

### 2.4.2.1 Debris Basins

Debris basins will be included in the planning areas to capture debris from the natural area tributary to the development. Preliminary sizing was conducted for the large offsite areas tributary to the planning areas but will be analyzed in greater detail in future design efforts. The potential debris volume was determined based on the US Army Corps of Engineers LA District procedure for the *Prediction of Debris Yield* (regression equations) per the County of Orange guidelines for detention basins. These calculations were performed for offsite areas that would ultimately drain through the basin systems as explained in Section 2.4.2 above. Debris volumes were estimated for offsite areas for Subwatersheds C, E, and F, the results are shown in Table 2-7. From the Army Corps of Engineers (ACOE) manual, the equation shown below, was used to determine the potential debris volume for watersheds from 0.1 to 3.0 square miles.

$$\text{Log (Dy)} = 0.65(\text{Log P}) + 0.62(\text{Log RR}) + 0.18(\text{Log A}) + 0.12(\text{FF})$$

Where:

Dy = Unit Debris Yields (yd<sup>3</sup>/mi<sup>2</sup>)

P = Maximum 1-hour precipitation (OC Hydrology Manual values were used to the hundredths place and converted to percentages)

RR = Relief Ratio (ft/mi)

A = Drainage Area (ac)

FF = Non-dimensional Fire Factor

**Table 2-7: 100-year Debris Volume Calculation**

Watershed Debris Basin	Total Drainage Area (ac)	Undeveloped Drainage Area (A)	100-year - 1-hour Precipitation (P)	Relief Ratio (slope) (ft/mile) (RR)	Fire Factor (FF)	Dy Unit Debris Yield (yd <sup>3</sup> /mi <sup>2</sup> )	Dy Unit Debris Yield (ac-ft)	Parent Material	Soils	Channel Morphology	Hillslope Morphology	A-T Factor	Computed 100-year Debris Production (ac-ft)
C Debris Basin	870.6	85.1	145	430	4.5	8416	7.1	0.15	0.15	0.25	0.15	0.7	5.0
E Debris Basin 1	171.0	34.1	145	853	4.5	10913	1.8	0.15	0.15	0.25	0.15	0.7	1.3
E Debris Basin 2	171.0	20.8	145	815	4.5	9707	1.6	0.15	0.15	0.25	0.15	0.7	1.1
E Debris Basin 3	171.0	17.8	145	796	4.5	9303	1.5	0.15	0.15	0.25	0.15	0.7	1.1
F Debris Basin 1	553.8	23.6	145	1185	4.5	12521	6.7	0.15	0.15	0.25	0.15	0.7	4.7
F Debris Basin 2	553.8	269.2	145	580	4.5	12462	6.7	0.15	0.15	0.25	0.15	0.7	4.7
F Debris Basin 3	553.8	5.7	145	1947	4.5	13192	7.1	0.15	0.15	0.25	0.15	0.7	5.0
F Debris Basin 4	553.8	18.5	145	1823	4.5	15656	8.4	0.15	0.15	0.25	0.15	0.7	5.9
F Debris Basin 5	553.8	120.7	145	897	4.5	14140	7.6	0.15	0.15	0.25	0.15	0.7	5.3
F Debris Basin 6	553.8	1.2	145	314	4.5	14140	7.6	0.15	0.15	0.25	0.15	0.7	0.9

The different watershed parameters using in the debris production analysis following the ACOE procedures were based on the following background for their selection:

**Watershed Drainage Area** = Only the debris producing portions of the watershed are included in the analysis, consistent with recommendations in the ACOE guidance document. The drainage area would include the natural area excluding the development area.

**Maximum 1-hour Precipitation** = The 100-year 1-hour precipitation from the *Orange County Hydrology Manual* will utilize the high confidence since this is debris volume is used in the “design” of the basin storage. This high confidence value is 1.45 inches, so this value is multiplied by 100 for the equation of a value of 145.

**Relief Ratio** = This is the slope measured from the digital watershed topography tributary to the detention basin location from the upstream most remote point in the watershed to the downstream basin. The slope units are in feet/mile.

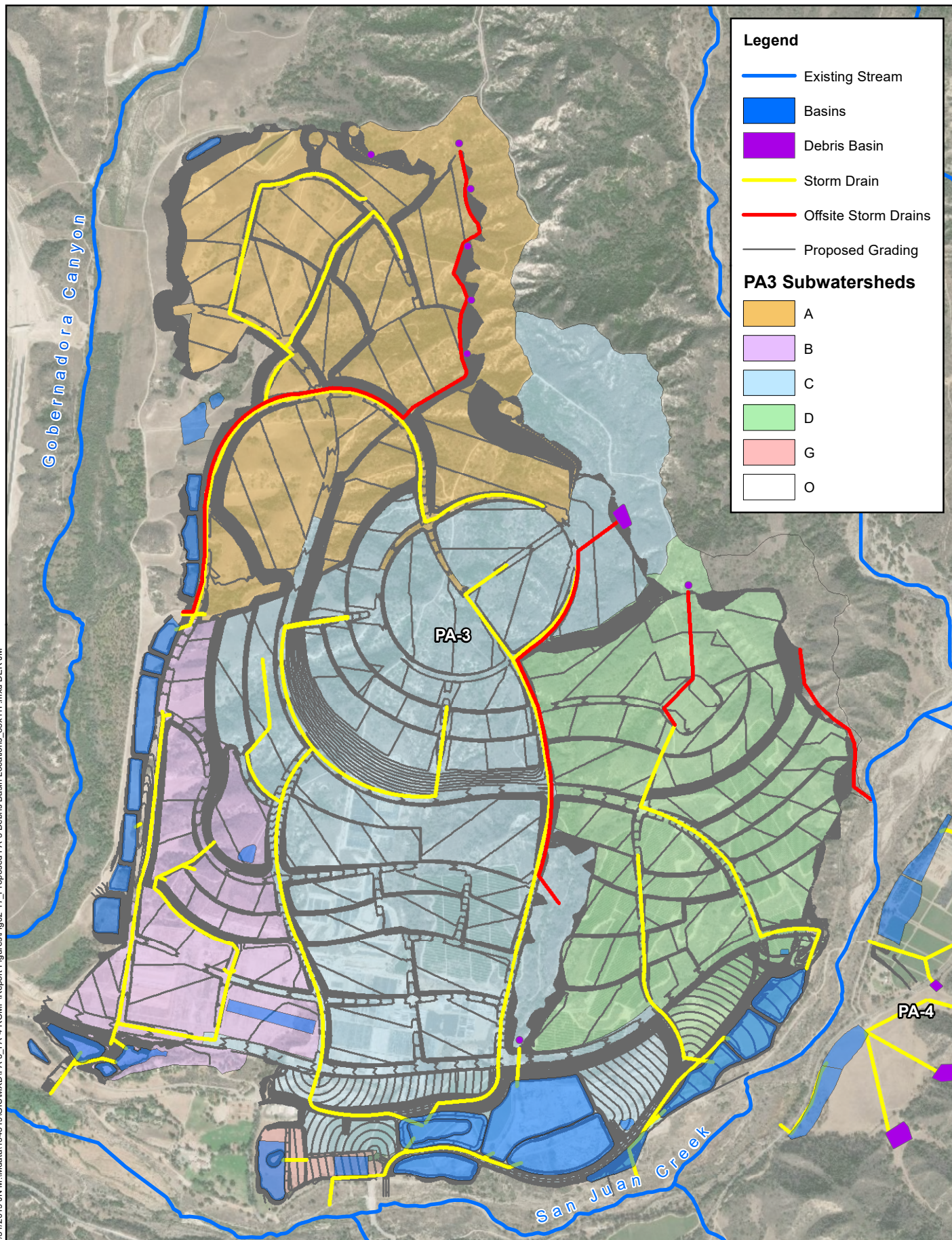
**Fire Factor** = The *Orange County Draft Detention Basin Design Criteria* indicates a 4-year after burn in the County’s guidelines for the time period of the burn within the watershed. Refer to the 2013 ROMP *Chapter 14 – Regulatory Requirements and Design Criteria* under Section 4.3 and the category “sediment and debris criteria”.

