1.8	
	32,000	332.6	44	54743	1.3	
	33,000	335.3	7	25644	0.6	
End	33,500			1725	0.0	
			Total	422512	**9.7**	
Check Sta:	**300+00**					
	Water surface elev:		340	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	30,000	331.45	234			
	31,000	331.8	187	210886	4.8	
	32,000	332.6	151	169217	3.9	
	33,000	335.3	81	116098	2.7	
	34,000	337.1	56	68685	1.6	
	35,000	337.65	42	48915	1.1	
	36,000	337.95	26	33974	0.8	
End	37,000			13217	0.3	
			Total	660992	**15.2**	

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Check Sta:	**376+00**					
	Water surface elev:		348	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	37,501	340	182			
	38,000	340.75	244	106404	2.4	
	39,000	341.75	147	195585	4.5	
	40,000	342.5	119	133179	3.1	
	41,000	342.3	87	103253	2.4	
	42,000	344.75	43	65250	1.5	
	43,000	345.55	26	34887	0.8	
End	44,000			13242	0.3	
			Total	651799	**15.0**	
Cameron Creek						
Check Sta:	**142+00**					
	Water surface elev:		328.5	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	14,000	321.5	191			
	15,000	324.2	87	111219	2.6	
	16,000	325.9	60	73349	1.7	
	17,000	326.8	40	49903	1.1	
End	17,800			16065	0.4	
			Total	250536	**5.8**	
Check Sta:	**203+00**					
	Water surface elev:		336	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	20,000	330.1	178			
	21,000	331.6	140	111121	2.6	
	22,000	332	108	123661	2.8	
	23,000	333	59	83230	1.9	
	24,000	334	66	62625	1.4	
	25,000	334.1	48	57106	1.3	
	26,000	334.6	32	39763	0.9	
End	26,900			14266	0.3	
			Total	491773	**11.3**	

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JOB #: 1225 0901
COMP. BY: ASC
CHKD. BY:
DATE: 8/11/2010

Check Sta:	**280+00**					
	Water surface elev:		344	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	28,037	337.5	233			
	28,993	339.14	151	183808	4.2	
	30,000	339.9	103	128243	2.9	
	31,000	340.05	70	86611	2.0	
	32,000	341.55	51	60232	1.4	
	33,000	342.2	36	43139	1.0	
	34,000	343.5	10	22689	0.5	
End	35,000			4914	0.1	
			Total	529635	**12.2**	
Check Sta:	**325+00**					
	Water surface elev:		349	ft		
	Sta	**Floor Elev**	**Area**	**Volume (CF)**	**Volume (AF)**	
	32,335	341.2	228			
	33,000	342.2	199	141926	3.3	
	34,000	343.5	156	177517	4.1	
	35,000	343.9	126	140950	3.2	
	36,000	346.4	50	87839	2.0	
End	36,854			21399	0.5	
			Total	569630	**13.1**	

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

KAWEAH DELTA WATER CONSERVATION DISTRICT
PACKWOOD AND CAMERON CREEKS RECONAISSANCE STUDY
PACKWOOD CREEK CHECK STRUCTURES AND POND INTERTIES
8/10/2010

CONCEPTUAL

Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
Station 6+00 Check Improvements (11.9 AF)					
1	Raise left bank to maintain freeboard (150 LF)	200	CY	$15	$3,000
				Total	$3,000
Station 56+00 Check Improvements (19.0 AF)					
2	Raise both banks to maintain freeboard (100 LF)	200	CY	$15	$3,000
				Total	$3,000
Station 143+00 (West St.) Check Improvements (7.7 AF)					
	Earth Dam Option				
3	Raise both banks to maintain freeboard (600 LF)	1,200	CY	$15	$18,000
4	Construct earth dam (include overexcavation and scarification)	50	CY	$30	$1,500
5	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$25,000
	Check Structure Option				
6	Raise both banks to maintain freeboard (600 LF)	1,200	CY	$15	$18,000
7	Modify West Street culvert with board guides	1	LS	$40,000	$40,000
				Total	$58,000
Station 208+00 Check Improvements (13.2 AF)					
	Earth Dam Option				
8	Raise right bank to maintain freeboard (600 LF)	1,100	CY	$15	$16,500
9	Construct earth dam (include overexcavation and scarification)	70	CY	$30	$2,100
10	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$24,000
	Check Structure Option				
11	Raise right bank to maintain freeboard (600 LF)	1,100	CY	$15	$16,500
12	Construct new check structure (no gates)	1	LS	$150,000	$150,000
13	Channel improvements around structure (lining, rip rap, etc.)	1	LS	$20,000	$20,000
				Total	$187,000
	Optional for Basin Recharge				
14	Construct tie-in to proposed basin south of creek	1	LS	$110,000	$110,000

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

KAWEAH DELTA WATER CONSERVATION DISTRICT
PACKWOOD AND CAMERON CREEKS RECONAISSANCE STUDY
PACKWOOD CREEK CHECK STRUCTURES AND POND INTERTIES
8/10/2010

CONCEPTUAL

Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
Station 280+00 Check Improvements (9.7 AF)					
	Earth Dam Option				
15	Raise right bank to maintain freeboard (600 LF)	1,100	CY	$15	$16,500
16	Construct earth dam (include overexcavation and scarification)	70	CY	$30	$2,100
17	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$24,000
	Check Structure Option				
18	Raise right bank to maintain freeboard (1100 LF)	2,200	CY	$15	$33,000
19	Construct new check structure (no gates)	1	LS	$150,000	$150,000
20	Channel improvements around structure (lining, rip rap, etc.)	1	LS	$20,000	$20,000
				Total	$203,000
	Optional for Basin Recharge				
21	Construct tie-in to existing orchard/basin east of creek	1	LS	$110,000	$110,000
Station 300+00 Check Improvements (15.2 AF)					
	Earth Dam Option				
22	Raise both banks to maintain freeboard (450 LF)	700	CY	$15	$10,500
23	Construct earth dam (include overexcavation and scarification)	70	CY	$30	$2,100
24	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$18,000
	Check Structure Option				
25	Raise left bank to maintain freeboard (450 LF)	500	CY	$15	$7,500
26	Construct new check structure (no gates)	1	LS	$150,000	$150,000
27	Channel improvements around structure (lining, rip rap, etc.)	1	LS	$20,000	$20,000
				Total	$178,000

