

# MEMORANDUM

**DATE:** March 27, 2015

**TO:** Lisa Rheinheimer – MST

**FROM:** Nathaniel Milam, P.E.

**Cc:** Carl Wulf – MST  
Rob McKie – AECOM

**SUBJECT:** Monterey Salinas Transit – Water Use Analysis for the Monterey Operations and Maintenance (TDA) Facility Renovation and Expansion Project

## Introduction

Pursuant to our contracted scope of work, Whitson Engineers has:

1. Estimated the site's water use based on Monterey Peninsula Water Management District guidelines;
2. Reviewed and analyzed the site's actual historic water use;
3. Developed an alternative estimate for existing water use;
4. Estimated post-project water use; and
5. Prepared this Memorandum.

## MPWMD Water Use Calculation

The site is located within the Monterey Peninsula Water Management District (MPWMD) service area. We are not aware of any existing site water allocation restrictions associated with the subject property.

MPWMD requires project applicants to complete the worksheet entitled "Non-Residential Water Use Factors" dated 7/1/2014. Capacity is calculated based on building floor area, Group (use category) and landscape irrigation demand.

Group I uses have the lowest water use factor, 0.00007 acre feet per year (AFY) per square foot of building floor space. Likely both the existing and proposed building uses would be considered Group I, as Auto and Office uses are both listed as Group I. Group II includes relatively high water demand foodservice uses, such as bakeries and coffee shops, and is assigned a factor of 0.00020 AFY/SF.

Select use categories, such as dog grooming facilities, dormitories, laundromats, meeting halls, and plant nurseries, are assigned to Group III and are assigned various water use rates. Landscape irrigation is the only Group III category that would apply to the MST site. Landscape water use is calculated as Estimated Total Water Use (ETWU), based on irrigated area, climate, landscape water needs, and irrigation efficiency. ETWU calculations for both existing and proposed site conditions are provided in Appendix A.

The Group IV category is assigned to a site if it has applied for and received a Water Use Credit for a permanent reduction in use. This occurs if an applicant proposes to expand a building or change a use and the resulting Water Use calculation exceeds the site's allotment.

A fifth Group, "Other", is "any Non-Residential water use which cannot be characterized by one of the use categories set forth ..." The water use capacity for such sites is "assigned a factor which has a positive correlation to the anticipated Water Use Capacity for that Site." This is the approach utilized herein.

**Actual Existing Water Use**

The TDA facility is currently served by California American Water via a single 2"-diameter water service and a 2" commercial meter. This provides service for entire site, including domestic, irrigation, and industrial uses. A second 6" fire service with a detector-check meter serves the site's fire system, and is not considered in this analysis.

The Cal Am water meter readings were provided by MST for the period of June 2009 to May 2014 (5 years total). Annual water use averaged 2.61 AFY. Monthly usage is provided in Appendix B.

*Table 2. Site Water Use, 2009 - 2014*

	<b>Site Water Use, Gallons per Day (GPD)</b>	<b>Site Water Use, Acre-Feet per Year (AFY)</b>
June 2009 – May 2010	2,382	2.67
June 2010 – May 2011	2,670	2.99
June 2011 – May 2012	2,050	2.30
June 2012 – May 2013	2,421	2.71
June 2013 – May 2014	2,123	2.38
<b>Average</b>	<b>2,329</b>	<b>2.61</b>

Private sub-meters were installed by MST in August of 2013 in order to better understand the distribution of water use on site. One meter was installed at the steam rack, and a second meter was installed on the line feeding the bus wash and nearby hose bibs. These metered uses are provided in Table 3, below.

*Table 3. Sub-Meter Readings*

<b>Meter</b>	<b>Reading Interval</b>	<b>Average Use (GPD)</b>	<b>Average Use (AFY)</b>
Steam Rack	8/13/13 – 1/27/15	179	0.20
Bus Wash Meter	8/13/13 – 12/6/13	732	0.82
<b>Total</b>		<b>911</b>	<b>1.02</b>

**Existing Water Use Estimated Break-Down**

Table 4, below, provides an estimated break-down of water uses within the existing site. The overall site, bus wash, and steam rack demands are based on the actual metered uses. Exterior (irrigation) use is estimated based on the site's landscaped area. The remainder of the site's use is assigned to interior (domestic) use.