**Adjustment-Transposition Factor (A-T Factor)** = The estimation of the AT factor was based on the summing of the four different factors. These watersheds all fall within the moderate range of all the different descriptors except for the “Morphology” indicated in values of 0.15 for each of the factors except the morphology that is 0.25. The total average AT factor would be 0.7 for the different watersheds. This is consistent with the ACOE guidance document which indicates that “watershed areas of less debris yield potential than the San Gabriel Mountains, such as the Peninsular Ranges of San Diego and Orange Counties would have A-T factors less than 1.0”.

Proposed debris basin locations are shown on Figures 2-17 and 2-18 for PA-3 and PA-4 respectively. The debris basins will be designed per the Los Angeles County Sedimentation Manual 2nd Edition dated March 2006.

A minimum pipe size of 36-inches should be used in area where debris is present, but no debris structure has been provided per the Orange County Local Drainage Manual.

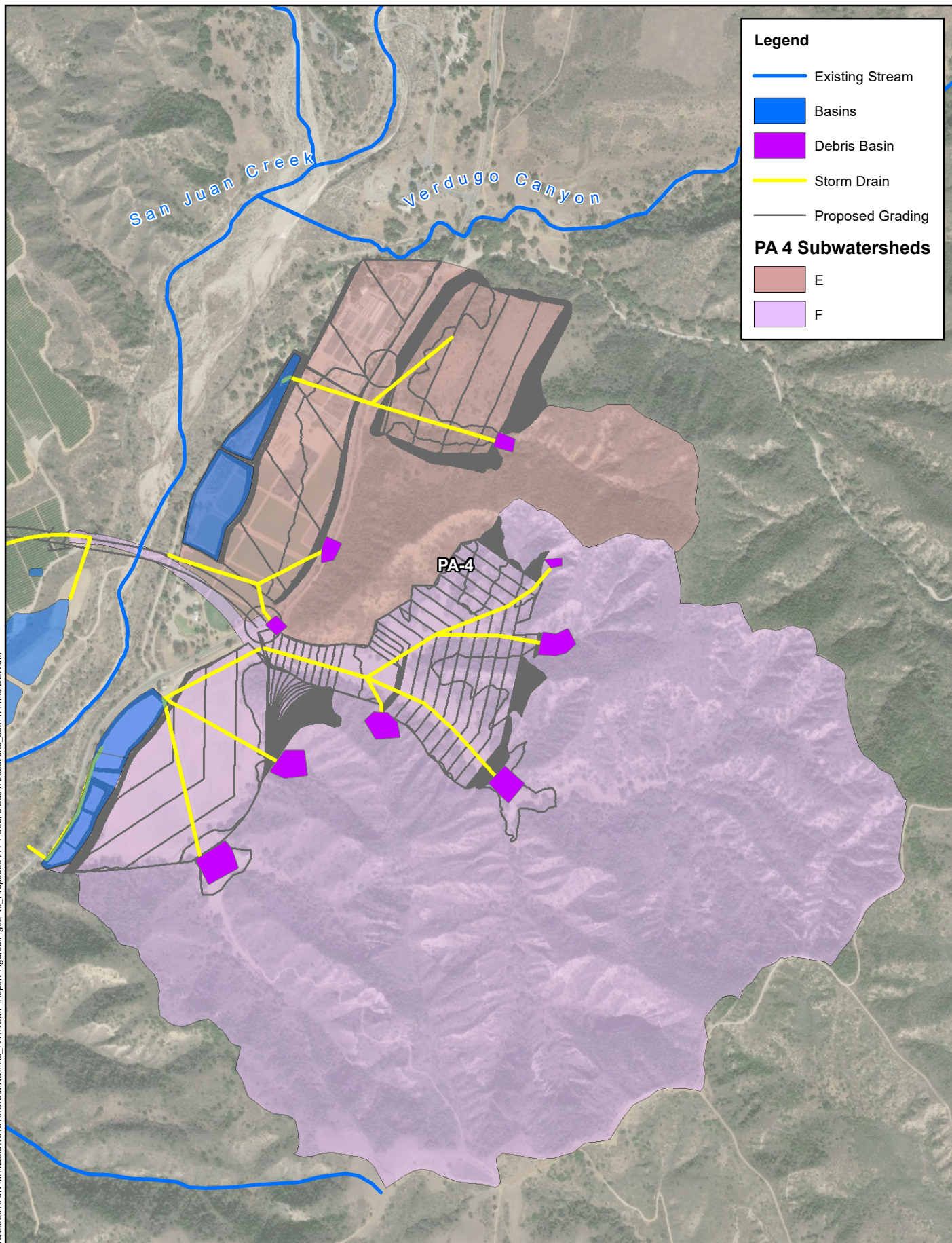
7/31/2019 JIN M:\data\134519\GIS\WDXD\PA-3 PA-4 ROMP\Report Figures\Fig02-17\_Proposed PA-3 Debris Basin Locations\_85x11P.mxd DER JM







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### 2.4.3 Unit Hydrograph Models

The unit hydrographs for the regional analysis, in accordance with Section K of the Orange County Hydrology Manual included:

1. Single Area Model: single hydrograph to a concentration point (see Appendices D.2, E.3, F.3, and G.3)
2. Free Draining Model: multiple hydrographs representing the same concentration point as the single area (Appendices D.3, E.4, F.4, and G.4)
3. Calibrated Free Draining: free draining model with increased rainfall so that the free draining model is equal to or greater than the single area model. Free draining models with flows within 2% of the single area model were not calibrated (see Appendices E.5, F.5, and G.5)
4. Complex Model: free draining or calibrated free draining model with proposed basins (see Appendices E.6, F.6, and G.6).