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PACKWOOD AND CAMERON CREEKS RECONAISSANCE STUDY
PACKWOOD CREEK CHECK STRUCTURES AND POND INTERTIES
8/10/2010

CONCEPTUAL

Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
Station 376+00 Check Improvements (15.0 AF)					
	Earth Dam Option				
28	Raise both banks to maintain freeboard (150 LF)	200	CY	$15	$3,000
29	Construct earth dam (include overexcavation and scarification)	70	CY	$30	$2,100
30	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$10,000
	Check Structure Option				
31	Raise both banks to maintain freeboard (150 LF)	200	CY	$15	$3,000
32	Construct new check structure (no gates)	1	LS	$150,000	$150,000
33	Channel improvements around structure (lining, rip rap, etc.)	1	LS	$20,000	$20,000
				Total	$173,000
	Optional for Basin Recharge				
34	Construct tie-in to existing basin north of creek	1	LS	$110,000	$110,000
35	Construct tie-in to existing basin south of creek	1	LS	$110,000	$110,000
36	Construct tie-in to proposed basins north of creek	1	LS	$110,000	$110,000
37	Construct tie-in to proposed basins south of creek	1	LS	$110,000	$110,000
				Total	$440,000

NOTE(S):

Excludes mobilization/demobilization, bonds, insurance, etc.

Excludes costs for proposed basin construction.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

KAWEAH DELTA WATER CONSERVATION DISTRICT
PACKWOOD AND CAMERON CREEKS RECONAISSANCE STUDY
CAMERON CREEK CHECK STRUCTURES AND POND INTERTIES
8/10/2010

CONCEPTUAL

Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
Station 142+00 Check Improvements (5.8 AF)					
1	Raise left bank to maintain freeboard (500 LF)	600	CY	$15	$9,000
				Total	$9,000
Station 208+00 Check Improvements (11.3 AF)					
	Earth Dam Option				
2	Raise both banks to maintain freeboard (800 LF)	1,000	CY	$15	$15,000
3	Construct earth dam (include overexcavation and scarification)	50	CY	$30	$1,500
4	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$22,000
	Check Structure Option				
5	Raise banks to maintain freeboard (800 LF)	1,000	CY	$15	$15,000
6	Modify Lovers Lane culvert with board guides	1	LS	$40,000	$40,000
				Total	$55,000
Station 280+00 Check Improvements (12.2 AF)					
	Earth Dam Option				
7	Raise right bank to maintain freeboard (600 LF)	500	CY	$15	$7,500
8	Construct earth dam (include overexcavation and scarification)	50	CY	$30	$1,500
9	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$14,000
	Check Structure Option				
10	Raise right bank to maintain freeboard (600 LF)	500	CY	$15	$7,500
11	Modify Road 148 culvert with board guides	1	LS	$40,000	$40,000
				Total	$48,000

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

KAWEAH DELTA WATER CONSERVATION DISTRICT
PACKWOOD AND CAMERON CREEKS RECONAISSANCE STUDY
CAMERON CREEK CHECK STRUCTURES AND POND INTERTIES
8/10/2010

