



TECHNICAL MEMORANDUM NO. 6

DATE: October 19, 2005 Project No.: 423-02-03-01
TO: Don Ridenhour, Project Manager CC: WATRTAC Members
FROM: Gerry Nakano, Project Manager
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SUBJECT: 2050 Napa Valley Water Resources Study Project
Comparison of Demand Projections and Supply Capabilities

PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize and compare the following:

- Present and projected municipal and industrial (M&I) demands for the incorporated areas, discussed in TM 2, to the water supplies available to Napa County municipalities discussed in TM 4.
- Present and projected demands of the unincorporated areas (rural residential, wineries, improved open areas, and agriculture) discussed in TM 3 to the water supplies available to Napa County unincorporated areas discussed in TM 5.

The purpose of this demand and supply comparison is to determine if a valley-wide deficit or surplus in overall water supply exists. The quantity, timing, and geographical location of anticipated, supplemental water supply needs are also identified in this TM.

SUMMARY

As described in previous TMs, the Napa Valley water supply and demand evaluations were separated into groundwater basin areas. The three groundwater basin areas are the Main Basin, which includes the valley floor from American Canyon to Calistoga; the Milliken-Sarco-Tulucay creek (MST) basin, which includes the lower watersheds of the three creeks listed above; and the Carneros basin, south and west of Napa.

Because it was found that there was insufficient groundwater data and perennial yield estimates for the Carneros basin to allow comparison of supplies and demands, and the MST basin had recently been evaluated by the USGS, only the Main Basin supplies and demands were fully analyzed. All municipalities are included in the Main Basin study area.

The comparison of M&I supplies and demands suggests, based on the assumptions used in this Study, a supply deficit during single-dry years for the 2020 and 2050 study periods and for multiple-dry years for the 2050 study period. Excess supplies are currently available during all years, and projected to be available in 2020 during normal and multiple-dry years, and in normal years in 2050.

For Main Basin unincorporated area water supplies, there appears to be a projected deficit in water supplies in all periods studied, except for present normal years.

Combining the water supplies and demands for Main Basin incorporated and unincorporated areas suggests there is a net surplus of water during normal years, assuming supplies could be distributed among all the parties. The water supply situation in multiple-dry years indicates a net deficit of water supply would occur if water demands increase as projected in TM 2 and TM 3, although currently there appears to be a net surplus in supply. The total supply deficit at the end of a six-year drought is estimated to be over 54,340 acre-feet (6 x 9,057 acre-feet) for the 2050 supply and demand. Supplies in single-dry years appear to be over-allocated for all study periods with a total supply deficit following a single dry year of 17,680 acre-feet for the 2050 supply and demand.

INTRODUCTION

Since each water purveyor in the Napa Valley is ultimately responsible for developing its own water supply, the first step in the analysis was to determine the supply/demand situation for each agency. Based on this individual analysis, if it is determined that any agencies have a surplus in their water supplies in the short-term, long-term, or permanently, then they may be able to use that surplus to address the needs of other agencies on a short-term or permanent basis if equitable financial arrangements could be agreed upon, to the mutual satisfaction of participating parties. In order to determine what the valley-wide solution might look like, individual agency's water rights, supplies, treatment capacity, storage and conveyance/transmission capacity were combined. The results of the individual agency analysis of supply compared to demands is summarized in Attachments A and B to this TM.

A more detailed list of M&I supply and demand assumptions used in this TM is included in Attachment C.

The agencies involved are:

- The City of Napa (Napa)
- The City of American Canyon (American Canyon)
- The Town of Yountville (Yountville)
- The City of St. Helena (St. Helena)
- The City of Calistoga (Calistoga)
- Napa Sanitation District (NSD - source of recycled water)
- The County of Napa (County)

INCORPORATED AREA M&I WATER DEMANDS

The present and projected water demands, discussed in TM 2, are shown in Table 1.

Table 1. Summary of Projected Incorporated Area M&I Demands

Municipality	1991 Study	2050 Study			
	Year 2020, afa ^(a)	Present	Year 2020, afa	Year 2050, afa	Annual Percent Increase 2020-2050
Napa	18,195	15,370	18,798 ^(b)	21,643	0.5
American Canyon	2,316	2,187	6,459 ^(c)	7,500	0.5
Yountville	625	520	679 ^(d)	679	0.0
St Helena	2,690	2,092	2,179 ^(e)	2,458 ^(f)	0.4
Calistoga	1,515	910	1,285 ^(g)	1,560	0.7
Total M&I Demand	25,341	21,079	29,400	33,840	0.5

- ^(a) afa = acre-feet annually
- ^(b) Buildout demand of 18,798 afa in 2020.
- ^(c) From Draft 2003 Water Master Plan Update. Estimated buildout demand is 6,300 afa in 2015.
- ^(d) Uses Unit Water Demands from WYA 2004 Study. Estimated buildout demand is 679 afa in 2010.
- ^(e) Year 2020 from Urban Water Management Plan (UWMP). Includes 6 percent unaccounted for water.
- ^(f) Estimated buildout demand is 2,458 afa in 2050.
- ^(g) Based on Draft 2003 General Plan and August 2000 Water Facilities Plan. Estimated buildout demand is 1,517 afa in 2038.

During reduced water availability conditions, it is assumed demand reduction and water conservation practices would reduce the M&I demand. The estimated demands during normal, multiple-dry years and single-dry years is shown in Table 2. It is assumed M&I demands would be reduced by 15 percent during each multiple-dry year, and by 15 percent during a single-dry year.

Table 2. Projected M&I Demands During Limited Supply Conditions

Supply Year Condition	Percent of Normal Demand	Estimated Present Demand, afa	Estimated Demand in 2020, afa	Estimated Demand in 2050, afa
Normal or Wet	100	21,079	29,400	33,840
Multiple-Dry	85	17,918	24,990	28,764
Single-Dry	85	17,918	24,990	28,764

For a single-dry year, it was assumed that indications of such a condition would be evident early enough in the year to allow for a 15 percent demand reduction to be achieved, and would be the same as expectations for demand reduction for an extended drought period.

M&I WATER SUPPLIES

The projected M&I water supplies developed in TM 4 are consolidated in detail in Attachment A and summarized in Table 3 for each study period.

Table 3. Summary of Projected Available M&I Water Supplies, afa^(a)

Water Supply Year	Yield Condition	Present	2020	2050
Wet	Maximum Yield ^(b) , afa	55,925	63,000	63,056
Normal	Average Yield ^(c) , afa	37,670	44,387	44,519
Multiple-Dry	Reliable Yield ^(d) , afa	23,955	28,117	28,205
Single Dry	Perennial Yield ^(e) , afa	18,261	21,069	21,160

- ^(a) See Attachment A for detailed water supply calculations.
- ^(b) Maximum Yield = Total water available in a wet year with a 0 percent exceedence probability. SWP deliveries are 100 percent of entitlement.
- ^(c) Average Yield = Water that would be available in a normal year with a 60 percent exceedence probability. SWP deliveries are 76 percent of entitlement.
- ^(d) Reliable Yield = Water that would be available in a multiple-dry year with an 85 percent exceedence probability. SWP deliveries are 40 percent of entitlement.
- ^(e) Perennial Yield = Water that would be available in a single-dry-year with 100 percent exceedence probability. SWP deliveries are 20 percent of entitlement.

A detailed summary of the projected available water supplies, discussed in previous TMs, is presented in Figures 1, 2, and 3 for the study periods of the Existing, Buildout, and 2050, respectively.

COMPARISON OF M&I WATER DEMANDS AND SUPPLIES

A comparison of the projected M&I supply and demand for the study periods under normal year, multiple dry year and single dry year conditions is presented in Table 4, and represented graphically in Figures 4, 5, and 6.

Table 4. Comparison of Projected M&I Supply and Demand

Supply Year Condition	Estimated Supply, afa	Estimated Demand, afa	Excess Supply or (Shortfall) , afa
Existing			
Normal	37,670	21,079	16,590
Multiple-Dry	23,955	17,918	6,037
Single Dry	18,261	17,918	344
2020			
Normal	44,387	29,400	14,987
Multiple-Dry	28,117	24,990	3,127
Single Dry	21,069	24,990	(3,921)
2050			
Normal	44,519	33,840	10,679
Multiple-Dry	28,205	28,764	(559)
Single Dry	21,160	28,764	(7,604)

A review of the data suggests a supply deficit during single-dry years for the 2020 and 2050 study periods and for multiple-dry years for the 2050 study period. Excess supplies are currently available during all hydrologic conditions, and projected to be available in 2020 during normal and multiple-dry years, and in normal years in 2050. A comparison of the existing and projected supplies and demands for each municipality is shown in Attachment B.

As indicated in Attachment B, Napa appears to have sufficient supply to meet existing demands, even in a single-dry year. For 2020 and 2050, the data suggest a supply deficit for Napa only during a single-dry year condition.

For the existing demands, the data suggest a supply deficit for American Canyon only during a single-dry year condition. For 2020 and 2050, the data suggest a supply deficit for American Canyon during all supply conditions.

For the existing demands, the data suggest a supply deficit for Yountville only during a single-dry year condition. Once the proposed well is installed, the data suggest Yountville will not have any supply deficit conditions, even at the projected 2050 demands under single-dry-year conditions.

For the existing and 2020 demands, the data suggest a supply deficit for St. Helena during multiple-dry and single-dry year conditions. For 2050, the data suggest a supply deficit for St. Helena during average, multiple-dry and single-dry year conditions.

For the existing and 2020 demands, the data suggest a supply deficit for Calistoga only during a single-dry year condition. For 2050, the data suggest a supply deficit for Calistoga during all supply conditions.

M&I MAXIMUM-DAY PRODUCTION AND DELIVERY LIMITATIONS

The projected urban M&I maximum-day production and delivery capacity is summarized in Table 5.

Table 5. Projected M&I Maximum Water Production/Conveyance Capacity

Water Supply	Present		2020		2050	
	cfs	mgd	cfs	mgd	cfs	mgd
Hennessey WTP	31.0	20.0	31.0	20.0	31.0	20.0
Rector to Yountville	1.7	1.1	1.7	1.1	1.7	1.1
Milliken WTP	6.2	4.0	6.2	4.0	6.2	4.0
Louis Stralla WTP	5.4	3.5	5.4	3.5	5.4	3.5
Kimball WTP	1.9	1.2	1.9	1.2	1.9	1.2
Stonebridge Wells	0.6	0.4	0.6	0.4	0.6	0.4
Vallejo Potable Water ^(c)	1.5	1.0	3.1	2.0	3.1	2.0
Subtotal	48.3	31.2	49.9	32.2	49.9	32.2
Jamieson Canyon WTP (NBA)	18.6	12.0	32.5 ^(a)	21.0 ^(a)	32.5 ^(a)	21.0 ^(a)
American Canyon WTP (NBA)	8.7	5.6	7.5 ^(b)	4.8 ^(b)	7.5 ^(b)	4.8 ^(b)
Total	75.6	48.8	89.9	58.0	89.9	58.0

^(a) Production capacity is limited by existing NBA conveyance. [40 cfs x (20,300/25,000) = 32.5 cfs]

^(b) Production capacity is limited by existing NBA conveyance. [40 cfs x (4,700/25,000) = 7.5 cfs]

^(c) Production and conveyance of Vallejo potable water is independent of NBA capacity.

The projected urban M&I maximum-day demand for the year 2050 is approximately two times the annual average demand of 33,840 afa (46.7 cfs, 30.2 mgd), or 93.4 cfs (60.4 mgd). Comparing the production capacities summarized in Table 5 to the maximum day demand suggests a production deficiency of 3.7 cfs (2.4 mgd) in 2050, as shown in Table 6 and represented graphically in Figure 7.

Table 6. Present and Projected M&I Maximum Day Production, mgd

Parameter	Present	2020	2050
Estimated Production Capacity	48.8	58.0	58.0
Projected Maximum-Day Demand	37.6	52.5	60.4
Production Surplus (Deficiency)	11.2	5.5	(2.4)

UNINCORPORATED AREA WATER DEMANDS

Unincorporated area water uses include rural residential, wineries, improved open areas (such as golf courses), and agricultural uses. The present and projected unincorporated area water demands discussed in TM 3 are summarized in Table 7.

Table 7. Unincorporated Area Water Demands for Napa Valley

Study Area	Estimated Present Unincorporated Area Water Demand, afa	Projected 2020 Unincorporated Area Water Demand, afa	Projected 2050 Unincorporated Area Water Demand, afa
Main Basin	33,656	36,416	41,148
MST	3,313	3,710	4,601
Carneros	2,547	3,467	5,719
Total	39,516	41,593	51,468

The increase in projected unincorporated area demand is predominately a result of existing vineyards ultimately being converted to denser plantings, except in Carneros, where significant new plantings are projected, if sufficient water supply sources can be identified.

UNINCORPORATED AREA WATER SUPPLIES

The water uses in the unincorporated area include vineyards and other agriculture, wineries, rural residential, and other improved open areas (such as golf courses). These water uses are discussed separately in TM 5 and are combined in this TM.

Water demands for all areas are anticipated to be met by three sources; groundwater, surface water, and recycled water. The anticipated delivery of recycled water and the approximate diversion of surface water were estimated in TM 5. The remaining water supply would presumably be withdrawn from the groundwater basin. As explained in TM 5, insufficient data are available to reliably predict the existing and projected groundwater supplies in the Carneros region and it is not known at this time if sufficient groundwater resources exist to satisfy the demands in the Carneros basin. The USGS has also recently completed a preliminary assessment of the groundwater conditions in the MST Basin. Therefore, in the following discussion, ranges are presented for the MST and Carneros region groundwater supplies, based on the total estimated and projected water demand minus the water demand that is assumed to be satisfied with surface water and recycled water.

A summary of the estimated existing unincorporated area water supplies, discussed in TM 5, is presented in Table 8. Estimated existing water supplies for the Main Basin Unincorporated Area are shown in Figure 8.

Table 8. Estimated Existing Unincorporated Area Maximum Water Supplies^(a), afa

Study Area	Groundwater ^(b)	Surface Water	Recycled Water	Total
Main Basin	28,000 ^(c)	7,900	900	36,800
MST ^(c)	3,054 ^(d)	250	—	3,304
Carneros	1,347 to 1,747 ^(d)	800 to 1,200	—	2,147 to 2,947
Total	32,401 to 32,801	8,950 to 9,350	900	42,251 to 43,051

- (a) “Maximum Water Supplies” assumes full availability (wet year conditions) of surface water sources.
- (b) Projected groundwater supply for unincorporated area use.
- (c) MST = Region near the Milliken, Sarco, and Tulucay creeks, north and east of Napa.
- (d) It is not known if sufficient groundwater resources exist to satisfy the anticipated water demands.
- (e) Based on estimated perennial yield. Current pumping capacity is 24,856 afa.

A summary of the projected unincorporated area water supplies for 2020, discussed in TM 5, is presented in Table 9. Projected 2020 water supplies for the Main Basin Unincorporated Area are shown in Figure 9.

Table 9. Summary of Projected Unincorporated Area Maximum Water Supplies^(a) for 2020, afa

Study Area	Groundwater ^(b)	Surface Water	Recycled Water	Total
Main Basin	28,000	7,900	1,072	36,972
MST ^(c)	3,040 ^(d)	250	420	3,710
Carneros	744 to 1,172 ^(d)	800 to 1,200	1,495 to 2,110	3,039 to 4,482
Total	31,784 to 32,212	8,950 to 9,350	2,987 to 3,602	43,721 to 45,164

(a) “Maximum Water Supplies” assumes full availability (wet year supplies) of surface water sources.

(b) Projected groundwater supply for unincorporated area use.

(c) MST = Milliken-Sarco-Tulucay study area.

(d) It is not known if sufficient groundwater resources exist to satisfy the anticipated water demands.

A summary of the projected unincorporated area water supplies for 2050, discussed in TM 5, is presented in Table 10. Projected 2050 water supplies for the Main Basin Unincorporated Area are shown in Figure 10.

Table 10. Summary of Projected Unincorporated Area Maximum Water Supplies^(a) for 2050, afa

Study Area	Groundwater ^(b)	Surface Water	Recycled Water	Total
Main Basin	28,000	7,900	1,500	37,400
MST ^(c)	3,931 ^(d)	250	420	4,600
Carneros	2,409 to 3,424 ^(d)	800 to 1,200	1,495 to 2,110	4,704 to 6,734
Total	34,340 to 35,355	8,950 to 9,350	3,415 to 4,030	46,700 to 48,735

(a) “Maximum Water Supplies” assumes full availability (wet year supplies) of surface water sources.

(b) Projected groundwater supply for unincorporated area use.

(c) MST = Milliken-Sarco-Tulucay study area.

(d) It is not known if sufficient groundwater resources exist to satisfy the anticipated water demands.

A summary of the unincorporated area Main Basin water supplies available under the maximum, average, multiple-dry year, and single-dry year water supply conditions are shown in Table 11. During normal, multiple-dry and single-dry years, available surface water supplies have been curtailed from the maximum water supplies shown in Tables 8, 9, and 10 by the same curtailments used to project surface water supplies for M&I State Water Project supplies. It is anticipated the available surface water supply in a normal year is 76 percent of the supply in a wet year. Similarly, the supply available in multiple-dry years and a single dry-year would be 40 percent and 20 percent, respectively, of the maximum supply available in a wet year. These reductions are shown in Attachment D

Table 11. Summary of Projected Unincorporated Area Main Basin Water Supplies, afa

Water Supply Year	Yield Condition	Present	2020	2050
Wet	Maximum Yield ^(a) , afa	36,800	36,972	37,400
Normal	Average Yield ^(b) , afa	34,904	35,076	35,504
Multiple-Dry	Reliable Yield ^(c) , afa	32,060	32,232	32,660
Single Dry	Perennial Yield ^(d) , afa	30,480	30,652	31,080

- (a) Maximum Yield = Total water available in a wet year with a 0 percent exceedence probability.
- (b) Average Yield = Water that would be available in a normal year with a 60 percent exceedence probability.
- (c) Reliable Yield = Water that would be available in a multiple-dry year with an 85 percent exceedence probability.
- (d) Perennial Yield = Water that would be available in a single-dry-year with 100 percent exceedence probability.

COMPARISON OF UNINCORPORATED AREA MAIN BASIN DEMANDS AND SUPPLIES

A comparison of the projected unincorporated area Main Basin water demands and water supplies is shown in Table 12, and shown in Figures 11, 12, and 13. Because of the reduction in surface water supplies described above, a deficiency in total water supplies (surface water, recycled water, and groundwater) is anticipated to occur in normal, multiple-dry, and single-dry years.

Table 12. Comparison of Present and Projected Unincorporated Area Main Basin Supply and Demand

Supply Year Condition	Estimated Supply, afa	Estimated Demand, afa	Excess Supply or (Shortfall) , afa
Present			
Normal	34,904	33,656	1,248
Multiple-Dry	32,060	33,656	(1,596)
Single-Dry	30,480	33,656	(3,176)
2020			
Normal	35,076	36,416	(1,340)
Multiple-Dry	32,232	36,416	(4,184)
Single-Dry	30,652	36,416	(5,764)
2050			
Normal	35,504	41,148	(5,644)
Multiple-Dry	32,660	41,148	(8,488)
Single-Dry	31,080	41,148	(10,068)

As shown in Table 12, there appears to be a projected deficit in unincorporated area Main Basin water supplies in all cases except for present normal years. Frequently, when demands exceed supplies, groundwater is pumped at a rate that exceeds the long-term ability of the hydrologic system to replenish it. This practice is sometimes termed groundwater mining and is not sustainable as a long-term practice.

COMBINED INCORPORATED AND UNINCORPORATED AREA WATER SUPPLIES AND DEMANDS

Because of the uncertainty in the groundwater capacity in the MST and Carneros basins, the Main Basin unincorporated area demands were combined with the incorporated area demands (also in the Main Basin) to generate an overall comparison of Main Basin supplies and demands. The combined Main Basin incorporated and unincorporated area supplies and demands, discussed above, are shown in Table 13. The combined Main Basin incorporated and unincorporated area demands and supplies are shown in Figures 14, 15, and 16.

Table 13. Comparison of Combined Incorporated and Unincorporated Area Main Basin Supply and Demand, afa

Supply Year Condition	Estimated Supply, afa	Estimated Demand, afa	Excess Supply or (Shortfall) , afa
Present			
Normal	72,574	54,735	17,838
Multiple-Dry	56,015	51,574	4,441
Single-Dry	48,741	51,574	(2,832)
2020			
Normal	79,462	65,816	13,646
Multiple-Dry	60,349	61,406	(1,057)
Single-Dry	51,721	61,406	(9,685)
2050			
Normal	80,022	74,988	5,034
Multiple-Dry	60,865	69,912	(9,047)
Single-Dry	52,240	69,912	(17,672)

As can be seen from Table 13, there is a net surplus of water during normal years, assuming supplies could be distributed among all the parties.

The water supply situation in future multiple-dry years indicates a net deficit of water supply would occur if water demands increase as projected above, although currently there appears to be

a net surplus in supply. The total supply deficit for the Main Basin area at the end of a six-year drought is estimated to be over 54,280 acre-feet (6 years times 9,047 acre-feet per year) for the 2050 supply and demand.

If it were assumed that this water supply deficit (to meet the drought demands for both incorporated and unincorporated users) were to be provided by the Main Groundwater Basin through increased groundwater extractions, approximately 27 percent (54,280 af/200,000 af) of the available storage capacity of the Main Groundwater Basin would be required over the 6-year drought period. An alternative to using the available drought storage in the Main Groundwater Basin would be to try to develop additional local surface water storage, additional recycled water supplies and/or secure supplemental non-local storage, or dry-year supplies/options, to meet the demands during these drought periods.

Supplies in single-dry years appear to be over-allocated for all study periods with a total supply deficit following a single dry year of 17,672 acre-feet for the 2050 supply and demand.

Opportunities to reduce the apparent deficit will be explored in later TMs. Potential opportunities include acquiring dry-year water options to offset SWP cut-backs, and implementing a drought contingency groundwater conjunctive use program. A groundwater production and recharge program (conjunctive use program) would withdraw water from groundwater storage during dry years and recharge the groundwater basin during normal and wet years.

In TM 7, WYA will discuss the feasibility of a few regional water supply projects and potential individual City supply projects.