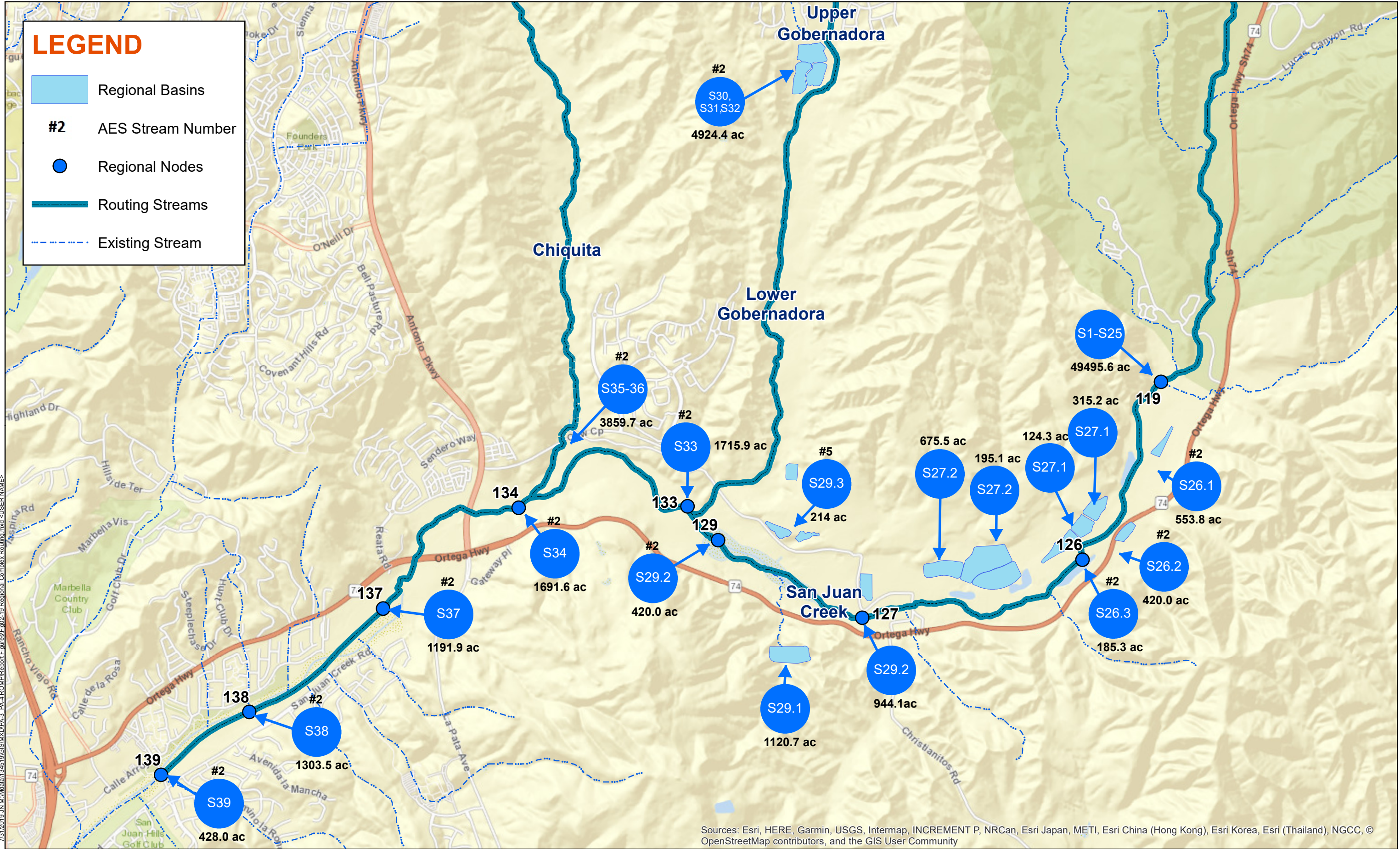
The models were run for the concentration points (nodes) that are impacted by the PA-3&4 development and Gobernadora Basin. An exhibit with all the regional nodes is included as Exhibit 6, and a simplified routing schematic is shown in Figure 2-19. The nodes studied in this update include:

- 119: San Juan Creek upstream of PA-3 and PA-4
- 126: San Juan Creek downstream of PA-4
- 127: San Juan Creek downstream of PA-3 local subwatersheds C and D
- 132c: Gobernadora Canyon downstream of Gobernadora Basin
- 133t: Gobernadora Canyon upstream of confluence with San Juan Creek
- 133u: San Juan Creek upstream of Gobernadora Canyon
- 133c: San Juan Creek downstream of the confluence with Gobernadora Canyon
- 134t: Chiquita Canyon upstream of confluence with San Juan Creek
- 134u: San Juan Creek upstream of confluence with Chiquita Canyon
- 134c: San Juan Creek downstream of confluence with Chiquita Canyon
- 137: San Juan Creek at the RMV boundary
- 138: San Juan Creek downstream of the RMV boundary
- 139: San Juan Creek at La Novia Bridge

The area weighted regional rainfall used at each node is presented in Appendix D.4, E.7, F.7 and G.7 for the Existing, Phased and Ultimate conditions, respectively. Depth area reduction factors are based on the total tributary area to node according to the Orange County Hydrology Manual. Loss rates were based on the methods used in the Ranch Plan ROMP and the Orange County Hydrology Manual and are included in Appendix H. S-graphs were selected based on the Valley Developed S-graph consistent with the Ranch Plan ROMP.











## 2.4.4 Area Discussion

There are area discrepancies between the rational method, the loss rate calculations, and the unit hydrograph method models in the Approved Ranch Plan ROMP. This PA-3&4 update revises the areas within S26, S27, S29, and S33 to eliminate these inconsistencies. Table 2-8 and Table 2-9 show the discrepancies in total tributary area at each of the regional nodes. Changes in total tributary area at each of the regional nodes from the 2013 Ranch Plan ROMP can be attributed to revised grading and delineation of watershed areas. Inconsistencies within PA-5 of the Ranch ROMP will be addressed with the future PA-5 ROMP submittals.

**Table 2-8: Existing and Phase Area Comparison**

Existing Condition				Phase Condition 1 (PA-1, -2 & -3)				Phase Condition 2 (PA-1, -2, -3 & -4)			
Regional Node	Subarea ID	Area (ac)	Total Area (ac)	Subarea Area (ac)	RM (ac)	Loss Rate (ac)	Differences (ac)	Subarea Area (ac)	RM (ac)	Loss Rate (ac)	Differences (ac)
119	S19	3358	49512	3358	49511.8	49511.8	0.0	3342	49495.7	49495.7	0.0
126	S26	1006	50518	894.3	50406.1	50406.1	0.0	910.1	50405.8	50405.8	0.0
127	S27	1562	52080	2031.0	52437.1	52437.1	0.0	2031.0	52436.8	52436.8	0.0
-	S28	1066	53147	1066.4	53500.5	53500.5	0.0	1066.4	53500.2	53500.2	0.0
133u	S29	966	54113	851.7	54352.1	54352.1	0.0	851.7	54351.7	54351.9	0.2
-	S30	2016	-	2016.1	-	-	-	2016.1	-	-	-
-	S31	1781	-	1780.7	-	-	-	1780.7	-	-	-
-	S32	1128	-	1127.6	-	-	-	1127.6	-	-	-
133c	S33	2190	61227	1716.1	60992.6	60992.6	0.0	1716.1	60992.3	60992.5	0.2
134u	S34	1244	62471	1705.5	62698.2	62698.2	0.0	1705.5	62697.9	62698.0	0.1
-	S35	1580	-	1579.8	-	-	-	1579.8	-	-	-
134c	S36	2503	66554	2279.9	66557.9	66557.9	0.0	2279.9	66557.6	66557.8	0.2
137	S37	1239	67793	1240.9	67798.5	67798.5	0.0	1240.9	67798.2	67798.4	0.2
138	S38	1333	69125	1303.7	69102.2	69102.2	0.0	1303.7	69101.9	69101.8	0.1
139	S39	428	69553	427.8	69530.0	69530.0	0.0	427.8	69529.7	69530.1	0.4