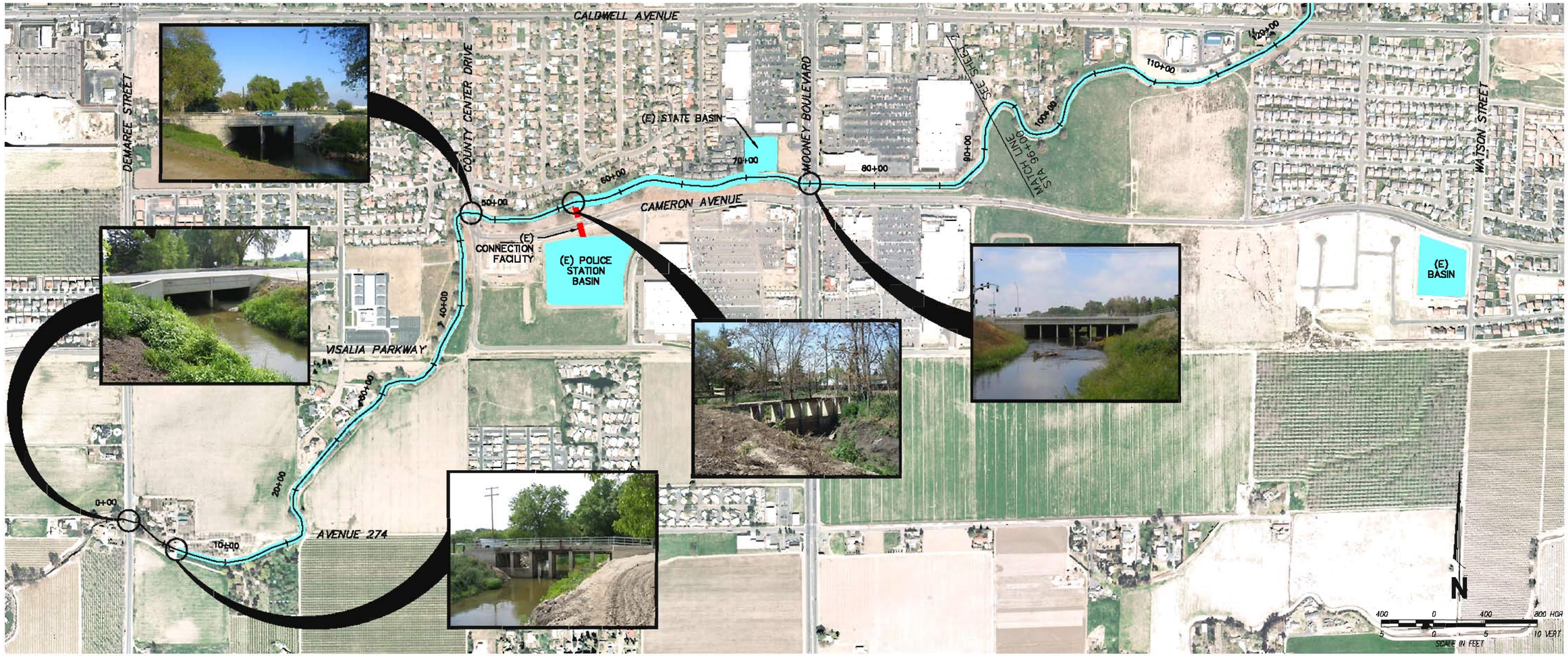
CONCEPTUAL

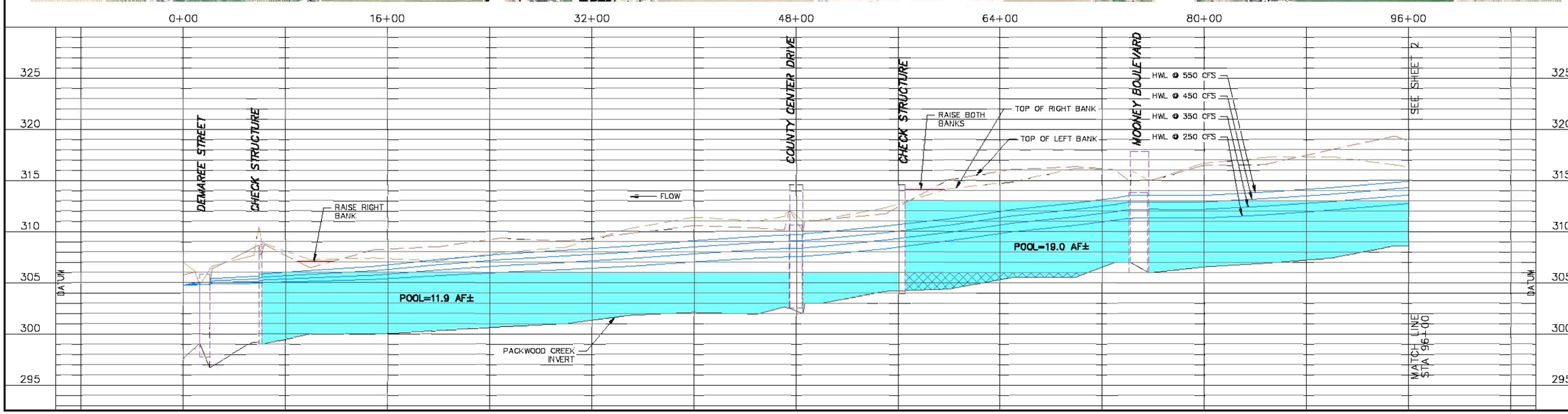
Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
Station 325+00 Check Improvements (13.1 AF)					
	Earth Dam Option				
12	Construct earth dam (include overexcavation and scarification)	70	CY	$30	$2,100
13	Construct half pipe CMP riser	1	LS	$5,000	$5,000
				Total	$7,000
	Check Structure Option				
14	Construct new check structure (no gates)	1	LS	$150,000	$125,000
15	Channel improvements around structure (lining, rip rap, etc.)	1	LS	$20,000	$20,000
				Total	$145,000
	Optional for Basin Recharge				
16	Construct tie-in to proposed basin south of creek	1	LS	$250,000	$250,000

NOTE(S):

Excludes mobilization/demobilization, bonds, insurance, etc.

Excludes costs for proposed basin construction.





08/10/2010

No.	REVISION	BY	DATE

PACKWOOD CREEK
HYDRAULIC STUDY
KAWEAH DELTA WATER CONSERVATION DISTRICT
TULARE COUNTY

PACKWOOD CREEK
PLAN & PROFILE 1

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An Employee Owned Company
2506 ALLUVIAL AVENUE
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559/298-1100 FAX 559/298-1080
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JOB NO: 122510V1	
DWG. NO	
SHEET 1 OF 5	

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PACKWOOD CREEK
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KAWEAH DELTA WATER CONSERVATION DISTRICT
TULARE COUNTY

PACKWOOD CREEK
PLAN & PROFILE 2

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DWG. NO
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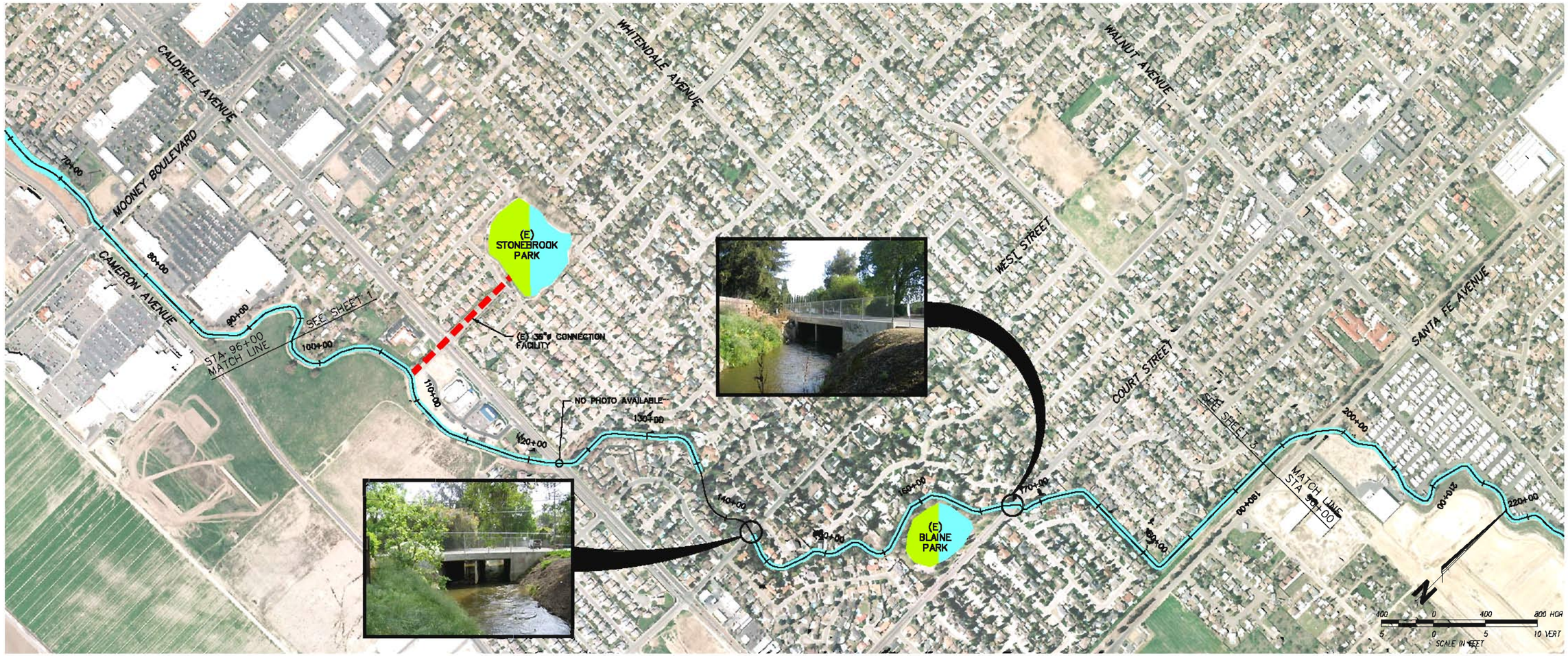