GSN/JPC:ajb

Figure 1. Estimated Existing M&I Water Supplies

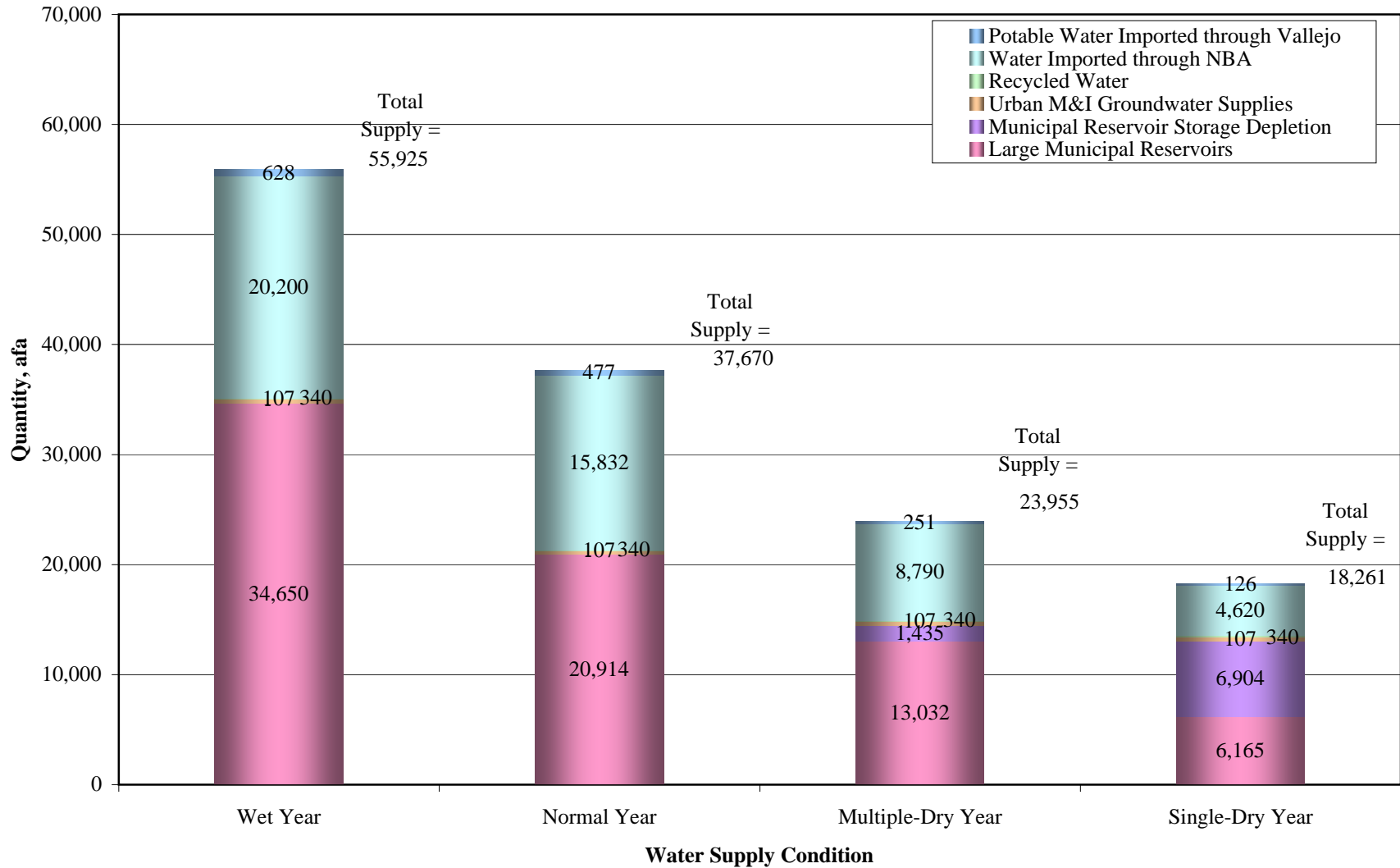


Figure 2. Projected Buildout M&I Water Supplies

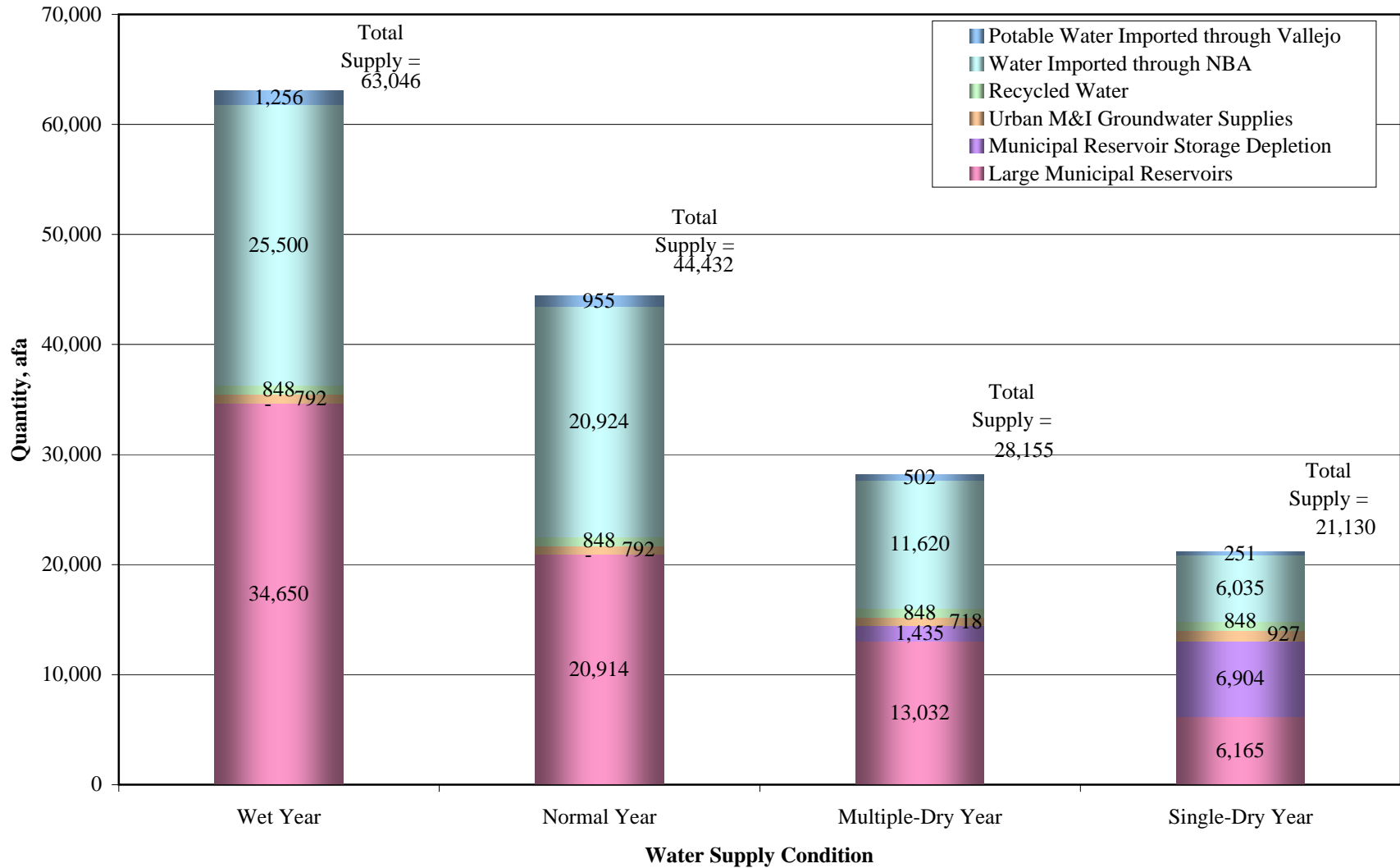


Figure 3. Projected 2050 M&I Water Supplies

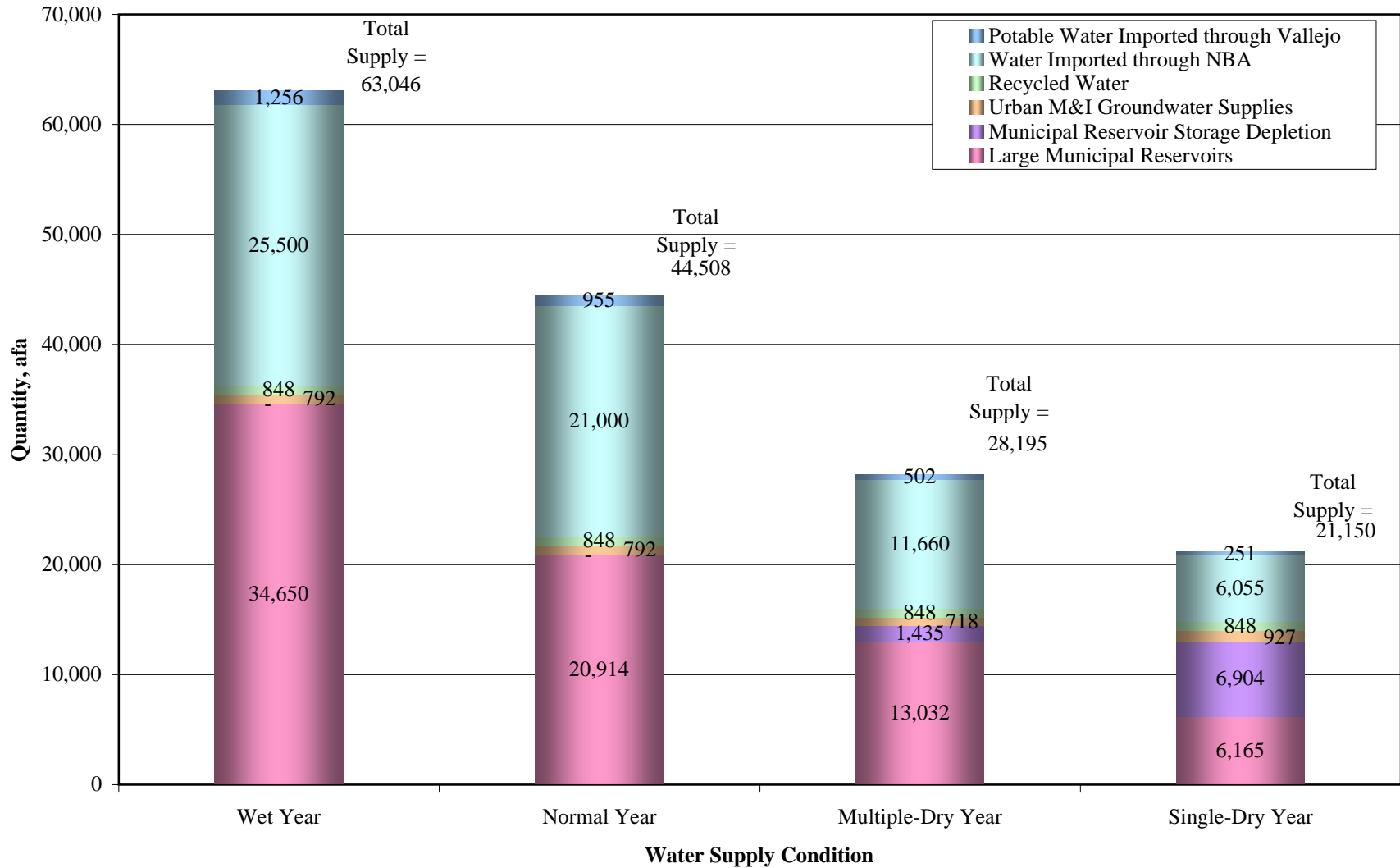


Figure 4. Comparison of Existing M&I Supply and Demand

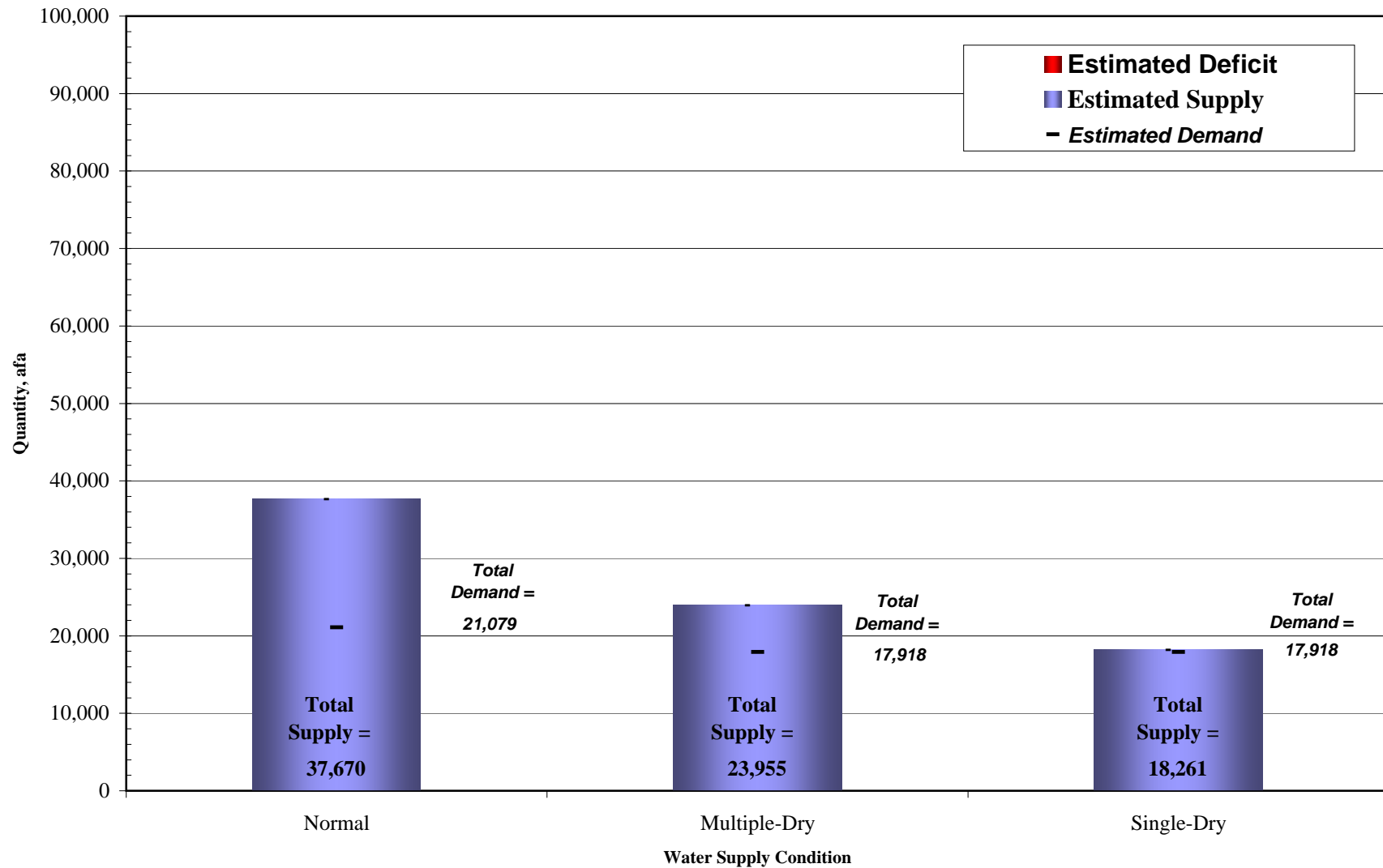


Figure 5. Comparison of 2020 M&I Supply and Demand

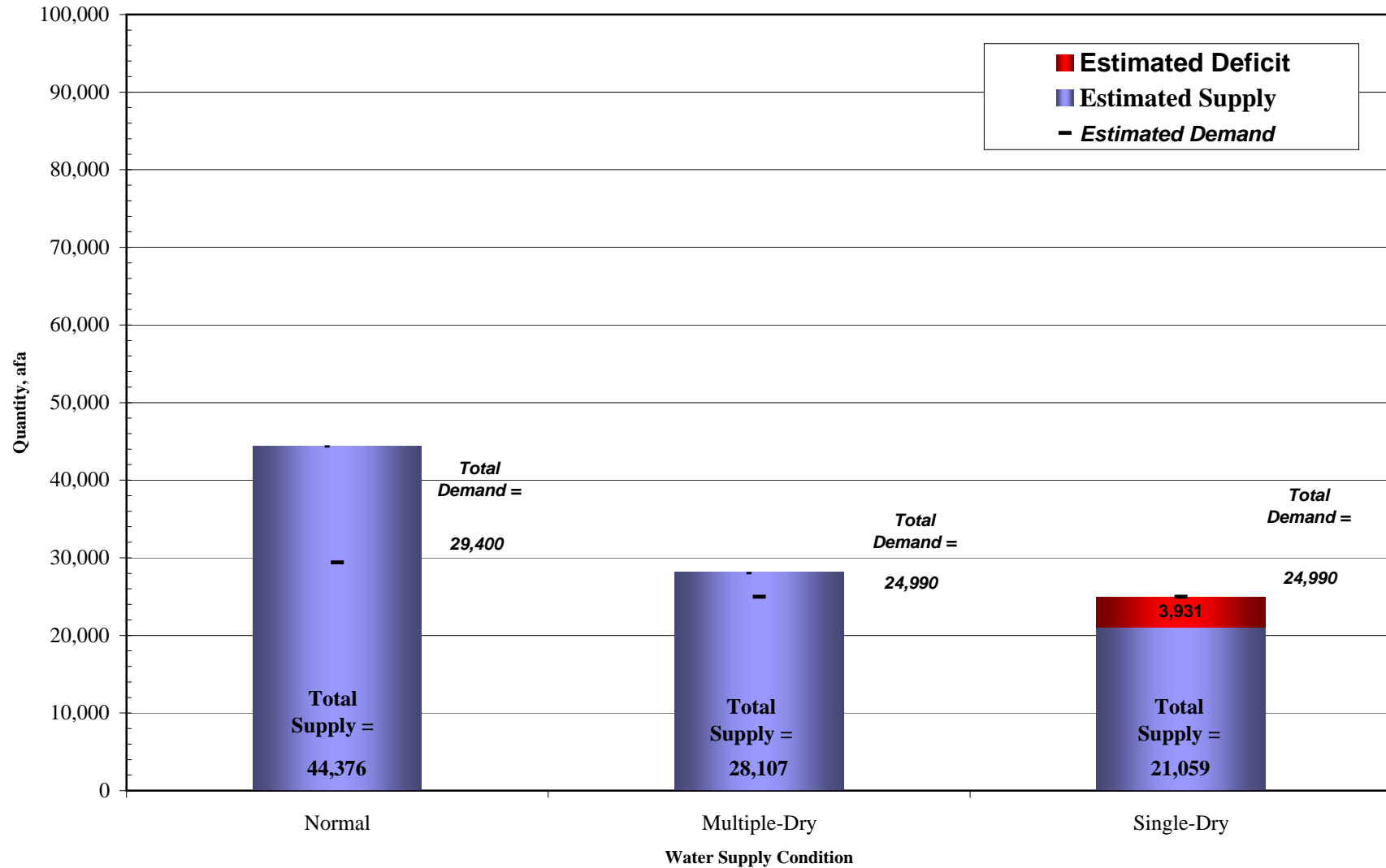


Figure 6. Comparison of 2050 M&I Supply and Demand

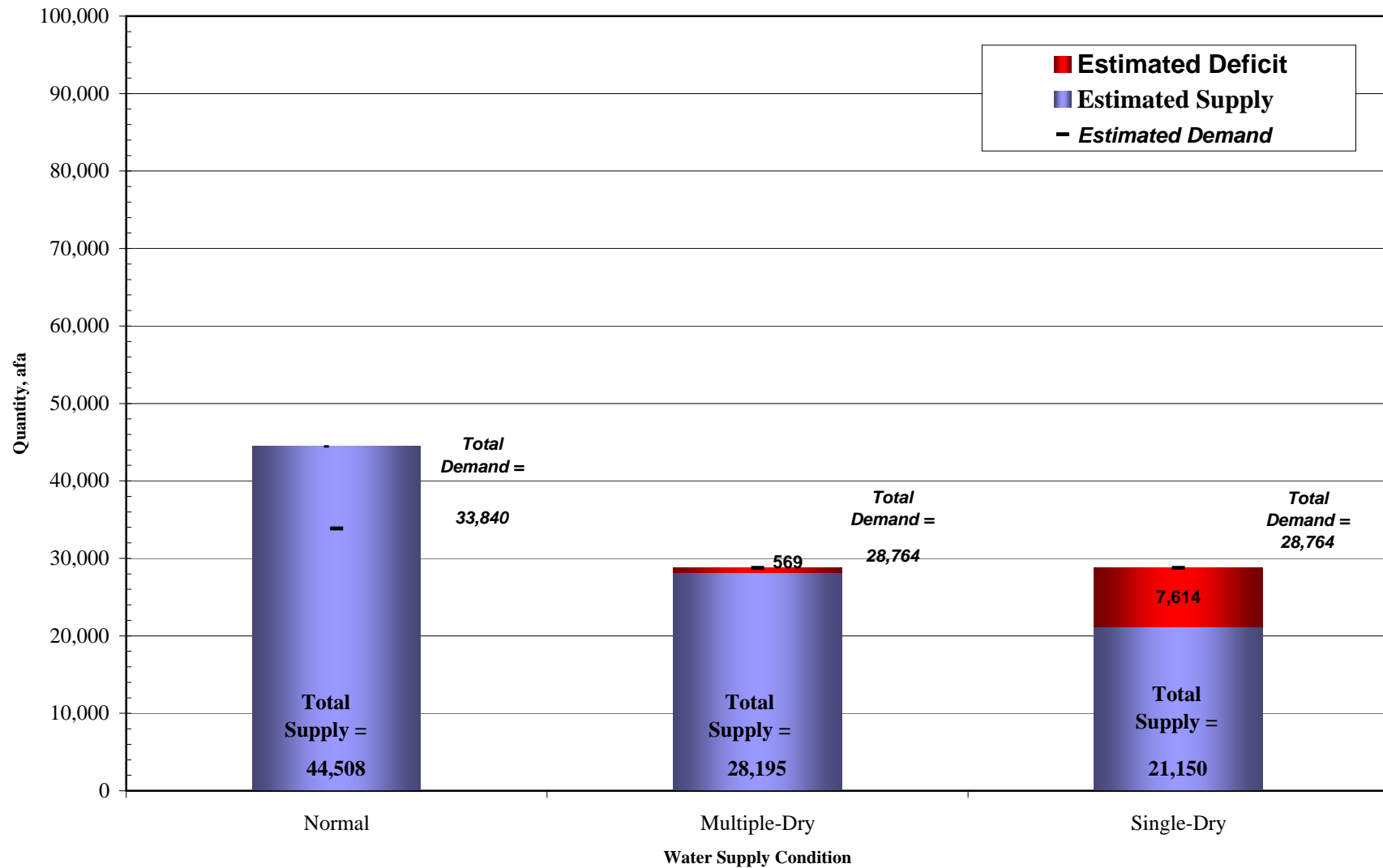


Figure 7. Projected Urban M&I Maximum Day Water Supply By Source
(Current supplies operating at maximum capacity)

