Existing Conditions

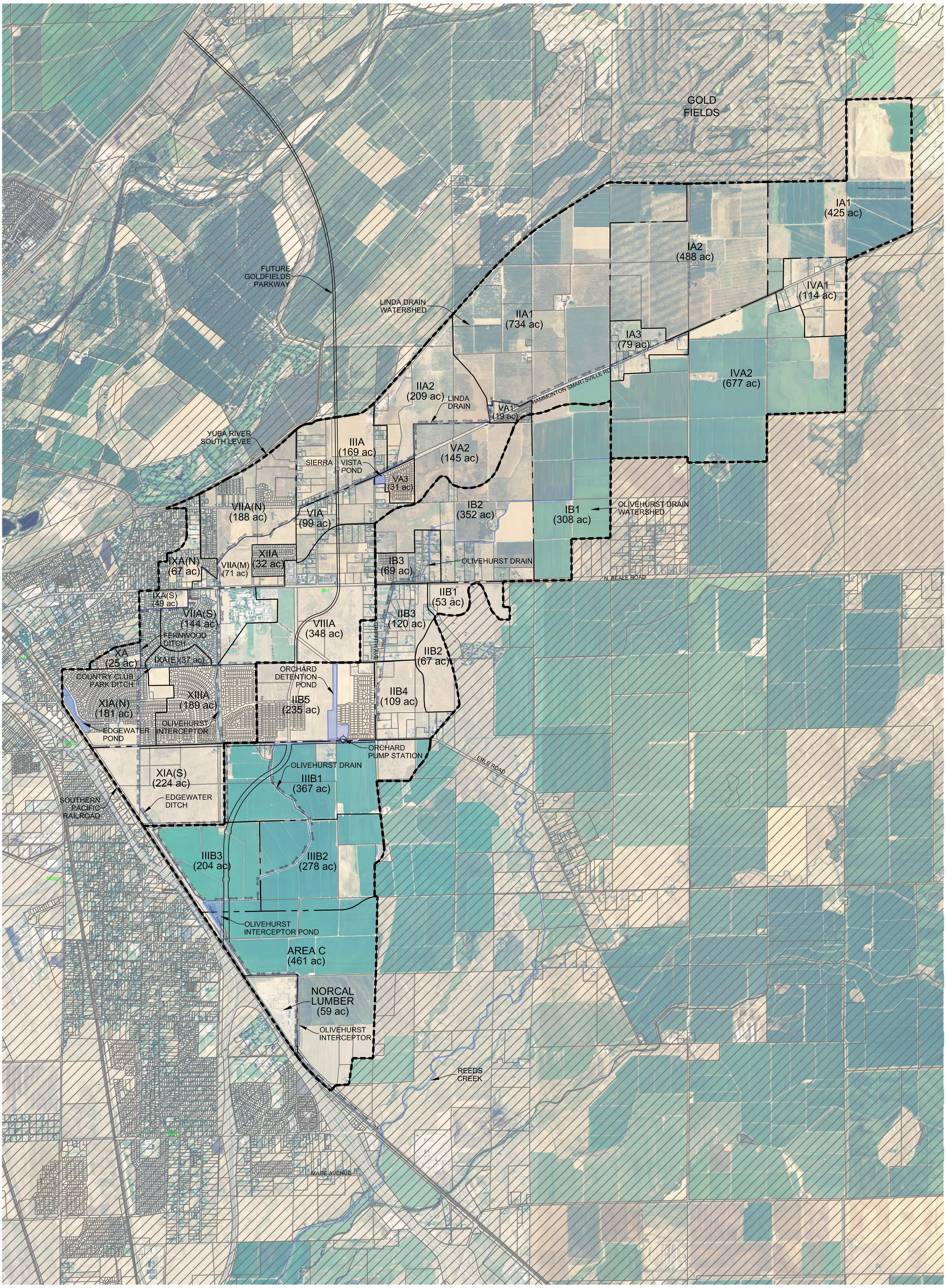
Existing Conditions Hydrologic Models

The shed map for the study area under existing conditions is shown in Figure 2. Subsheds containing the "A" designation drain to Linda Drain (Horseman's Ditch) and subsheds containing the "B" designation drain to Olivehurst Drain (Clark Slough). As can be noted in Figure 2, large regions of the area are in agricultural use, especially in the east and south. The community of East Linda does have significant residential and commercial development, and planning for further development within the East Linda Specific Plan Area was a consideration for this study.

U.S. Army Corps of Engineers HEC-1, version 4.1 utilizing the 10-year 24-hour, 50-year 24-hour, 100-year 24-hour, and 200-year 24-hour storms was used to model rainfall runoff over the entire Linda Drain and Olivehurst Drain watersheds. The hydrologic parameters for the subsheds have been analyzed and determined for this study. Table 1 displays the values used in this study for the existing conditions. Specifics of the hydrologic parameters are discussed in subsequent sections. Figure 3 is a screen shot of the HEC-1 visual model, useful for checking the names, connections and routing used.

Storm Frequency and Degree of Protection

The storm frequency and intensities correspond to the events used by the past studies of the East Linda area. Storms are generally classified by "frequency" or "return period" such a 10-year storm, a 50-year storm, etc. A 10-year storm, for example, is the intensity of storm which will occur an average of once in every 10-year period as computed from available data. It might occur this year, next year, or any year, or even twice in one year; but it will have a long-term average occurrence of once in 10 years. The greater the "return period," the greater the intensity of rainfall. The precipitation totals used for this study are listed in Table 2. The rainfall is based on the historic data from the "Wheatland 2 NE" station, which is generally used for studies in southern Yuba County. The hydrographs have been computed well past the end of the storms so that the hydraulics can be studied long enough to catch peak storage conditions. As an example, the 24-hour storms include hydrograph runoff simulations for 120 hours. Storm precipitation values utilized in the HEC-1 model were subjected to no spatial variability, which conservatively assumes the storm falls over the entire study area simultaneously.



