



## TECHNICAL MEMORANDUM

DATE: February 22, 2017 Project No.: 295-10-15-05.002  
 SENT VIA: EMAIL

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SUBJECT: City of Ceres General Plan Update, Land Use Alternatives—Water

This Technical Memorandum (TM) presents an evaluation of the water distribution system infrastructure needed for the three General Plan Update (GPU) Land Use Alternatives (LUAs) for the City of Ceres (City). This TM includes the following sections:

- Land Uses
- Water Demands
- Required Water System Infrastructure
- Water System Infrastructure Costs
- Conclusions

### LAND USES

The City's existing land uses are shown on Figure 1. Land uses for buildout of the currently adopted General Plan are shown on Figure 2. The land uses for GPU LUAs 1, 2 and 3 are shown on Figures 3, 4 and 5, respectively. Table 1 summarizes acreages for each of the land use types for existing land uses, General Plan land use, and GPU LUAs 1, 2 and 3 for the areas within the City's GPU Planning Limit. The City's water service area excludes North Ceres and Walnut Manor, which are currently served by the City of Modesto. These areas are shown on the figures, designated as areas under consideration for acquisition.

Table 1 also shows the conversion of land use from gross area to net area, where net area excludes streets and public rights-of-way for the General Plan land use and alternatives. This conversion from gross area to net area was necessary because water use factors, discussed below, were derived from existing parcel information, and represent water use per net acre.

Table 1. Land Uses

Existing Land Uses		Current General Plan				Alternative 1				Alternative 2				Alternative 3						
Land Use Designation	Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres			
<b>Inside Current SOI (Excluding Whitmore Ranch Specific Plan) (Note: The Inside Current SOI growth area excludes the area within the current city limit.)</b>																				
Ag Residential/Rural Residential	404.7	Business Park	111.0	0.80	88.8	Business Park	-	0.80	-	Business Park	-	0.80	-	Business Park	-	0.80	-			
Agriculture	155.1	Community Commercial	40.8	0.80	32.6	Community Commercial	40.8	0.80	32.6	Community Commercial	40.8	0.80	32.6	Community Commercial	40.8	0.80	32.6			
Auto Commercial	19.8	Community Facilities	15.5	0.80	12.4	Community Facilities	15.5	0.80	12.4	Community Facilities	15.5	0.80	12.4	Community Facilities	15.5	0.80	12.4			
Duplex/Two Family Residential	30.5	General Industrial	74.6	0.80	59.7	General Industrial	74.6	0.80	59.7	General Industrial	74.6	0.80	59.7	General Industrial	74.6	0.80	59.7			
Educational Facility	96.3	High Density Residential	37.8	0.80	30.3	High Density Residential	37.8	0.80	30.3	High Density Residential	16.7	0.80	13.3	High Density Residential	37.8	0.80	30.3			
General Industrial	104.7	Highway Commercial	12.5	0.80	10.0	Highway Commercial	12.5	0.80	10.0	Highway Commercial	12.5	0.80	10.0	Highway Commercial	12.5	0.80	10.0			
General/Retail Commercial	11.6	Industrial Reserve	76.5	1.00	76.5	Industrial Reserve	76.5	1.00	76.5	Industrial Reserve	76.5	1.00	76.5	Industrial Reserve	76.5	1.00	76.5			
Hospital/Nursing Facility	1.5	Light Industrial	48.1	0.80	38.5	Light Industrial	48.1	0.80	38.5	Light Industrial	48.1	0.80	38.5	Light Industrial	48.1	0.80	38.5			
Light Industrial	55.0	Low Density Residential	913.8	0.85	776.7	Low Density Residential	913.8	0.85	776.7	Low Density Residential	913.8	0.85	776.7	Low Density Residential	894.6	0.85	760.4			
Mixed Use Residential	13.3	Medium Density Residential	157.5	0.80	126.0	Medium Density Residential	157.5	0.80	126.0	Medium Density Residential	157.5	0.80	126.0	Medium Density Residential	157.5	0.80	126.0			
Mobile Homes	20.9	Medium High Density Residential	87.0	0.80	69.6	Medium High Density Residential	87.0	0.80	69.6	Medium High Density Residential	83.0	0.80	66.4	Medium High Density Residential	87.0	0.80	69.6			
Multi Family Residential	32.5	Neighborhood Commercial	9.9	0.80	7.9	Neighborhood Commercial	9.9	0.80	7.9	Neighborhood Commercial	9.9	0.80	7.9	Neighborhood Commercial	29.0	0.80	23.2			
Parks/Open Space/Greenways	2.7	Railroad ROW	7.8	1.00	7.8	Railroad ROW	7.8	1.00	7.8	Railroad ROW	7.8	1.00	7.8	Railroad ROW	7.8	1.00	7.8			
Public Facility	15.5	Regional Commercial	-	0.80	-	Regional Commercial	140.3	0.80	112.3	Regional Commercial	91.9	0.80	73.6	Regional Commercial	140.3	0.80	112.3			