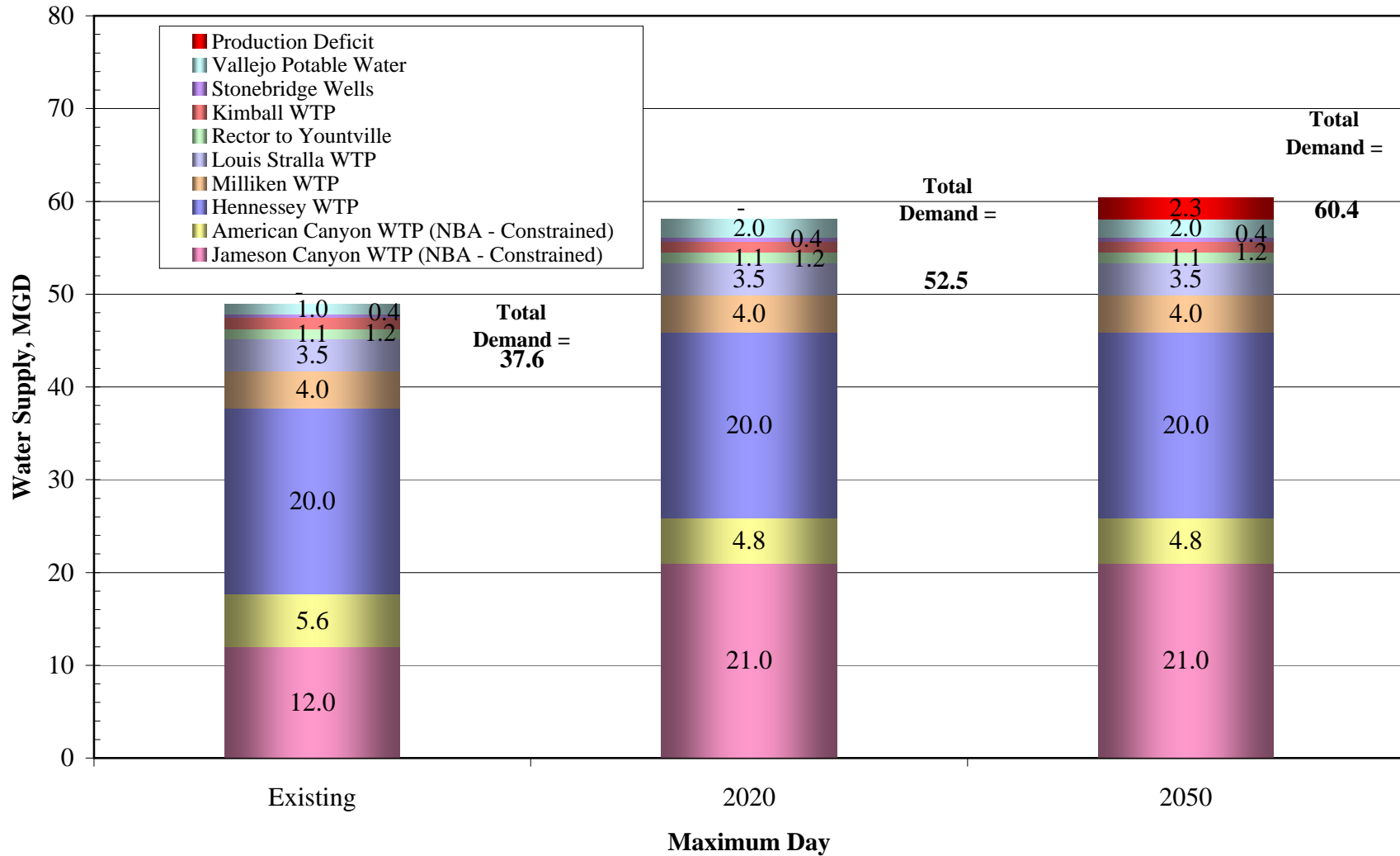


Figure 8. Estimated Existing Main Basin Unincorporated Area Water Supplies

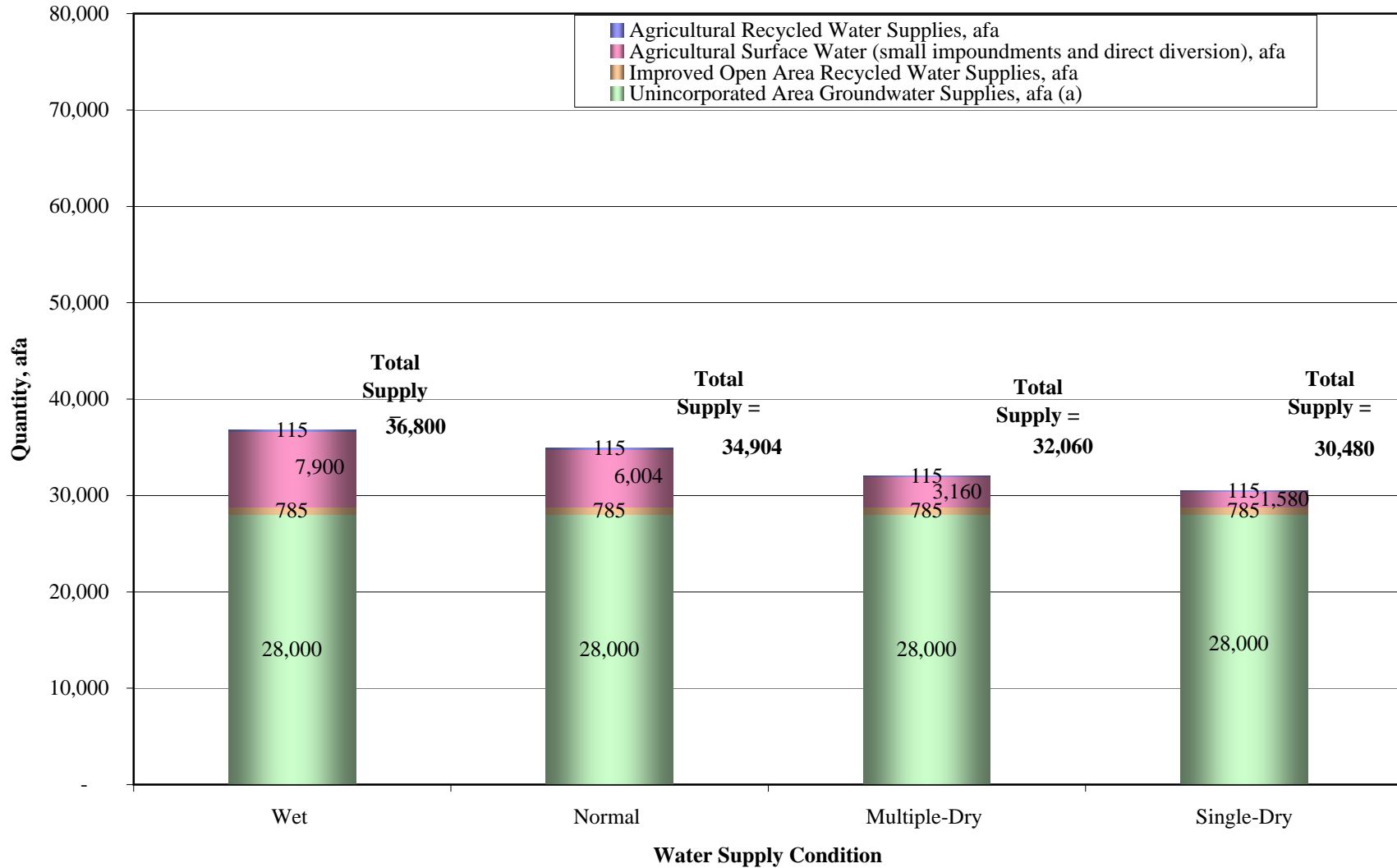


Figure 9. Projected Main Basin Unincorporated Area Water Supplies for the Year 2020

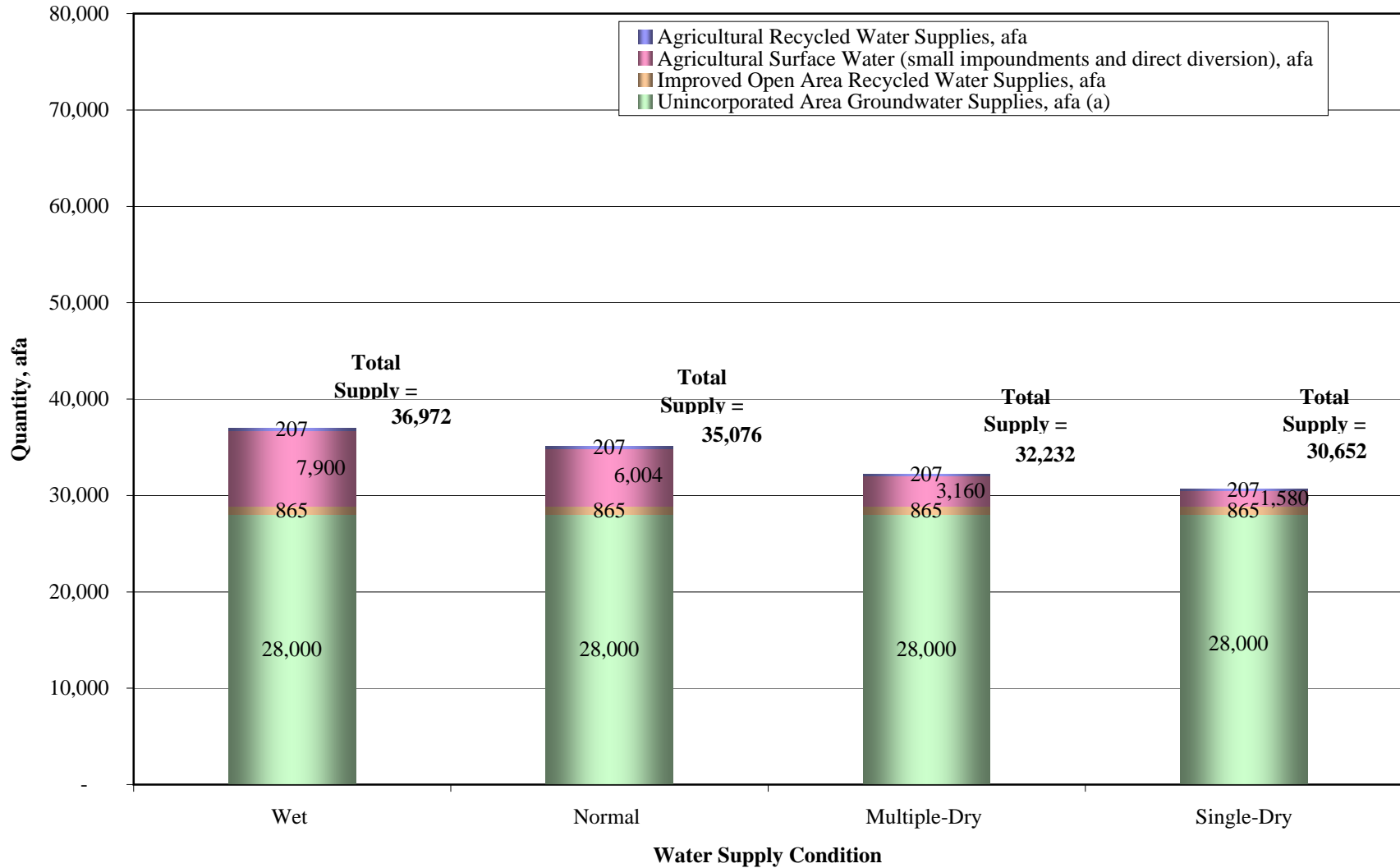


Figure 10. Projected Main Basin Unincorporated Area Water Supplies for the Year 2050

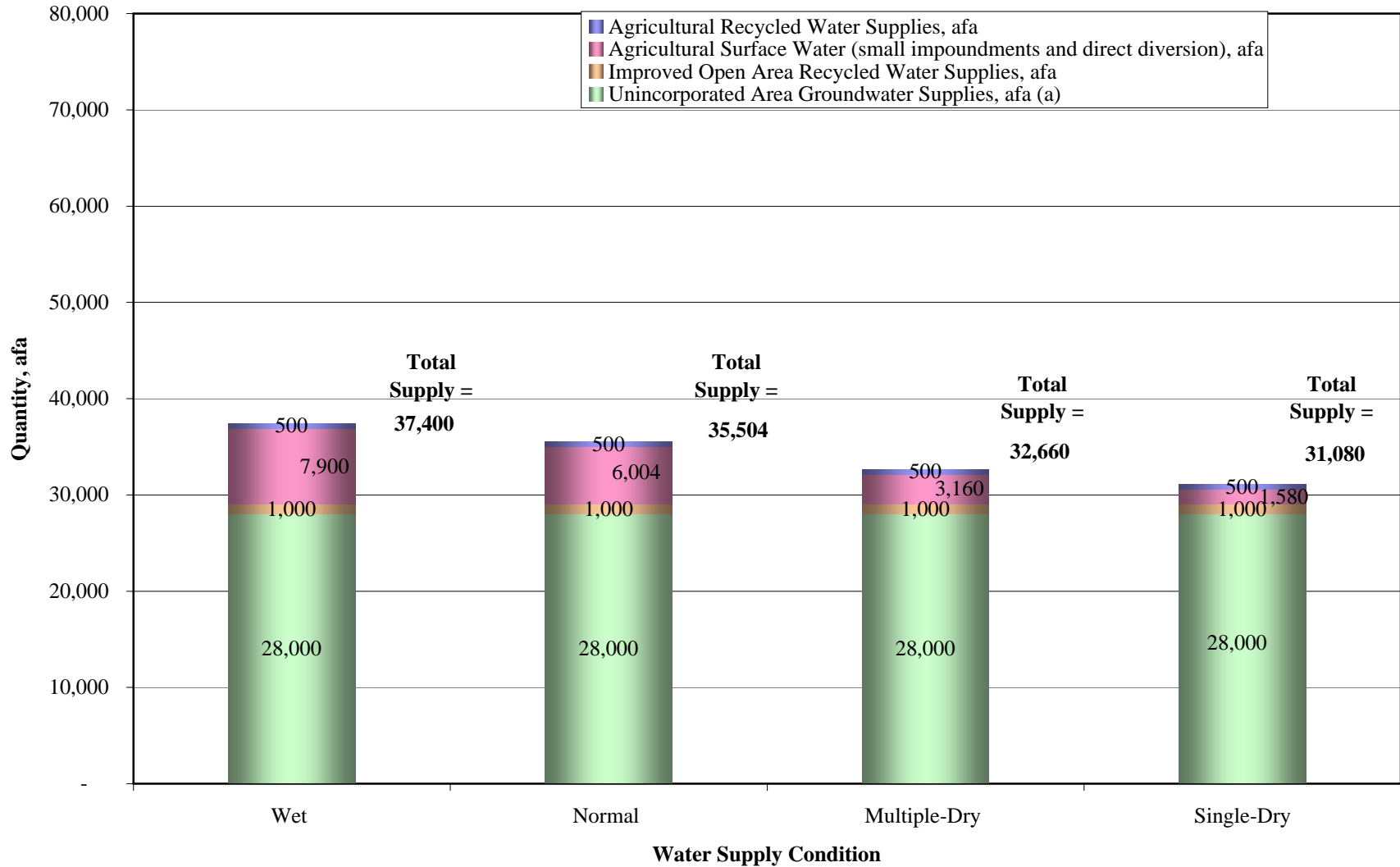


Figure 11. Comparison of Existing Main Basin Unincorporated Area Supply and Demand

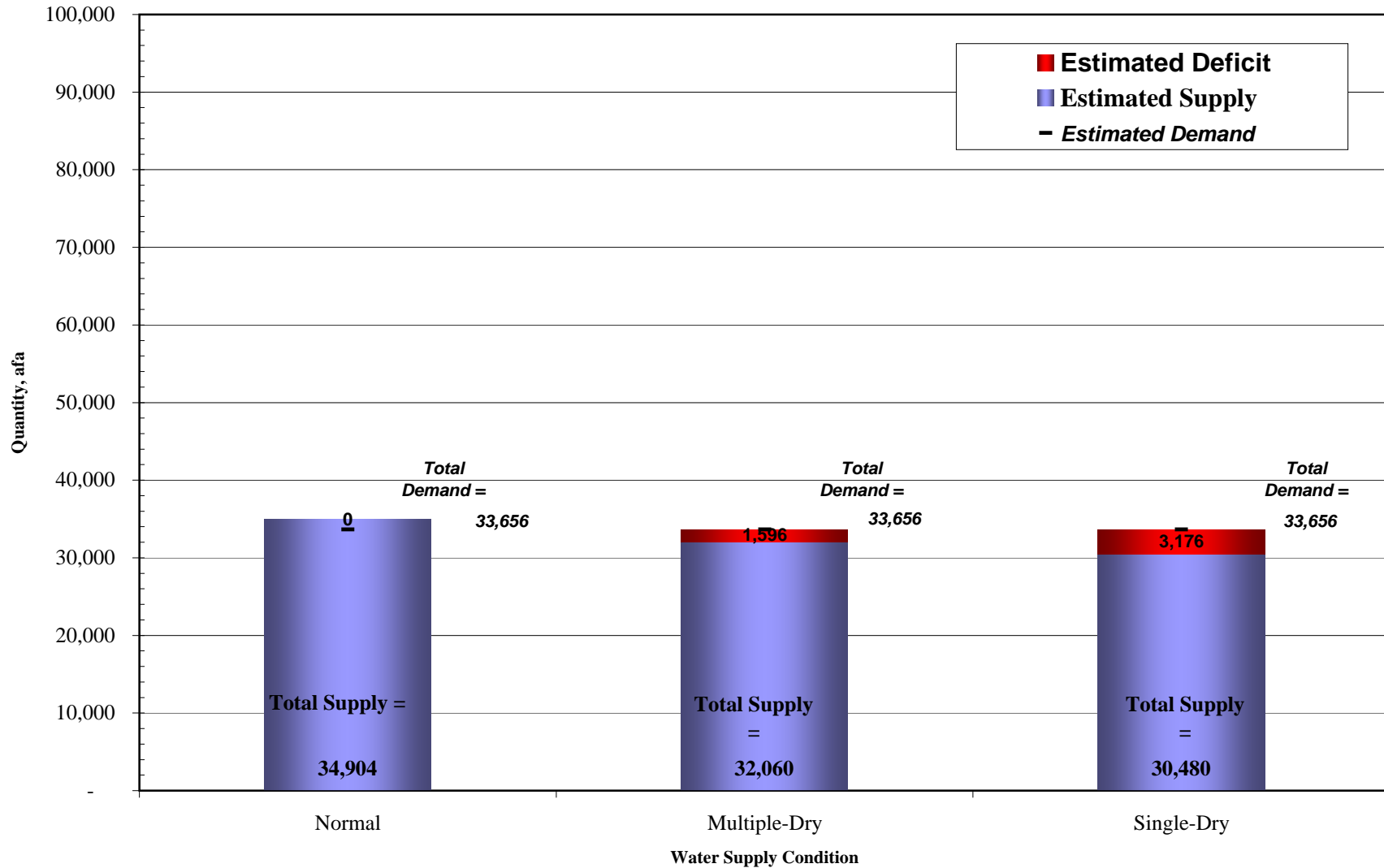


Figure 12. Comparison of Projected 2020 Main Basin Unincorporated Area Supply and Demand

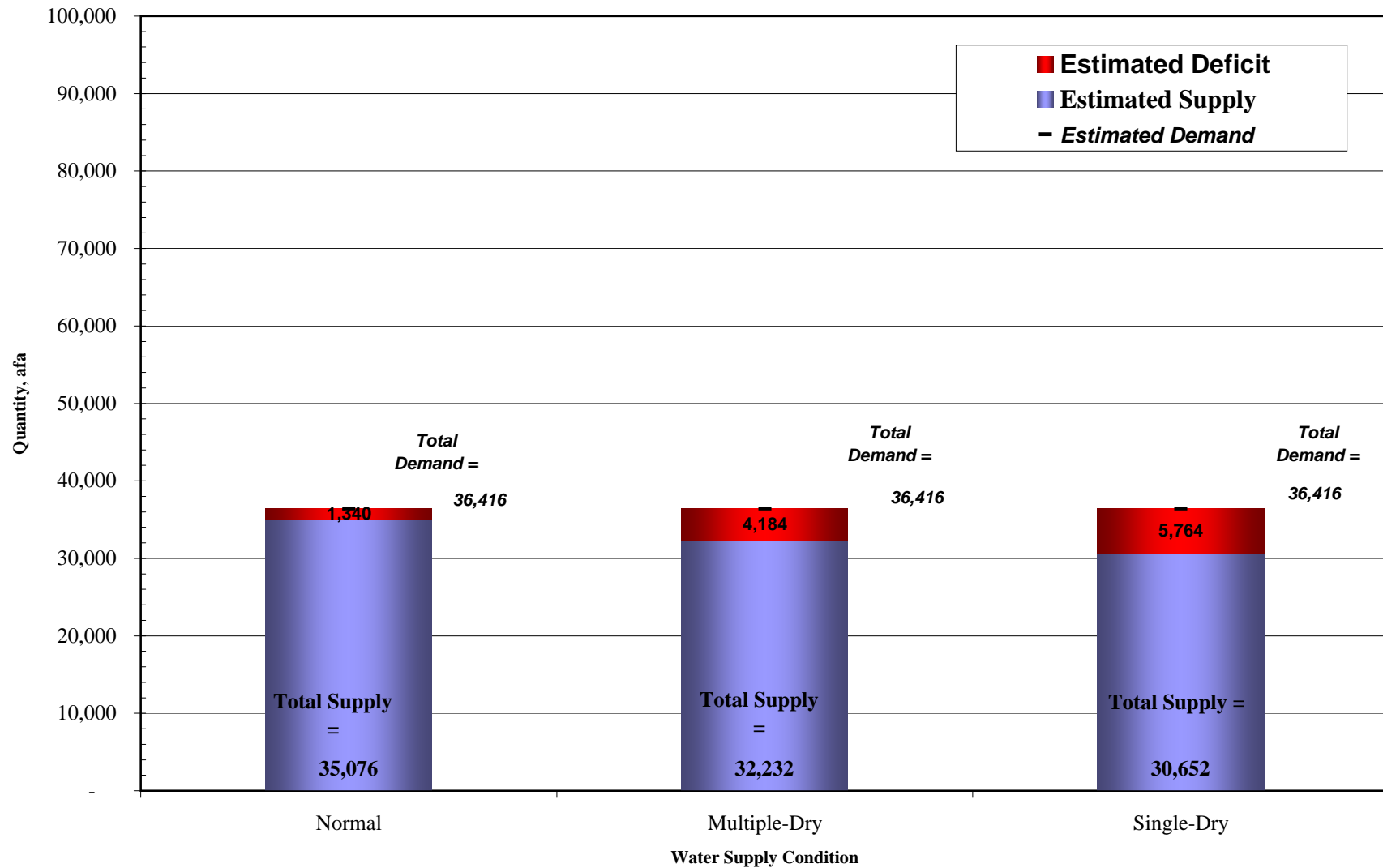


Figure 13. Comparison of Projected 2050 Main Basin Unincorporated Area Supply and Demand