LEGEND

- PUMP STATION
- LATERAL
- DETENTION POND
- DRAINAGE BASIN BOUNDARY

0 375 750 1500 3000

FIGURE 2
SOUTH YUBA DRAINAGE
MASTER PLAN
CURRENT CONDITIONS
SUBSHED MAP
YUBA COUNTY, CALIFORNIA

Table 1 – Existing Conditions Runoff Parameters

Olivehurst Drain - Runoff Parameters
Existing Conditions 2011

Shed	Area acres	Area sq. mi.	Drainage Description	Main Soil Groups	SCS CN	% Impervious	Computed SCS Lag Hours	Computed Peak Runoff, cfs 10yr, 24hr	100yr, 24hr
IB1	308.0	0.4813	Rice	75% D; 25% B	78.5	1	8.528	22	41
IB2	351.5	0.5492	Orchard/Grassland	60% D; 40% B	70.6	2	2.437	32	71
IB3	68.8	0.1075	Rural Residential/Open	50% D; 50% B	77.5	15	1.124	19	33
IIB1	53.4	0.0834	Rural - Low Ponding	75% B; 25% D	72.8	2	0.556	13	28
IIB2	77.3	0.1208	Rural - Low Ponding	B	69.0	1	1.044	9	23
IIB3	120.1	0.1877	Rural Residential - Griffith	60% D; 40% B	77.6	15	1.509	28	49
IIB4	108.7	0.1698	Ranch Grassland	60% D; 40% B	78.0	1	1.254	23	45
IIB5	235.5	0.3680	MDR Montrose/Orchard	D	87.0	38	0.312	201	306
IIIB1	366.9	0.5733	Rice	90% D; 10% B	80.0	1	5.419	39	70
IIIB2	277.7	0.4339	Rice	85% D; 15% B	79.5	1	3.156	39	72
IIIB3	204.2	0.3191	Rice	D	81.0	1	5.066	24	42
Area C	461.0	0.7203	Rice	83% D; 17% B	79.3	1	3.50	60	112
NorCal	59.0	0.0922	NorCal Lumber	87% D; 13% B	87.8	10	0.20	54	86

Linda Drain - Runoff Parameters
Existing Conditions 2011

Shed	Area acres	Area sq. mi.	Drainage Description	Main Soil Groups	SCS CN	% Impervious	Computed SCS Lag Hours	Computed Peak Runoff, cfs 10yr, 24hr	100yr, 24hr
IA1	425.0	0.6641	Rice	62% D; 38% B	77.2	2	4.586	43	81
IA2	488.2	0.7628	Orchards - Ponding	85% B; 15% D	76.2	2	3.636	53	102
IA3	79.3	0.1239	Rural Residential/School	60% D; 30% B; 10% C	76.4	5	1.295	16	31
IIA1	734.0	1.1469	Orchards/Ag.	72% B; 15% A; 13% D	56.8	1	7.474	12	34
IIA2	208.7	0.3261	Mixed Orchards/Farm	44% A; 30% B; 26% D	52.0	1	5.955	2	7
IIIA	169.2	0.2644	Mixed Rural Residential	82%D; 12% B; 6% A	77.8	2	2.359	26	48
IVA1	113.9	0.1780	Rural Residential	D	82.0	5	1.038	36	62
IVA2	677.3	1.0583	Rice	D	81.0	1	4.170	88	158

Table 1 – Continued

Shed	Area acres	Area sq. mi.	Drainage Description	Main Soil Groups	SCS CN	% Impervious	Computed SCS Lag Hours	Computed Peak Runoff, cfs 10yr, 24hr	Computed Peak Runoff, cfs 100yr, 24hr
VA1	19.1	0.0298	Trailer/Residential	B	68.0	20	0.663	5	9
VA2	145.1	0.2267	Open, Orchards - Ponding	85% D; 15% B	75.9	2	1.076	30	60
VA3	30.7	0.0480	MDR Sierra Vista and Pond	D	87.0	35	0.296	26	40
VIA	99.2	0.1550	Mixed Rural Residential	89% D; 11% B	80.1	5	1.220	26	46
VIIA(M)	71.0	0.1109	Mostly Ag/Some Residential	83% D; 17% B	77.8	4	0.83	20	38
VIIA(N)	188.0	0.2938	Mixed Rural Residential/Ag	83% D; 17% B	78.9	10	0.83	61	109
VIIA(S)	144.0	0.2250	Residential/College	71% D; 29% B	84.5	35	0.74	74	115
VIIIA	348.0	0.5438	Pasture/Some Rural Residential	83% D; 17% B	78.8	6	0.80	109	199
IXA(E)	37.0	0.0578	Mixed Residential/Open	60% D; 40% B	80.8	25	0.23	27	44
IXA(N)	67.0	0.1047	Mixed Residential/School	80% D; 18% B; 2% A	84.3	30	0.43	44	69
IXA(S)	49.0	0.0766	Mixed Residential	67% D; 33% B	83.0	30	0.23	39	63
XA	25.0	0.0391	Mixed Residential	67% D; 33% B	81.4	30	0.33	17	28
XIA(N)	181.0	0.2828	W. Edgewater Residential/Pond	83% D; 17% B	85.0	35	0.50	116	181
XIA(S)	224.0	0.3500	Open Pasture	70% D; 30% B	79.5	1	0.75	71	131
XIIA	32.0	0.0500	College View Residential	73% B; 27% D	85.0	40	0.25	27	42
XIIIA	189.0	0.2953	E. Edgewater Residential	63% D; 37% B	83.6	40	0.50	121	188