*Table 4. Existing Site Water Demand Estimate*

<b>Use</b>	<b>Calculation</b>	<b>Demand (AFY)</b>
Interior (Domestic) Use	See Table 5, below	1.27
Exterior (Irrigation) Use	See MAWA Calculation, Appendix A.	0.32
Bus Wash	730 GPD (based on sub-meter readings)	0.82
Steam Rack	180 GPD (based on sub-meter readings)	0.20
<b>Total</b>		<b>2.61</b>

It is necessary to estimate per-capita demands for the interior water use in order to correlate existing use to anticipated post-project water use. Table 5 provides the estimated use based on the number of employees and shifts per day. Because the interior use is back-calculated from actual meter readings, the demand per employee is considered to be a more representative estimate in this circumstance than one which would rely on the "typical" formulaic use factor for Group I, Auto Use and Office.

*Table 5. Existing Interior Water Demand Estimate*

<b>Category</b>	<b>Staff-Shifts per Day</b>	<b>Demand per Staff-Shift</b>	<b>Total (AFY)</b>
Bus Driver (3.5-hr shift)	35	10 GPD	0.39
Office Staff (8-hr shift)	30	17 GPD	0.57
Mechanic (8-hr shift)	14	17 GPD	0.27
Other <sup>1</sup> (equivalent 8-hr shift)	2	17 GPD	0.04
<b>Total</b>	<b>81</b>		<b>1.27</b>

<sup>1</sup> Miscellaneous deliveries and visitors are approximated as equivalent to two 8-hour shifts.

### Post-Project Water Use Estimate

The proposed water use is calculated using the same basis as the existing site water demand, and is presented in Table 6.

Table 6. Proposed Site Water Demand Calculation

Use	Calculation	Demand (AFY)
Interior (Domestic) Use	See Table 7, below	1.34
Exterior (Irrigation) Use	See MAWA Calculation, Appendix A.	0.20
Bus Wash	730 GPD	0.82
Steam Rack	180 GPD	0.20
<b>Total</b>		<b>2.56</b>

Table 7. Proposed Interior Water Demand Estimate

Category	Staff-Shifts per Day	Demand Per Staff-Shift	Total, AFY
Bus Driver (3.5-hr shift)	40	10 GPD	0.45
Office Staff (8-hr shift)	14	17 GPD	0.27
Maintenance Staff (8-hr shift)	25	17 GPD	0.48
Other (equivalent 8-hr shift) <sup>1</sup>	8	17 GPD	0.15
<b>Total</b>	<b>87</b>		<b>1.34</b>

<sup>1</sup> Deliveries, visitors, and training classes. Miscellaneous deliveries and visitors are approximated as equivalent to two 8-hour shifts. In addition, classes of 8 to 15 new operators are proposed. Classes are assumed to last 6 weeks and would occur on a 12 week schedule, so are approximated as equivalent to six regular 8-hour shifts.

### Discussion

Although the building is proposed to be expanded from approximately 16,200 SF to 31,604 SF (a 95% increase), the staffing at the site is not proposed to change significantly, as office personnel are being relocated to a different facility and replaced with additional maintenance staff and bus drivers. This results in only a slight anticipated increase in the interior water demand.

Exterior (irrigation) demand is estimated to be reduced from approximately 0.32 AFY to approximately 0.20 AFY, mainly because the project proposes to remove the existing lawn area, replacing it with low-water use landscaping.

For the overall site, assuming the wash systems operate at their same rate, the site water usage is anticipated to be reduced very slightly. This assumes that the bus wash and steam rack water uses will remain at their current levels. MST will be replacing the existing mechanical systems with systems at least as efficient as the current systems as part of the project. Steam cleaning and bus washing frequency may thus be increased proportionally, while maintaining the overall site water use at or below its existing use of 2.61 AFY.