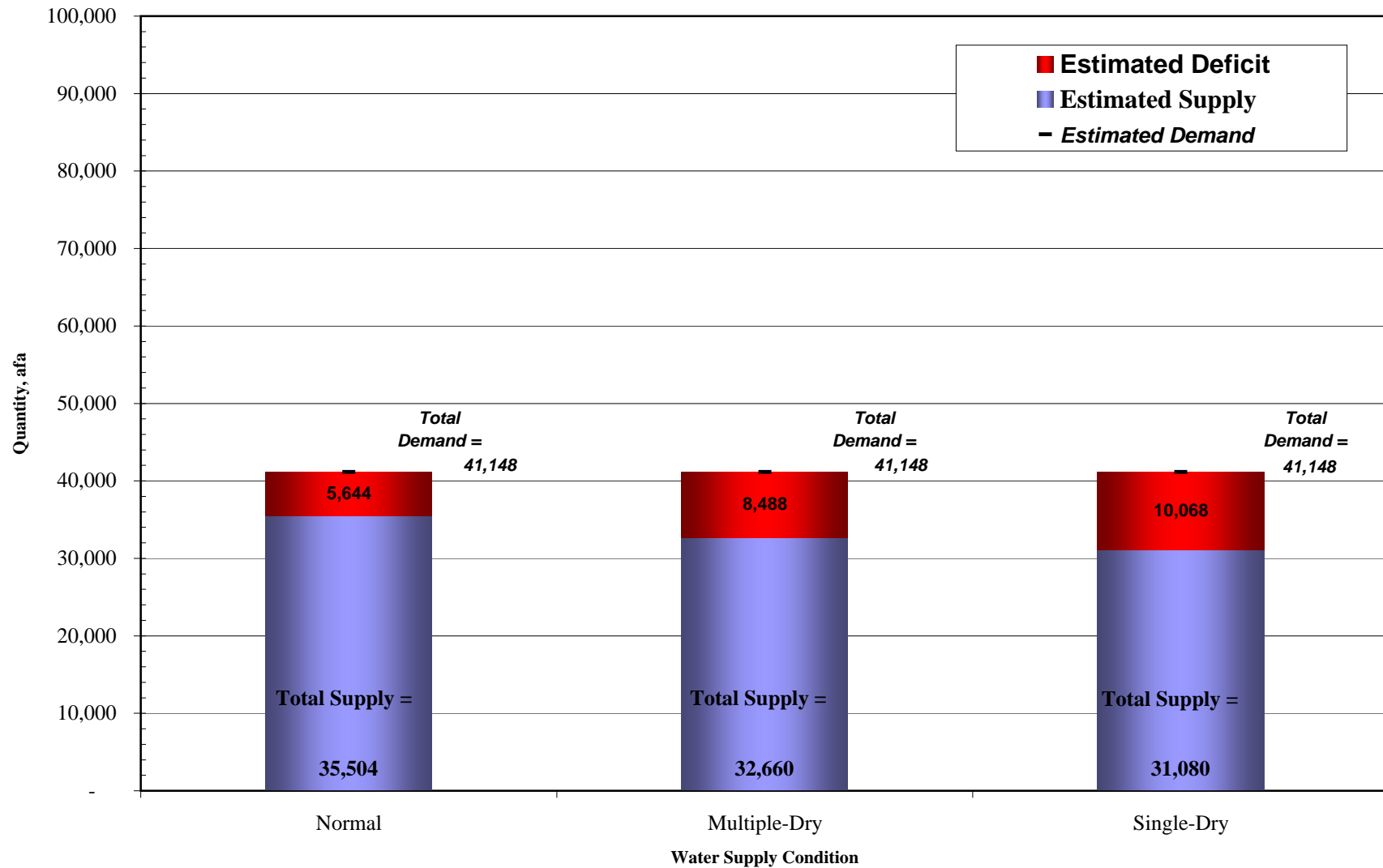


Figure 14. Comparison of Existing M&I and Main Basin Unincorporated Area Supply and Demand

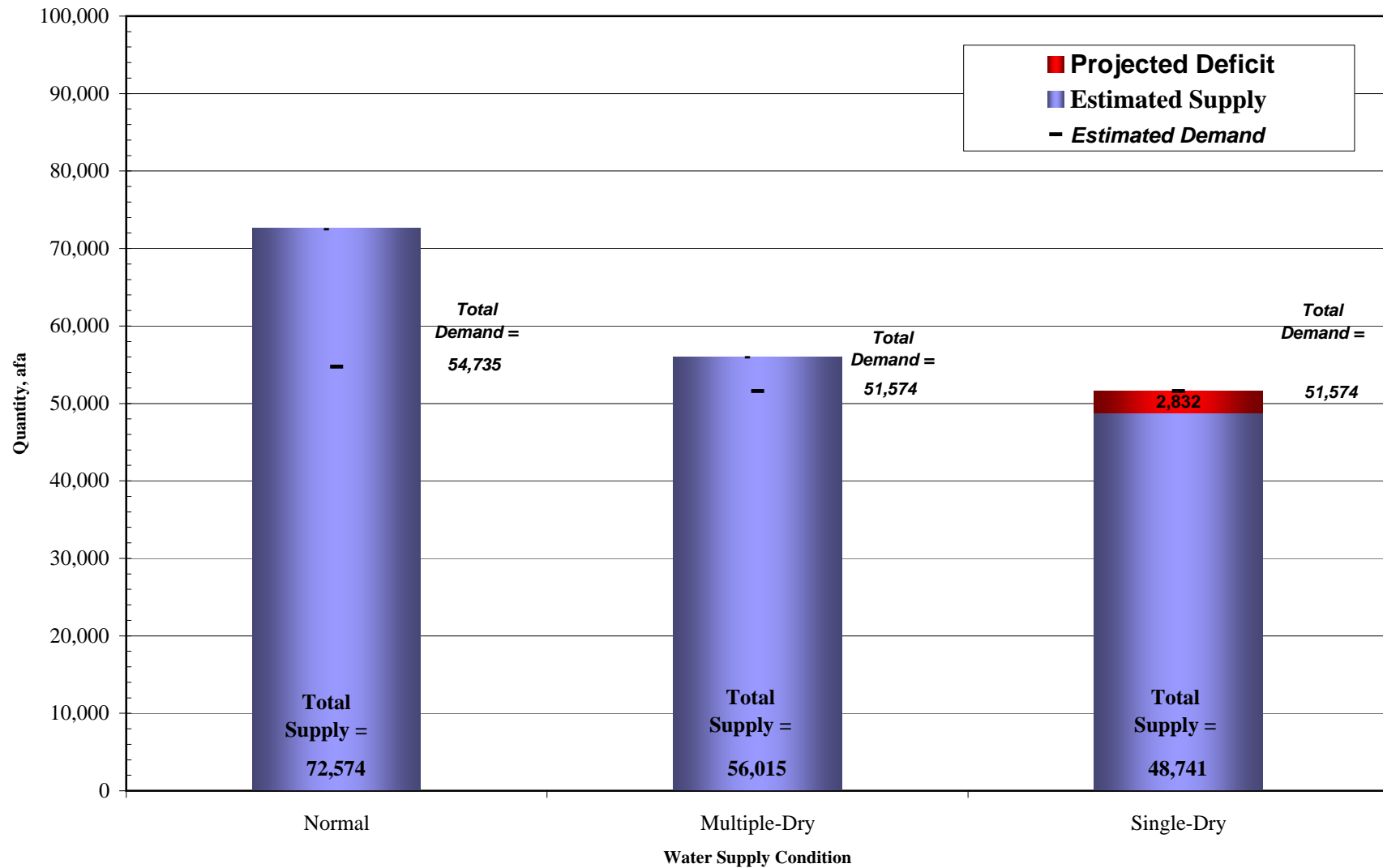


Figure 15. Comparison of Projected 2020 M&I and Main Basin Unincorporated Area Supply and Demand

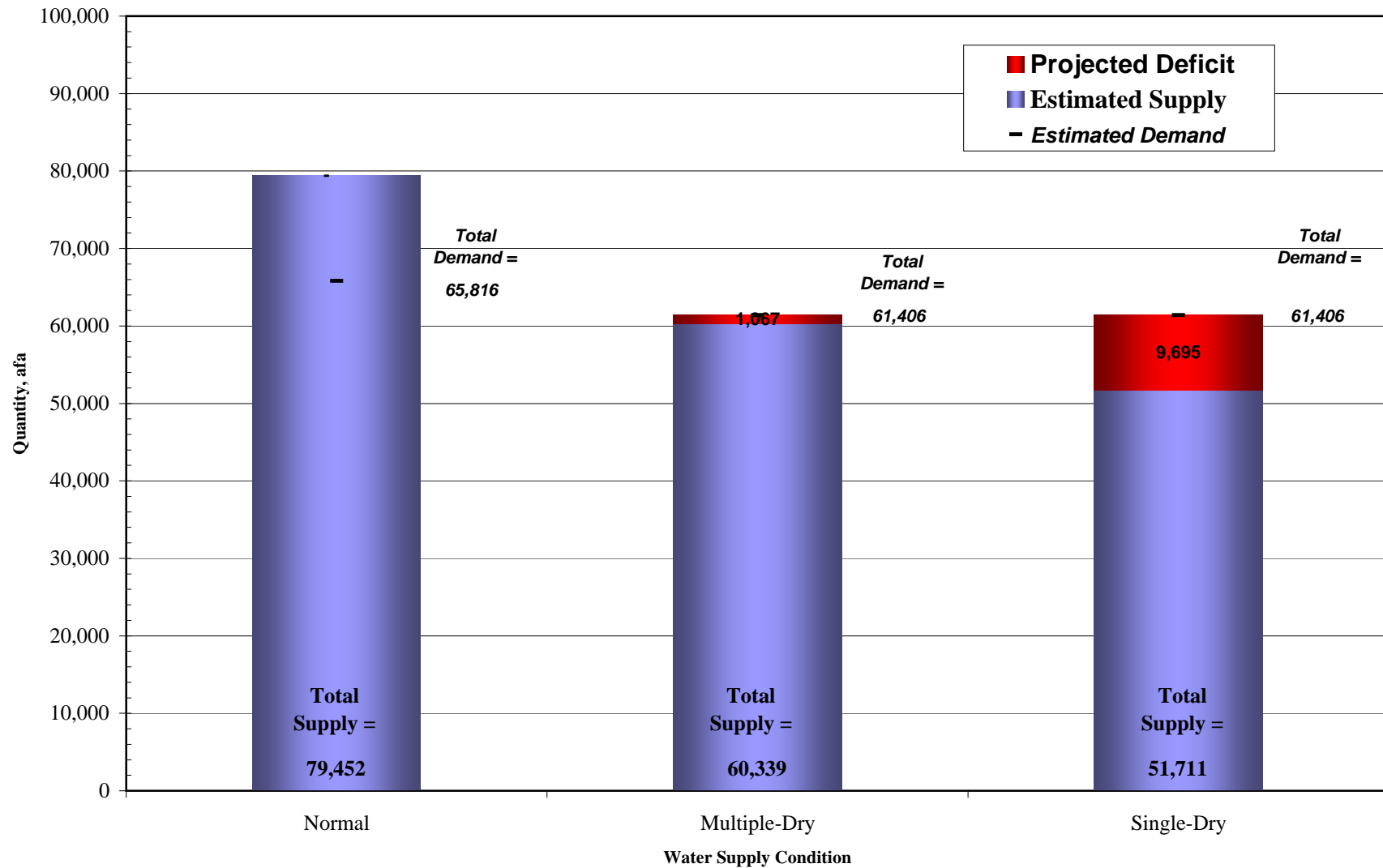
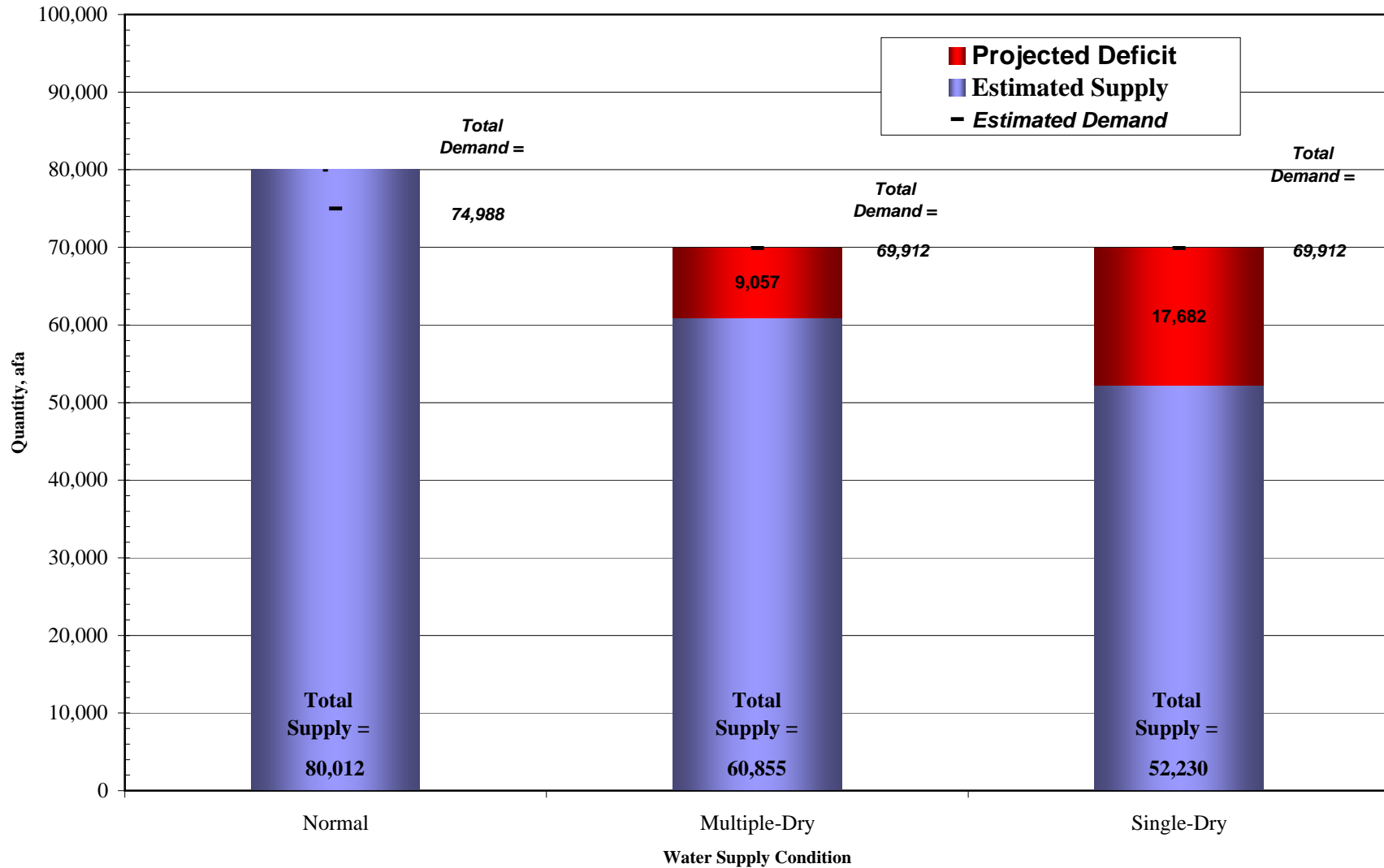


Figure 16. Comparison of Projected 2050 M&I and Main Basin Unincorporated Area Supply and Demand



ATTACHMENT A
Municipal Water Supplies

Total M&I Water Supplies

Existing Conditions

Water Source	Full			
	Entitlement	Normal	Multi-Dry	Single Dry
Hennessey	31,000	17,500	10,417	5,000
Milliken	700	700	700	400
Rector	500	500	500	125
Bell Canyon	2,050	1,814	1,035	530
Kimball	400	400	380	110
Total Local Storage	34,650	20,914	13,032	6,165
Hennessey Depletion	-	-	1,300	6,500
Milliken Depletion	-	-	33	100
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	85	254
Kimball Depletion	-	-	17	50
Total Depletion of Storage	-	-	1,435	6,904
Original Table A SWP Entitlement	17,825	13,547	7,130	3,565
NBA Conveyance Capacity	25,000	25,000	25,000	25,000
KCWA Purchase	4,025	3,059	1,610	805
Total SWP Water through NBA	19,700	15,332	8,340	4,170
Permit Water (AC)	500	500	450	450
Imported Potable Water	628	477	251	126
Recycled Water	107	107	107	107
Groundwater	340	340	340	340
Total Other Supplies	1,575	1,424	1,148	1,023
Total of All Supplies	55,925	37,670	23,955	18,261

Buildout

Hennessey	31,000	17,500	10,417	5,000
Milliken	700	700	700	400
Rector	500	500	500	125
Bell Canyon	2,050	1,814	1,035	530
Kimball	400	400	380	110
Total Local Storage	34,650	20,914	13,032	6,165
Hennessey Depletion	-	-	1,300	6,500
Milliken Depletion	-	-	33	100
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	85	254
Kimball Depletion	-	-	17	50
Total Depletion of Storage	-	-	1,435	6,904
Original Table A SWP Entitlement	24,900	18,924	9,960	4,980
NBA Conveyance Capacity	25,000	25,000	25,000	25,000
KCWA Purchase	4,025	3,059	1,610	805
Total SWP Water through NBA	25,000	20,424	11,170	5,585
Permit Water (AC)	500	500	450	450
Imported Potable Water	1,256	955	502	251
Recycled Water	858	858	858	858
Groundwater	792	792	718	927
Total Other Supplies	3,406	3,105	2,528	2,486
Total of All Supplies	63,056	44,442	28,165	21,140

2050

Hennessey	31,000	17,500	10,417	5,000
Milliken	700	700	700	400
Rector	500	500	500	125
Bell Canyon	2,050	1,814	1,035	530
Kimball	400	400	380	110
Total Local Storage	34,650	20,914	13,032	6,165
Hennessey Depletion	-	-	1,300	6,500
Milliken Depletion	-	-	33	100
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	85	254
Kimball Depletion	-	-	17	50
Total Depletion of Storage	-	-	1,435	6,904
Original Table A SWP Entitlement	25,000	19,000	10,000	5,000
NBA Conveyance Capacity	25,000	25,000	25,000	25,000
KCWA Purchase	4,025	3,059	1,610	805
Total SWP Water through NBA	25,000	20,500	11,210	5,605
Permit Water (AC)	500	500	450	450
Imported Potable Water	1,256	955	502	251
Recycled Water	858	858	858	858
Groundwater	792	792	718	927
Total Other Supplies	3,406	3,105	2,528	2,486
Total of All Supplies	63,056	44,518	28,205	21,160

Napa Water Supplies

Existing Conditions

Water Source	Full			
	Entitlement	Normal	Multi-Dry	Single Dry
Hennessey	31,000	17,500	10,417	5,000
Milliken	700	700	700	400
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
Total Local Storage	31,700	18,200	11,117	5,400
Hennessey Depletion	-	-	1,300	6,500
Milliken Depletion	-	-	33	100
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
Total Depletion of Storage	-	-	1,333	6,600
Original Table A SWP Entitlement	12,600	9,576	5,040	2,520
NBA Conveyance Capacity	18,800	18,800	18,800	18,800
KCWA Purchase	1,000	760	400	200
Total SWP Water through NBA	13,600	10,336	5,440	2,720
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
Total Other Supplies	-	-	-	-
Total of All Supplies	45,300	28,536	17,890	14,720

Buildout (2020)

Hennessey	31,000	17,500	10,417	5,000
Milliken	700	700	700	400
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
Total Local Storage	31,700	18,200	11,117	5,400
Hennessey Depletion	-	-	1,300	6,500
Milliken Depletion	-	-	33	100
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
Total Depletion of Storage	-	-	1,333	6,600
Original Table A SWP Entitlement	18,700	14,212	7,480	3,740
NBA Conveyance Capacity	18,800	18,800	18,800	18,800
KCWA Purchase	1,000	760	400	200
Total SWP Water through NBA	18,800	14,972	7,880	3,940
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
Total Other Supplies	-	-	-	-
Total of All Supplies	50,500	33,172	20,330	15,940

2050

Hennessey	31,000	17,500	10,417	5,000
Milliken	700	700	700	400
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
Total Local Storage	31,700	18,200	11,117	5,400
Hennessey Depletion	-	0	1,300	6,500
Milliken Depletion	-	0	33	100
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
Total Depletion of Storage	-	-	1,333	6,600
Original Table A SWP Entitlement	18,800	14,288	7,520	3,760
NBA Conveyance Capacity	18,800	18,800	18,800	18,800
KCWA Purchase	1,000	760	400	200
Total SWP Water through NBA	18,800	15,048	7,920	3,960
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
Total Other Supplies	-	-	-	-
Total of All Supplies	50,500	33,248	20,370	15,960

American Canyon Water Supplies

Existing Conditions

Water Source	Full			
	Entitlement	Normal	Multi-Dry	Single Dry
Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
<i>Total Local Storage</i>	-	-	-	-
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	-	-	-	-
Original Table A SWP Entitlement	4,100	3,116	1,640	820
NBA Conveyence Capacity	4,700	4,700	4,700	4,700
KCWA Purchase	500	380	200	100
<i>Total SWP Water through NBA</i>	<i>4,600</i>	<i>3,496</i>	<i>1,840</i>	<i>920</i>
Permit Water (AC)	500	500	450	450
Imported Potable Water	628	477	251	126
Recycled Water	107	107	107	107
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>1,235</i>	<i>1,084</i>	<i>808</i>	<i>683</i>
Total of All Supplies	5,835	4,580	2,648	1,603

Buildout (2015)

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
<i>Total Local Storage</i>	-	-	-	-
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	-	-	-	-
Original Table A SWP Entitlement	4,700	3,572	1,880	940
NBA Conveyence Capacity	4,700	4,700	4,700	4,700
KCWA Purchase	500	380	200	100
<i>Total SWP Water through NBA</i>	<i>4,700</i>	<i>3,952</i>	<i>2,080</i>	<i>1,040</i>
Permit Water (AC)	500	500	450	450
Imported Potable Water	1,256	955	502	251
Recycled Water	858	858	858	858
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>2,614</i>	<i>2,313</i>	<i>1,810</i>	<i>1,559</i>
Total of All Supplies	7,314	6,265	3,890	2,599

2050

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
<i>Total Local Storage</i>	-	-	-	-
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	-	-	-	-
Original Table A SWP Entitlement	4,700	3,572	1,880	940
NBA Conveyence Capacity	4,700	4,700	4,700	4,700
KCWA Purchase	500	380	200	100
<i>Total SWP Water through NBA</i>	<i>4,700</i>	<i>3,952</i>	<i>2,080</i>	<i>1,040</i>
Permit Water (AC)	500	500	450	450
Imported Potable Water	1,256	955	502	251
Recycled Water	858	858	858	858
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>2,614</i>	<i>2,313</i>	<i>1,810</i>	<i>1,559</i>
Total of All Supplies	7,314	6,265	3,890	2,599

Yountville Water Supplies

Existing Conditions

Water Source	Full			
	Entitlement	Normal	Multi-Dry	Single Dry
Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	500	500	500	125
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
<i>Total Local Storage</i>	<i>500</i>	<i>500</i>	<i>500</i>	<i>125</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Original Table A SWP Entitlement	500	380	200	100
NBA Conveyence Capacity	500	500	500	500
KCWA Purchase	600	456	240	120
<i>Total SWP Water through NBA</i>	<i>500</i>	<i>500</i>	<i>440</i>	<i>220</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Total of All Supplies	1,000	1,000	940	345