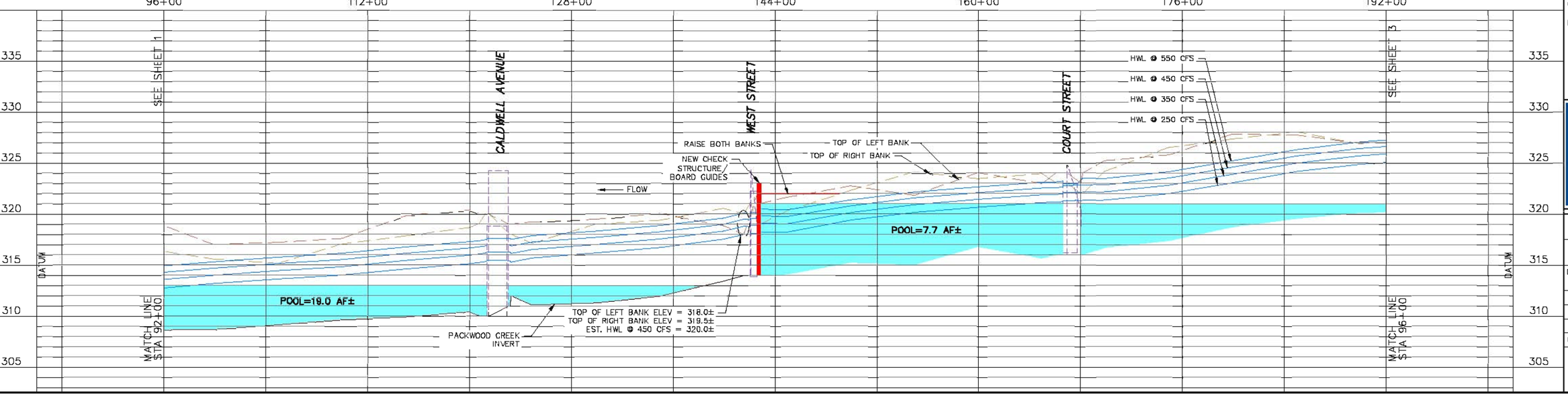

SANTA FE AVENUE

WALNUT AVENUE

BEN MADDOX WAY

LOVERS LANE

RAILROAD TRACKS

PROPOSED BASIN (17 AC±)

PROPOSED BASIN ((E) ORCHARD) (14 AC±)

(E) BASIN PARK

(E) BASIN PARK

NO PHOTO AVAILABLE

SEE SHEET 2

MATCH LINE STA 192+00

SEE SHEET 4

MATCH LINE STA 288+00

170+00 180+00 190+00 200+00 210+00 220+00 230+00 240+00 250+00 260+00 270+00 280+00 290+00 300+00 310+00

N

0 400 800 HOR

5 0 5 10 VERT

SCALE IN FEET

192+00 208+00 224+00 240+00 256+00 272+00 288+00

345 340 335 330 325 320 315

DATUM

SEE SHEET 2

SANTA FE AVENUE

WALNUT AVENUE

BEN MADDOX WAY

PINKHAM STREET

CEDAR STREET

SEE SHEET 4

NEW CHECK STRUCTURE

RAISE RIGHT BANK

TOP OF LEFT BANK

TOP OF RIGHT BANK

FLOW

POOL=13.2 AF±

EST. HWL @ 450 CFS = 327.6±
TOP OF RIGHT BANK ELEV = 326.2±

PACKWOOD CREEK INVERT

HWL @ 550 CFS

HWL @ 450 CFS

HWL @ 350 CFS

HWL @ 250 CFS

NEW CHECK STRUCTURE

RAISE RIGHT BANK

POOL=9.7 AF±

MATCH LINE STA 192+00

MATCH LINE STA 288+00

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PACKWOOD CREEK
HYDRAULIC STUDY
KAWEAH DELTA WATER CONSERVATION DISTRICT
TULARE COUNTY

PACKWOOD CREEK
PLAN & PROFILE 3

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DWG. NO:

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TULARE COUNTY

PACKWOOD CREEK
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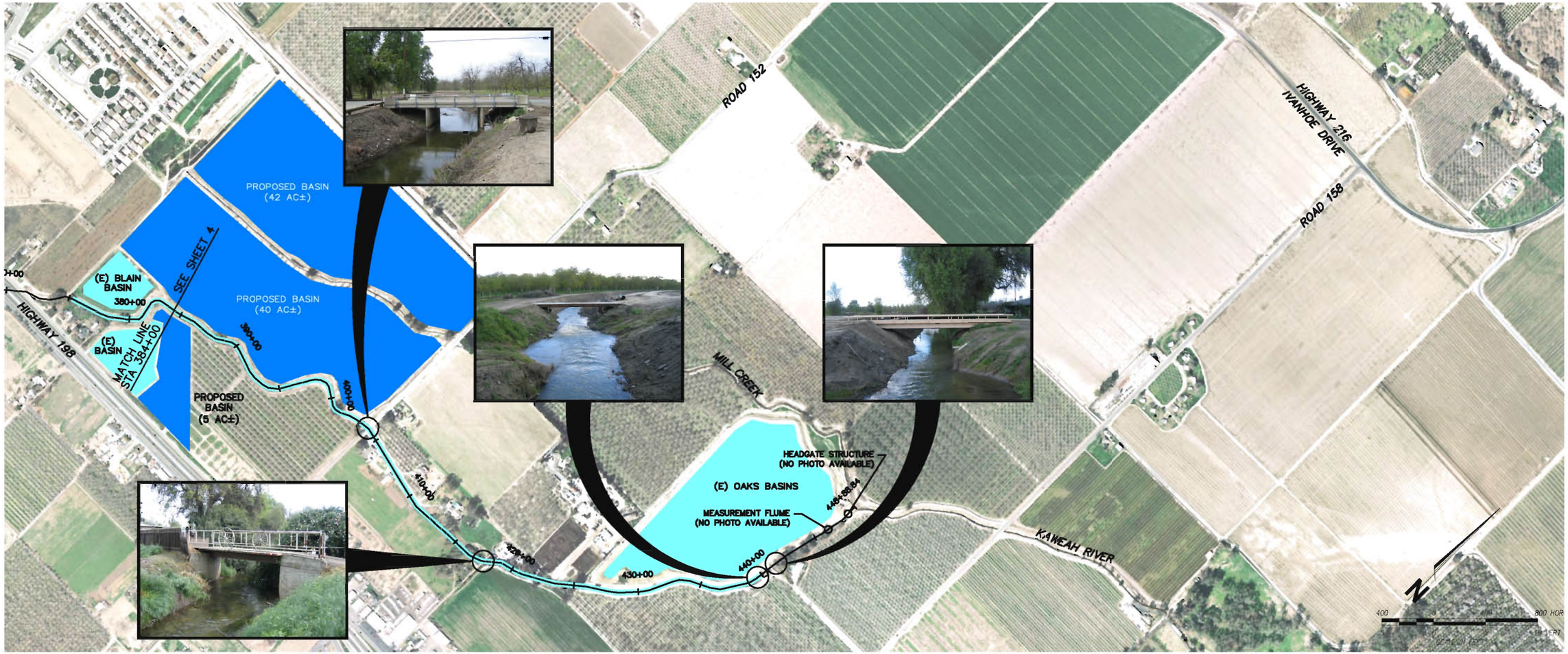