**Table 2-9: Ultimate Approved and PA-3 Ultimate Area Comparison**

Ranch Plan Ultimate Condition				PA-2 Ultimate Condition		PA-3&4 Ultimate Condition			
Regional Node	Subarea ID	Area (ac)	Total Area (ac)	Area (ac)	RM (ac)	Area (ac)	RM (ac)	Loss Rate (ac)	Differences (ac)
119	S19	3413.6	49567.3	3413.6	49567.3	3342.0	49495.7	49495.7	0.0
126	S26	969.1	50536.4	969.1	50536.4	910.1	50405.8	50405.8	0.0
127	S27	1414.5	51950.9	1414.5	51950.9	2031.0	52436.8	52436.8	0.0
-	S28	223.2	52174.1	223.2	52174.1	223.2	52660.0	52660.0	0.0
133u	S29	2166.6	54340.7	2166.6	54340.7	1755.4	54415.3	54415.3	0.0
-	S30	2015.8	-	2015.8	-	2016.2	-	-	-
-	S31	1780.7	-	1780.7	-	1780.7	-	-	-
-	S32	1127.5	-	1127.6	-	1127.6	-	-	-
133c	S33	2022.5	61291.2	1787.8	61052.6	1716.1	61055.8	61055.8	0.0
134u	S34	1186.0	62477.3	1691.6	62744.2	1691.6	62747.4	62747.4	0.0
-	S35	1579.0	-	1579.8	-	1579.8	-	-	-
134c	S36	2549.9	66602.0	2279.9	66603.8	2279.9	66607.1	66607.1	0.0
137	S37	1191.6	67794.0	1191.9	67795.7	1191.9	67798.9	67798.9	0.0
138	S38	1303.5	69097.0	1303.7	69099.4	1303.7	69102.6	69102.6	0.0

Ranch Plan Ultimate Condition				PA-2 Ultimate Condition		PA-3&4 Ultimate Condition			
Regional	Subarea	Area	Total Area	Area	RM	Area	RM	Loss Rate	Differences
Node	ID	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)	(ac)
139	S39	427.8	69524.1	427.8	69527.2	427.8	69530.4	69530.4	0.0

## 2.4.5 Basin Footprint Discussion

A comparison of the estimate footprint area size identified in the 2013 Ranch Plan ROMP for the regional detention facilities to the footprint size provided in the PA-3&4 ROMP is summarized in Tables 2-10 and 2-11 below as required by item 1.6 of Table 19-1 of the Ranch Plan ROMP. The comparison was prepared to ensure that adequate area was provided in the land plan for regional mitigation. It should be noted that in the comparison for PA-4, the footprint provided in the PA-3&4 ROMP is less than the identified footprint due to the drastic reduction in development area and proposed developed land.

**Table 2-10: PA-3 Basin Footprint Comparison**

Flood Control Basin	Tributary Area	Outlet	Basin Area at Top	Max. Depth	Max. Storage
Name	(ac)	#	(ac)	(ft)	(ac-ft)
S29.2 Basin*	710	12	12.6	8.1	95.5
S27.1 Basin*	736	13	14.0	8.3	110.8
3B-1	214.7	11	1.4	9	12.5
3B-4			4.0	24	53.8
3C-1	870.6	13	10.5	10	88.5
3C-3			20.8	6	119.6
3C-5			15.11	15	200.6
3D-1	439.5	14	6.2	11	54.9
3D-2			5.8	9	40.5
3D-3			6.4	11	44.7
Total Storage Identified for PA-3 in 2013 Ranch Plan ROMP				206.3 ac-ft	
Total Storage Provided for PA-3				414.5 ac-ft	

\* Denotes basins from 2013 Ranch Plan ROMP

**Table 2-11: PA-4 Basin Footprint Comparison**

Flood Control Basin	Tributary Area	Outlet	Basin Area at Top	Max. Depth	Max. Storage
Name	(ac)	#	(ac)	(ft)	(ac-ft)
S26.2 Basin*	442	21	10.9	4.8	47.7
S19.2 Basin*	742	19	10.9	9.2	94.7
4E-1	171	20	2.8	10	21.1
4F-1	553.8	21	3.5	10	29.3
Total Storage Identified for PA-4 in 2013 Ranch Plan ROMP				142.4 ac-ft	
Total Storage Provided for PA-4				50.4 ac-ft	

\* Denotes basins from 2013 Ranch Plan ROMP



### **2.4.6 Existing Condition Regional Hydrology**

The existing condition regional models were approved as part of the Ranch Plan Planned Community Runoff Management Plan (Ranch Plan ROMP) dated April 2013. However, discrepancies between the loss rates calculations and the hydrology models were discovered during the PA-2 ROMP and updated for nodes downstream of Gobernadora Canyon for the AES hydrograph runs. The updates upstream of Gobernadora Canyon are contained in Appendix D. Appendix D includes the following existing condition models: regional rational method free draining model from the Ranch Plan ROMP for reference (Appendix D.1), single area unit hydrographs (Appendix D.2), and free draining unit hydrographs (Appendix D.3). Loss Rates are included in Appendix H. In accordance with the Ranch Plan ROMP (Table 9-18), the higher discharge between the single area UH and free draining UH was selected for comparison in the ultimate condition. Exhibits 4 and 5 show the rational method map from the Ranch Plan ROMP for reference. Exhibit 6 shows the watershed unit hydrograph map from the Ranch Plan ROMP. Table 2-12 describes the results of the single area, free draining, and complex ultimate condition models.