Buildout (2010)

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	500	500	500	125
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
<i>Total Local Storage</i>	<i>500</i>	<i>500</i>	<i>500</i>	<i>125</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Original Table A SWP Entitlement	500	380	200	100
NBA Conveyence Capacity	500	500	500	500
KCWA Purchase	600	456	240	120
<i>Total SWP Water through NBA</i>	<i>500</i>	<i>500</i>	<i>440</i>	<i>220</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	300	300	300	300
<i>Total Other Supplies</i>	<i>300</i>	<i>300</i>	<i>300</i>	<i>300</i>
Total of All Supplies	1,300	1,300	1,240	645

2050

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	500	500	500	125
Bell Canyon	-	-	-	-
Kimball	-	-	-	-
<i>Total Local Storage</i>	<i>500</i>	<i>500</i>	<i>500</i>	<i>125</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Original Table A SWP Entitlement	500	380	200	100
NBA Conveyence Capacity	500	500	500	500
KCWA Purchase	600	456	240	120
<i>Total SWP Water through NBA</i>	<i>500</i>	<i>500</i>	<i>440</i>	<i>220</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	300	300	300	300
<i>Total Other Supplies</i>	<i>300</i>	<i>300</i>	<i>300</i>	<i>300</i>
Total of All Supplies	1,300	1,300	1,240	645

St. Helena Water Supplies

Existing Conditions

Water Source	Full			
	Entitlement	Normal	Multi-Dry	Single Dry
Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	2,050	1,814	1,035	530
Kimball	-	-	-	-
<i>Total Local Storage</i>	<i>2,050</i>	<i>1,814</i>	<i>1,035</i>	<i>530</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	85	254
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>85</i>	<i>254</i>
Original Table A SWP Entitlement	-	-	-	-
NBA Conveyence Capacity	-	-	-	-
KCWA Purchase	1,000	760	400	200
<i>Total SWP Water through NBA</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	340	340	340	340
<i>Total Other Supplies</i>	<i>340</i>	<i>340</i>	<i>340</i>	<i>340</i>
Total of All Supplies	2,390	2,154	1,460	1,124

2020

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	2,050	1,814	1,035	530
Kimball	-	-	-	-
<i>Total Local Storage</i>	<i>2,050</i>	<i>1,814</i>	<i>1,035</i>	<i>530</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	85	254
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>85</i>	<i>254</i>
Original Table A SWP Entitlement	-	-	-	-
NBA Conveyence Capacity	-	-	-	-
KCWA Purchase	1,000	760	400	200
<i>Total SWP Water through NBA</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	436	436	370	556
<i>Total Other Supplies</i>	<i>436</i>	<i>436</i>	<i>370</i>	<i>556</i>
Total of All Supplies	2,486	2,250	1,490	1,340

Buildout (2050)

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	2,050	1,814	1,035	530
Kimball	-	-	-	-
<i>Total Local Storage</i>	<i>2,050</i>	<i>1,814</i>	<i>1,035</i>	<i>530</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	85	254
Kimball Depletion	-	-	-	-
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>85</i>	<i>254</i>
Original Table A SWP Entitlement	-	-	-	-
NBA Conveyence Capacity	-	-	-	-
KCWA Purchase	1,000	760	400	200
<i>Total SWP Water through NBA</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	492	492	418	627
<i>Total Other Supplies</i>	<i>492</i>	<i>492</i>	<i>418</i>	<i>627</i>
Total of All Supplies	2,542	2,306	1,538	1,411

Calistoga Water Supplies

Existing Conditions

Water Source	Full			
	Entitlement	Normal	Multi-Dry	Single Dry
Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	400	400	380	110
<i>Total Local Storage</i>	<i>400</i>	<i>400</i>	<i>380</i>	<i>110</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	17	50
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>17</i>	<i>50</i>
Original Table A SWP Entitlement	625	475	250	125
NBA Conveyence Capacity	1,000	1,000	1,000	1,000
KCWA Purchase	925	703	370	185
<i>Total SWP Water through NBA</i>	<i>1,000</i>	<i>1,000</i>	<i>620</i>	<i>310</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Total of All Supplies	1,400	1,400	1,017	470

Buildout (2038)

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	400	400	380	110
<i>Total Local Storage</i>	<i>400</i>	<i>400</i>	<i>380</i>	<i>110</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	17	50
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>17</i>	<i>50</i>
Original Table A SWP Entitlement	1,000	760	400	200
NBA Conveyence Capacity	1,000	1,000	1,000	1,000
KCWA Purchase	925	703	370	185
<i>Total SWP Water through NBA</i>	<i>1,000</i>	<i>1,000</i>	<i>770</i>	<i>385</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Total of All Supplies	1,400	1,400	1,167	545

2050

Hennesey	-	-	-	-
Milliken	-	-	-	-
Rector	-	-	-	-
Bell Canyon	-	-	-	-
Kimball	400	400	380	110
<i>Total Local Storage</i>	<i>400</i>	<i>400</i>	<i>380</i>	<i>110</i>
Hennesey Depletion	-	-	-	-
Milliken Depletion	-	-	-	-
Rector Depletion	-	-	-	-
Bell Canyon Depletion	-	-	-	-
Kimball Depletion	-	-	17	50
<i>Total Depletion of Storage</i>	<i>-</i>	<i>-</i>	<i>17</i>	<i>50</i>
Original Table A SWP Entitlement	1,000	760	400	200
NBA Conveyence Capacity	1,000	1,000	1,000	1,000
KCWA Purchase	925	703	370	185
<i>Total SWP Water through NBA</i>	<i>1,000</i>	<i>1,000</i>	<i>770</i>	<i>385</i>
Permit Water (AC)	-	-	-	-
Imported Potable Water	-	-	-	-
Recycled Water	-	-	-	-
Groundwater	-	-	-	-
<i>Total Other Supplies</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Total of All Supplies	1,400	1,400	1,167	545

ATTACHMENT B

Municipal Water Demands Compared to Supplies

Napa Valley 2050 Water Supply Study - Attachment B
Comparison of Incorporated Area Water Supplies and Demands

Present Supply versus Demand

Full Entitlement Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	45,300	5,835	1,000	2,390	1,400	55,925
Current Water Demand	15,370	2,187	520	2,092	910	21,079
Surplus (Deficit)	29,930	3,648	480	298	490	34,846

Average Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	28,536	4,580	1,000	2,154	1,400	37,670
Current Water Demand	15,370	2,187	520	2,092	910	21,079
Surplus (Deficit)	13,166	2,393	480	61	490	16,590

Multi-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	17,890	2,648	940	1,460	1,017	23,955
Current Water Demand (85%)	13,065	1,859	442	1,779	774	17,918
Surplus (Deficit)	4,826	789	498	(319)	243	6,037

Single-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	14,720	1,603	345	1,124	470	18,261
Current Water Demand (85%)	13,065	1,859	442	1,779	774	17,918
Surplus (Deficit)	1,656	(256)	(97)	(655)	(304)	344

Napa Valley 2050 Water Supply Study - Attachment B
Comparison of Incorporated Area Water Supplies and Demands

Buildout Supply versus Demand

Full Entitlement Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	50,500	7,314	1,300	2,542	1,400	63,056
Buildout Water Demand	18,798	6,300	679	2,458	1,517	29,752
Surplus (Deficit)	31,702	1,014	621	84	(117)	33,304

Average Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	33,172	6,265	1,300	2,306	1,400	44,442
Buildout Water Demand	18,798	6,300	679	2,458	1,517	29,752
Surplus (Deficit)	14,374	(35)	621	(152)	(117)	14,690

Multi-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	20,330	3,890	1,240	1,538	1,167	28,165
Buildout Water Demand (85%)	15,978	5,355	577	2,089	1,289	25,289
Surplus (Deficit)	4,352	(1,465)	663	(552)	(123)	2,876

Single-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	15,940	2,599	645	1,411	545	21,140
Buildout Water Demand (85%)	15,978	5,355	577	2,089	1,289	25,289
Surplus (Deficit)	(38)	(2,756)	68	(679)	(744)	(4,149)

Napa Valley 2050 Water Supply Study - Attachment B
Comparison of Incorporated Area Water Supplies and Demands

2020 Supply versus Demand

Full Entitlement Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	50,500	7,314	1,300	2,486	1,400	63,000
2020 Water Demand	18,798	6,459	679	2,179	1,285	29,400
Surplus (Deficit)	31,702	855	621	307	115	33,600

Average Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	33,172	6,265	1,300	2,250	1,400	44,386
2020 Water Demand	18,798	6,459	679	2,179	1,285	29,400
Surplus (Deficit)	14,374	(194)	621	70	115	14,986

Multi-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	20,330	3,890	1,240	1,490	1,167	28,117
2020 Water Demand (85%)	15,978	5,490	577	1,852	1,092	24,990
Surplus (Deficit)	4,352	(1,600)	663	(363)	74	3,127

Single-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	15,940	2,599	645	1,340	545	21,069
2020 Water Demand (85%)	15,978	5,490	577	1,852	1,092	24,990
Surplus (Deficit)	(38)	(2,891)	68	(513)	(547)	(3,921)

Napa Valley 2050 Water Supply Study - Attachment B
Comparison of Incorporated Area Water Supplies and Demands

2050 Supply versus Demand

Full Entitlement Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	50,500	7,314	1,300	2,542	1,400	63,056
2050 Water Demand	21,643	7,500	679	2,458	1,560	33,840
Surplus (Deficit)	28,857	(186)	621	84	(160)	29,216

Average Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	33,248	6,265	1,300	2,306	1,400	44,518
2050 Water Demand	21,643	7,500	679	2,458	1,560	33,840
Surplus (Deficit)	11,605	(1,235)	621	(152)	(160)	10,678

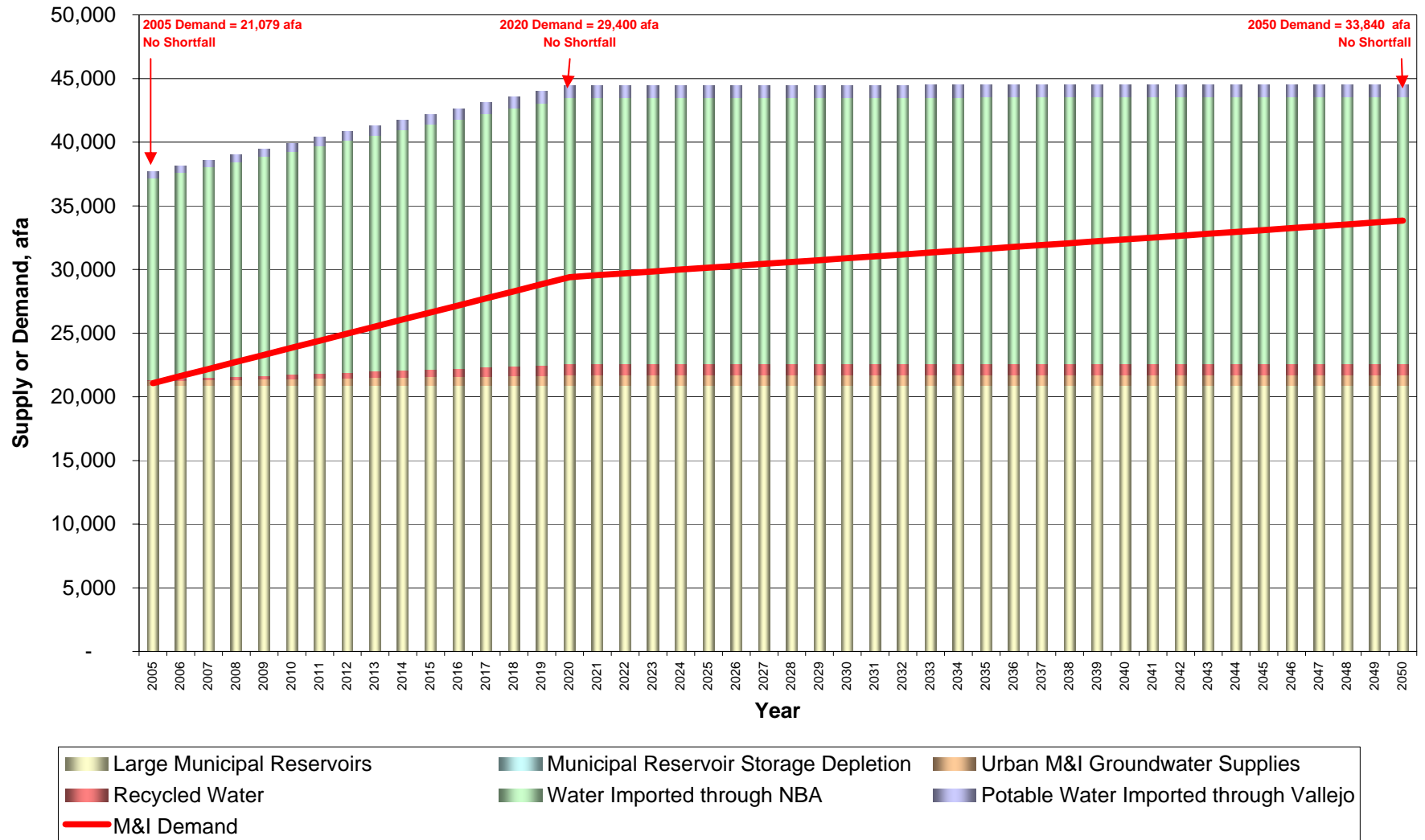
Multi-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	20,370	3,890	1,240	1,538	1,167	28,205
2050 Water Demand (85%)	18,397	6,375	577	2,089	1,326	28,764
Surplus (Deficit)	1,974	(2,485)	663	(552)	(159)	(559)

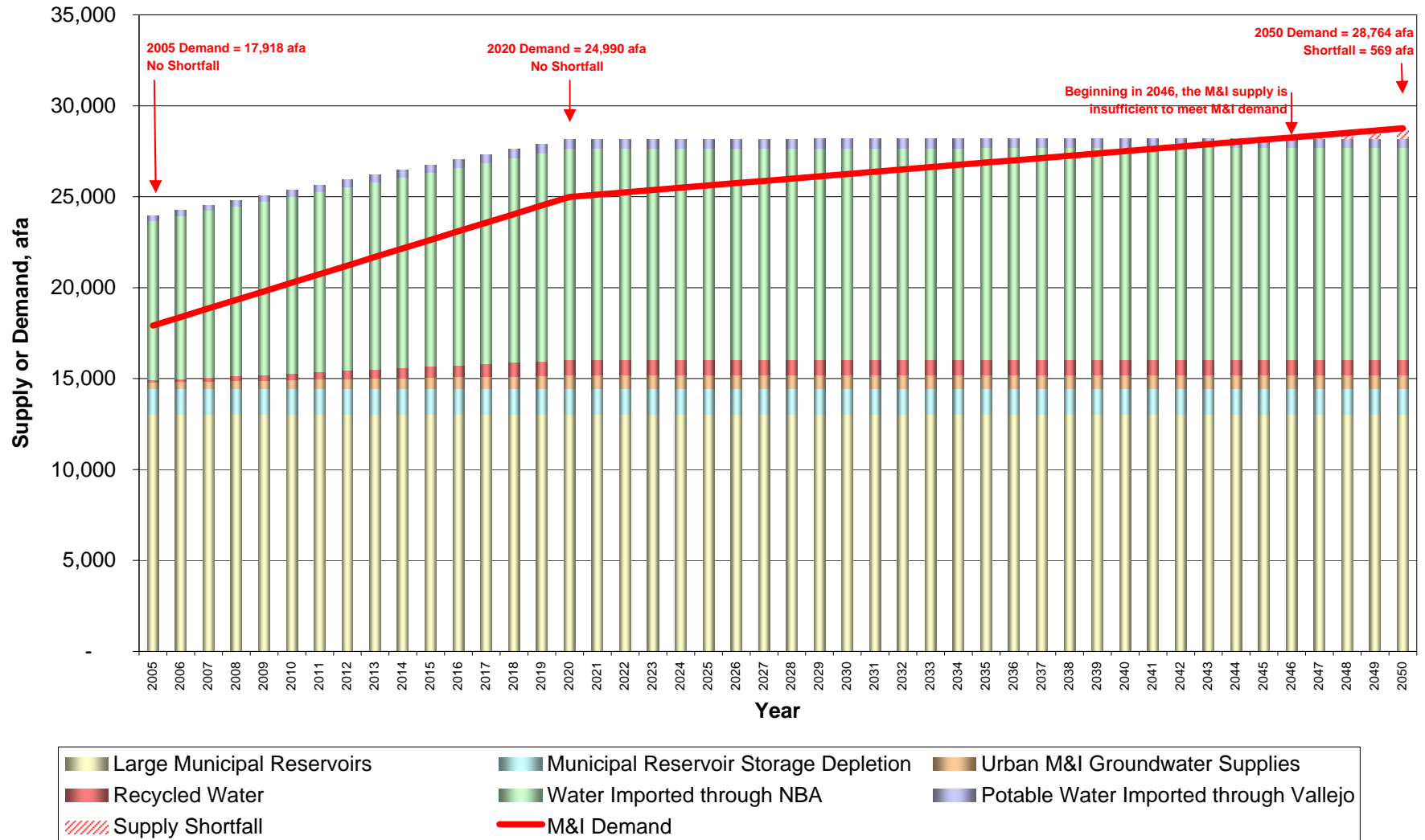
Single-Dry Supply Year

	Napa	American Canyon	Yountville	St. Helena	Calistoga	Total
Total Water Supply	15,960	2,599	645	1,411	545	21,160
2050 Water Demand (85%)	18,397	6,375	577	2,089	1,326	28,764
Surplus (Deficit)	(2,437)	(3,776)	68	(679)	(781)	(7,604)

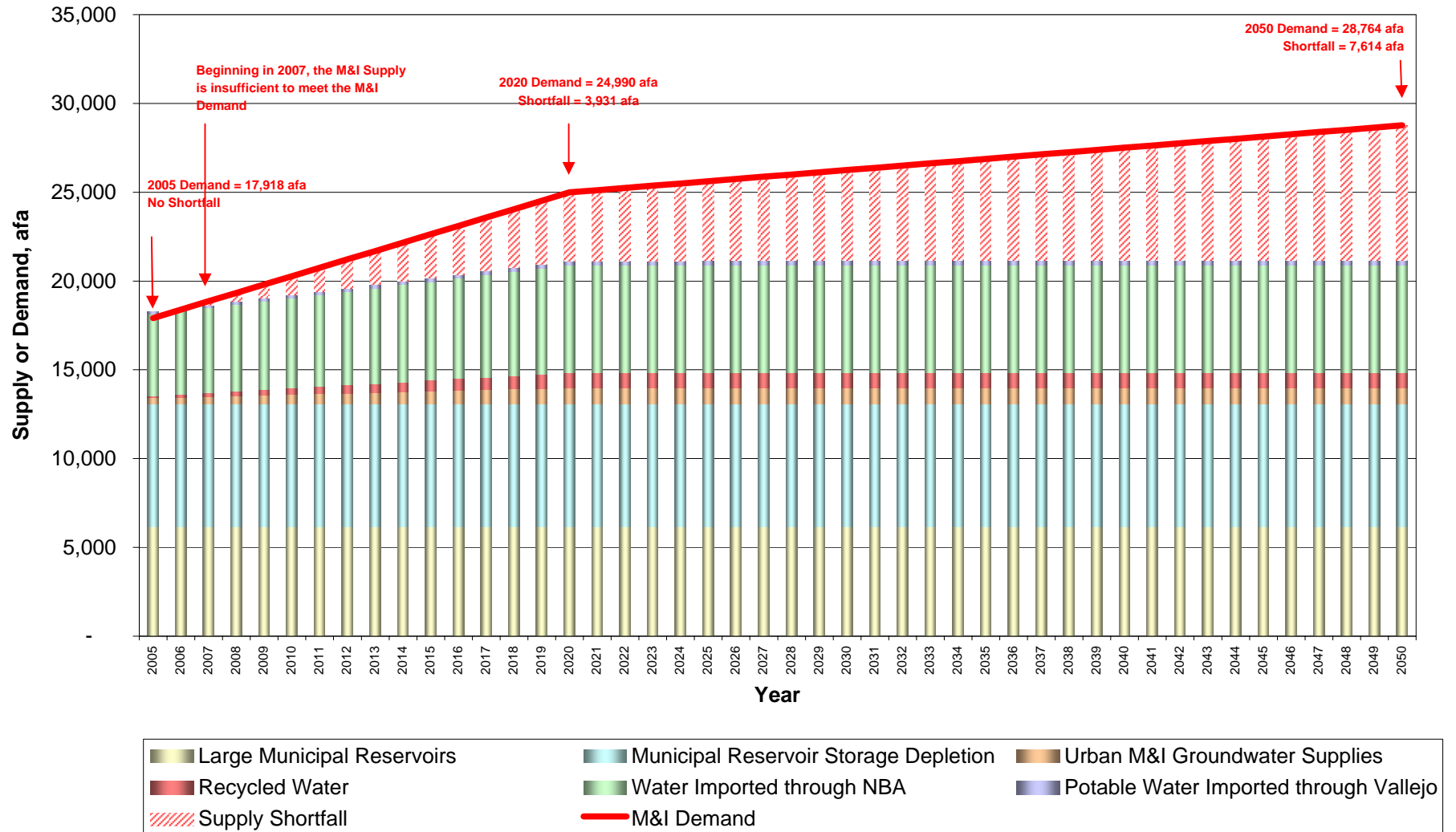
**Figure B-1. M&I Supply vs. Demand
(assuming Normal Year supply conditions)**