Religious Facilities/Institutional	55.3	Right of Way	1.7	1.00	1.7	Right of Way	1.7	1.00	1.7	Right of Way	1.7	1.00	1.7	Right of Way	1.7	1.00	1.7			
Road ROW	19.3	Schools	95.1	0.80	76.0	Schools	95.1	0.80	76.0	Schools	95.1	0.80	76.0	Schools	95.1	0.80	76.0			
Single Family Residential	836.9	Service Commercial	117.2	0.80	93.8	Service Commercial	117.2	0.80	93.8	Service Commercial	190.7	0.80	152.6	Service Commercial	117.2	0.80	93.8			
Utilities	2.8	Very Low Density Residential	185.9	0.80	148.7	Very Low Density Residential	185.9	0.80	148.7	Very Low Density Residential	185.9	0.80	148.7	Very Low Density Residential	185.9	0.80	148.7			
Vacant	143.5	Commercial Recreation	29.4	0.80	23.5	Commercial Recreation	-	0.80	-	Commercial Recreation	-	0.80	-	Commercial Recreation	-	0.80	-			
	<b>Subtotal</b>	<b>2,021.9</b>			<b>Subtotal</b>	<b>2,021.9</b>			<b>1,680.4</b>		<b>Subtotal</b>	<b>2,021.9</b>			<b>1,680.4</b>		<b>Subtotal</b>	<b>2,021.9</b>		<b>1,679.4</b>
<b>Outside Current SOI</b>																				
Ag Residential/Rural Residential	2,547.7	Agriculture	3,513.9	0.80	2,811.1	Agriculture	3,513.9	0.80	2,811.1	Agriculture	3,455.2	0.80	2,764.2	Agriculture	3,388.1	0.80	2,710.5			
Agriculture	2,616.4	General Industrial	-	0.80	-	General Industrial	-	0.80	-	General Industrial	180.6	0.80	144.5	General Industrial	81.4	0.80	65.2			
Auto Commercial	4.6	Highway Commercial	6.8	0.80	5.4	Highway Commercial	6.8	0.80	5.4	Highway Commercial	6.8	0.80	5.4	Highway Commercial	6.8	0.80	5.4			
Duplex/Two Family Residential	13.9	Industrial Reserve	508.2	0.80	406.5	Industrial Reserve	508.2	0.80	406.5	Industrial Reserve	447.4	0.80	357.9	Industrial Reserve	853.7	0.80	683.0			
Educational Facility	19.6	Low Density Residential	243.2	0.80	194.6	Low Density Residential	243.2	0.80	194.6	Low Density Residential	172.5	0.80	138.0	Low Density Residential	427.6	0.80	342.1			
General Industrial	67.4	Medium Density Residential	10.7	0.80	8.5	Medium Density Residential	10.7	0.80	8.5	Medium Density Residential	10.7	0.80	8.5	Medium Density Residential	10.7	0.80	8.5			
Golf Course	15.5	Parks	20.1	0.80	16.1	Parks	20.1	0.80	16.1	Parks	20.1	0.80	16.1	Parks	20.1	0.80	16.1			
Mixed Use Residential	6.0	Regional Commercial	-	0.80	-	Regional Commercial	145.8	0.80	116.6	Regional Commercial	121.3	0.80	97.1	Regional Commercial	155.3	0.80	124.3			
Mobile Homes	46.5	Residential Agriculture	123.3	0.80	98.7	Residential Agriculture	123.3	0.80	98.7	Residential Agriculture	123.3	0.80	98.7	Residential Agriculture	-	0.80	-			
Multi Family Residential	8.3	Regional Parks	-	0.80	-	Regional Parks	-	0.80	-	Regional Parks	-	0.80	-	Regional Parks	56.2	0.80	44.9			
Parks/Open Space/Greenways	31.0	Residential Reserve	506.9	0.80	405.6	Residential Reserve	506.9	0.80	405.6	Residential Reserve	506.9	0.80	405.6	Residential Reserve	506.9	0.80	405.6			
Religious Facilities/Institutional	0.7	Right of Way	11.9	0.80	9.5	Right of Way	11.9	0.80	9.5	Right of Way	11.9	0.80	9.5	Right of Way	11.9	0.80	9.5			
Road ROW	1.0	Schools	19.6	0.80	15.7	Schools	19.6	0.80	15.7	Schools	19.6	0.80	15.7	Schools	19.6	0.80	15.7			
Service Station	2.2	Service Commercial	9.1	0.80	7.2	Service Commercial	9.1	0.80	7.2	Service Commercial	43.1	0.80	34.5	Service Commercial	9.1	0.80	7.2			
Single Family Residential	239.3	Very Low Density Residential	518.5	0.80	414.8	Very Low Density Residential	518.5	0.80	414.8	Very Low Density Residential	518.5	0.80	414.8	Very Low Density Residential	90.6	0.80	72.5			
Utilities	10.3	Commercial Recreation	145.8	0.80	116.6	Commercial Recreation	-	0.80	-	Commercial Recreation	-	0.80	-	Commercial Recreation	-	0.80	-			
Vacant	7.7			0.80	-			0.80	-			0.80	-			0.80	-			
	<b>Subtotal</b>	<b>5,637.9</b>			<b>Subtotal</b>	<b>5,637.9</b>			<b>4,510.4</b>		<b>Subtotal</b>	<b>5,637.9</b>			<b>4,510.4</b>		<b>Subtotal</b>	<b>5,637.9</b>		<b>4,510.4</b>
<b>West Landing Specific Plan</b>																				
Ag Residential/Rural Residential	136.4	Business Park	72.7	0.80	58.2	Business Park	72.7	0.80	58.2	Business Park	72.7	0.80	58.2	Business Park	72.7	0.80	58.2			
Agriculture	320.2	Community Commercial	17.1	0.80	13.7	Community Commercial	17.1	0.80	13.7	Community Commercial	17.1	0.80	13.7	Community Commercial	17.1	0.80	13.7			
Duplex/Two Family Residential	0.6	Community Facilities	178.0	0.80	142.4															