Table 2-12: Regional Existing Condition Hydrology

Node		100-year Expected Value Storm Event (cfs)					50-year Expected Value Storm Event (cfs)					25-year Expected Value Storm Event (cfs)					10-year Expected Value Storm Event (cfs)					5-year Expected Value Storm Event (cfs)					2-year Expected Value Storm Event (cfs)				
	Area	Baseline 2008 <sup>1</sup>	Ranch Plan ROMP <sup>2</sup>	PA-3&4 ROMP			Baseline 2008 <sup>1</sup>	Ranch Plan ROMP <sup>2</sup>	PA-3&4 ROMP			Baseline 2008 <sup>1</sup>	Ranch Plan ROMP <sup>2</sup>	PA-3&4 ROMP			Baseline 2008 <sup>1</sup>	Ranch Plan ROMP <sup>2</sup>	PA-3&4 ROMP			Baseline 2008 <sup>1</sup>	Ranch Plan ROMP <sup>2</sup>	PA-3&4 ROMP			Baseline 2008 <sup>1</sup>	Ranch Plan ROMP <sup>2</sup>	PA-3&4 ROMP		
	(ac.)	Single Area	Existing Flow	Single Area	Free Draining	Existing Flow <sup>3</sup>	Single Area	Existing Flow	Single Area	Free Draining	Existing Flow <sup>3</sup>	Single Area	Existing Flow	Single Area	Free Draining	Existing Flow <sup>3</sup>	Single Area	Existing Flow	Single Area	Free Draining	Existing Flow <sup>3</sup>	Single Area	Existing Flow	Single Area	Free Draining	Existing Flow <sup>3</sup>	Single Area	Existing Flow	Single Area	Free Draining	Existing Flow <sup>3</sup>
119	49512	20221	20304	20326	20326	20326	17815	17836	17844	17844	17844	14999	14923	14939	14939	14939	7159	7195	7239	7238	7239	2462	2404	2403	2403	2403	538	525	534	534	534
126	50518	20284	20302	20352	20249	20352	17854	17810	17828	17767	17828	14798	14897	14924	14866	14924	7024	7101	7114	7145	7145	2340	2349	2380	2346	2380	531	516	514	525	525
127	53147	18254	20598	20460	20273	20460	17896	18013	17925	17779	17925	15014	15055	14964	14872	14964	6917	7076	6972	6990	6990	2331	2319	2303	2314	2314	456	513	494	514	514
133t	7115	3935	3982	3986	3926	3986	3430	3492	3500	3403	3500	2900	2937	2942	2856	2942	1846	1871	1875	1781	1875	776	796	781	786	786	329	364	354	350	354
133u	54113	20274	20362	20361	20213	20361	17849	17894	17911	17719	17911	14986	14923	14948	14829	14948	6769	6874	6908	6914	6914	2345	2287	2308	2298	2308	452	512	483	515	515
133c	61228	25162	21839	21636	21828	21828	18930	19145	19018	19143	19143	15936	15954	15882	15972	15972	7117	7148	7150	7172	7172	2464	2466	2458	2412	2458	576	586	583	568	583
134t	4083	2383	2409	2415	2415	2415	2110	2121	2124	2124	2124	1776	1787	1792	1792	1792	1024	1034	1039	1039	1039	385	381	329	329	329	124	148	121	121	121
134u	62471	21655	22026	21792	22000	22000	19068	19304	19119	19284	19284	15736	16077	15932	16080	16080	7123	7115	7015	7148	7148	2420	2413	2415	2409	2415	575	578	582	569	582
134c	66554	22515	22964	22661	22933	22933	19800	20143	19841	20118	20118	16390	16774	16536	16770	16770	7175	7247	7066	7275	7275	2504	2473	2470	2525	2525	601	605	610	600	610
137	67793	22575	23098	22728	23080	23080	19929	20253	19864	20237	20237	16424	16865	16526	16869	16869	7107	7236	7076	7267	7267	2531	2496	2501	2496	2501	600	608	617	604	617
138	69125	22752	23260	22878	23249	23249	20038	20388	19985	20380	20380	16567	16972	16654	16983	16983	7031	7219	7056	7270	7270	2529	2510	2510	2505	2510	598	622	625	612	625
139	69553	22846	23309	22805	23299	23299	20119	20429	19930	20423	20423	16507	17009	16621	17013	17013	7042	7224	7041	7270	7270	2516	2523	2531	2512	2531	597	635	640	617	640

<sup>1</sup> Approved 2008 Single Area Hydrology Analysis.

<sup>2</sup> April 2013 Ranch Plan ROMP (Table 9-18 in the Approved ROMP). Q is selected from the higher discharge between Single Area and Free-draining model.

<sup>3</sup> Existing flow used for mitigation comparison from PA-3&4 ROMP. Q is selected from the higher discharge between Single Area and Free-draining model.





### **2.4.7 Phase Condition Regional Hydrology**

Two phase conditions were analyzed as part of the PA-3&4 ROMP. The first phase condition assumes that PA-1, PA-2, and PA-3 are constructed. The second phased condition regional models assume that PA-1, PA-2, PA-3, and PA-4 are constructed. Appendices E and F include the following models: regional rational method free draining model, regional rational method complex model, single area unit hydrographs, free draining unit hydrographs, calibrated free draining unit hydrographs, and complex unit hydrographs. Appendix H shows the loss rate calculations. Phased condition hydrology maps are included as Exhibits 7 and 8.

#### **2.4.7.1 Model Development**

In order to develop the phased condition model, a combination of the existing condition hydrology, PA-1 hydrology, and PA-2 hydrology was used in conjunction with the updated hydrology for PA-3&4 presented in Section 2.2. The analysis used a combination of the Ranch Plan ROMP land use tables (for both existing and proposed conditions), the PA-2 ROMP, and current PA-3&4 land use. See Figure 2-20 and Figure 2-21 for the revised phased land uses.

For the rational method, the existing Ranch Plan ROMP models were used for areas S19, S26, S28, S30, S31, S32 and S35 in the phase condition where PA-1, PA-2 and PA-3 are developed. The existing Ranch Plan ROMP models were used for areas S19, S28, S30, S31, S32 and S35 in the phase condition where it is assumed only PA-1, PA-2, PA-3 and PA-4 are constructed. Areas S27 and S29 were modified to reflect the drainage patterns for PA-3. The PA-2 ROMP models were used for S34 and S36. Area S33 is a hybrid of PA-2 ROMP and proposed Subwatershed A in PA-3. Areas S37, S38, and S39 were the proposed condition models from the Ranch Plan ROMP.

The loss rates were calculated by using the Ranch Plan ROMP land use data, and replacing PA-2, PA-3 and PA-4 revised land uses.

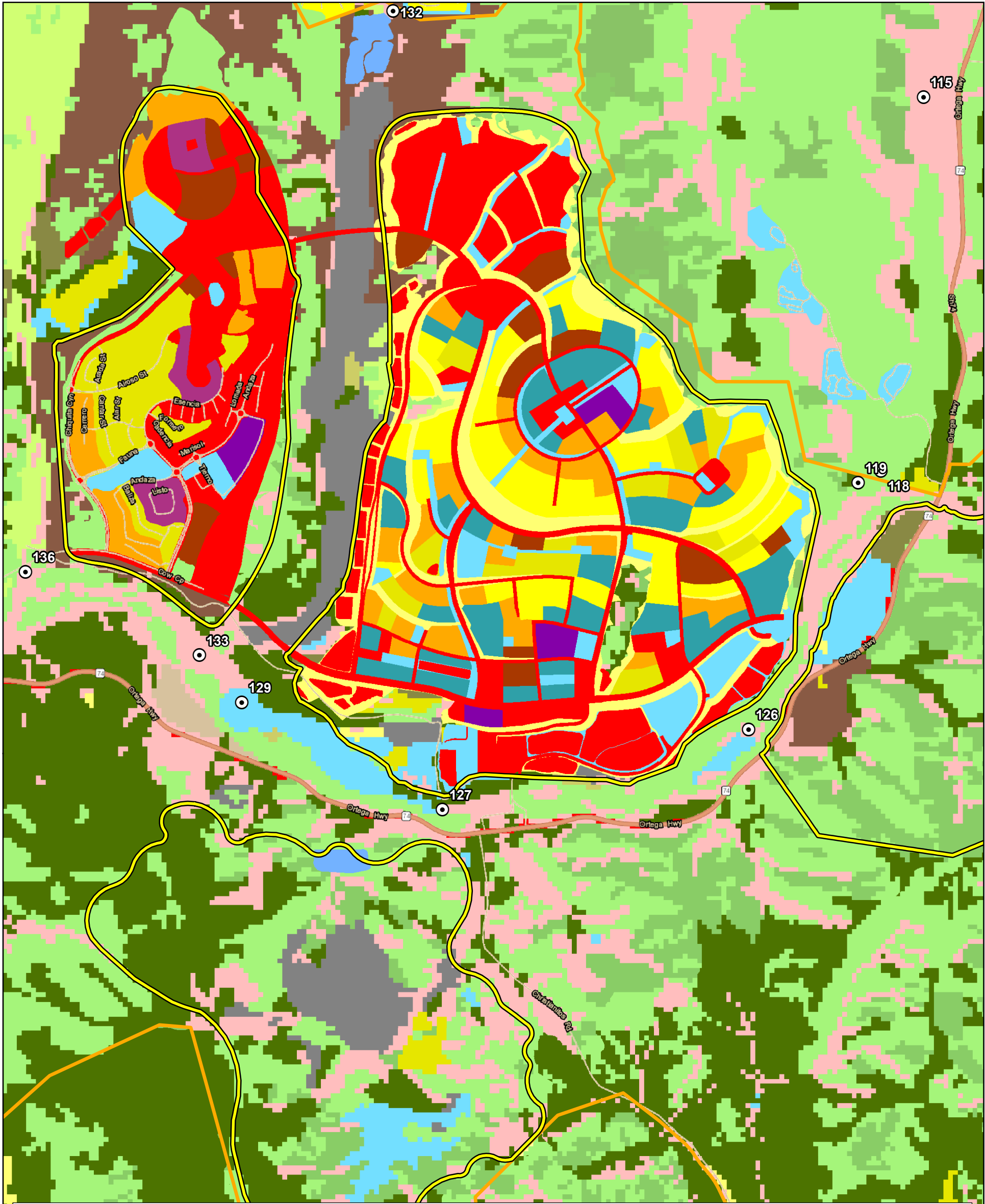
Calibration was required for the 2-, 5-, and 10-year events. The calibration was performed by increasing the rainfall in the free draining unit hydrograph models. Free draining models which underestimate the single area flow by less than 2% were not calibrated.