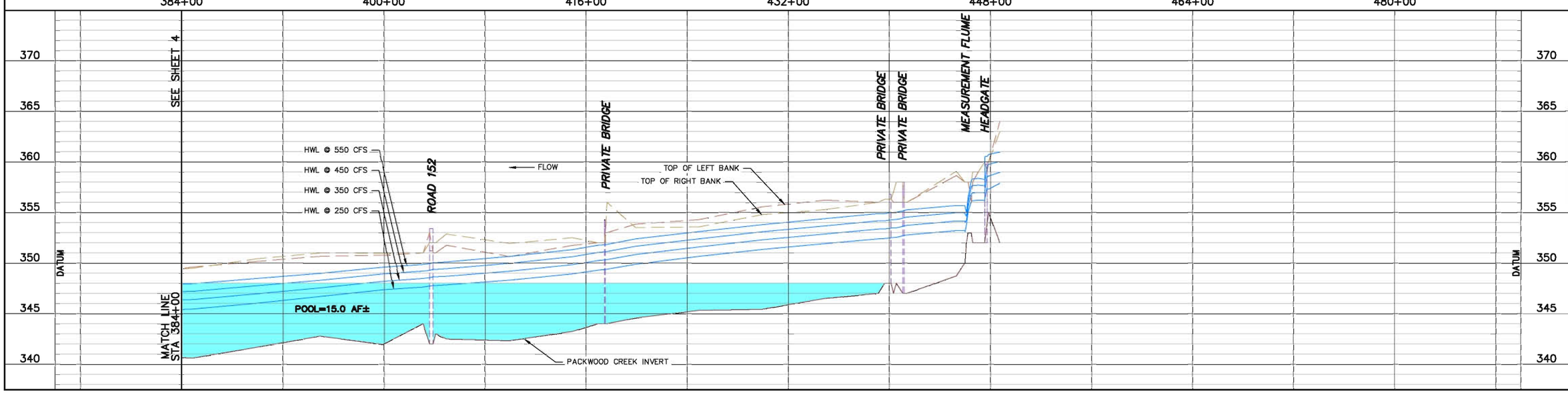

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PACKWOOD CREEK
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TULARE COUNTY

PACKWOOD CREEK
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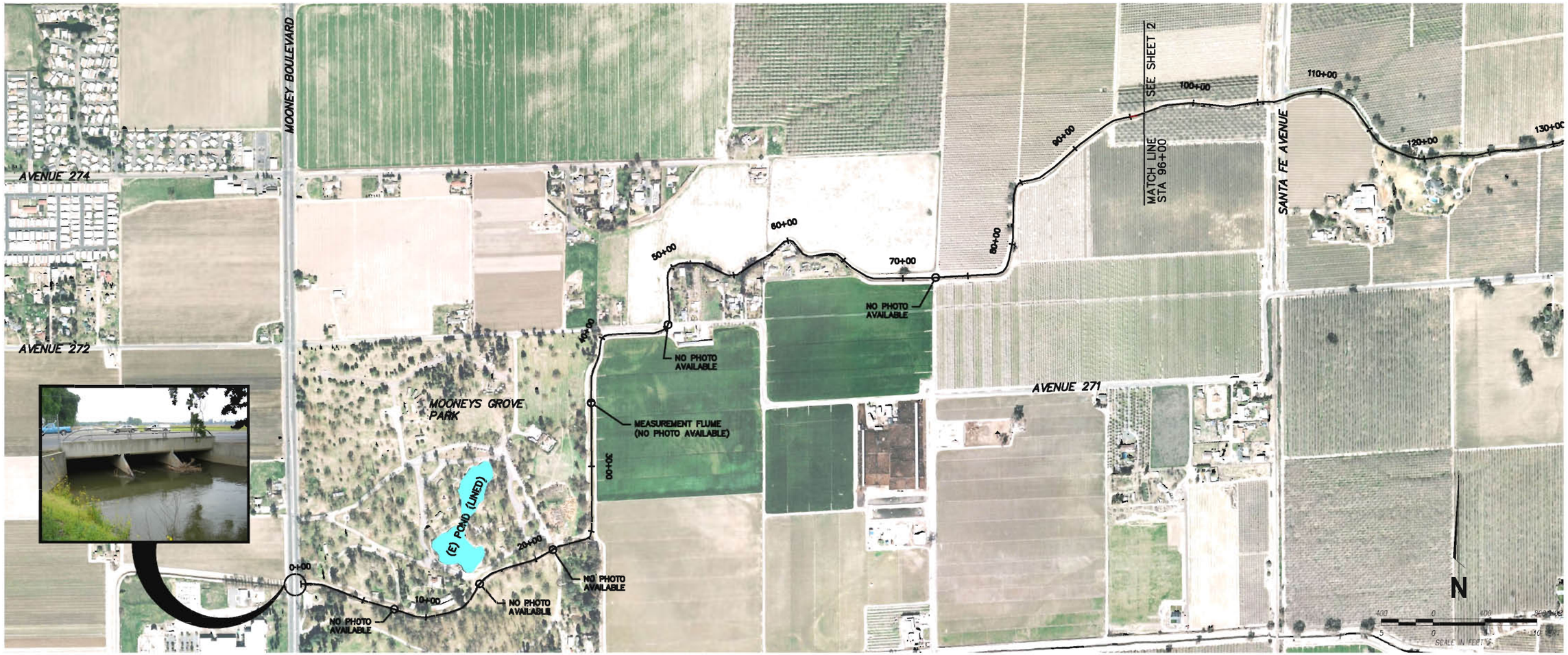