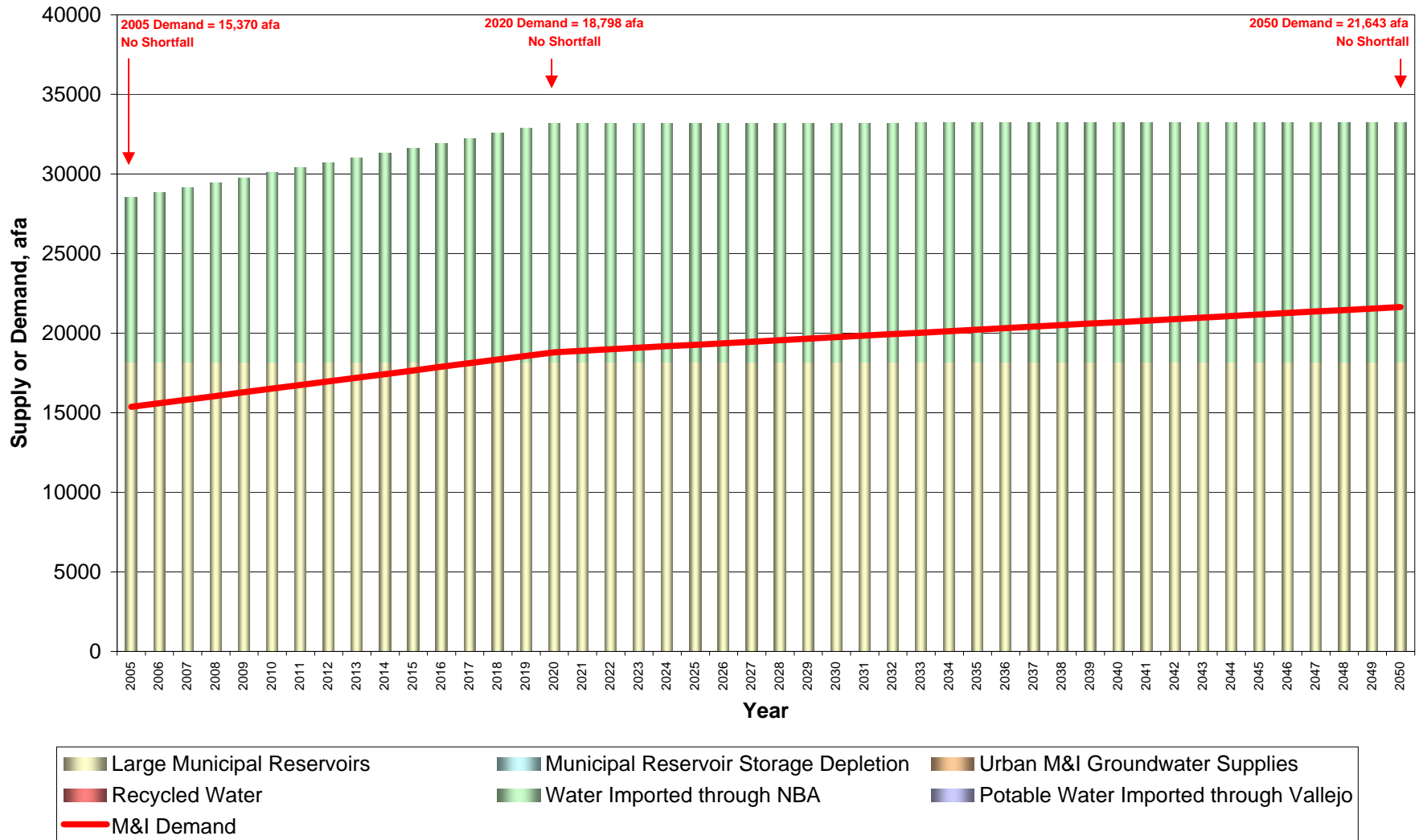
**Figure B-2. M&I Supply vs. Demand
(assuming Multiple Dry Year supply conditions)**



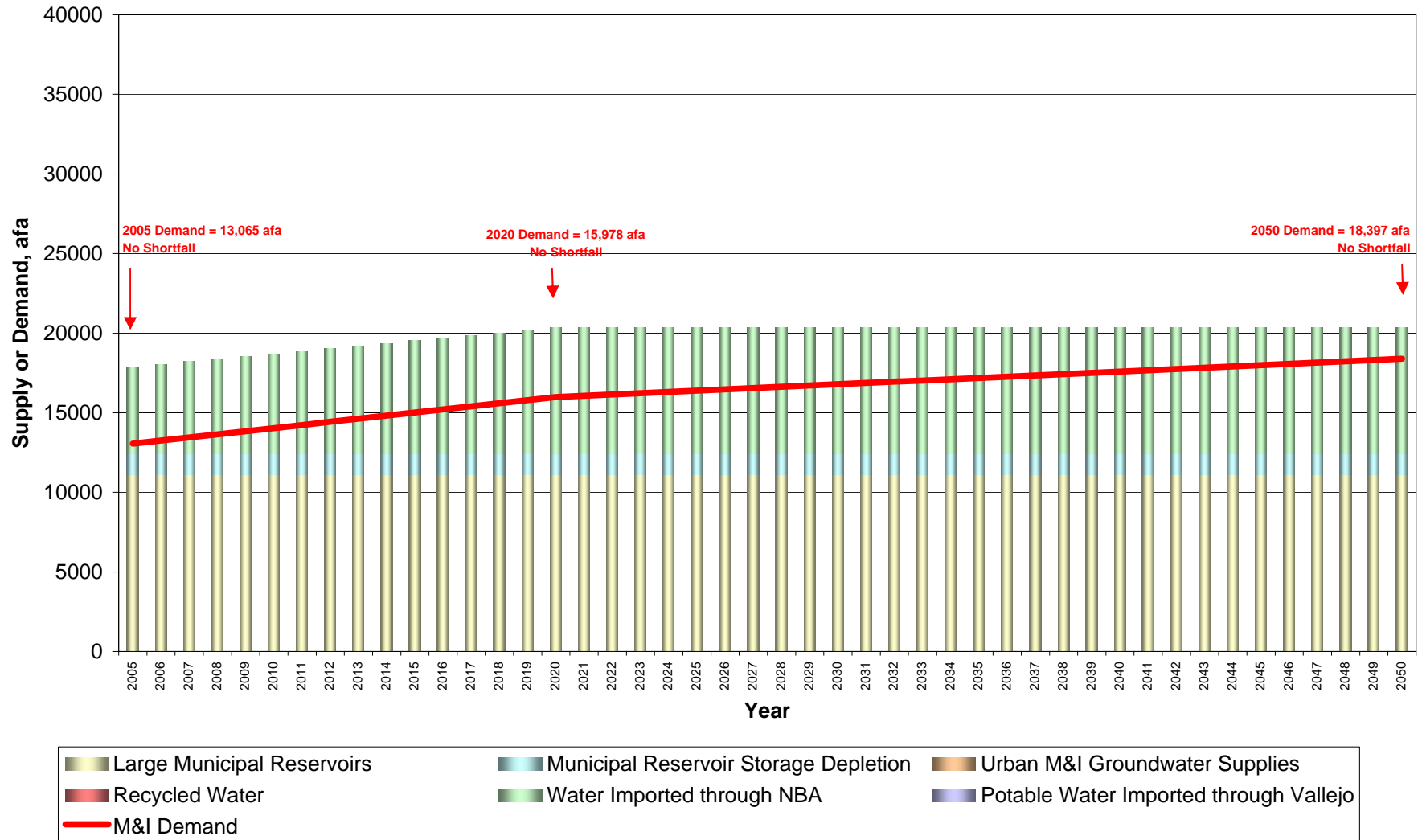
**Figure B-3. M&I Supply vs. Demand
(assuming Single Dry Year supply conditions)**



**Figure B-4. City of Napa Supply vs. Demand
(assuming Normal Year supply conditions)**



**Figure B-5. City of Napa Supply vs. Demand
(assuming Multiple Dry Year supply conditions)**



**Figure B-6. City of Napa Supply vs. Demand
(assuming Single Dry Year supply conditions)**

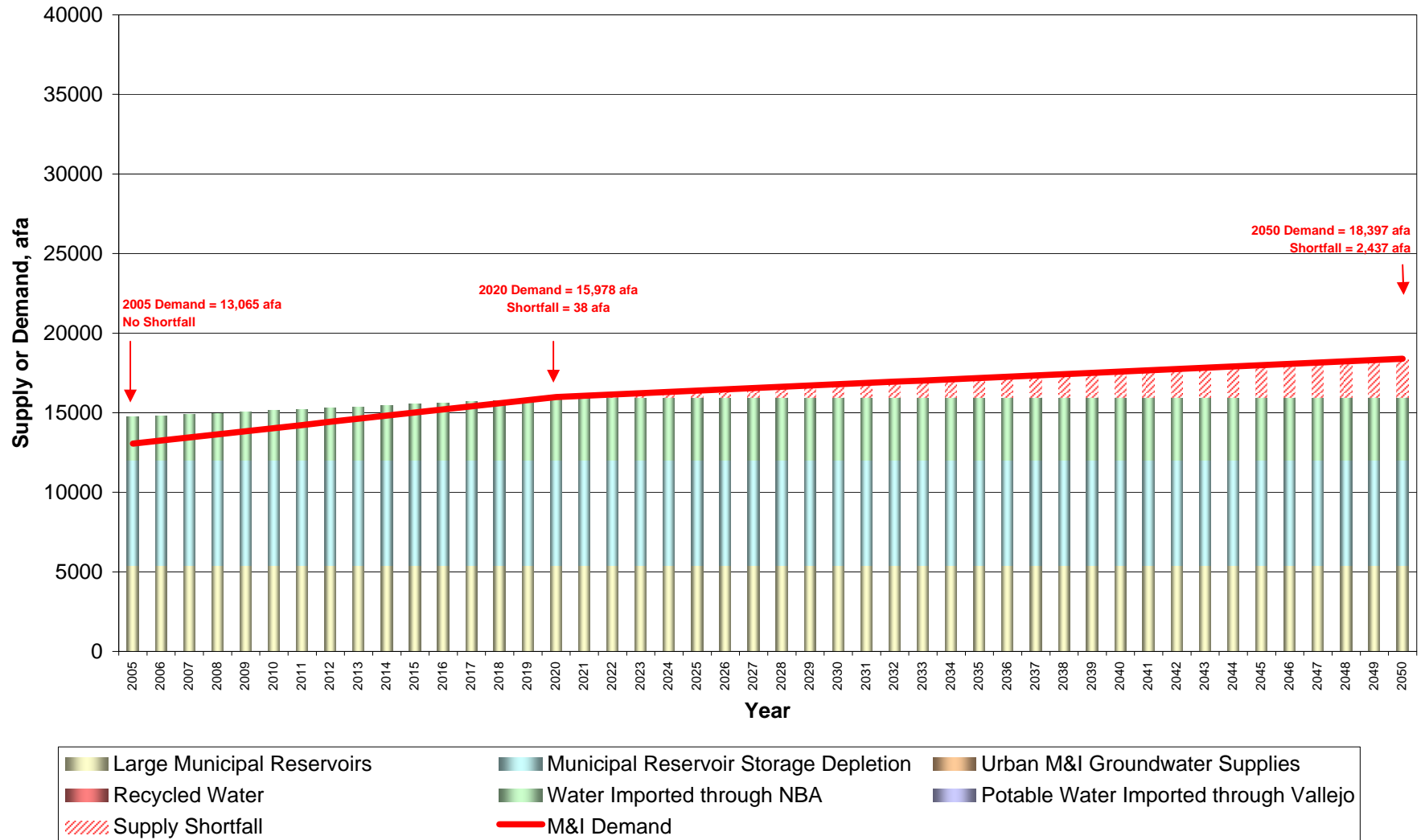


Figure B-7. American Canyon Supply vs. Demand
(assuming Normal Year supply conditions)

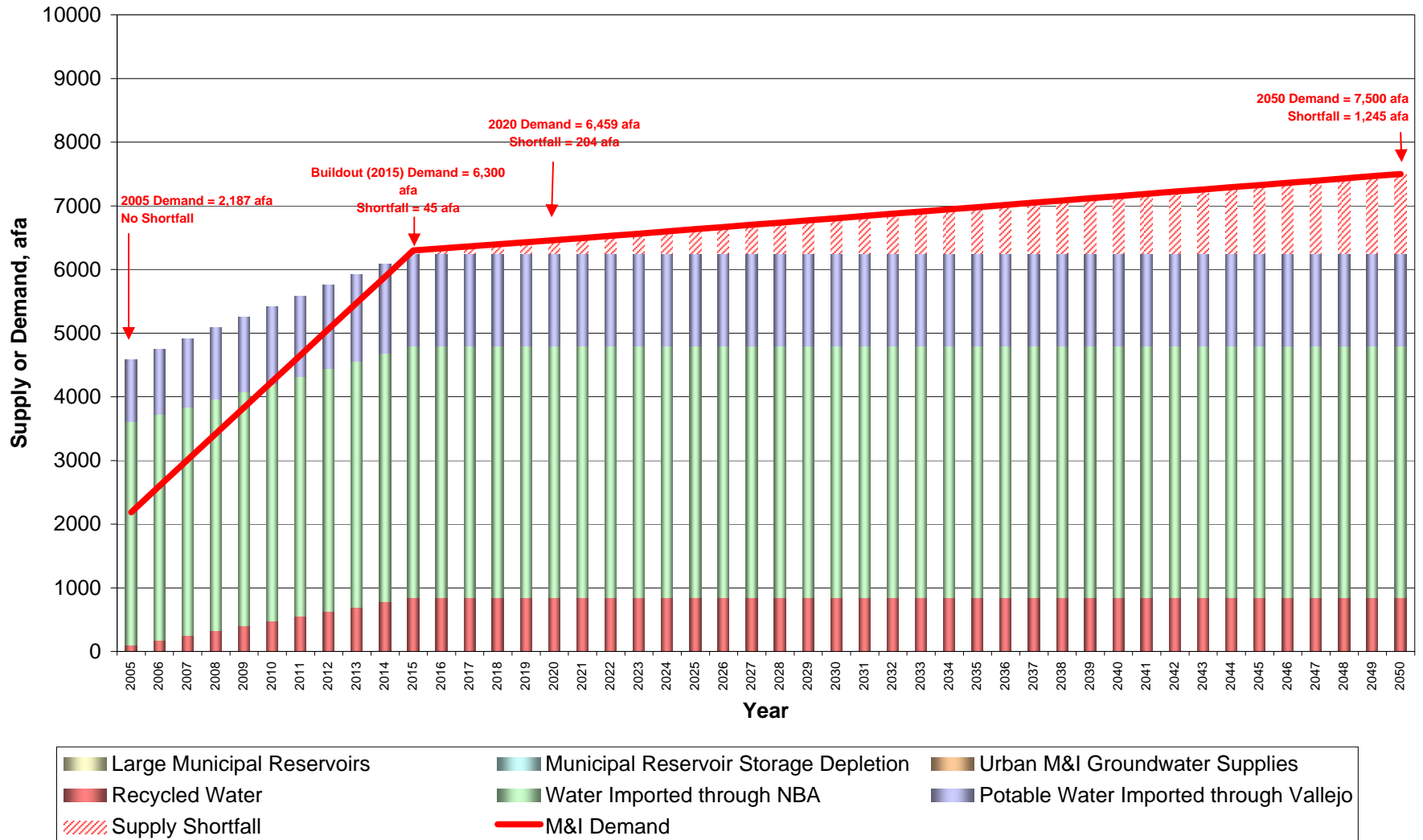


Figure B-8. American Canyon Supply vs. Demand
(assuming Multiple Dry Year supply conditions)

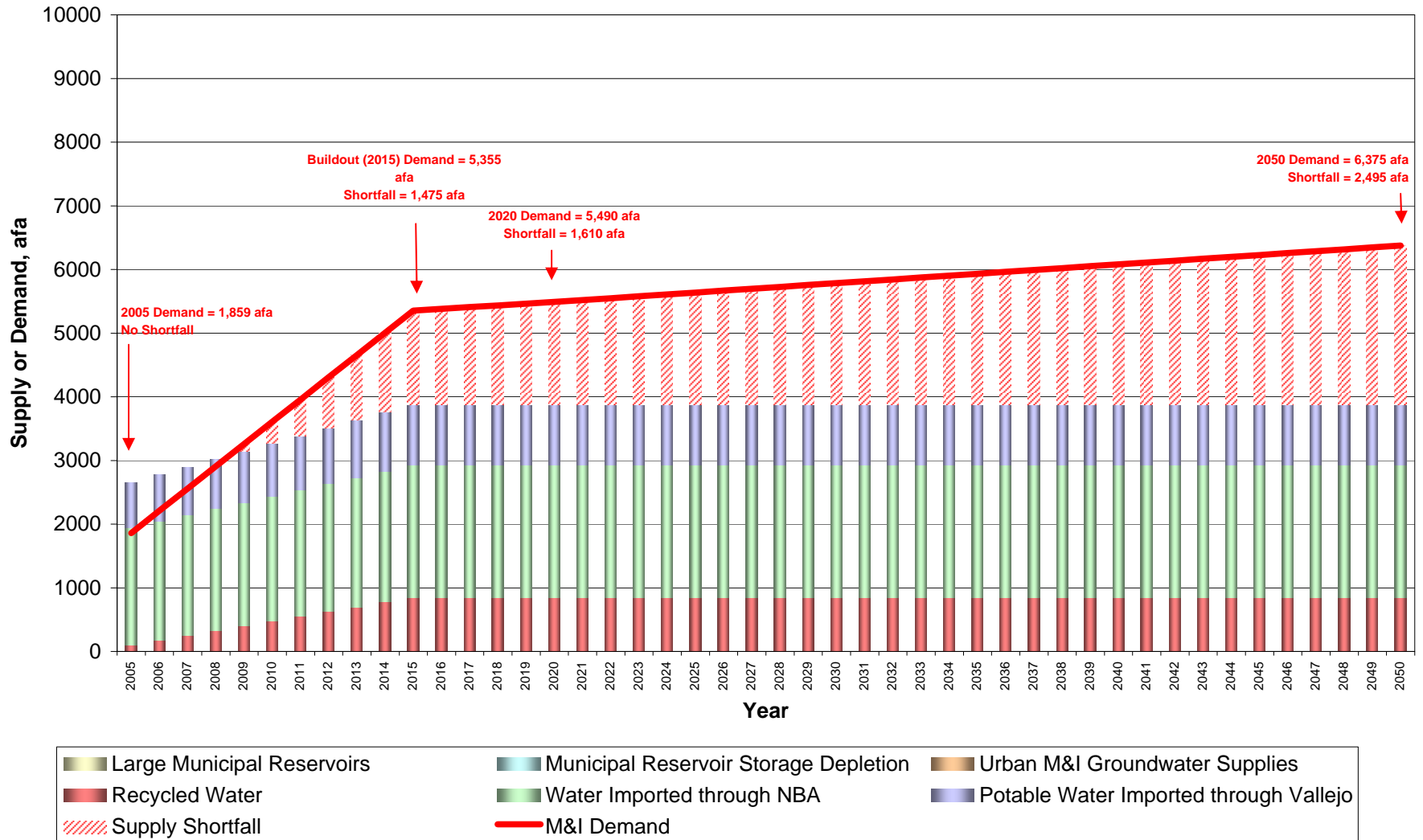


Figure B-9. American Canyon Supply vs. Demand
(assuming Single Dry Year supply conditions)

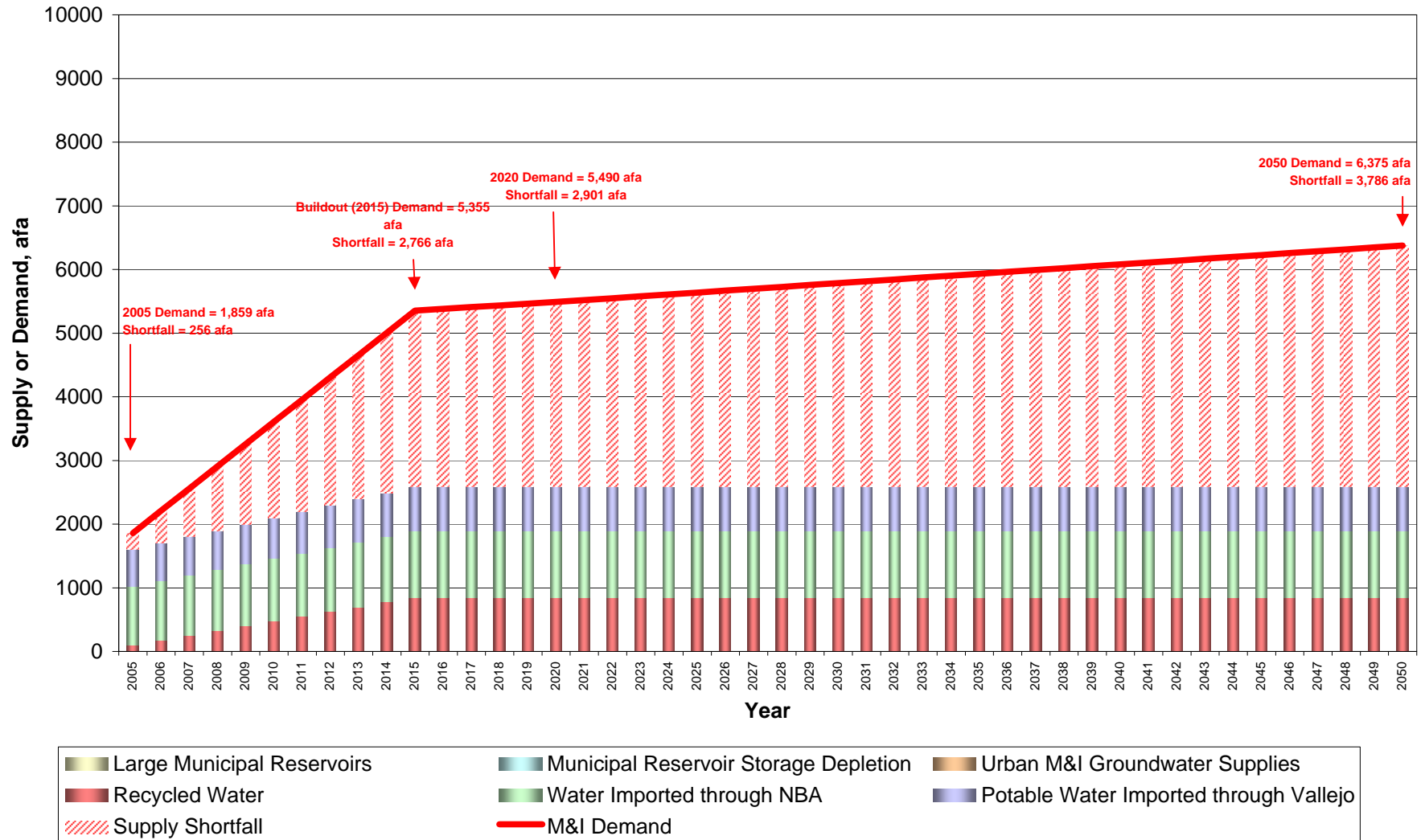


Figure B-10. Yountville Supply vs. Demand (assuming Normal Year supply conditions)