The following regional node points were analyzed: 119, 126, 127, 129, 132c, 133t, 134t, 133c, 134c, 133u, and 134u, 137, 138, and 139. The analyses were run for the following storms: 2, 5, 10, 25, 50, and 100-year expected value storm events.


#### **2.4.7.2 Phased Condition Results**

To meet mitigation requirements, the 25-, 50-, and 100-yr complex models need to be less than or equal to the existing values and the target 10-, 5-, and 2-yr peak discharges are the 2013 Ranch Plan value. Based on the analysis, Table 2-13 and Table 2-14 describe the results of the single area, free draining, and complex phased condition models.







Legend

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Regional Nodes




Planning Area Boundary




RMV Property Boundary


**Ultimate Land Use**




Residential 1 acre lots




Residential 2 dwellings/acre




Residential 2.5 acre lots




Residential 3-4 dwellings/acre




Residential 5-7 dwellings/acre
- 


Residential 8-10 dwellings/acre




Residential More than 10 dwellings




Condominiums




Apartments




Mobile Home Park




Commercial




School




Public Park
- 


Fallow




Open Brush (Good); Open Brush, Fair




Chaparral, Broadleaf, Fair




Chaparral, Narrowleaf, Fair




Meadows or Cienegas, Fair




Grass, Annual or Perennial, Fair




Turf, Good




Orchards, Evergreen, Fair
- 


Row Crops, Good




Row Crops, Poor




Woodland, Fair




Woodland, Grass, Fair




Woodland, Poor



Water



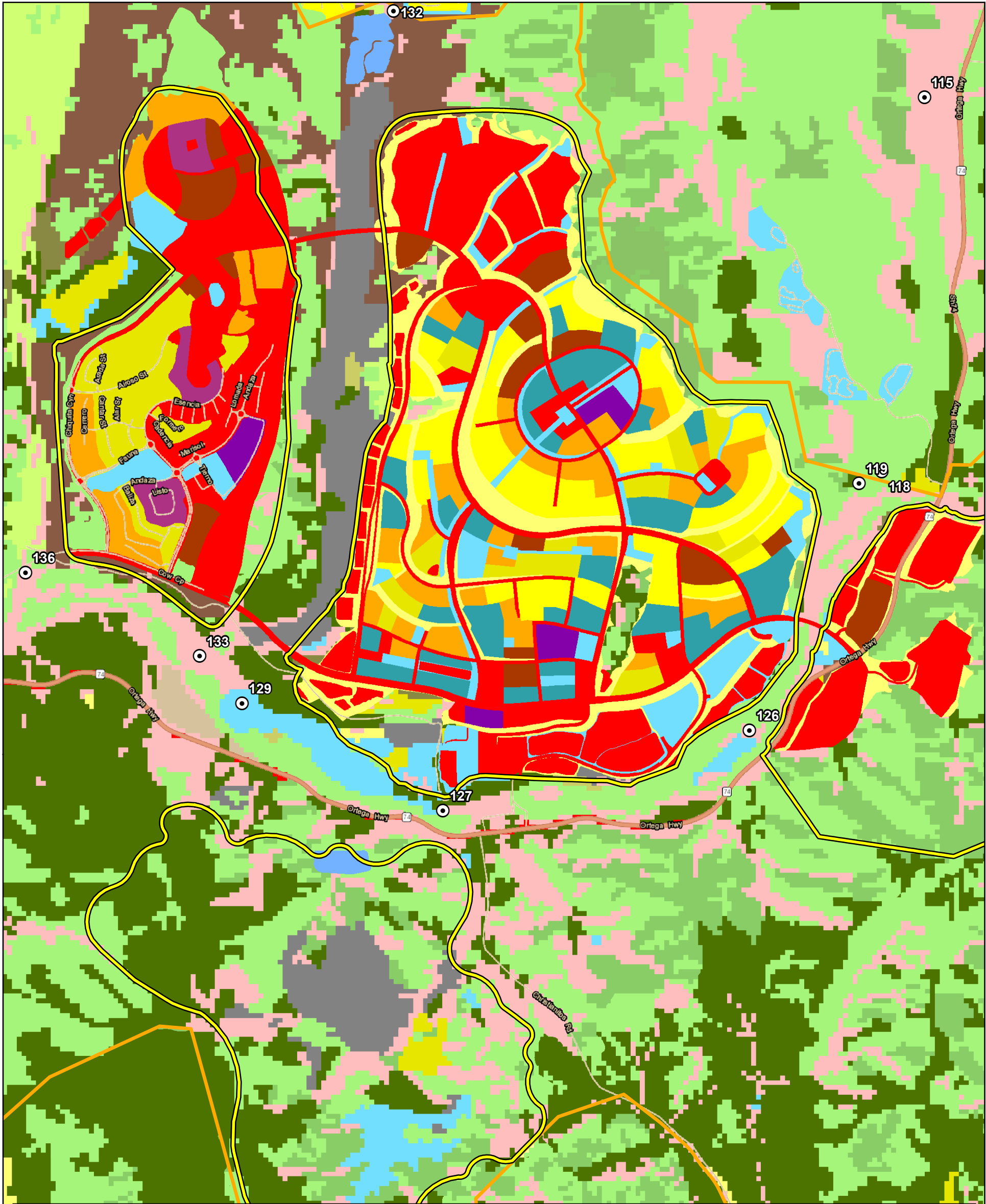
Barren



Road, Paved with storm sewers







**Legend**

- |                                |                                    |                                     |                               |
|--------------------------------|------------------------------------|-------------------------------------|-------------------------------|
| Regional Nodes                 | Residential 8-10 dwellings/acre    | Fallow                              | Row Crops, Good               |
| Planning Area Boundary         | Residential More than 10 dwellings | Open Brush (Good); Open Brush, Fair | Row Crops, Poor               |
| RMV Property Boundary          | Condominiums                       | Chaparral, Broadleaf, Fair          | Woodland, Fair                |
| <b>Ultimate Land Use</b>       | Apartments                         | Chaparral, Narrowleaf, Fair         | Woodland, Grass, Fair         |
| Residential 1 acre lots        | Mobile Home Park                   | Meadows or Cienegas, Fair           | Woodland, Poor                |
| Residential 2 dwellings/acre   | Commercial                         | Grass, Annual or Perennial, Fair    | Water                         |
| Residential 2.5 acre lots      | School                             | Turf, Good                          | Barren                        |
| Residential 3-4 dwellings/acre | Public Park                        | Orchards, Evergreen, Fair           | Road, Paved with storm sewers |
| Residential 5-7 dwellings/acre |                                    |                                     |                               |





Table 2-13: Phased Condition PA-1, -2 and -3 Developed Regional Hydrology San Juan Creek

Node	Area (ac)	100-year Expected Value Storm Event				50-year Expected Value Storm Event				25-year Expected Value Storm Event				10-year Expected Value Storm Event				5-year Expected Value Storm Event				2-year Expected Value Storm Event			
		Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model
119	49512	20326	20326	-	-	17854	17851	-	-	14919	14919	-	-	7197	7197	-	-	2407	2407	-	-	527	525	-	-
126	50406	20308	20242	-	20242	17804	17769	-	17769	14866	14844	-	14844	7092	7112	-	7112	2343	2345	-	2347	510	518	-	526
127	53500	20643	20309	-	20310	18055	17820	-	17810	15096	14850	-	14857	7176	6984	7168	7165	2450	2344	2418	2409	583	533	578	558
133t	6640	3877	3889	-	2985	3414	3391	-	2683	2869	2849	-	2347	1906	1871	-	1654	867	858	-	797	404	403	-	403
133u	54352	20544	20328	-	20290	18041	17847	-	17787	15098	14832	-	14837	7092	6928	7110	7118	2537	2335	2539	2537	580	536	578	562