Table 1. Land Uses

Existing Land Uses		Current General Plan				Alternative 1				Alternative 2				Alternative 3			
Land Use Designation	Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres	Land Use Designation	Area, acres	Conversion Factor to Net Area	Net Area, acres
<b>Whitmore Ranch Specific Plan</b>																	
Educational Facility	39.4	Low Density Residential	28.9	0.80	23.1	Low Density Residential	28.9	0.80	23.1	Low Density Residential	28.9	0.80	23.1	Low Density Residential	28.9	0.80	23.1
Mixed Use Residential	4.4	Medium Density Residential	12.8	0.80	10.3	Medium Density Residential	12.8	0.80	10.3	Medium Density Residential	12.8	0.80	10.3	Medium Density Residential	12.8	0.80	10.3
Single Family Residential	4.8	Medium High Density Residential	6.0	0.80	4.8	Medium High Density Residential	6.0	0.80	4.8	Medium High Density Residential	6.0	0.80	4.8	Medium High Density Residential	6.0	0.80	4.8
Vacant	46.2	Parks	7.7	0.80	6.2												
		Schools	39.4	1.00	39.4												
<b>Subtotal</b>	<b>94.8</b>	<b>Subtotal</b>	<b>94.8</b>		<b>83.8</b>												
<b>Within Current City Limits (Excluding West Landing Specific Plan)</b>																	
Ag Residential/Rural Residential	61.8	Business Park	23.7	1.00	23.7	Business Park	23.7	1.00	23.7	Business Park	23.7	1.00	23.7	Business Park	23.7	1.00	23.7
Auto Commercial	34.6	Commercial Recreation	55.5	0.90	49.9	Commercial Recreation	55.5	0.90	49.9	Commercial Recreation	55.5	0.90	49.9	Commercial Recreation	55.5	0.90	49.9
Cemetery	22.1	Community Commercial	218.3	1.00	218.3	Community Commercial	218.3	1.00	218.3	Community Commercial	218.3	1.00	218.3	Community Commercial	218.3	1.00	218.3
Duplex/Two Family Residential	38.4	Community Facilities	245.3	0.80	196.3	Community Facilities	245.3	0.80	196.3	Community Facilities	245.3	0.80	196.3	Community Facilities	245.3	0.80	196.3
Educational Facility	203.2	Downtown Mixed Use	13.3	1.00	13.3	Downtown Mixed Use	13.3	1.00	13.3	Downtown Mixed Use	13.3	1.00	13.3	Downtown Mixed Use	13.3	1.00	13.3
General Industrial	324.4	Downtown Office	10.9	1.00	10.9	Downtown Office	10.9	1.00	10.9	Downtown Office	10.9	1.00	10.9	Downtown Office	10.9	1.00	10.9
General/Retail Commercial	173.4	Downtown Residential	27.4	1.00	27.4	Downtown Residential	27.4	1.00	27.4	Downtown Residential	27.4	1.00	27.4	Downtown Residential	27.4	1.00	27.4
Golf Course	65.5	General Industrial	335.2	1.00	335.2	General Industrial	335.2	1.00	335.2	General Industrial	335.2	1.00	335.2	General Industrial	387.7	1.00	387.7
Hospital/Nursing Facility	5.8	High Density Residential	30.3	1.00	30.3	High Density Residential	30.3	1.00	30.3	High Density Residential	30.3	1.00	30.3	High Density Residential	30.3	1.00	30.3
Light Industrial	98.9	Highway Commercial	82.8	1.00	82.8	Highway Commercial	82.8	1.00	82.8	Highway Commercial	82.8	1.00	82.8	Highway Commercial	82.8	1.00	82.8
Mixed Use Residential	13.5	Light Industrial	178.0	1.00	178.0	Light Industrial	178.0	1.00	178.0	Light Industrial	178.0	1.00	178.0	Light Industrial	178.0	1.00	178.0
Mobile Homes	79.5	Low Density Residential	1,626.2	1.00	1,626.2	Low Density Residential	1,626.2	1.00	1,626.2	Low Density Residential	1,626.2	1.00	1,626.2	Low Density Residential	1,626.2	1.00	1,626.2
Multi Family Residential	141.5	Medium Density Residential	332.1	1.00	332.1	Medium Density Residential	332.1	1.00	332.1	Medium Density Residential	332.1	1.00	332.1	Medium Density Residential	332.1	1.00	332.1
Office	39.4	Medium High Density Residential	64.6	1.00	64.6	Medium High Density Residential	64.6	1.00	64.6	Medium High Density Residential	64.6	1.00	64.6	Medium High Density Residential	64.6	1.00	64.6
Parks/Open Space/Greenways	156.3	Neighborhood Commercial	25.8	1.00	25.8	Neighborhood Commercial	25.8	1.00	25.8	Neighborhood Commercial	25.8	1.00	25.8	Neighborhood Commercial	25.8	1.00	25.8
Public Facility	20.9	Office	26.4	1.00	26.4												
Public Parking	0.8	Parks	174.1	0.90	156.7												
Religious Facilities/Institutional	85.2	Regional Commercial	95.2	1.00	95.2	Regional Commercial	95.2	1.00	95.2	Regional Commercial	95.2	1.00	95.2	Regional Commercial	95.2	1.00	95.2
Road ROW	1.1	Right of Way	1.1	1.00	1.1	Right of Way	1.1	1.00	1.1	Right of Way	1.1	1.00	1.1	Right of Way	1.1	1.00	1.1
Service Station	11.4	Schools	158.0	1.00	158.0												
Single Family Residential	1,821.2	Service Commercial	39.8	1.00	39.8	Service Commercial	39.8	1.00	39.8	Service Commercial	39.8	1.00	39.8	Service Commercial	39.8	1.00	39.8
Townhomes	13.7	Very Low Density Residential	196.5	0.90	176.8	Very Low Density Residential	196.5	0.90	176.8	Very Low Density Residential	196.5	0.90	176.8	Very Low Density Residential	144.0	0.90	129.6
Utilities	204.5																
Vacant	343.3																
<b>Subtotal</b>	<b>3,960.3</b>	<b>Subtotal</b>	<b>3,960.5</b>		<b>3,868.9</b>	<b>Subtotal</b>	<b>3,960.5</b>		<b>3,868.9</b>	<b>Subtotal</b>	<b>3,960.5</b>		<b>3,868.9</b>	<b>Subtotal</b>	<b>3,960.5</b>		<b>3,874.1</b>
<b>Grand Total</b>	<b>12,591.8</b>	<b>Grand Total</b>	<b>12,592.0</b>		<b>10,844.8</b>	<b>Grand Total</b>	<b>12,592.0</b>		<b>10,844.8</b>	<b>Grand Total</b>	<b>12,592.0</b>		<b>10,844.8</b>	<b>Grand Total</b>	<b>12,592.0</b>		<b>10,849.1</b>

## **WATER DEMANDS**

This section summarizes average day, maximum day and peak hour water demands for the potable water system for existing conditions, buildup of the current General Plan, and the GPU LUAs. The City does not currently use recycled water, but did require the installation of recycled water piping in the West Landing Specific Plan Area. The City will be investigating the potential use of recycled water in the future, but recycled water is not included in this evaluation.

### **Average Day Demands**

Table 2 presents the average day water demand factors used for existing and future land use scenarios. Water demand factors developed for the City's 2011 Water Master Plan (WMP) were used as a starting point for calculating existing and future demands. Water demand factors in the WMP were based on 2007 use. The economic downturn, the drought, metering of residential customers and ongoing conservation programs have reduced water use significantly for the City. Water demand factors for existing land uses were adjusted uniformly to match 2016 service area water use, which was 3,800 acre-feet/year, with a per capita water use of 72 gallons per capita per day (gpcd) for an estimated current service area population of 47,600. Water use factors for future scenarios were adjusted based on a projected future service area population of 96,000 people and a conservative per capita use of 125 gpcd, based on input from the City.<sup>1</sup>

Table 3 presents the estimated annual water use, in acre-feet/year (AFY), and the corresponding average day water demand, in million gallons per day (mgd) for existing land uses, buildup land uses and GPU LUAs. The average day demand is the annual water use divided by 365 days per year, and converted to mgd.

Water use calculations were initially made using all land use within the City's GPU Planning Limit, and then deducting water demands in North Ceres and Walnut Manor (1.23 mgd and 0.06 mgd, respectively) from these totals. Water use for North Ceres and Walnut Manor is based on historical well production from the City of Modesto for wells serving these areas, and is not expected to increase in the future, as these areas are essentially built out.

The current General Plan and GPU LUA average day water demands differ from each other by less than 0.3 percent. For purposes of this potable water evaluation, this level of difference is less than significant.

### **Maximum Day and Peak Hour Demands and Fire Flows**

Maximum day and peak hour water demands and fire flow requirements are used for sizing water storage reservoirs. Peak hour water demands and maximum day demands plus fire flow requirements are used for sizing water distribution system piping.

The maximum day demands and peak hour demands were estimated by multiplying the average day demands by the appropriate peaking factor. The peaking factors used in this TM are based on peaking

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<sup>1</sup> The service area population of 96,000 people is based on projections developed for the 2011 Water Master Plan. The required potable water infrastructure analyzed in this memorandum for each General Plan land use alternative is based on land use and is not expected to be impacted by differences in buildup population, since infrastructure sizing will depend on fire flow requirements associated with the different land uses.

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factors used in the 2011 WMP. Maximum day demand is 1.8 times average day demand and peak hour demand is 2.9 times average day demand. The maximum day demands and the peak hour demands are presented in the bottom portion of Table 3.