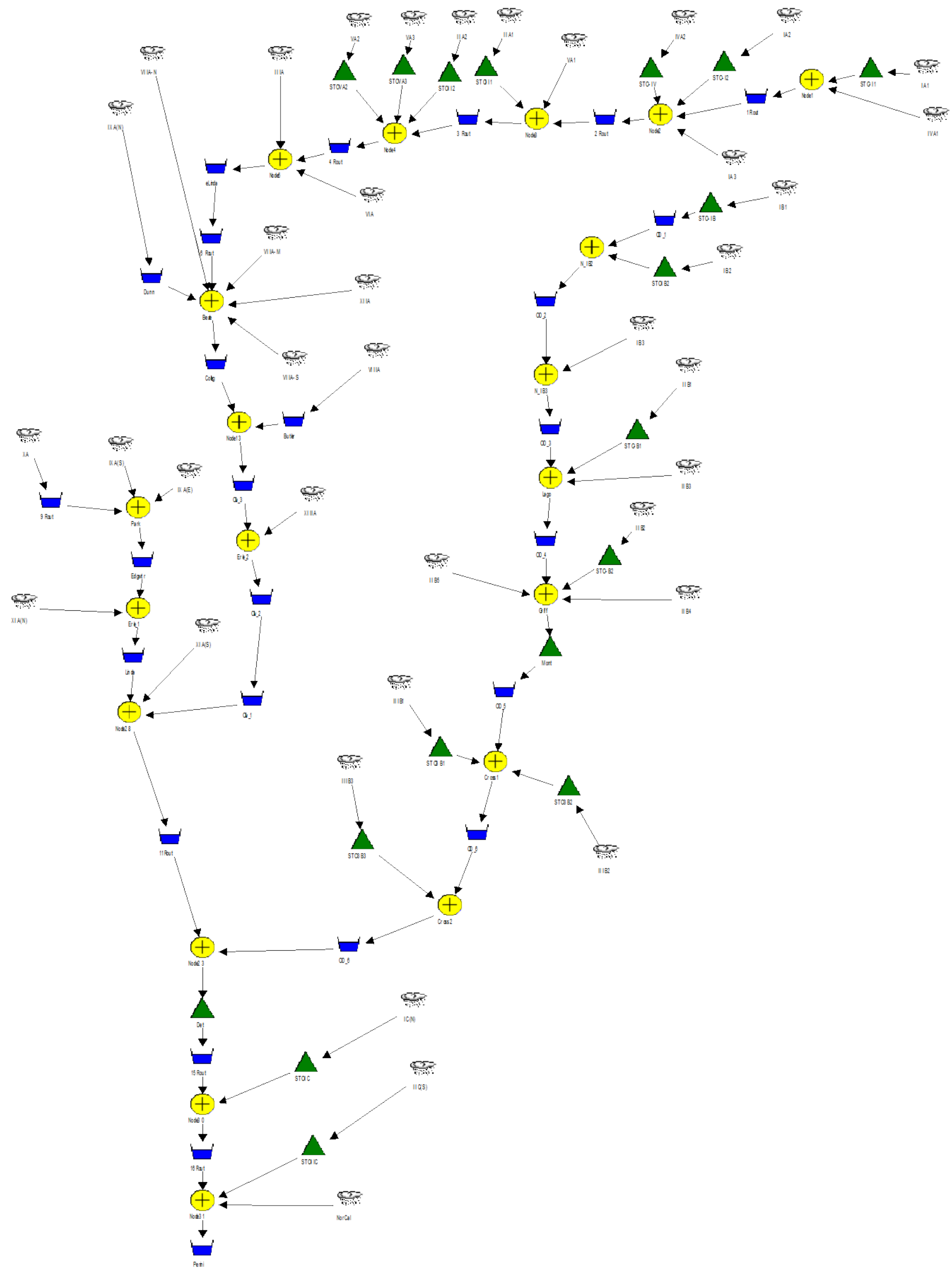


Figure 3 – Existing Conditions HEC-1 Model Screen

Table 2 – Rainfall Frequency Duration Design Storms for this South Yuba Drainage Master Plan

Return Period (years)	Storm Duration	Annual Exceedance Probability	Rainfall* (inches)
10	24 hours	10%	2.95
50	24 hours	2%	3.81
100	24 hours	1%	4.16
200	24 hours	0.5%	4.51

*Wheatland 2NE Gage

Infiltration Rate Characteristics

The amount of infiltration is related to the permeability of the surficial soils, the local geomorphology, and the amount and type of vegetation cover or canopy. Soil Survey maps prepared for the Yuba County Soil Conservation Service (hereinafter referred to as "SCS") were used to determine the extent of Type A, B, C, and D hydrological soil groups within the watershed. The areas of each respective soil group were then summarized for each watershed and assigned SCS curve numbers corresponding to a Type II antecedent moisture condition (AMCII), representing the average curve number. As an example, Type "A" (relatively pervious) soils are predominantly localized sand and gravel areas, while the Type "D" (relatively impervious) soils are generally poorly drained clays. The soils in the study area have been classified by the SCS as Types A, B, C and D, with type D being more common than the other three. The soil characteristics are detailed in Table 1.

Runoff Potential – Curve Numbers and SCS Lag Time

Runoff potential is directly related to land use, and for this study has been analyzed for existing conditions. The SCS curve number was established for each subshed based on soil type and land use. The curve number was used in addition to help establish the SCS lag time. The SCS lag time is generally considered to be approximately 60% of the time of concentration. The SCS lag time was used directly in the HEC-1 simulation and influences peak runoff significantly. The subsheds with the lowest composite Curve Numbers (CN) were undeveloped orchards with A Type soil resulting in a CN as low as 52. The developed CN varied widely depending on the land use, and the percentage of the drainage basin actually developed. The highest values used were for the areas of concentrated development and poor Type D soils. Most of the drainage subsheds used area-weighted CN values between 60 and 80. The curve numbers and lag times used are detailed in Table 2.

Existing Conditions Runoff Hydrographs – Peak Flows

The primary purpose of the runoff hydrographs from the HEC-1 models was to produce the input at numerous locations for the HEC-RAS model of each watershed. The infusion of the runoff hydrographs has been implemented through HEC DSS (Data Storage System). Some of the inputs are from specific subsheds and others are routed hydrographs as various subsheds collect and route to main channels. This is discussed further in the report in the hydraulic model section. The peak runoff for the 10-year and 100-year storms from each shed as predicted by HEC-1 is also shown in Table 1 for existing conditions. The results of the HEC-1 computer model for existing conditions are provided in the Appendix A of this report.

Agricultural Ponding

A large portion of the contributing drainage area, particularly to the east is in farm lands. Much is in rice fields, some in pasture and some in orchards with perimeter dikes. In the January 1980 "Hydrology Review Report" by the Corps of Engineers (Ref. 12), it was stated:

> *"A large portion of the area is farmed to rice. Rice fields are non-contributing to downstream peak flows because the rice fields are completely diked and prevent rapid runoff."*

The Corps of Engineers' approach was to reduce the area by 50% in the hydrologic analysis. The approach used by MHM Incorporated in this study is to treat a portion of the diked fields as ponds which will overflow once a 4-inch depth is reached. Each pond area also has a limited low drainage route which ensures that all runoff will reach drainage ditches at some point. Thus, in the HEC-1 models, numerous storage nodes are included and are shown in the Figure 3 schematic as represented by the green triangles. The exceptions are "STOVA3" which represents the Sierra Vista detention pond, "Det" which represents the Olivehurst Interceptor Pond, and "Mont" which represents the Montrose/Orchard detention pond. The areas of agricultural ponding were estimated from aerial photographs and field visits. Estimated ponding areas ranged from 10% for several western subsheds to 95% for several rice areas in the east part of the drainage. Table 3 presents a summary of the subsheds which have ponding above 10% and are in the hydrologic models.