133c	60993	21718	21960	-	21609	19126	19272	-	18936	15979	16033	-	15765	7451	7346	-	7204	2672	2543	2677	2621	728	654	720	655
134t	3860	2323	-	-	-	2048	-	-	-	1726	-	-	-	1021	-	-	-	348	-	-	-	131	-	-	-
134u	62698	22024	22191	-	21833	19325	19466	-	19132	16146	16192	-	15923	7375	7361	-	7221	2734	2563	2711	2654	757	686	744	653
134c	66558	22838	23109	-	22734	20050	20289	-	19925	16747	16876	-	16597	7461	7522	-	7369	2812	2666	2764	2705	790	729	781	696
137	67799	22977	23258	-	22888	20099	20411	-	20057	16773	16983	-	16699	7520	7545	-	7390	2834	2692	2793	2719	817	757	806	704
138	69102	23087	23421	-	23044	20228	20538	-	20178	16853	17077	-	16802	7496	7548	-	7391	2835	2711	2783	2702	825	780	810	703
139	69530	23030	23465	-	23100	20120	20572	-	20217	16841	17111	-	16830	7472	7548	-	7391	2839	2719	2819	2741	831	793	822	707



Table 2-14: Phased Condition PA-1, -2, -3 and -4 Developed Regional Hydrology San Juan Creek

Node	Area (ac)	100-year Expected Value Storm Event				50-year Expected Value Storm Event				25-year Expected Value Storm Event				10-year Expected Value Storm Event				5-year Expected Value Storm Event				2-year Expected Value Storm Event			
		Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model
119	49496	20321	20321	-	-	17850	17850	-	-	14918	14918	-	-	7196	7196	-	-	2407	2407	-	-	525	525	-	-
126	50406	20336	20191	-	20205	17831	17731	-	17748	14911	14830	-	14844	7131	7125	-	7144	2380	2353	-	2360	525	522	-	520
127	53500	20700	20320	-	20317	18082	17822	-	17825	15143	14863	-	14878	7226	6998	7109	7127	2491	2349	2453	2449	598	537	591	570
133t	6640	3877	3889	-	2985	3414	3392	-	2683	2869	2849	-	2347	1906	1871	-	1654	867	858	-	797	404	403	-	404
133u	54352	20574	20383	-	20316	18069	17866	-	17812	15123	14869	-	14864	7133	6942	7081	7109	2459	2343	2460	2461	595	541	591	573
133c	60992	21748	22012	-	21663	19126	19294	-	18990	16006	16070	-	15816	7469	7378	-	7252	2700	2565	2655	2592	744	670	736	653
134t	3860	2323	-	-	-	2048	-	-	-	1726	-	-	-	1021	-	-	-	348	-	-	-	131	-	-	-
134u	62698	22055	22240	-	21890	19355	19488	-	19187	16173	16229	-	15974	7420	7394	-	7271	2762	2587	2724	2654	765	702	759	658
134c	66558	22838	23162	-	22789	20082	20315	-	19978	16776	16918	-	16646	7513	7558	-	7419	2843	2690	2801	2732	799	744	786	695
137	67798	22979	23307	-	22943	20131	20433	-	20112	16775	17023	-	16747	7569	7583	-	7440	2852	2718	2819	2733	826	776	820	713
138	69102	23089	23472	-	23102	20228	20652	-	20231	16882	17118	-	16850	7545	7585	-	7439	2852	2737	2798	2706	834	798	825	711
139	69530	23064	23513	-	23154	20152	20602	-	20272	16841	17150	-	16878	7485	7586	-	7440	2870	2745	2847	2753	848	812	843	721





## **2.4.8 Ultimate Condition Regional Hydrology**

The PA-3&4 ROMP updates to the ultimate condition regional models assumes that PAs 1 through 5 and the seven regional basins are constructed (one more than was identified in Chapter 14 of the Ranch Plan ROMP), including the final as-built condition of Gobernadora Basin. Appendix G includes the following models: regional rational method free draining model, regional rational method complex model, single area unit hydrographs, free draining unit hydrographs, calibrated free draining unit hydrographs, and complex unit hydrographs. Appendix H contains the loss rate calculations. An ultimate condition hydrology map is included as Exhibit 9.

### **2.4.8.1 Model Development**

In order to develop the ultimate condition model, the PA-3&4 .DNA files and hydrographs from the Ranch Plan ROMP were replaced with the updated hydrology for PA-3&4 presented in Section 2. The study used the Ranch Plan ROMP land use data and combined it with the current PA-3&4 land use. See Figure 2-22 for the revised ultimate land use.

For the rational method, the proposed condition models from the Ranch Plan ROMP were used for all areas. The proposed condition models S19, S26, S27, S29, and S33 were modified to reflect the changes in land use and drainage patterns for PA-3/4. The loss rates were calculated by using the Ranch Plan ROMP land use data and replacing PA-2, PA-3 and PA-4 with the updated land use data.