**Table 2 Water Demand Factors**

Existing Land Use Demand Factors		Future Land Use Demand Factors	
Existing Land Uses	Demand Factor, gpd/net acre	Future Land Uses	Demand Factor, gpd/net acre
Ag Residential/Rural Residential	-	Agriculture	-
Agriculture	-	Business Park	1,237
Auto Commercial	887	Commercial Recreation	1,237
Cemetery	1,689	Community Commercial	1,237
Duplex/Two Family Residential	1,224	Community Facilities	884
Educational Facility	633	Downtown Mixed Use	2,533
General Industrial	844	Downtown Office	1,237
General/Retail Commercial	887	Downtown Residential	2,533
Golf Course	1,689	General Industrial	1,178
Hospital/Nursing Facility	633	High Density Residential	2,533
Light Industrial	844	Highway Commercial	1,237
Mixed Use Residential	1,816	Industrial Reserve	177
Mobile Homes	1,224	Light Industrial	1,178
Multi-Family Residential	1,224	Low Density Residential	1,944
Office	887	Medium Density Residential	1,709
Parks/Open Space/Greenways	1,689	Medium High Density Residential	2,533
Public Facility	633	Neighborhood Commercial	1,237
Public Parking	-	Office	1,237
Religious Facilities/Institutional	844	Parks	2,357
Road ROW	-	Railroad ROW	-
Service Station	887	Regional Commercial	1,237
Single Family Residential	1,393	Regional Parks	2,357
Townhomes	1,224	Residential Agriculture	1,768
Utilities	633	Residential Reserve	-
Vacant	-	Right of Way	-
		Schools	884
		Service Commercial	1,237
		Very Low Density Residential	1,944

Notes:

- 1) Demand factors were developed from the 2011 Ceres Water Master Plan and adjusted to reflect reductions in water use based on the downturn in the economy, the drought, residential customer metering, and ongoing conservation. Existing land use factors are based on current per capita water use of 72 gallons/capita/day (gpcd); future scenarios use 125 gpcd.
- 2) The industrial reserve demand factor was reduced to 10 percent of the industrial demand factor to account for the projection that only about 10 percent of the total industrial reserve land use areas would develop for each land use alternative.
- 3) The residential reserve demand factor was reduced to zero to account for the projection that none of the residential reserve land use areas would develop for each land use alternative.

**Table 3. Average Day, Maximum Day and Peak Hour Water Use for GPU Land Use Alternatives**

Land Use Scenarios					
	Existing	Currently Adopted General Plan Land Use	Alternative 1 Land Use	Alternative 2 Land Use	Alternative 3 Land Use
Annual Demand, AFY <sup>(a)</sup>	6,062	12,041	12,041	12,080	11,643
Average Day Demand, mgd <sup>(b)</sup>	5.41	10.75	10.75	10.78	10.39
Maximum Day Demand, mgd <sup>(c)</sup>	9.74	19.35	19.35	19.41	18.71
Peak Hour Demand, mgd <sup>(d)</sup>	15.69	31.17	31.17	31.27	30.14

(a) Based on land uses in Table 1 and water demand factors in Table 2. Totals reduced by 1,447 AFY, the average annual demand for North Ceres and Walnut Manor.  
 (b) Average daily demand equals annual water use divided by 365 days/year, and converted to mgd.  
 (c) 1.8 times average daily water use, as estimated in the City's 2011 WMP.  
 (d) 2.9 times average daily water use, as estimated in the City's 2011 WMP.

Fire flow requirements vary for different land use types. The 2011 WMP used fire flows of 1,500 to 2,000 gpm for residential land uses, 2,750 gpm to 3,000 gpm for commercial/office and 3,500 to 4,000 gpm for industrial uses. For commercial and industrial land uses, the lower requirement assumes sprinklered buildings, and the higher requirement assumes non-sprinklered buildings.

## REQUIRED WATER SYSTEM INFRASTRUCTURE

Figure 6 summarizes required water infrastructure for the General Plan Land Use and land use alternatives. Required water infrastructure for the General Plan Land Use was developed in the 2011 WMP and then further refined as part of Ceres' participation in the Stanislaus Regional Water Authority (SRWA) Surface Water Supply Project. The figure shows only pipelines that are 10-inch diameter and larger.

The required major water infrastructure for the GPU LUAs will be similar for each alternative. Since the total water demands for each GPU LUA are essentially the same, the required tanks, booster pump stations, and wells will be the same. Where land use alternatives include industrial land uses that are not in the General Plan, it is assumed that transmission pipelines serving those areas would be sized at 16-inch diameter, rather than 12-inch diameter, because of higher fire flow requirements for industrial uses, compared with residential or commercial land uses. The required water infrastructure shown on Figure 6 (with GPU LUA 1 land uses) includes:

- Planned SRWA Surface Water Project Water Treatment Plant
- Planned SRWA Surface Water Project Transmission Main
- Future wells
- Future storage reservoirs
- Future water distribution system transmission pipelines

The required water infrastructure should be confirmed through the preparation of an update of the City's WMP when the GPU land uses have been finalized and adopted.

## **WATER SYSTEM INFRASTRUCTURE COSTS**

The construction and capital costs of the major water distribution system infrastructure are shown in Table 4.<sup>2</sup> Costs are presented in December 2016 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 10,530 (20 Cities Average). Costs are listed for each of the GPU LUAs. Costs are highest for GPU LUA 3 because of the larger diameter pipelines required to serve the parcels designated for industrial use in the southeastern portion of the City. In addition to these major water infrastructure costs, there would be additional costs for the water distribution systems within the growth areas.

Approximate water infrastructure unit costs are discussed below:

- The City's recent Central Avenue Transmission Project was used to determine pipe unit costs for this TM. The project included 10,500 feet of 16-inch diameter ductile iron pipe, with a construction cost of \$1.908 million. The unit cost for that project is approximately \$11.40 per inch-diameter per foot. For this TM a construction cost of approximately \$14 per inch-diameter per foot was used.
- The unit price for wells is based on the City's 2011 WMP, which used a construction cost of approximately \$940,000 per well. This was escalated to a construction cost of \$1,100,000 per well.
- Storage costs (including booster pump station at the tanks) were developed as a part of the SRWA Surface Water Supply Project.
- The 40 percent implementation multiplier, for engineering, environmental, administration, construction management, etc, is from West Yost Associates' experience with similar, typical projects.

Infrastructure costs and costs per acre are discussed below:

- LUA 1 – The estimated construction cost for the water infrastructure for LUA 1 is \$76.5 million, and the estimated total capital cost is \$111.0 million.

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<sup>2</sup> Costs for the SRWA Surface Water Supply Project Water Treatment Plant and transmission pipeline are not included, but would be the same for all alternatives.

- LUA 2 – The estimated construction cost for the water infrastructure for LUA 2 is \$77.2 million, and the estimated total capital cost is \$112.1 million.
- LUA 3 – The estimated construction cost for the water infrastructure for LUA 3 is \$78.7 million, and the estimated total capital cost is \$114.2 million.

These preliminary water infrastructure cost estimates should be verified through the preparation of a City-wide water master plan or through development of water plans for the individual development regions or individual development projects.

## CONCLUSIONS

Water system infrastructure conclusions are provided below:

- All LUA have very similar costs, since water system infrastructure is the same except for alternatives where industrial development is planned that is commercial or residential in other alternatives. Differences between the three alternatives is less than three percent.
- LUA 1 has a slightly lower cost than other alternatives. This is because LUA 1 has more residential and less industrial and commercial areas than LUAs 2 and 3.
- LUA 3 has slightly higher infrastructure costs (\$114.2M compared with \$111.0M for LUA 1 and \$112.1M for LUA 2). This is because LUA 3 requires pipelines to be installed to serve the industrial reserve area in the southeastern part of the City.
- LUA 2 requires slightly more large-diameter pipelines (pipeline diameter greater than 12 inches), because it has the largest areas of high intensity land uses such as General Industrial and Service Commercial.