Table 3
Ponding Models Used in HEC-1 for this Study
(Subsheds not listed were assumed to have insignificant ponding)

Drainage Subshed	Total Area, Acres	Estimated Percent Ponding	Area of Ponding, Acres
IA1	425	95	400
IA2	488	33	162
IIA1	734	33	242
IIA2	209	33	70
IVA2	677	95	644
VA2	145	33	48
IB1	308	95	293
IB2	352	50	176
IIB1	53	50	27
IIB2	77	50	38
IIIB1	367	90	330
IIIB2	278	90	250
IIIB3	204	90	184
Area C	461	90	415

The net effect in regard to peak flow predictions may be fairly similar to the Corps' approach of reducing the effective area by 50%, however the timing of peaks is more accurate with the ponding approach used here. Photograph 17, taken on December 31, 2005 shows an example of agricultural ponding in shed IIA1. The storm event of December 30/31, 2005 represented a storm of approximately an eight-year return period.

Photograph 17 – Agricultural ponding December 31, 2005 in Linda Drain subshed IIA1.

Existing Conditions Hydraulic Models

U.S. Corps of Engineers HEC-RAS 3.1.3 unsteady models for all channels in this drainage study area have been developed for the existing conditions. Most of the reaches were completed in the 2006 East Linda LOMR and several additional upper reaches were completed as part of the 2010 PAL Area LOMR. The models developed for this study combine those separate previous models. The existing conditions models include all completed subdivision development and drainage improvements to date.

The dynamics of the drainage areas studied here are strongly influenced by the pond and channel storage areas, and by the time lags associated with the large distances involved. The only way to correctly model the dynamic nature of the ponds and linear detention channels is to use unsteady HEC-RAS modeling. Thus All HEC-RAS modeling done for this study has been unsteady. The HEC-RAS stationing for the channels is shown in Figure 4(a) located at the back cover of this report. The upstream limit of the hydraulic model on Linda Drain is at Station 455+27 at Brophy Road (see earlier Photograph 1). The upstream limit of the hydraulic model on Olivehurst Drain is at Station 206+02 (see earlier Photograph 10). Linda Drain meets the Olivehurst Interceptor at Station 228+00. Olivehurst Drain at Station 20+00 exits into the Olivehurst Interceptor at Station 119+00 on the Interceptor (see earlier Photograph 7). The downstream limit of the hydraulic model is at Station 6+71 on the Olivehurst Interceptor at the location it meets the backwater from Reeds Creek (see earlier Photograph 9). All referenced stationing is in feet.

The HEC-RAS models of this study were built using three main sources of geometric information: (1) Extensive field topographic surveys completed by MHM Incorporated conducted from the summer of 2005 through the winter of 2011, (2) the LiDAR maps produced in the Towhill report, and (3) the improvement plans for the developments and the drainage facilities. All bridges and culverts in the channels were surveyed, including invert elevations, sizes, and material. Those were used to build the HEC-RAS model. Topographic information outside the channels was gathered in three ways. In some areas, MHM ground survey crews gathered elevations. The other sources of topographic information were the USGS Quad Maps and the LiDAR maps produced in the Towhill report of 2006. The datum used for all topographic work (including the LiDAR) was NGVD 29. The HEC-RAS models utilize the same datum. For reference, in the location of this study, the conversion to elevations based on the NAVD 88 datum is 2.26 feet greater. An elevation of 100.00 feet reported under NGVD 29 would convert to 102.26 feet under NAVD 88.

The models required an extensive amount of optimization in order to produce stable results. The typical spatial slice in the models is about 100 feet of channel length. The typical time slice for the simulations is around 15 seconds, although some models run at 30 seconds and some require as small as 10 seconds. Various base flows are used in the models in the upstream reaches, and initial conditions were set to produce a restart file for each simulation. As mentioned in the hydrology section of this report, input hydrographs to HEC-RAS extend in time well past the end of the storms. For example, the 24-hour storms use hydrograph inputs of 120 hours and simulation outputs for 92 hours. This insures that peak storage conditions are reached in the simulations.

The existing conditions model for the study area was run for four storm events: The 10-year 24-hour storm, the 50-year 24-hour storm, the 100-year 24-hour storm and the 200-year 24-hour storm.

Modeling Assumptions

The items described below are some of the modeling assumptions and approaches that were used to perform the hydraulic analysis for this South Yuba Drainage Master Plan. For the most part these were the same assumptions used in the 2006 East Linda LOMR and the 2010 PAL Area LOMR for the area.

> Culverts — There are many road crossings on the channels. These include farm crossings, driveways, country roads, and other roads within new subdivisions. All culverts were modeled with the "Highest U.S. E.G." option as opposed to specifying either "Inlet control" or "Outlet control". Inverts and diameters of all culverts were collected during field surveying. Standard values of entrance and exit losses were utilized. Mannings "n" values used ranged from 0.013 to 0.024

depending on size and material. Ineffective areas were used upstream and downstream at all crossings where the cross sections allowed such an approach.

Channel Characteristics and Roughness Factors — Some of the channels in the model are man-made while others are primarily natural. The manning “n” values used for this study ranged from 0.035 to 0.04 in the channels and ranged from 0.06 to 0.08 for the overbank area. Standard values of 0.1 and 0.3 were used for contraction and expansion coefficients respectively.

Flows — Input flow hydrographs were determined from the HEC-1 analysis at a large number of locations and connected to HEC-RAS via the DSS system. The hydrographs were used as boundary conditions (in some cases Flow Hydrographs, in other cases Lateral Inflow Hydrographs, and in others Uniform Lateral Inflows) for the HEC-RAS unsteady flow data. Stage Hydrographs were used as the boundary condition at the downstream end of the Olivehurst Interceptor.