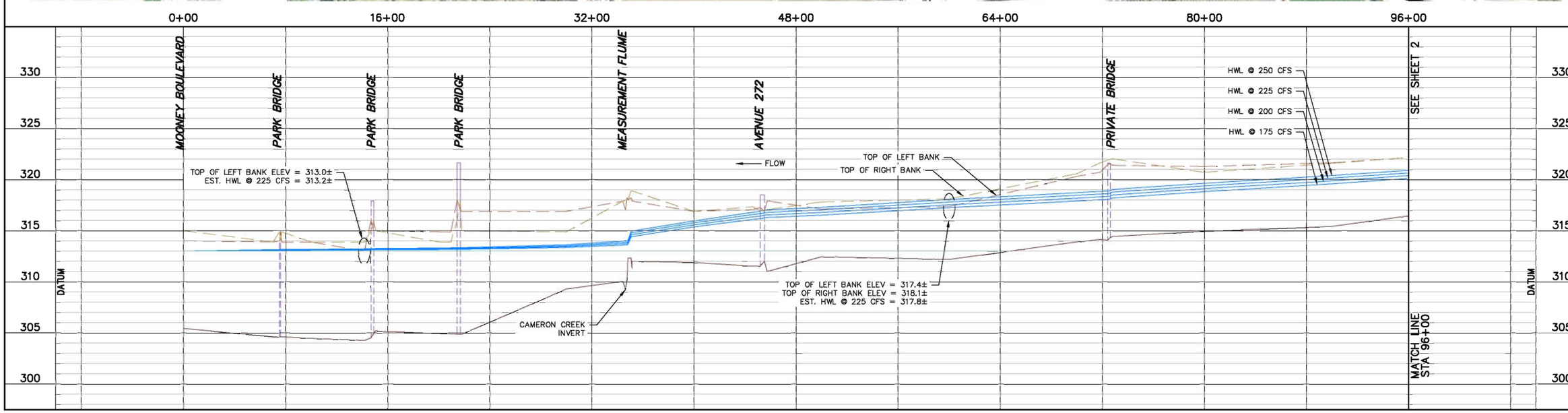

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CAMERON CREEK
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CAMERON CREEK
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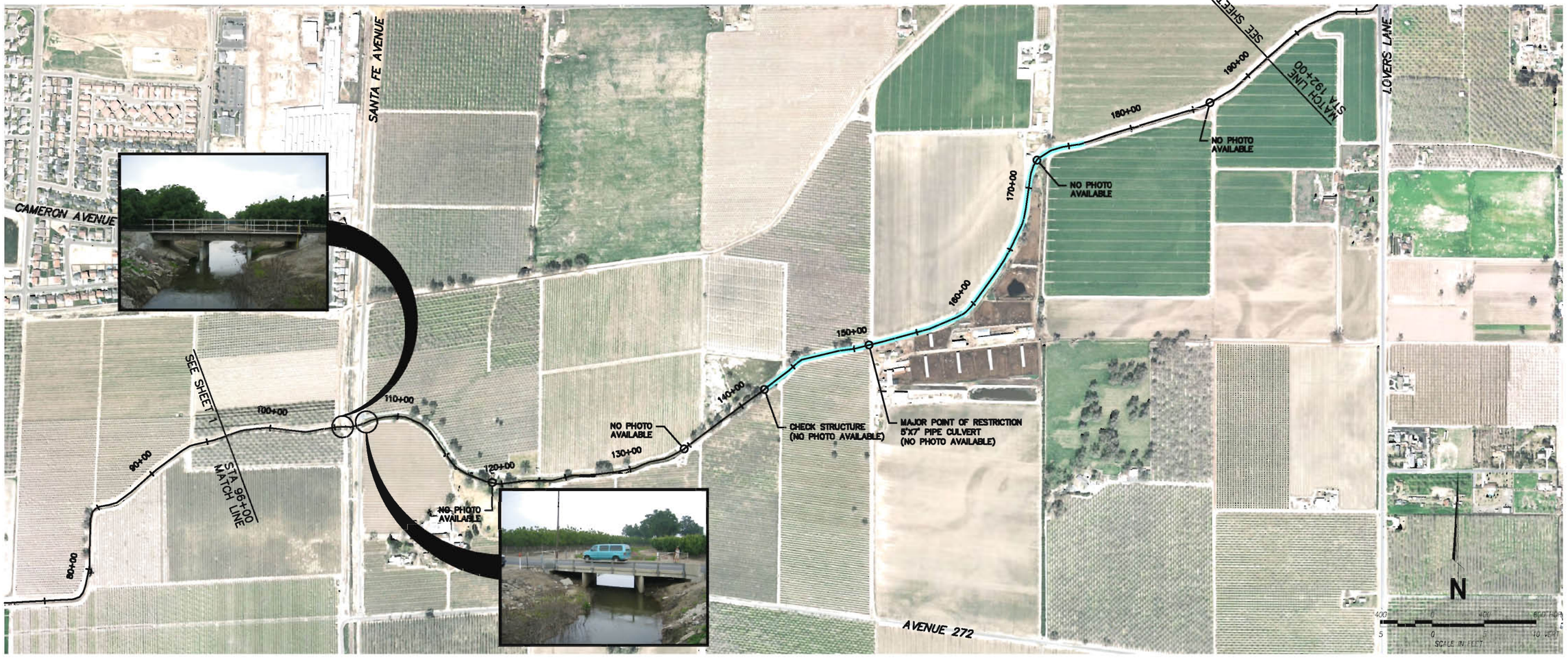