The land uses for the Whitmore Ranch Specific Plan are the same for all the LUAs, resulting in identical water infrastructure requirements and associated costs for each LUA for Whitmore Ranch.

**Table 4. General Plan Land Use and Alternative Distribution System Infrastructure Costs<sup>(a)</sup>**

CIP ID	Estimated Construction Cost, dollars <sup>(b)</sup>	Capital Cost, dollars (includes mark-ups) <sup>(c)</sup>
<b>General Plan Land Use</b>		
Pipelines <sup>(d)</sup>	47,700,000	69,200,000
Wells	7,700,000	11,200,000
Storage Reservoirs <sup>(e)</sup>	21,100,000	30,600,000
Total	\$76,500,000	\$111,000,000
<b>General Plan Land Use Alternative 1</b>		
Pipelines <sup>(d)</sup>	47,700,000	69,200,000
Wells	7,700,000	11,200,000
Storage Reservoirs <sup>(e)</sup>	21,100,000	30,600,000
Total	\$76,500,000	\$111,000,000
<b>General Plan Land Use Alternative 2</b>		
Pipelines <sup>(d)</sup>	48,400,000	70,300,000
Wells	7,700,000	11,200,000
Storage Reservoirs <sup>(e)</sup>	21,100,000	30,600,000
Total	\$77,200,000	\$112,100,000
<b>General Plan Land Use Alternative 3</b>		
Pipelines <sup>(d)</sup>	49,900,000	72,400,000
Wells	7,700,000	11,200,000
Storage Reservoirs <sup>(e)</sup>	21,100,000	30,600,000
Total	\$78,700,000	\$114,200,000

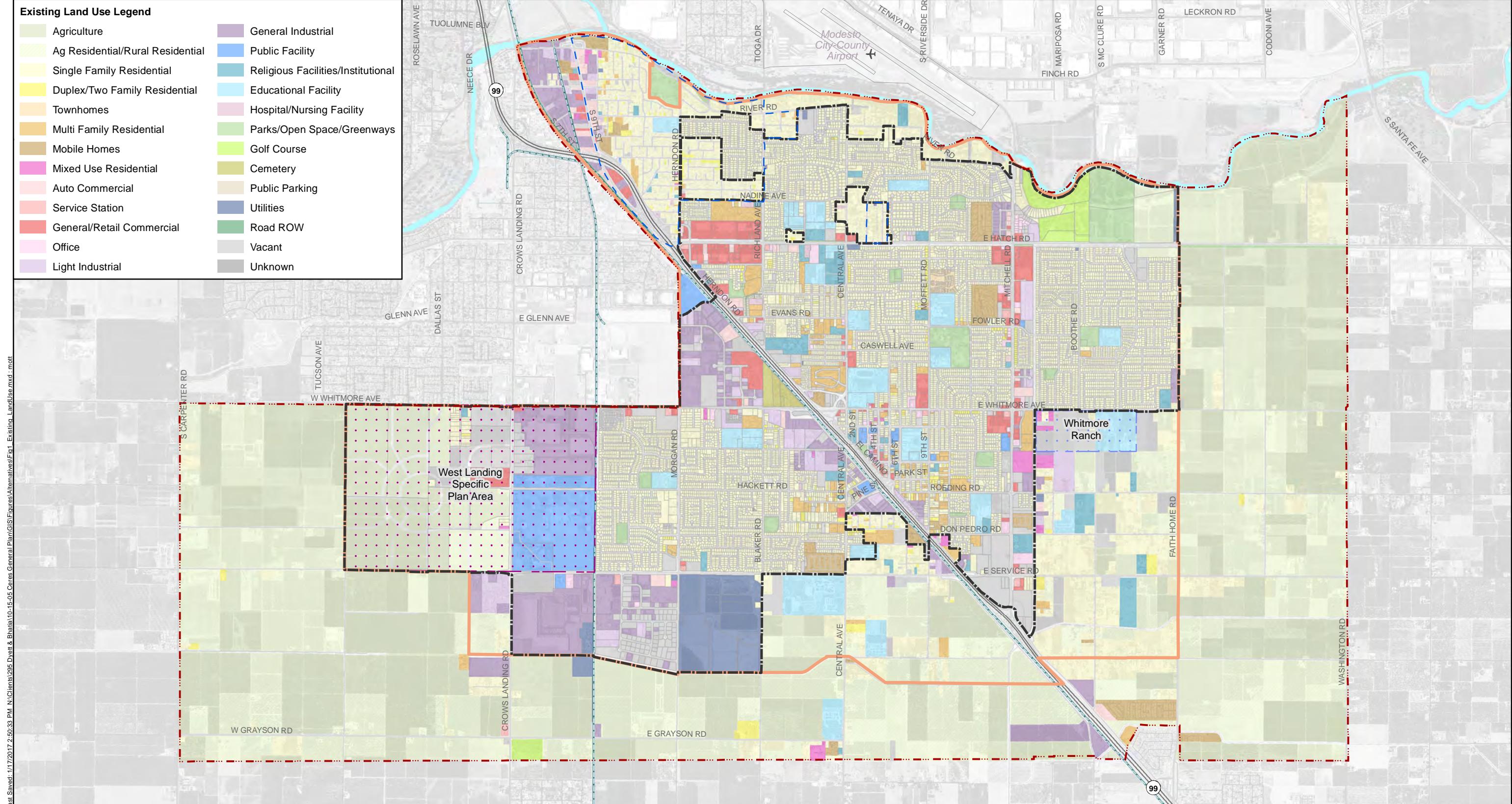
<sup>(a)</sup> Costs shown are based on the December 2016 20 Cities ENR CCI 10,530.

<sup>(b)</sup> Total rounded to nearest \$1000. Costs include base construction costs plus 25 percent construction contingency.

<sup>(c)</sup> Capital Costs computed as total construction cost plus 40 percent for implementation, including administration, design, construction management, and CEQA compliance.

<sup>(d)</sup> Future pipelines 10-inch diameters and larger.

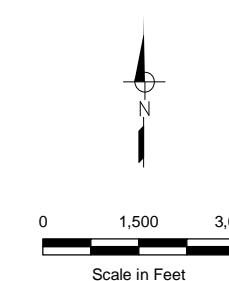
<sup>(e)</sup> Includes booster pump station.