Base Flows – Base flows on the order of 1 cfs were used at the upstream ends of reaches. The Base Flows would normally be removed at appropriate downstream pump stations by the use of a virtual pump operating continually. However, since in this study there are no pump stations at the downstream limits, the base flows were not removed. This approach is somewhat conservative.

Initial Conditions — Because unsteady HEC-RAS models can become unstable in the transition from a dry channel to developed flow, the channels in the models have initial flow values set. The initial conditions were set between 1 to 10 cfs. Initial conditions in the storage areas have generally been set at the lowest level to which they can drain naturally, or, in the case of Orchard Pond, the pumps-off level. The pond initial conditions used were: Sierra Vista at 65 feet (NGVD 29), Orchard at 54 feet, Edgewater at 59 feet and 55 feet for the Olivehurst Interceptor Pond. Once initial conditions are run once to produce a restart file, the initial conditions for subsequent runs are handled by that restart file. Restart files generally produce more stable results.

Ponds — While some storage in the HEC-RAS models is handled by the topography of the channel cross sections, several other ponds are included in the models as computational storage, providing a significant amount of storage to the system. The volume vs. elevation curves for those ponds were taken from topographic surveys or from the design drawings verified by field surveys.

Backwater — The downstream boundary conditions at Station 6+71 on the Olivehurst Interceptor were stage hydrographs based on the 1981 FIS. Specifically, the levels used were: 60.6 feet (NGVD 29) for the 200-year event, 60.0 feet for the 100-year event, 58.8 feet for the 50-year event and 57.1 feet for the 10-year event. These values are conservative. The Bear River Setback Levee Project completed in 2008 has lowered the peak water surface elevations in the WPIC and this in turn implies lower levels at Reeds Creek. Analysis by MBK Engineers (Ref. 4) done in 2010 indicates that the 100-year peak water surface at the north end of the WPIC should be reduced by about 1.1 feet due to the setback project. Because the hydraulic analysis has not been completed from the WPIC upstream on Reeds Creek it is not known how much the values at Reeds Creek should be lowered. Even though the expectation might be that the 100-year value of 60.0 would likely be reduced by around one foot, without the analysis this study continues to use the 1981 FIS values.

Pump Stations — There are no pumps at the line of protection in the study area of this report. All stormwater pumping is internal to this study. The pump station within the boundary of this report's study area is located in the Orchard Pond. The pump station is not affected by external water levels; the water levels in the local rivers and/or the WPIC have no bearing on the pump station performance as the pumps are miles upstream.

Gravity Flow to Exterior Rivers — All runoff from the watershed areas of this study conveys by gravity to the Olivehurst Interceptor, then to Reeds Creek, then to the Western Pacific Interceptor Canal (WPIC), and finally into the Bear River. As discussed above, this study conservatively continues the use of the backwater elevations from the 1981 FIS.

Levees — The drainage area studied is protected by the Yuba River levee and Goldfields. All models used rely on an underlying assumption that the levees are intact and functioning properly. This work represents just the internal drainage.

The existing conditions hydraulic model was used to produce the 100-year floodplain for this drainage study. The HEC-RAS geometry screen for the hydraulic model is shown in Figure 4 to give an idea of the components included in the models. The existing conditions model includes all development and drainage improvements completed to date. Although the Sierra Vista, Edgewater, Montrose and Orchard subdivisions currently are only partially built, they are treated as completely built out in this study since the ponds and facilities were designed to handle full build-out. The stationing used in HEC-RAS can be seen in Figure 4(a) which is located as an enclosure at the back cover of this report.

Even though this is a discussion of the current conditions models, with an eye to the future alternatives, the Orchard Pond takes on some extra significance since it will route much of the runoff from the development of the East Linda Specific Plan Area. The main connection from upper Olivehurst Drain to the Orchard Pond is an entrance structure just east of the south end of Griffith Avenue. The structure was shown earlier in Photograph 12. The structure feeds two 4-foot diameter concrete pipes which feed underground to the pond. The pond is nominally a 100 acre-foot facility with three main pumps with capacity 20 cfs each. The pump station was shown in Photograph 14. The pumps deliver to a box culvert of 8 feet wide by 2 feet high. High water in the pond can also overflow to the box structure and gravity flow to the downstream (Clark) reach of Olivehurst Drain just south of Erle Road. The outfall from the pond at Olivehurst Drain on the south side of Erle Road was shown in Photograph 15. The existing conditions HEC-RAS model uses all the known dimensions, elevations and pump parameters.

The three other ponds in the model do not have pumps. Edgewater Pond acts as a surge pond for the Edgewater Subdivision and drains via pipes underground to the piped historic Linda Drain route. The Olivehurst Interceptor Pond acts as a surge pond for the interceptor with a large open lateral connection. Sierra Vista Pond is purely a detention facility for the subdivision. The small diameter culvert connection meters flow from there to the Linda Drain and a flap gate prevents flow from Linda Drain back to the pond. The existing conditions HEC-RAS model uses all the known dimensions, elevations and other characteristics of these three pond connections.