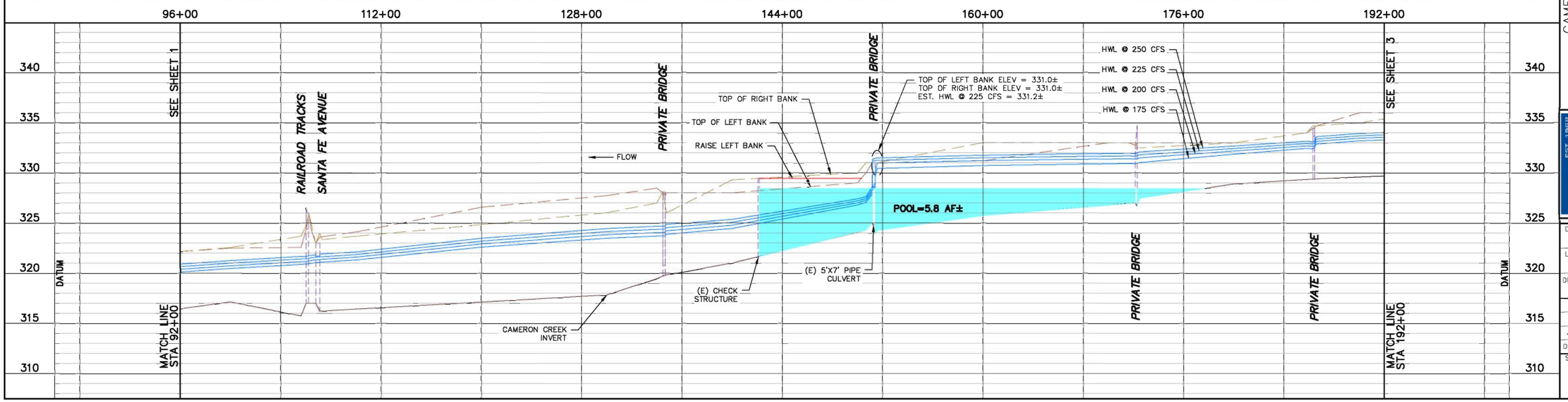

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CAMERON CREEK
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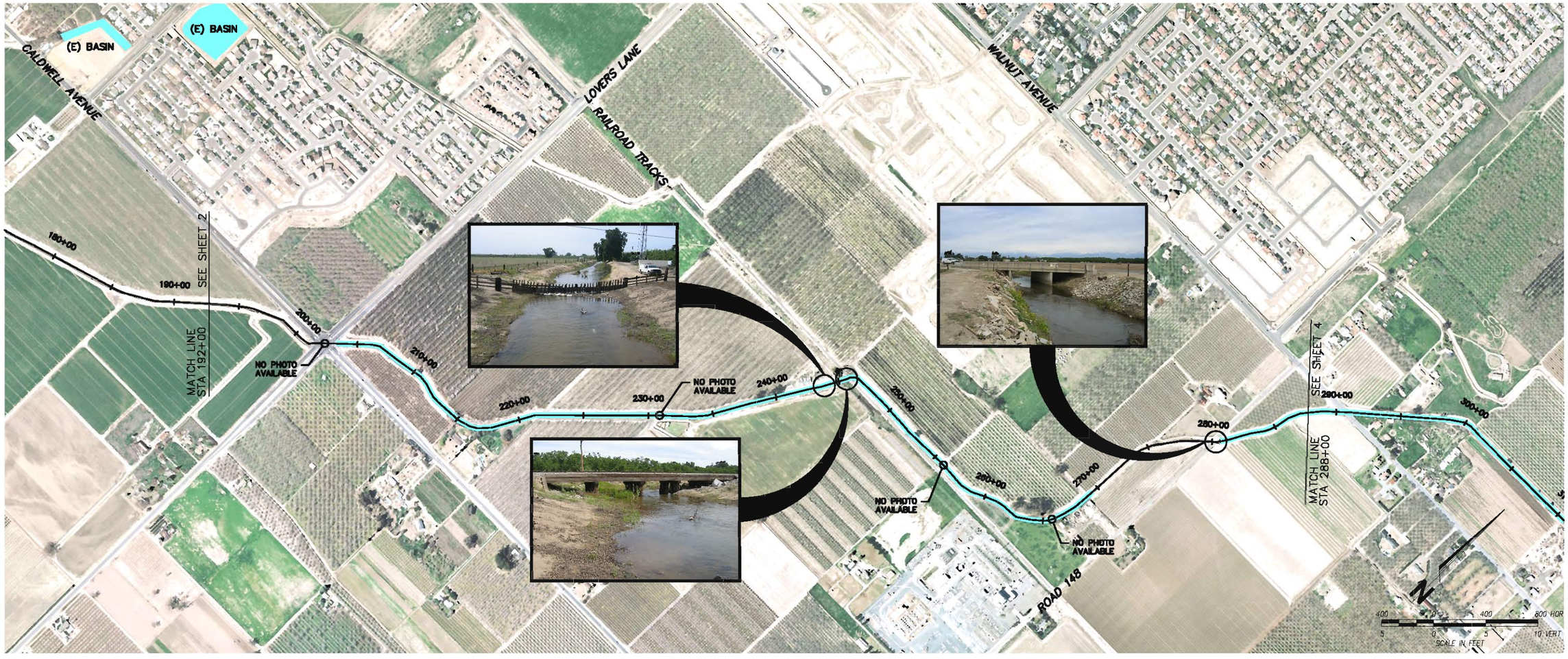