#### Symbology

- Airport
- River
- Railroads
- City Limit
- General Plan Update Planning Limit
- Ceres Sphere of Influence

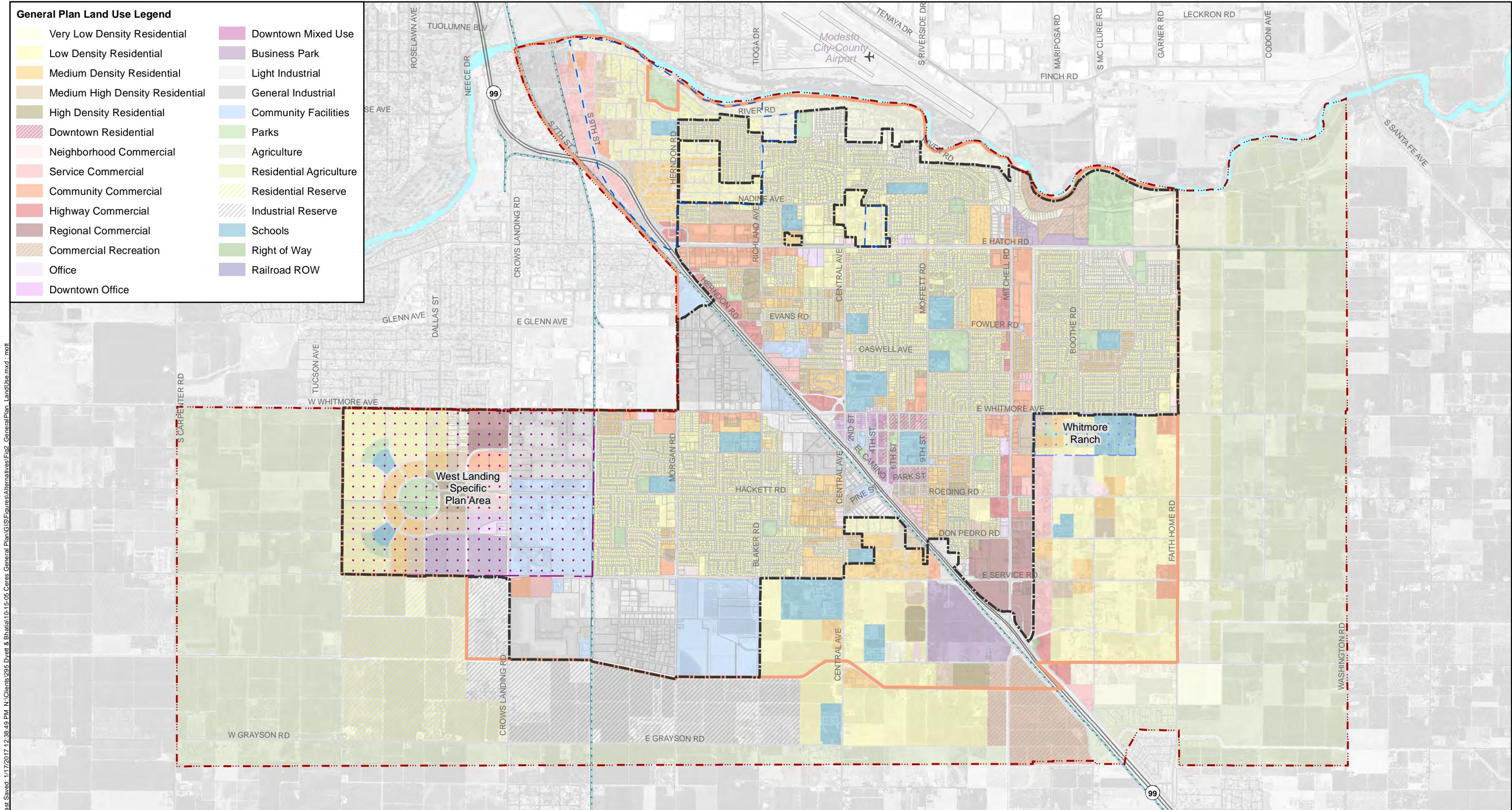
- Areas Under Consideration for Aquisition
- West Landing Specific Plan Area
- Whitmore Ranch
- Parcels



**Figure 1**

#### Existing Land Use

Dyett and Bhatia  
City of Ceres  
General Plan Update



## Symbology

- Airport
- River
- Railroads
- City Limit
- General Plan Update Planning Limit
- Ceres Sphere of Influence
- Areas Under Consideration for Acquisition
- West Landing Specific Plan Area
- Whitmore Ranch
- Parcels