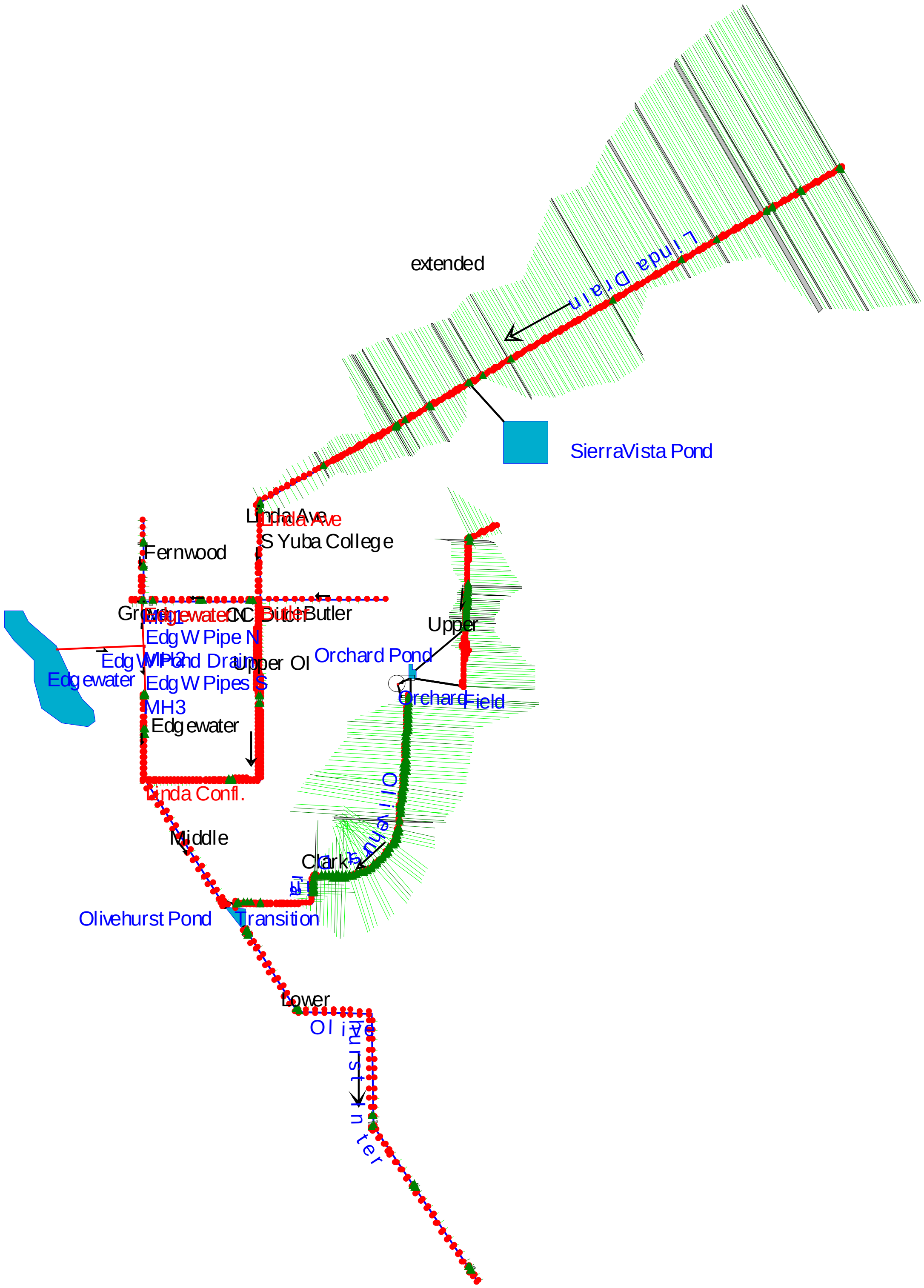


Figure 4 – HEC-RAS Geometry Screen for this Study under Existing Conditions.

Predicted Peak Water Surface Elevations and Flows

Some of the 100-year and 10-year calculated water elevations and flow rates under current conditions are shown in Table 4. More complete results may be found in Appendix B, including the profile data for stage versus location for different storm events. The datum presented in Table 4 is NGVD 1929. The difference between the NGVD 29 datum and the NAVD 88 datum varies by location, but it is generally close to 2.26 feet over the extent of this study.

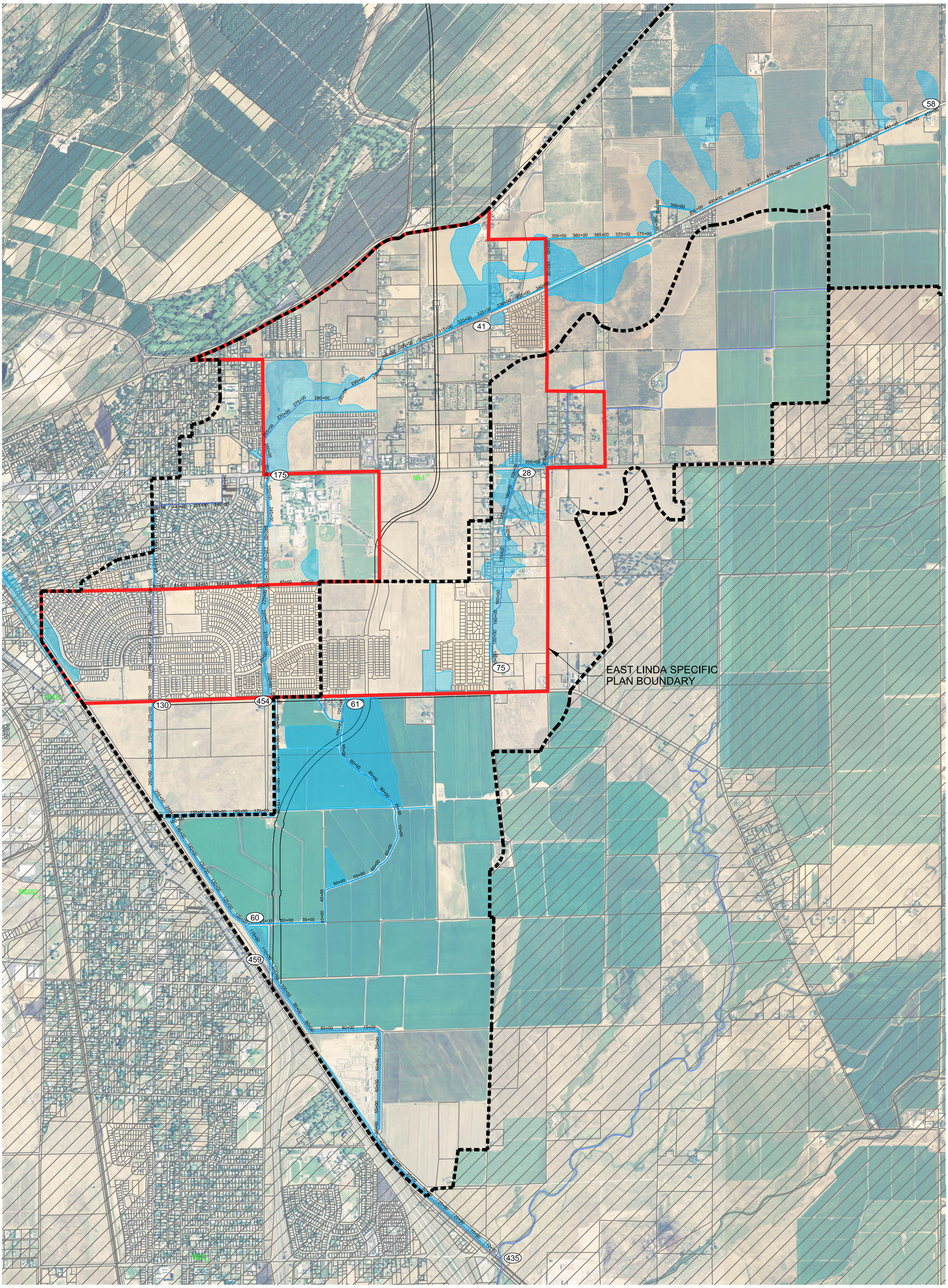
Table 4
Current Condition HEC-RAS Indications of Peak WSELs and Flows at Various Locations in the South Yuba Drainage Master Plan Area.