Calibration was required for the 2-, 5- and 10-year events. The calibration was performed by increasing the rainfall in the free draining unit hydrograph models. Free draining models which underestimate the single area flow by less than 2% were not calibrated.

The following regional node points were analyzed: 119, 126, 127, 132c, 133t, 134t, 133c, 134c, 137, 138, and 139. The analyses were run for the following storms: 2, 5, 10, 25, 50, and 100-year expected value storm events.

### **2.4.8.2 Ultimate Condition Results**

To meet mitigation requirements, the 25-, 50-, and 100-yr complex models need to be less than or equal to the existing values and the target 10-, 5-, and 2-yr peak discharges are the 2013 Ranch Plan value. Table 2-15 describes the results of the single area, free draining, and complex ultimate condition models. See appendix O.1 for memorandum regarding low frequency events.



7/25/2019 J:\M:\Mdaa\134519\GIS\MXD\PA-3\_P4-4 ROMP\Report Figures\Fig02-22\_UltimateCondition\_11x17.mxd Michael Baker International

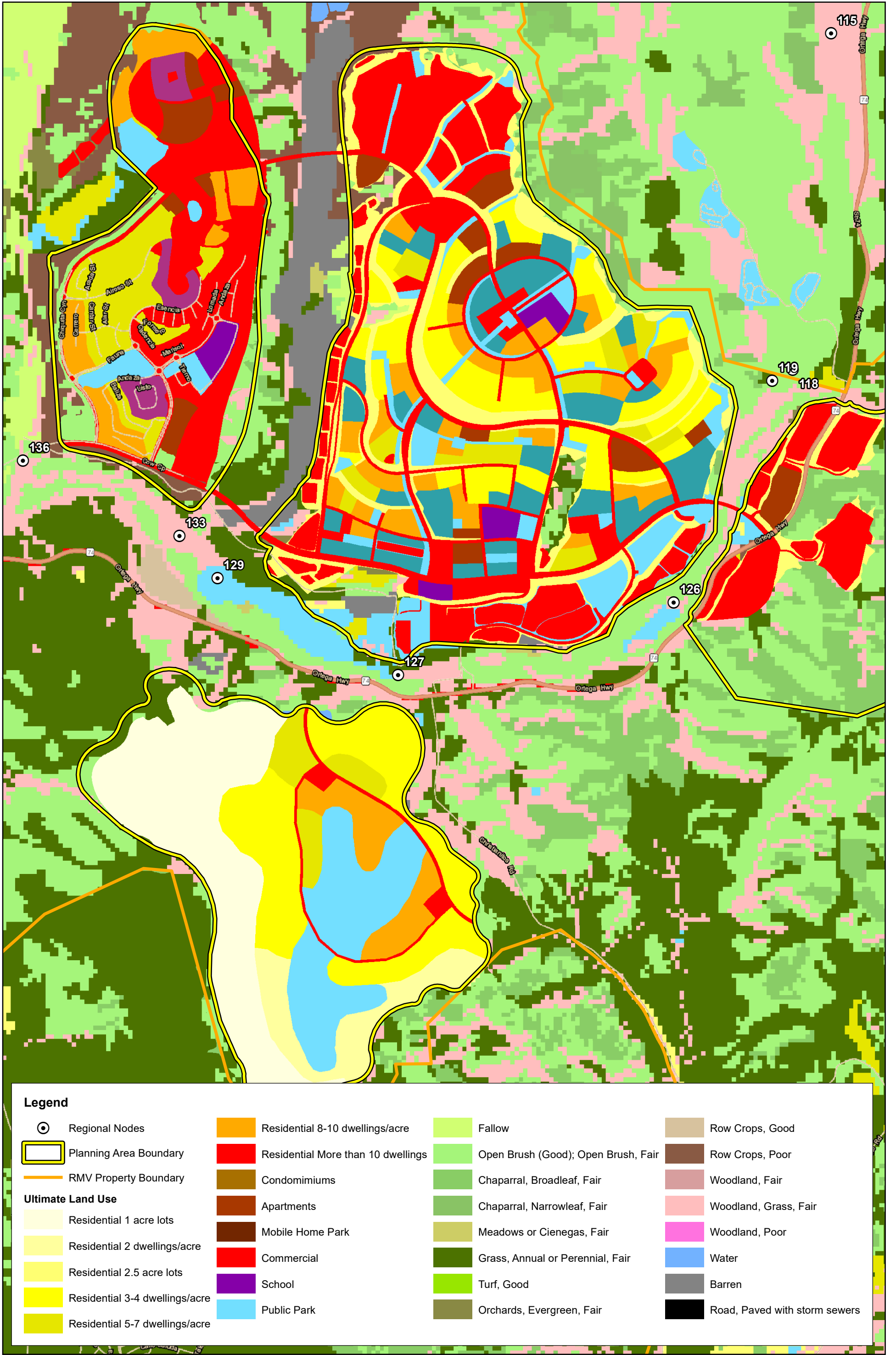




Table 2-15: Ultimate Condition Regional Hydrology San Juan Creek

Node	Area (ac)	100-year Expected Value Storm Event				50-year Expected Value Storm Event				25-year Expected Value Storm Event				10-year Expected Value Storm Event				5-year Expected Value Storm Event				2-year Expected Value Storm Event			
		Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model	Single Area Model	Free Draining Model	Calib Free Draining Model	w/Basin Model
119	49496	20321	20321	-	-	17850	17850	-	-	14918	14918	-	-	7196	7196	-	-	2407	2407	-	-	525	525	-	-
126	50406	20336	20191	-	20204	17831	17731	-	17748	14911	14830	-	14844	7131	7125	-	7144	2380	2353	-	2359	525	522	-	520
127	52660	20460	20250	-	20257	17899	17769	-	17782	14958	14827	-	14851	7235	7025	7122	7140	2459	2354	2416	2411	592	536	581	560
133t	6640	3877	3889	-	2985	3414	3391	-	2683	2869	2849	-	2347	1906	1871	-	1654	867	858	-	797	404	403	-	403
133u	54415	20590	20387	-	20237	18108	17874	-	17764	15160	14864	-	14836	7203	6966	7155	7183	2526	2357	2535	2542	634	549	633	619
133c	61056	21799	22016	-	21486	19174	19298	-	18855	16046	16069	-	15717	7564	7430	-	7254	2774	2597	2752	2670	778	705	766	652
134t	3860	2323	-	-	-	2048	-	-	-	1726	-	-	-	1021	-	-	-	348	-	-	-	131	-	-	-
134u	62747	22063	22223	-	21682	19365	19469	-	19022	16177	16212	-	15857	7495	7441	-	7263	2822	2616	2798	2701	800	744	799	654
134c	66607	22848	23137	-	22574	20083	20289	-	19808	16781	16894	-	16514	7581	7606	-	7407	2903	2724	2852	2748	834	782	822	687
137	67799	22976	23281	-	22720	20126	20406	-	19929	16769	16997	-	16616	7631	7628	-	7426	2913	2752	2865	2745	861	814	854	699
138	69103	23093	23444	-	22882	20228	20532	-	20055	16880	17090	-	16709	7608	7630	-	7424	2910	2773	2882	2751	868	836	864	704
139	69530	23056	23488	-	22928	20148	20566	-	20088	16841	17123	-	16741	7581	7632	-	7424	2917	2782	2886	2750	884	849	883	710