0 1,500 3,000

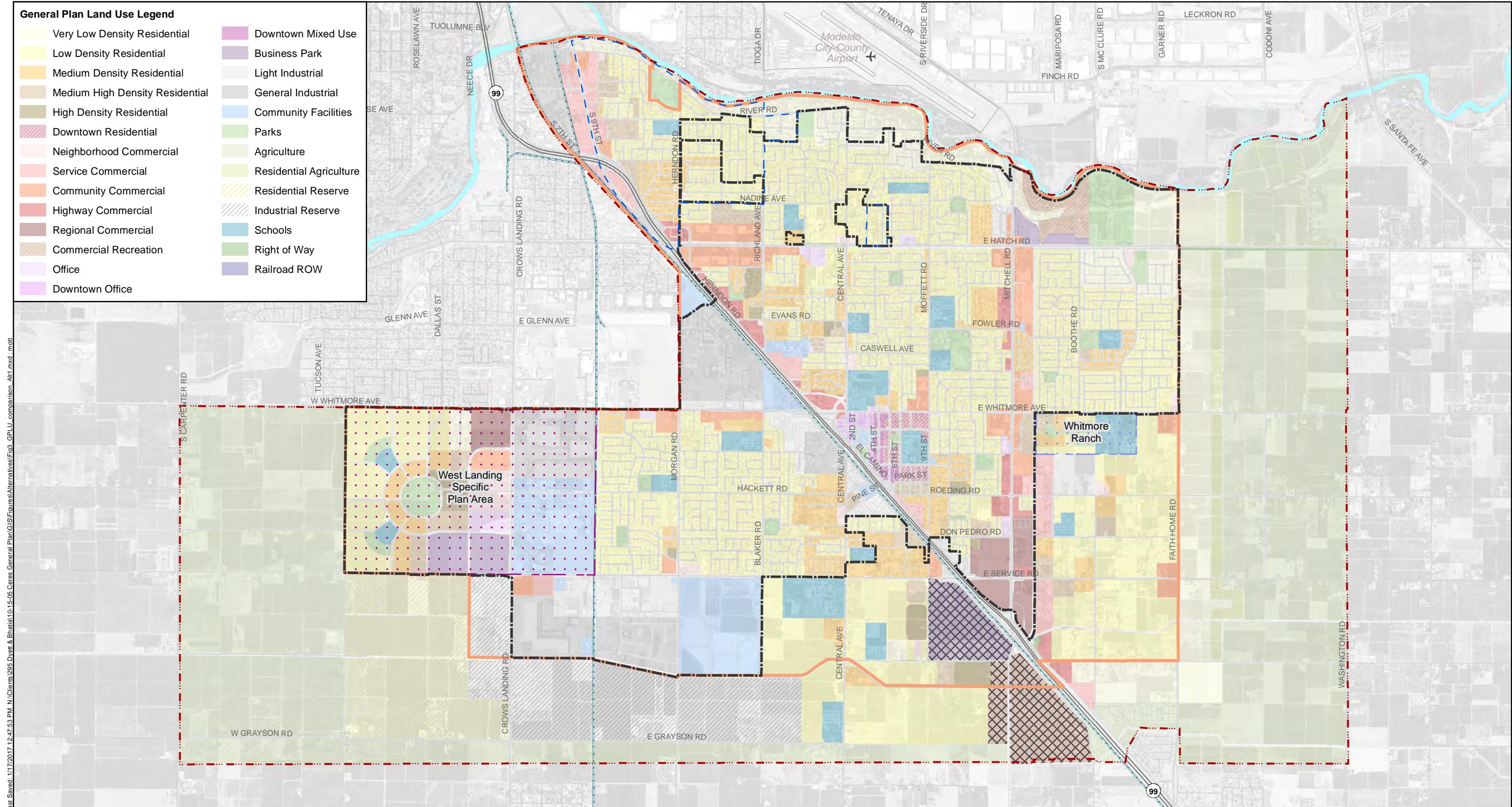
Scale in Feet



# Figure 2

## General Plan Land Use

Att and Bhatia  
City of Ceres  
Plan Update



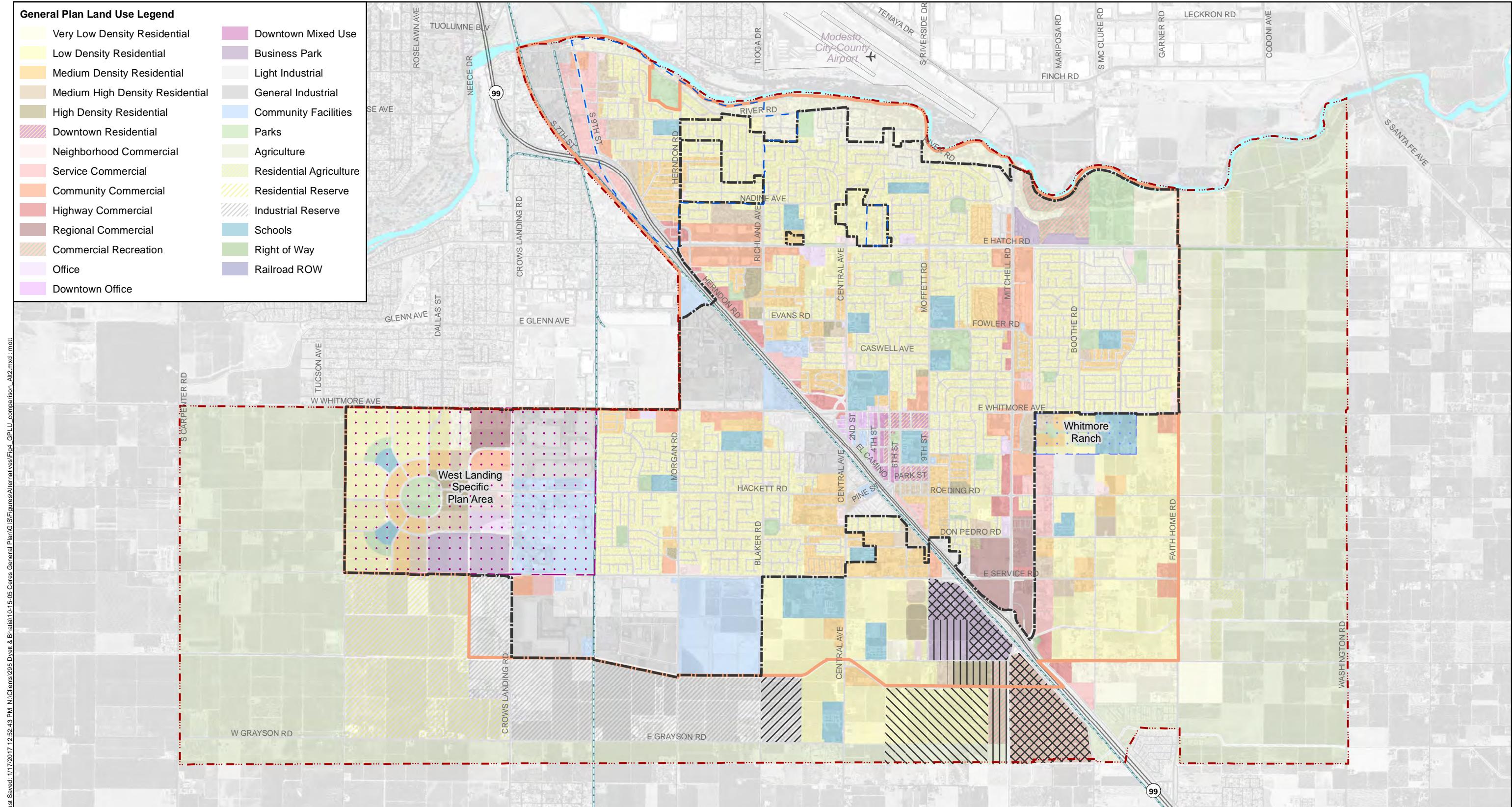
#### Symbology

- Airport
- River
- Railroads
- City Limit
- General Plan Update Planning Limit
- Ceres Sphere of Influence

- Areas Under Consideration for Aquisition
- West Landing Specific Plan Area
- Whitmore Ranch
- Parcels



**Figure 3**  
**General Plan Land Use Comparison to Alternative 1**  
Dyett and Bhatia  
City of Ceres  
General Plan Update



#### Symbology

- Airport
- River
- Railroads
- City Limit
- General Plan Update Planning Limit
- Ceres Sphere of Influence

- Areas Under Consideration for Acquisition
- West Landing Specific Plan Area
- Whitmore Ranch
- Parcels

#### Alternative 2 Change Areas

- General Industrial
- Low Density Residential
- Regional Commercial
- Service Commercial