Location	10-year Storm		100-year Storm	
	Computed Peak WSEL, (feet NGVD 29)	Peak Flow, cfs	Computed Peak WSEL, (feet NGVD 29)	Peak Flow, cfs
Olivehurst Interceptor at Reeds Creek, Sta 6+71	57.10	238	60.00	435
Olivehurst Interceptor below pond, Sta 108+60	59.85	238	61.88	459
Olivehurst Interceptor Pond	60.66	n/a	62.07	n/a
Edgewater Ditch at Erle Road, Sta 277+66	61.34	87	62.65	130
Edgewater Pond	61.30	n/a	62.49	n/a
Olivehurst Interceptor at Erle Road, Sta 200+00	61.92	282	63.32	454
Linda Drain at N. Beale Road, Sta 253+98	65.65	112	66.55	175
Linda Drain near Alberta Avenue, Sta 304+34	68.37	47	68.82	58
Linda Drain at upstream side of Griffith Avenue, Sta 326+48	69.96	26	70.50	41
Sierra Vista Pond	68.77	n/a	70.39	n/a
Linda Drain at east border of East Linda Specific Plan, Sta 340+95	70.63	25	71.48	40
Linda Drain at Brophy Road, Sta 455+27	78.31	33	79.60	58
Olivehurst Drain at junction with Interceptor, Sta 20+00	60.67	51	62.08	60

Olivehurst Drain south of Erle Road pond outfall, Sta 106+54	66.12	61	66.33	61
Orchard Pond	55.84	n/a	59.40	n/a
Olivehurst Drain south Griffith Road at pond inlet structure, Sta 149+25	64.05	37	64.96	75
Olivehurst Drain at Linda Avenue, Sta 169+33	68.16	32	68.56	58
Olivehurst Drain at N. Beale Road, Sta 195+43	69.71	18	69.95	28
Olivehurst Drain west of Wood Ln., Sta 206+02	70.78	19	71.15	33

Existing Conditions Flood Map

The existing conditions 100-year water surface elevations have been used with the topographic information to produce a flood map for the study area. The map in Figure 5 shows the 100-year water surface boundaries in the entire region under study. Areas not shown, outside the limit of this study, are cross-hatched out. Specifically, this study does not pertain to the surrounding regions to the west in the RD784 and Olivehurst drainage areas, areas to the north in the Yuba River floodway, or areas to the east and south in the Reeds Creek watershed. The HEC-RAS models for most channels utilize wide cross sections determined from topographic surveys so that the width of flooding is readily available at each cross section. Also shown in each of the flood maps in this study are the peak 100-year flows at critical locations in the study. The peak flows are shown with an oval containing the flow in cubic feet per second at that location. The flood map and flow values shown are based on the new consolidated model for existing conditions which combines all the areas covered piecemeal by the 2006 East Linda LOMR and the 2010 PAL Area LOMR. For technical reasons (such as the past use of routed hydrographs, treatment of agricultural ponding and the use of channel ineffective areas), the new combined model produces slightly different results than the former LOMR models. However, a comparison of projected inundation indicated by the new consolidated model with that indicated by the multiple models from the previous LOMRs shows very close agreement. Peak flow rates shown vary to a somewhat larger extent, but the values reported here are the result of the new consolidated model which is felt to represent better, more complete modeling than the previous work.



LEGEND

LATERAL

FLOODED AREAS

DRAINAGE BASIN BOUNDARY

100 YEAR PEAK FLOWS, CFS

EAST LINDA SPECIFIC PLAN BOUNDARY

0 250 500 1000 2000

FIGURE 5

SOUTH YUBA DRAINAGE MASTER PLAN CURRENT CONDITIONS 100-YR FLOOD PLAIN

YUBA COUNTY, CALIFORNIA

Existing Storm Drainage Problem Areas and Other Considerations

Linda Drain Flooding North of Hammonton-Smartsville in the Vicinity of Griffith Avenue

The flooded area adjacent to Linda Drain indicated on the Figure 5 map warrants special discussion. Much of the indicated flooding is less than one foot deep. However, these are generally very flat agricultural areas. The USGS Quad Maps were used to fill in topographic information where it would not be feasible to gather field topography over huge areas of land, and this leaves some uncertainty about the depth of flooding. For that reason, it was most prudent to show all areas with any flooding indicated as shaded. Some of this area is in the designated East Linda Specific Plan Area slated for future development. One of the aims of this study in the future alternatives presented later is to reduce the water surface level in Linda Drain for several thousand feet each way from Griffith Avenue to reduce the indicated flooding in the area. Additionally, any development project in the area will include grading which will be designed to alleviate the problems.

Linda Drain Flooding North of Yuba College

This is the grassy area shown in Photograph 3, historically known as the Butler Property. Shallow flooding in the area has been indicated by all flood maps dating back at least to the 1981 FIS. The current existing condition map shown in Figure 5 continues to show a significant amount of inundation on the property. One of the aims of this study in the future alternatives presented later is to reduce the water surface level in Linda Drain as it passes through this property to reduce the indicated flooding in the area. Additionally, any development project in the area will include grading which will be designed to alleviate the problems.

Butler Ditch Flooding in Southern Yuba College Property

The ditch running along the south border of Yuba College and the North border of the Edgewater Subdivision is designated the “Butler Ditch” in the HEC-RAS models. The model under current conditions indicates some flooding from this ditch into the southern portion of Yuba College softball fields. One of the aims of this study in the future alternatives presented later is to route runoff to other locations and reduce the water surface level in Butler Ditch in this area.