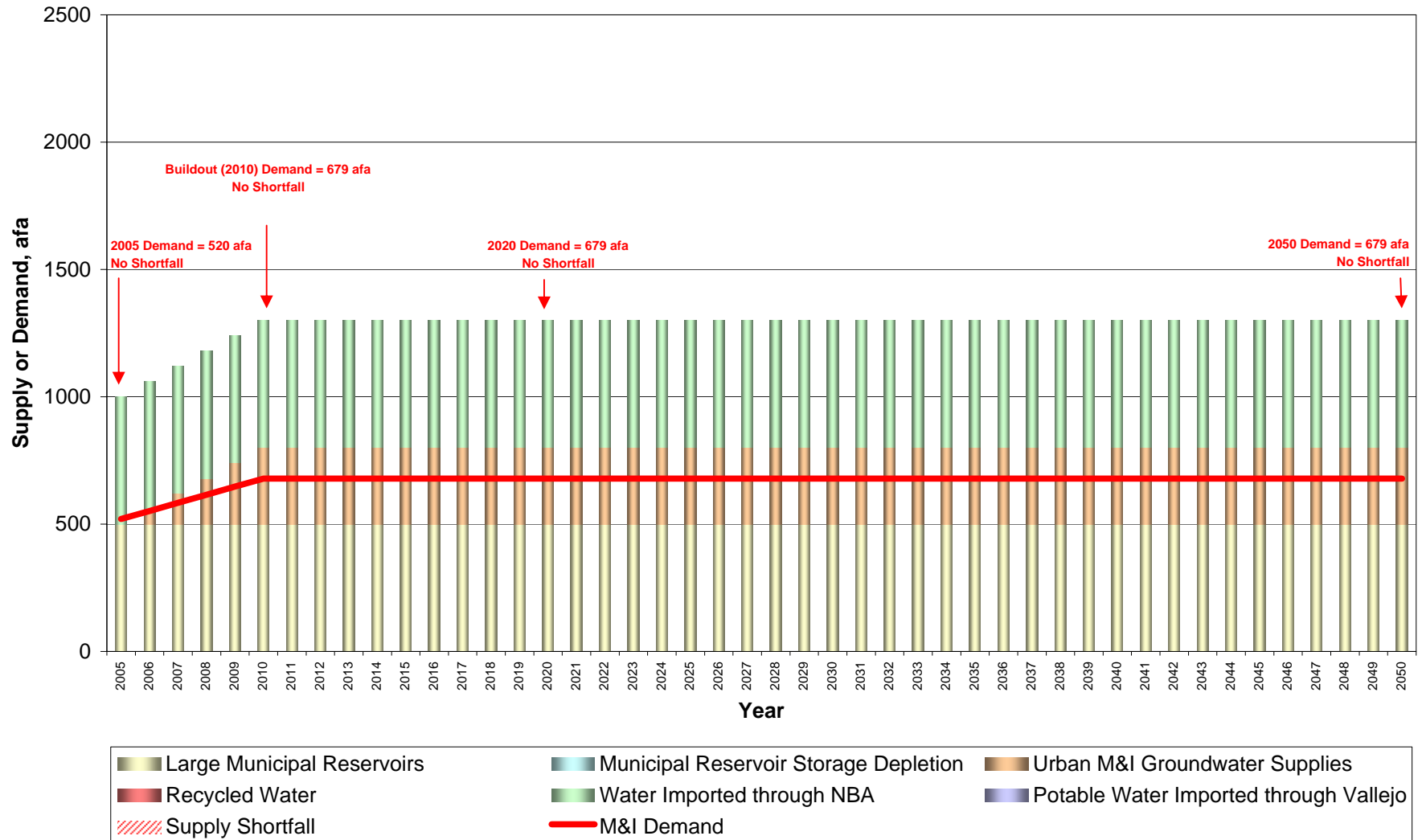


Figure B-11. Yountville Supply vs. Demand
(assuming Multiple Dry Year supply conditions)

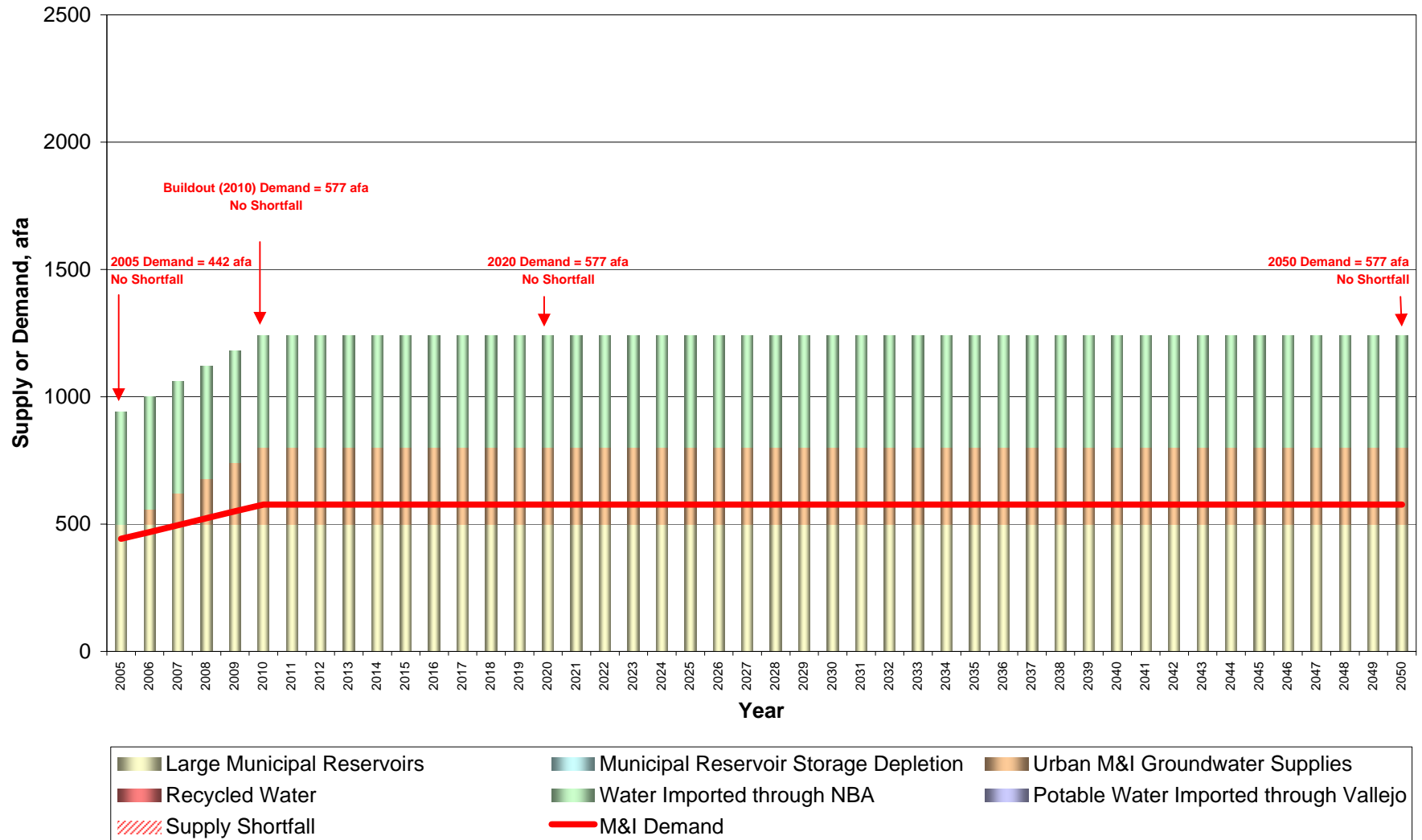


Figure B-12. Yountville Supply vs. Demand
(assuming Single Dry Year supply conditions)

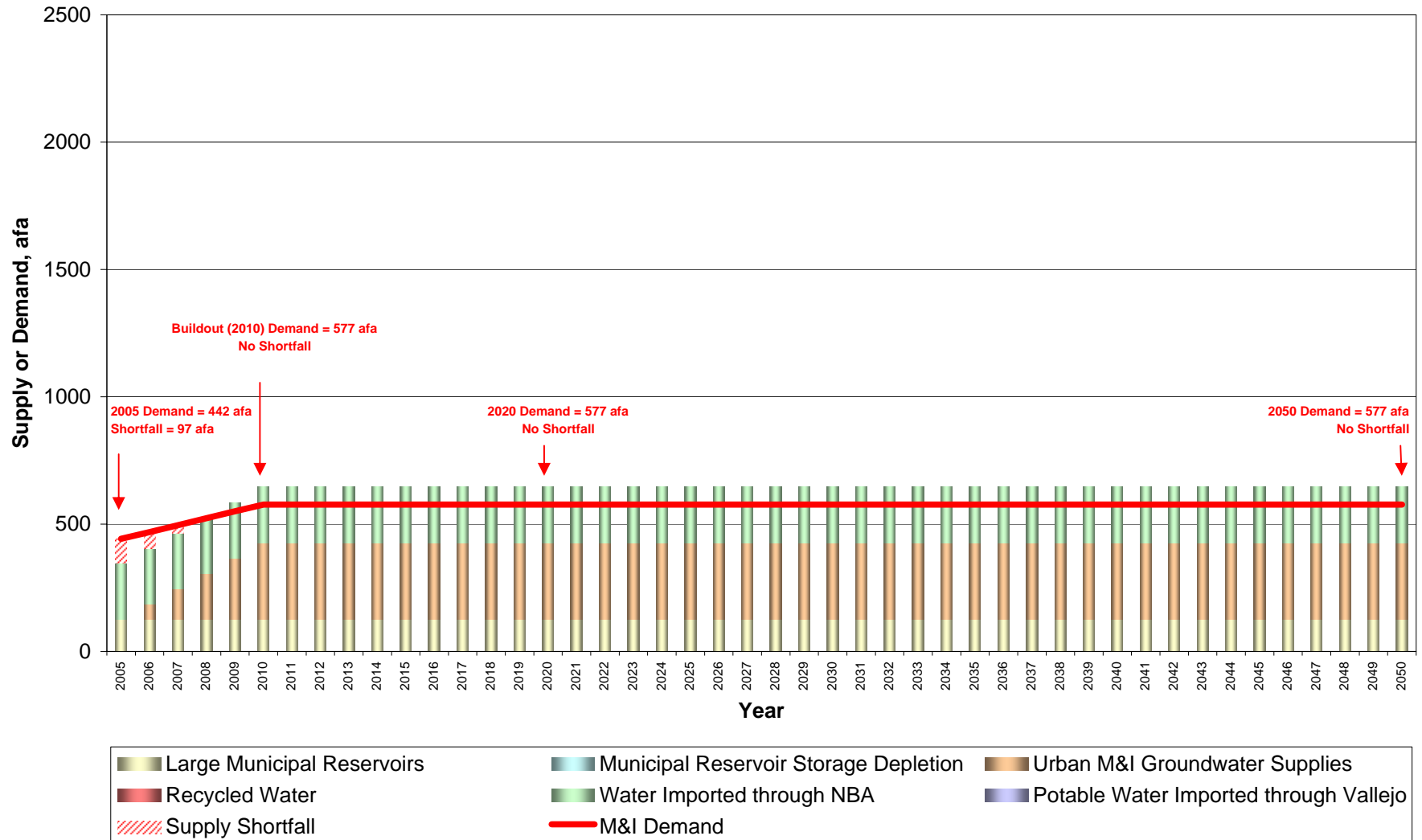
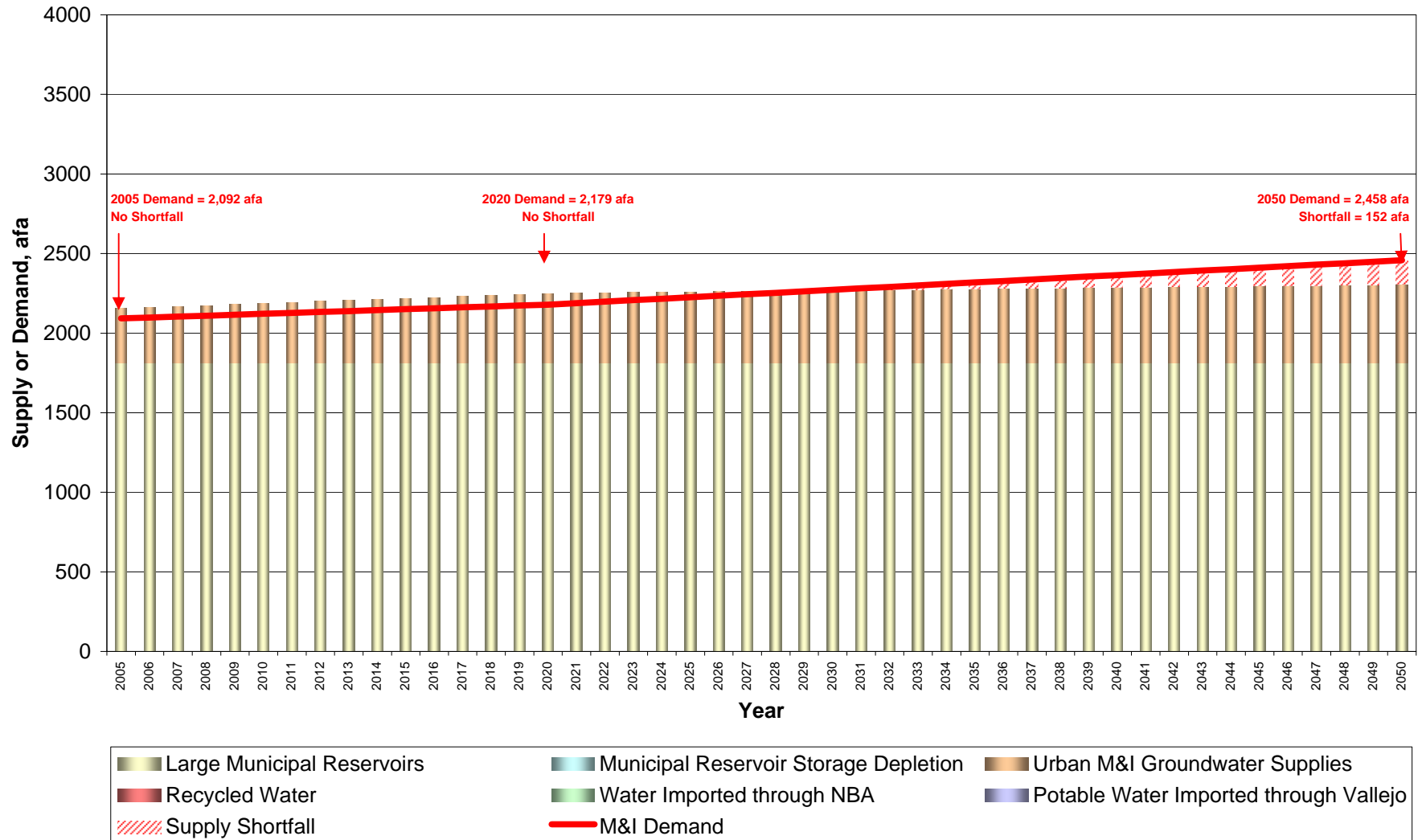
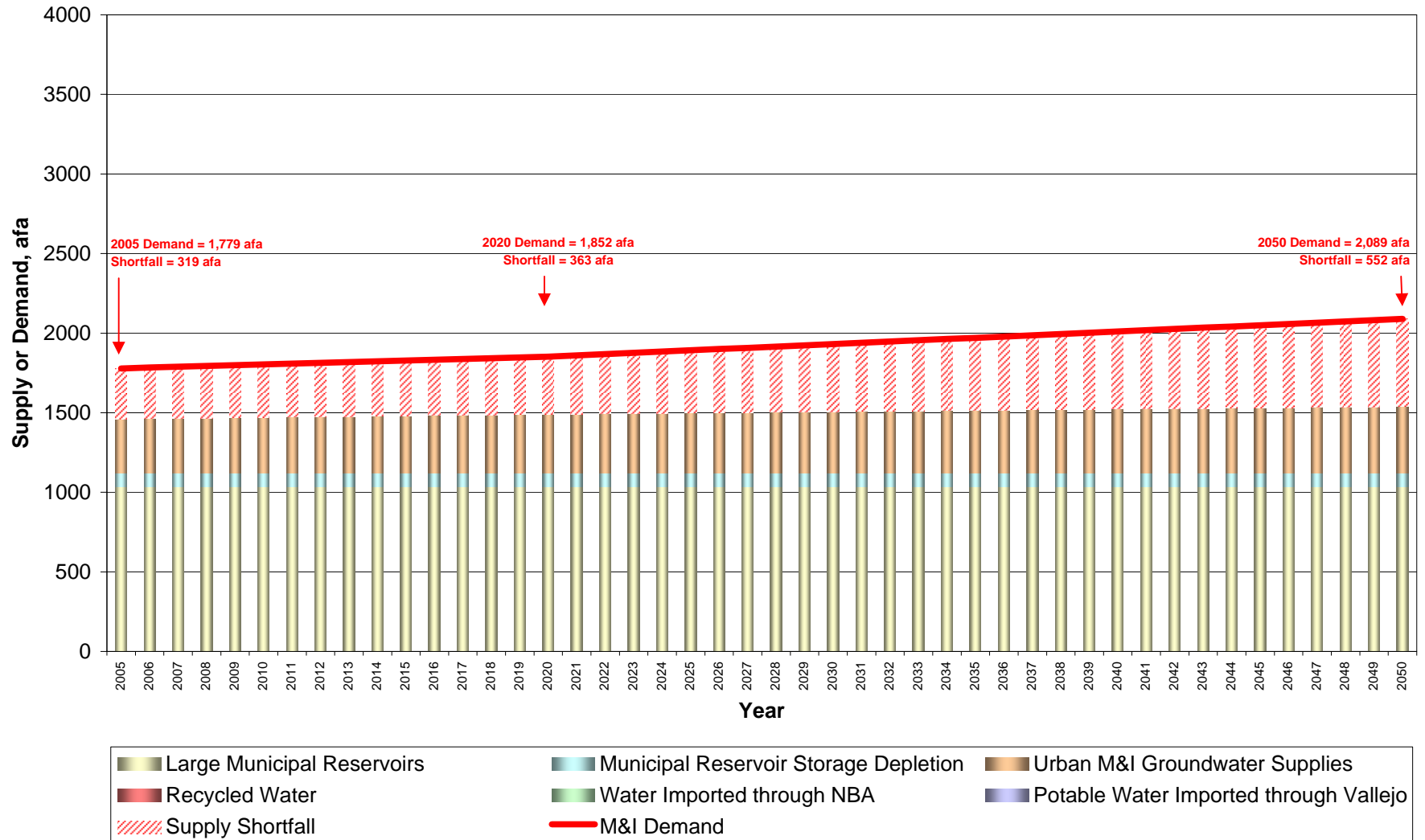


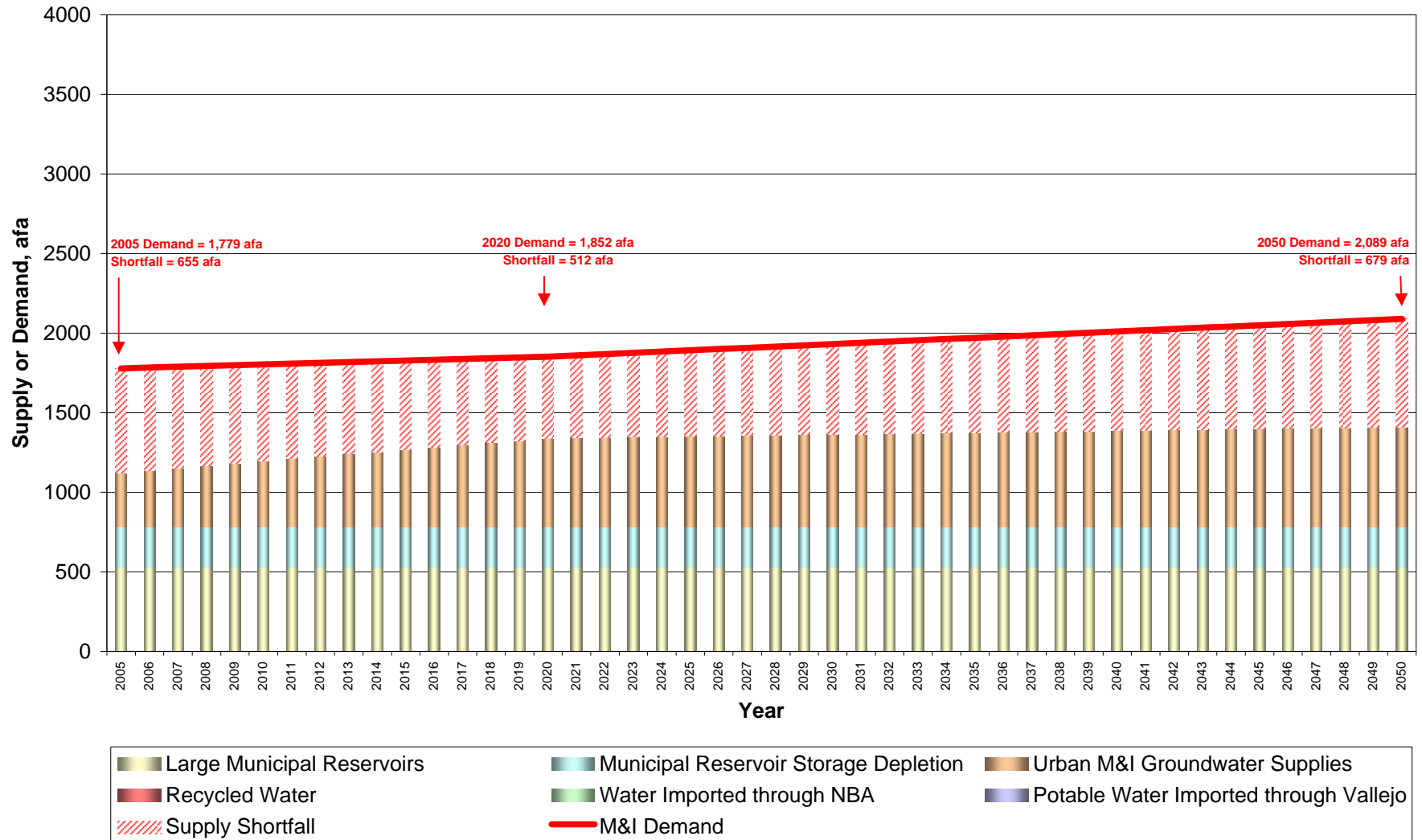
Figure B-13. St. Helena Supply vs. Demand
(assuming Normal Year supply conditions)