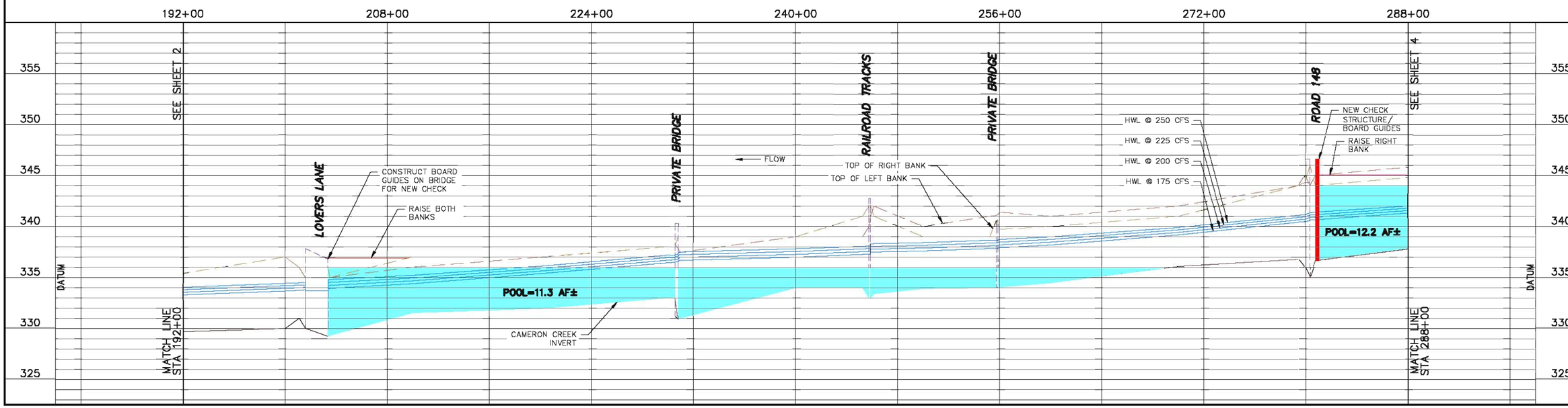

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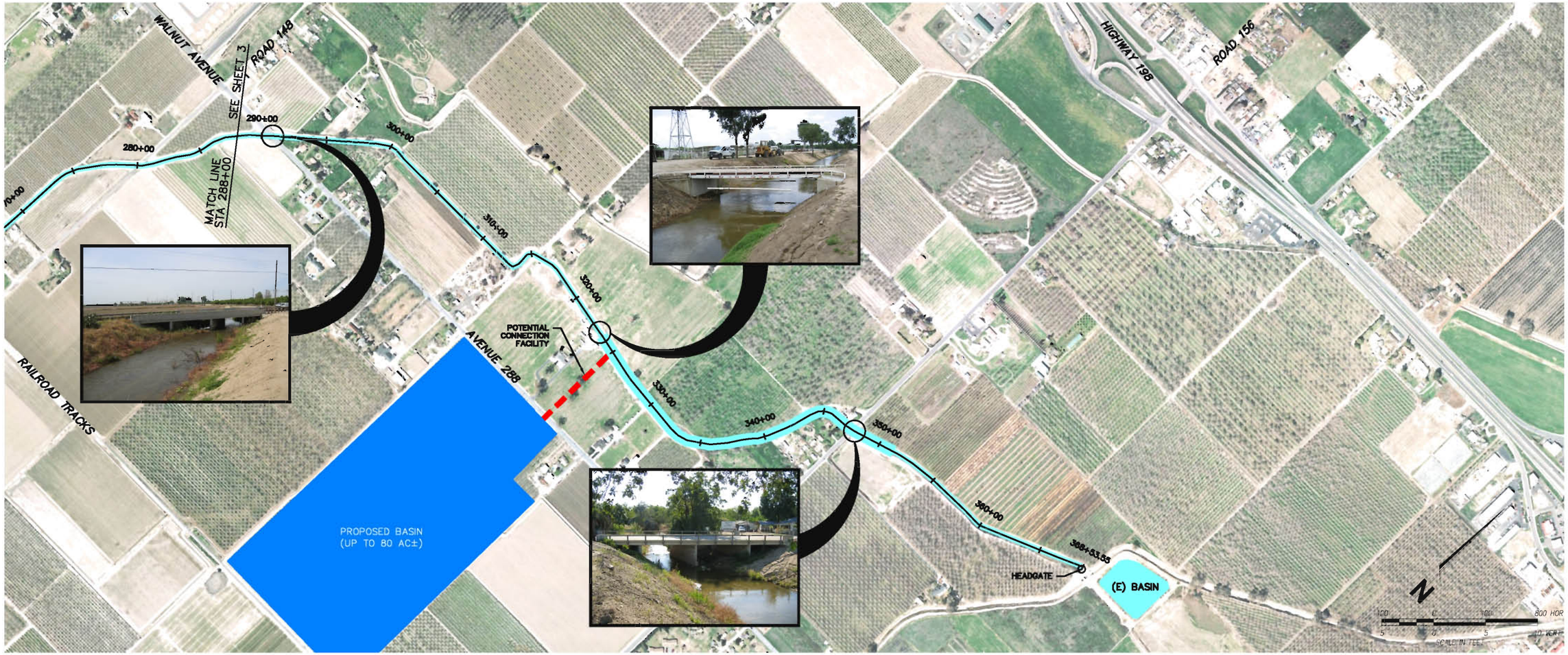

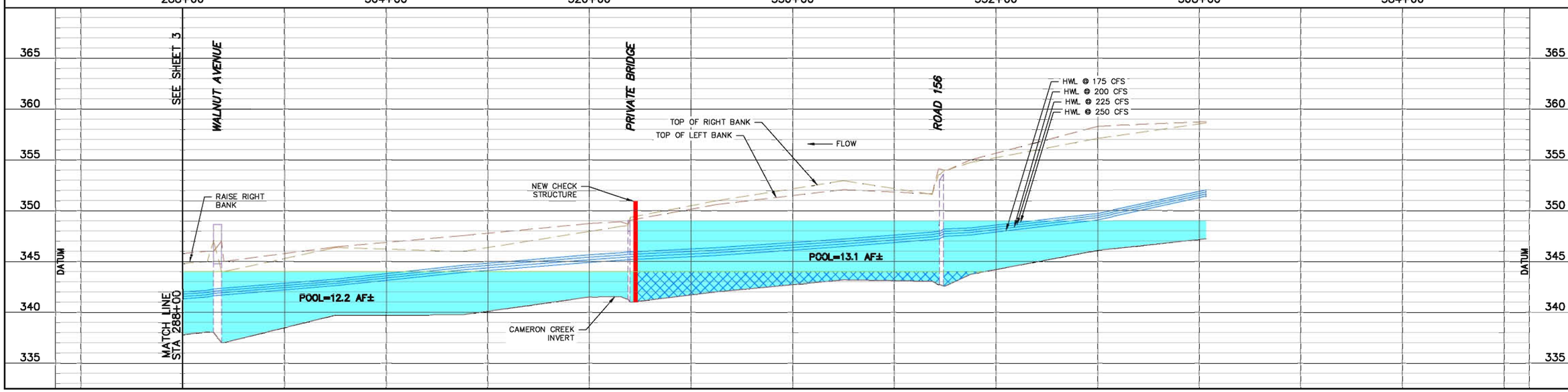

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