Olivehurst Drain Flooding near Griffith Avenue

The flooded areas indicated in Figure 5 adjacent to upper Olivehurst Drain warrant special discussion. A significant amount of flooding is shown starting at Wood Lane and continuing on both sides of Olivehurst Drain to the south almost to Erle Road. Much of the indicated flooding is less than one foot deep. However, these are generally very flat agricultural areas. The USGS Quad Maps were used to fill in topographic information where it would not be feasible to gather field topography over huge areas of land, and this leaves some uncertainty about the depth of flooding. For that reason, it was most prudent to show all areas with any flooding indicated as shaded. The flooding impacts a number of residential/ranch properties. One of the aims of this study in the future alternatives presented later is to reduce the water surface level in Olivehurst Drain as it passes through this area to reduce the indicated flooding in the area.

Seepage Inflow from the Goldfields

The Yuba County Goldfields border the north boundary of the Linda Drain watershed considered in this study. While the Goldfields generally act as a barrier to high stages in the Yuba River, there has been long-standing concern regarding potential seepage from the Goldfields south into the Linda Drain watershed. If significant, such seepage could contribute to the runoff to Linda Drain from subsheds IIa1, IA2 and IA1 (see Figure 2). The 2002 Tetra Tech study, “Analysis of Yuba River Surface and Groundwater Flows in the Vicinity of Marysville, California” (Ref. 8), found that, with the exception of some shallow (0.1 foot) "groundwater seepage flooding" just southwest of the Goldfields, all of the flow for their 100 year simulation stayed within the Goldfields itself or to north of the Yuba River south levee (Patrol Road). Such shallow flooding is generally not mapped for flood insurance purposes. However, the possibility that such flooding could in some way add to the flooding determined by the hydraulic analysis of this drainage was considered. A careful look at this situation reveals no such additive effect occurs. The two forms of flooding are separated both temporally and spatially. The flood events in Linda Drain and in the Yuba River operate on completely different scales, and thus are considered statistically independent. The likelihood of a 100-year flood event in Linda Drain coinciding with a 100-year flood event in the Yuba River is exceedingly small. Furthermore, the shallow seepage flooding suggested in the Tetra Tech report is separated spatially by over one-half mile from any of the flooding indicated by the hydraulic model for the Linda Drain. No additive effect could operate even if the 100-year flood events for the interior and exterior were to occur simultaneously. Since the 0.1 foot seepage flooding near the Goldfields is isolated and too shallow to map, Figure 5 and other maps presented later in this report indicate only flooding due to high water levels in Linda Drain.

Southeast Olivehurst

As discussed in an earlier section of this report, the Community of Olivehurst is not covered in the study area for this South Yuba Drainage Master Plan. Southeast Olivehurst in the general area of Mage Avenue has experienced flooding in the past, and it was addressed in the 1992 SYDMP. That report offered a three-prong solution: (1) completion of the East Linda improvements such as the Olivehurst Interceptor to cut the flow of runoff from the east into Olivehurst, (2) construction of a levee between highway 70 and highway 65 along the north side of Reeds Creek, and (3) construction of a large drainage storage and pumping facility south of McGowan Road. Except for number (2), those improvements have been accomplished. The levee between highway 70 and highway 65 protecting the Mage Avenue area has not been constructed. Many of the complicated issues associated with that potential levee project were discussed in the 1992 SYDMP. Those issues are still relevant today, and during the interim several new considerations have influenced the situation.

Quoting from the 1992 SYDMP: “The State of California, through the Sacramento and San Joaquin Drainage District, has easement rights to flood that south end of Yuba County. Those easement rights cover areas including the southerly end of Olivehurst”; and “Prior to any construction of a levee to keep the Bear River backflow out of Olivehurst the State will want to be assured that; a) a satisfactory plan to create a replacement volume of storage in or out of Olivehurst equivalent to the volume of water currently entitled by easement to flow over the land to be reclaimed has been prepared and approved by the State, or b) that the State does not need the easements.” The State flood easements are still in place. The approximate boundary of these easements is shown in the south portion of Figure 1. Note that the easement area overlaps much of the Mage Avenue region.

After the 1997 flood, some of the residents in the Mage Avenue area which had been inundated were offered grants under the FEMA Hazard Mitigation Grant Program (HMGP) allowing them to elevate their homes. Approximately four residences in the area were elevated during the program. This work has occurred since the 1992 SYDMP and has reduced somewhat the amount of property impacted in that area.

As previously discussed in the hydraulics section, The Bear River Setback Levee Project completed in 2008 has lowered the peak water surface elevations in the WPIC and this in turn implies lower levels at Reeds Creek. Analysis by MBK Engineers (Ref. 4) done in 2010 indicates that the 100-year peak water surface at the north end of the WPIC should be reduced by about 1.1 feet due to the setback project. Because the hydraulic analysis has not been completed from the WPIC upstream on Reeds Creek it is not known how much the values in the Mage Avenue area should be lowered. The hydraulic analysis is not being performed as part of this current study, but it is assumed that it is of sufficient importance to Yuba County that it will be done in the future. When this work is completed it might be reasonable to expect a lowering of the floodplain by around one foot in the Mage Avenue area, potentially reducing the flood exposure further in that area.

Because of the complications cited in the 1992 SYDMP, the recent grant history for Mage Avenue area residents and the potential of a lowered backwater due to levee setback projects, this South Yuba Drainage Master Plan will not address an alternative which includes the construction of the Reeds Creek north side levee.

Goal of Minimizing the County Costs with Pump Stations, Ditches and Distributed Small Detention Facilities.

As much as possible, it is recommended that Yuba County eliminate drainage pump stations, ditches and small distributed storage facilities which are maintained by the County. By eliminating pump stations, ditches and limiting detention ponds to larger planned regional facilities, County operations and maintenance expenses can be minimized. Under current conditions, this goal is not met. There is a small pump at the Dantoni Pond and full-fledge pump station at Orchard Pond. The existing detention facilities that are considered to be planned regional ponds are the Olivehurst Interceptor Pond, the Orchard Pond, and the Edgewater Pond. All the other small distributed ponds serve smaller isolated projects. Examples of those are the Grove Avenue Pond, Dantoni Pond, and the College View Estates Pond. An aim of this drainage master plan is to investigate ways to eliminate some or all of the pumping facilities and the local distributed ponds which are maintained by the County.