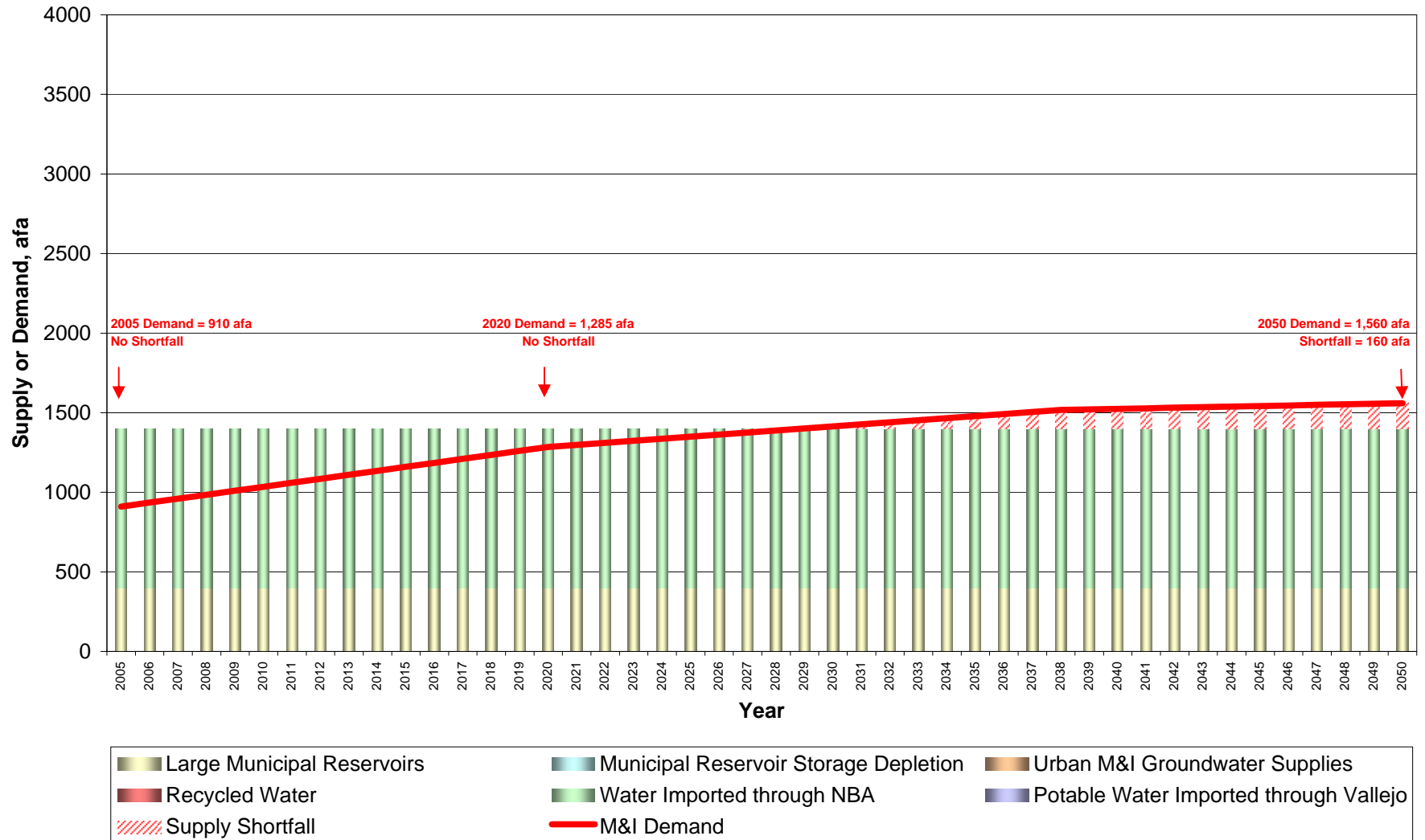
**Figure B-14. St. Helena Supply vs. Demand
(assuming Multiple Dry Year supply conditions)**



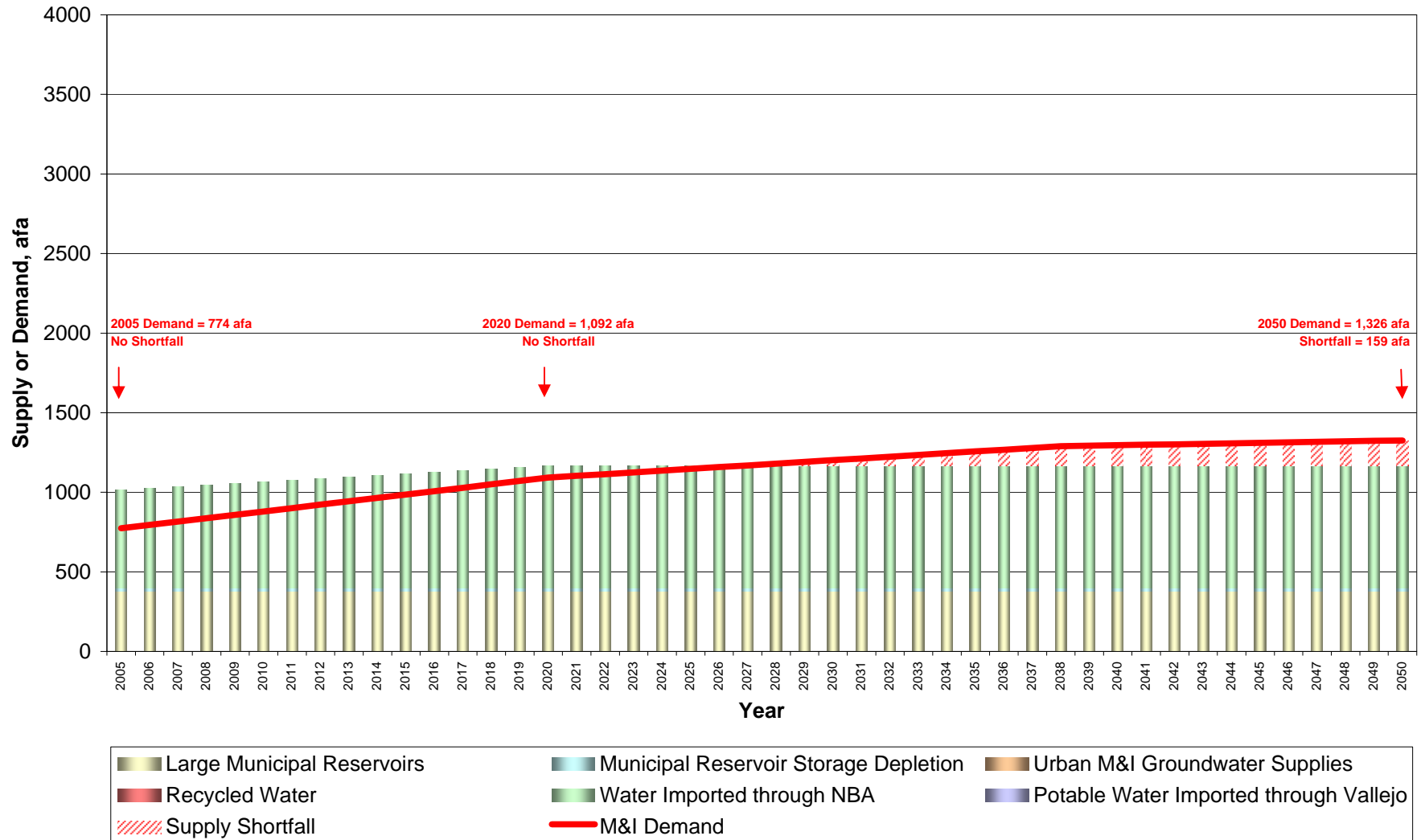
**Figure B-15. St. Helena Supply vs. Demand
(assuming Single Dry Year supply conditions)**



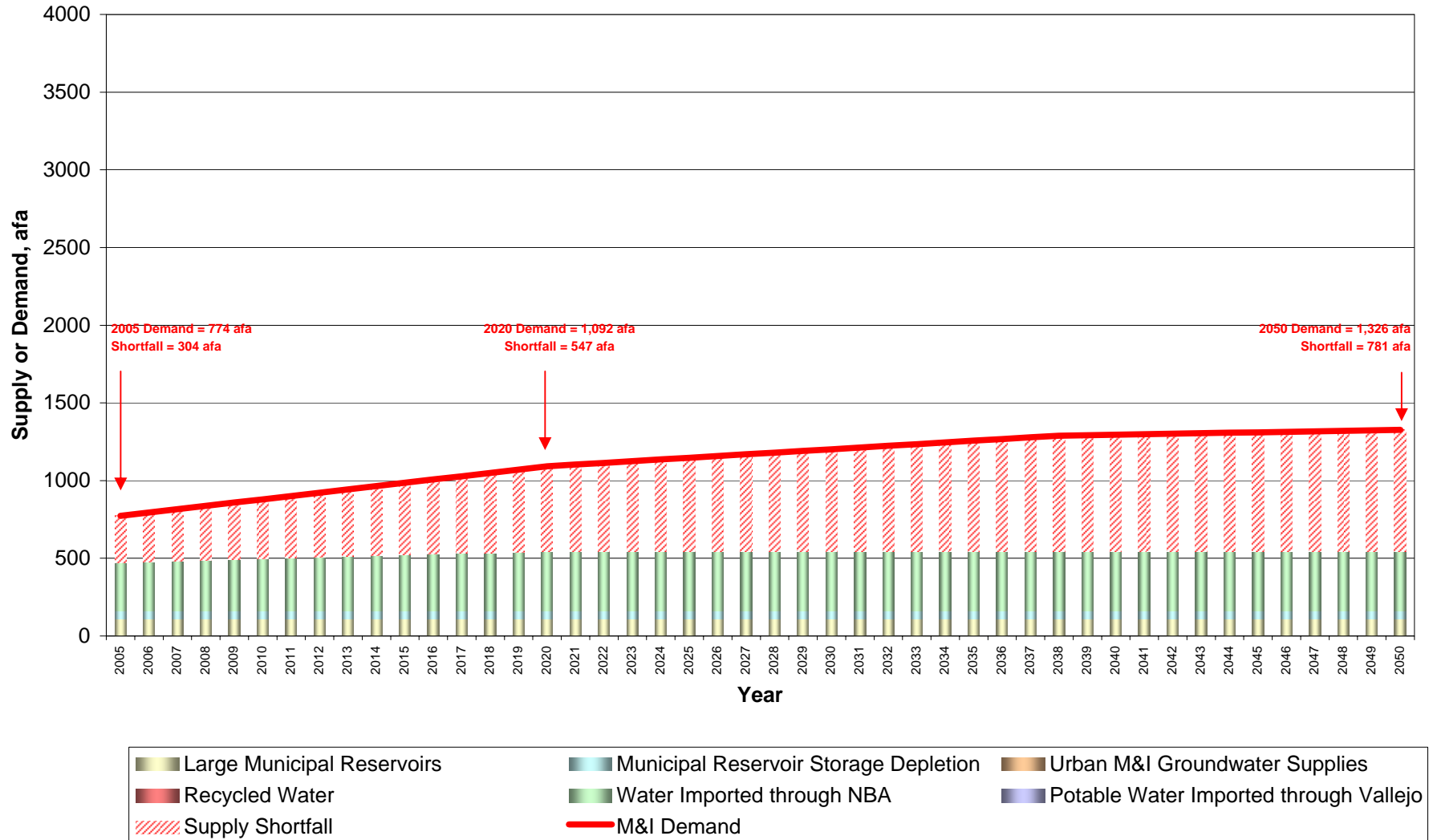
**Figure B-16. Calistoga Supply vs. Demand
(assuming Normal Year supply conditions)**



**Figure B-17. Calistoga Supply vs. Demand
(assuming Multiple Dry Year supply conditions)**



**Figure B-18. Calistoga Supply vs. Demand
(assuming Single Dry Year supply conditions)**



ATTACHMENT C

M&I Supply and Demand Assumptions

ATTACHMENT C

M&I SUPPLY AND DEMAND ASSUMPTIONS

GENERAL

1. Monthly M&I demands follow the Napa monthly demand curve.
2. For annual comparison of local supplies, local surface water reservoir yield is based on estimated safe yield.
3. Follow DWR/SWP standard of recurrence frequencies as discussed in TM 4 and shown below:

DWR Projected State Water Project Deliveries

Water-Year Type	Probability of Exceedence, percent ^(a)	SWP Delivery, percent of Total Entitlement
Full Entitlement	0	100
Average-year	60	76
Multiple Dry-years	85	40
Single Dry-year	100	20

^(a) Percent of time water supply is equal to or greater than.

4. Single dry year is based on 1977. Multi-dry year (6-year drought) is based on 1987-1992, or 1929-1934.
5. Reclaimed water use will satisfy an additional 1,500 afa of current and projected M&I potable water demands by the year 2050.
6. The conveyance capacity of the current NBA configuration is 40 cfs, once the final planned pump is installed.
7. M&I demands will be reduced 15 percent per year during a multiple year drought, and 15 percent per year in a single year drought.
8. Maximum day demands are twice the average annual demand.

NAPA

1. Milliken Reservoir would be operated to provide approximately 700 acre-feet per year on average.
2. The Milliken Reservoir yield curve presented in the 1991 Study is assumed to be accurate, modified to show a maximum yield of 700 acre-feet.

3. Milliken Reservoir is assumed to be at 20% of capacity at the start of a single or multi-year drought (400 acre-feet).
4. Hennessey WTP would be operated to provide approximately 5,000 acre-feet per year on average.
5. The Hennessey Reservoir yield curve in the 1991 Study is assumed to be accurate.
6. Hennessey is assumed to be at 84 percent of capacity at the start of a single or multi-year drought (26,000 acre-feet).
7. Depletion of storage for a single year drought is 25 percent of initial volume in reservoir. For Milliken Reservoir, depletion of storage for a multi-year (6-year) drought is 8.33 percent per year, or 50 percent of initial volume over the six-year period. For Lake Hennessey, it was assumed the first year of a multi-dry year period was a single dry year and the reservoir level would be depleted by 25 percent. The remaining years of a multi-dry year period would show a storage depletion of 5 percent per year for five years, equaling a total reservoir storage depletion of 50 percent over the six year multi-dry year period.
8. Intensification of use following buildout will be 0.5 percent until 2050.

AMERICAN CANYON

1. City of Vallejo Permit water supply (500 afa) is assumed to be delivered at 100 percent in normal years and at 90 percent in multi-dry and single dry years. Delivery of the Vallejo potable water supply is assumed to have the same reliability as the State Water Project water delivery.
2. Intensification of use following buildout will be 0.5 percent until 2050.

YOUNTVILLE

1. Rector Reservoir will supply 500 afa to Yountville during average (60 percent exceedence) and multiple dry years (85 percent exceedence), and 125 afa during single dry years (100 percent exceedence).
2. Yountville will rely on Rector Reservoir as the primary water source, receiving water from the NBA and the proposed well as necessary to satisfy demands.
3. There will be no intensification of use following completion of Buildout Scenario 1 (known development projects, plus full development of the remaining lots and maximum allowed in-fill density).
4. The proposed well will be capable of producing 300 acre-feet per year.

ST HELENA

1. Louis Stralla WTP would be operated to provide approximately 1,620 acre-feet per year on average (1998-2002 average).
2. Bell Canyon Reservoir is assumed to be at 50 percent of capacity at the start of a single or multi-year drought (1,025 acre-feet).

3. The Bell Canyon Reservoir yield curve in the 1991 Study is assumed to be accurate.
4. Depletion of storage for a single year drought is 25 percent of volume in reservoir. Depletion of storage for a multi-year (6-year) drought is 8.33 percent per year, or 50 percent of initial volume over the six-year period.
5. The Stonebridge wells would be operated to provide approximately 340 acre-feet per year under present conditions. For the years 2020 and 2050, it is assumed the Stonebridge Wells would operate to provide 20 percent of the total water supply during normal and multi-dry years and 30 percent of the total supply in single dry years.
6. SWP (KCWA) water cannot be conveyed, treated, and wheeled. Therefore, it is not included in the water supply projections.

CALISTOGA

1. The Fiege Canyon Well Site would not be available to serve M&I demands.
2. Kimball WTP would be operated to provide approximately 400 acre-feet per year on average (1998-2002 average).
3. The Kimball Reservoir yield curve in the 1991 Study is assumed to be accurate.
4. Kimball Reservoir is assumed to be at 50 percent of capacity at the start of a single or multi-year drought (200 acre-feet).
5. Depletion of storage for a single year drought is 25 percent of volume in reservoir. Depletion of storage for a multi-year (6-year) drought is 8.33 percent per year, or 50 percent of initial volume over the six year period.

ATTACHMENT D

Comparison of Main Basin Unincorporated Area Supplies Compared to Demands

Figure D-1. Main Basin Unincorporated Area Supply vs. Demand (assuming Normal Year supply conditions)

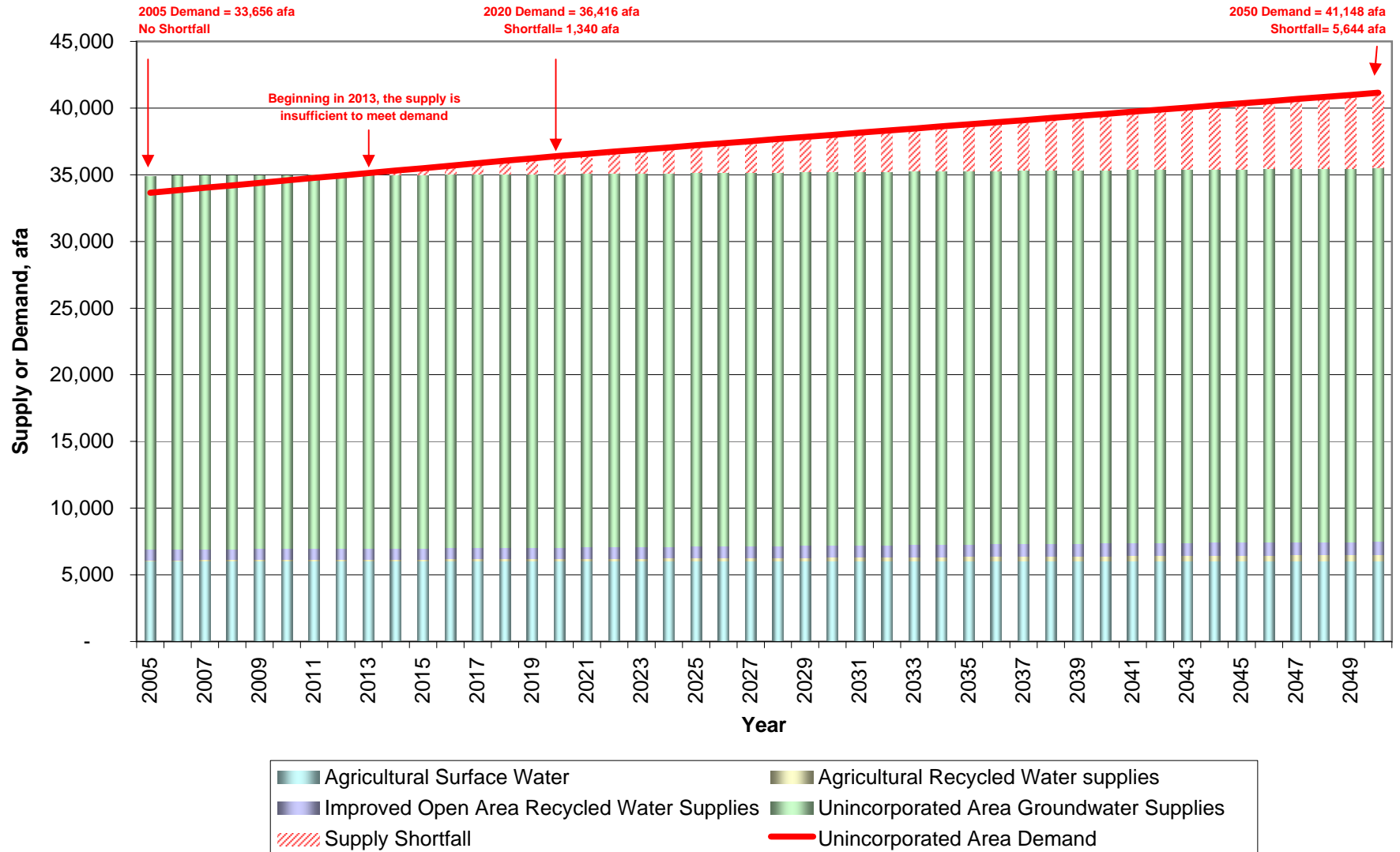
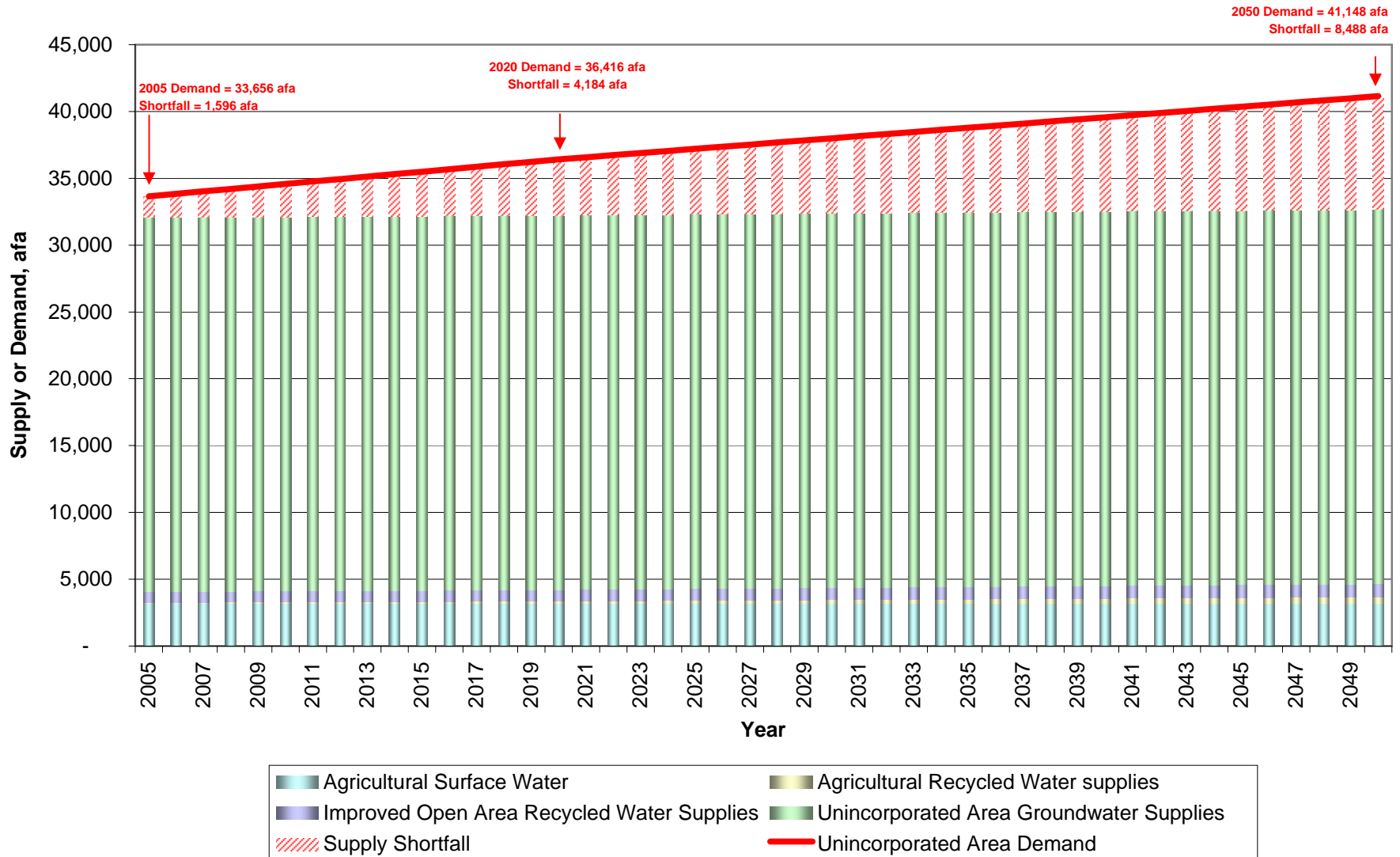


Figure D-2. Main Basin Unincorporated Area Supply vs. Demand (assuming Multiple Dry Year supply conditions)



**Figure D-3. Main Basin Unincorporated Area Supply vs. Demand
(assuming Single Dry Year supply conditions)**