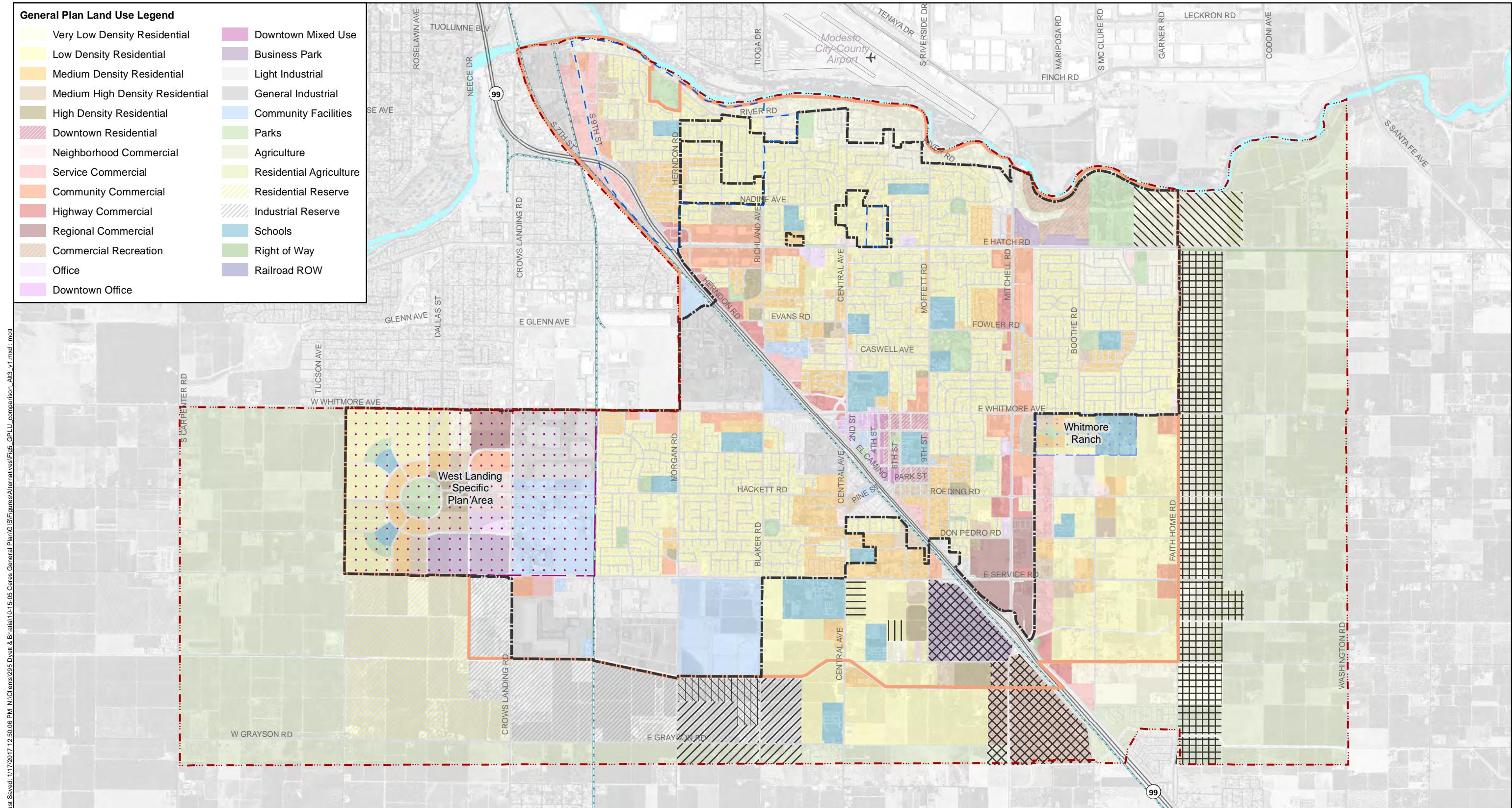
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Scale in Feet



Figure 4

#### General Plan Land Use Comparison to Alternative 2

Dyett and Bhatia  
City of Ceres  
General Plan Update



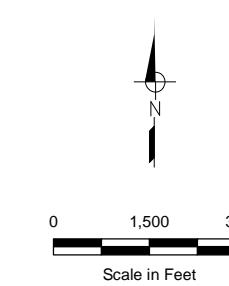
#### Symbology

- Airport
- River
- Railroads
- City Limit
- General Plan Update Planning Limit
- Ceres Sphere of Influence

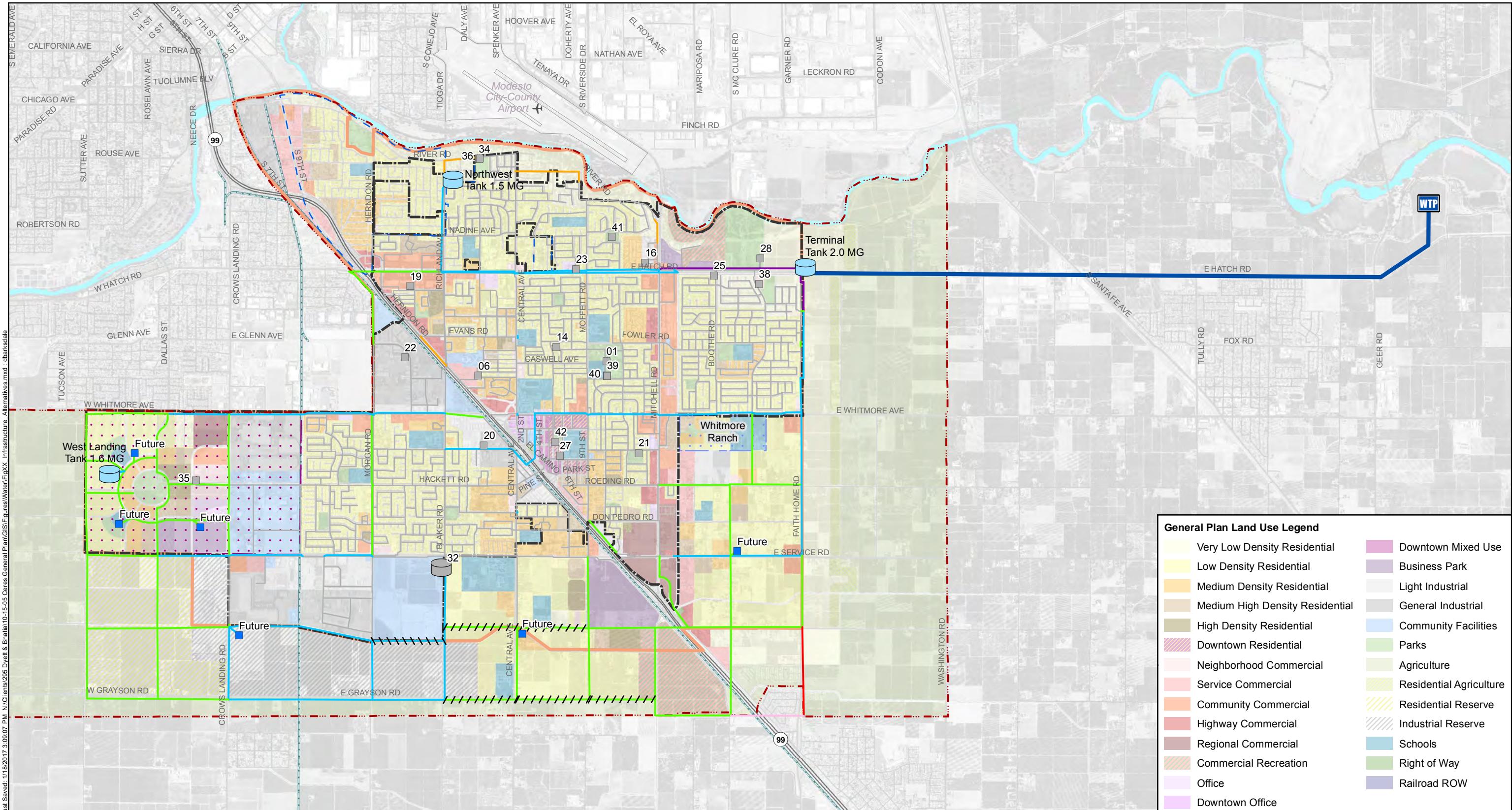
- Areas Under Consideration for Aquisition
- West Landing Specific Plan Area
- Whitmore Ranch
- Parcels

- Alternative 3 Change Areas
- General Industrial
- Industrial Reserve
- Low Density Residential
- Parcels

- Medium Density Residential
- Neighborhood Commercial
- Regional Commercial
- Regional Parks



**Figure 5**  
**General Plan Land Use Comparison to Alternative 3**  
Dyett and Bhatia  
City of Ceres  
General Plan Update



**Figure 6**

## Infrastructure Alternatives for Water System

## Dyett and Bhatia City of Ceres General Plan Update