### Appendix A. Exterior Non-Residential Water Demand

Exterior Non-Residential Water Demand (landscape irrigation) is estimated as follows:

$$\text{Estimated Total Water Use, ETWU (AFY)} = (\text{ETo}) (0.62) [\text{PF} \times \text{HA} / \text{IE} + \text{SLA}]$$

The existing irrigation demand is estimated based on the existing lawn (turf) area shown on the project topographic map, and an estimated 5,000 SF of drip irrigation.

ETo= 36.0 inches

0.62 = factor to convert inches to gallons per square foot

PF= Plant Factor = 0.8 (turf), 0.3 (other areas)

HA= Hydrozone Area = 1,850 SF (turf), 5,000 SF (other areas)

IE= Irrigation Efficiency= 0.5 (turf), 0.85 (other areas)

SLA= Special Landscape Area= 0

$$= (36.0) (0.62) (0.8 \times 1,850 / 0.5 + 0.3 \times 5,000 / 0.85 + 0)$$

$$= 105,000 \text{ gallons/year} = 0.32 \text{ AFY}$$

Approximately 0.2 AFY of the total 0.3 AFY demand is attributable to lawn irrigation.

The proposed irrigation demand is estimated based on the irrigation plans, and is calculated as follows:

ETo= 36.0 inches

0.62 = factor to convert inches to gallons per square foot

PF = Plant Factor = 0.3 (native, drought tolerant landscaping)

HA = Hydrozone Area = 8,600 SF

IE = Irrigation Efficiency = .85 (drip irrigation)

SLA = Special Landscape Area = 0

$$= (36.0) (0.62) (0.3 \times 8,200 / 0.85 + 0)$$

$$= 64,600 \text{ gallons/year} = 0.20 \text{ AFY}$$

**Appendix B. Metered Water Use, 2010 – 2014**

MST TDA Facility					
Commercial Service Meter					
Mon-Yr	Days (prior month)	Reading, 100 CF	Reading, 10 CF	Gallons (prior month)	gpd
Jun-09	31	106	1060	79,500	2565
Jul-09	30	116	1160	87,000	2900
Aug-09	31	104	1040	78,000	2516
Sep-09	31	108	1080	81,000	2613
Oct-09	30	106	1060	79,500	2650
Nov-09	31	81	810	60,750	1960
Dec-09	30	85	850	63,750	2125
Jan-10	31	94	940	70,500	2274
Feb-10	31		922	69,150	2231
Mar-10	28		988	74,100	2646
Apr-10	31		835	62,625	2020
May-10	30		848	63,600	2120
Jun-10	31		1214	91,050	2937
Jul-10	30		1510	113,250	3775
Aug-10	31		1375	103,125	3327
Sep-10	31		1445	108,375	3496
Oct-10	30		1358	101,850	3395
Nov-10	31		1256	94,200	3039
Dec-10	30		1182	88,650	2955
Jan-11	31		597	44,775	1444
Feb-11	31		661	49,575	1599
Mar-11	28		710	53,250	1902
Apr-11	31		714	53,550	1727
May-11	30		971	72,825	2428
Jun-11	31		1006	75,450	2434
Jul-11	30		857	64,275	2143
Aug-11	31		857	64,275	2073
Sep-11	31		987	74,025	2388
Oct-11	30		843	63,225	2108
Nov-11	31		765	57,375	1851
Dec-11	30		862	64,650	2155
Jan-12	31		702	52,650	1698
Feb-12	31		696	52,200	1684
Mar-12	28		838	62,850	2245
Apr-12	31		795	59,625	1923
May-12	30		770	57,750	1925

Jun-12	31		790	59,250	1911
Jul-12	30		931	69,825	2328
Aug-12	31		1315	98,625	3181
Sep-12	31		1162	87,150	2811
Oct-12	30		927	69,525	2318
Nov-12	31		634	47,550	1534
Dec-12	30		704	52,800	1760
Jan-13	31		636	47,700	1539
Feb-13	31		769	57,675	1860
Mar-13	28		789	59,175	2113
Apr-13	31		1886	141,450	4563
May-13	30		1241	93,075	3103
Jun-13	31		1256	94,200	3039
Jul-13	30		964	72,300	2410
Aug-13	30		816	61,200	2040
Sep-13	30		1025	76,875	2563
Oct-13	30		887	66,525	2218
Nov-13	30		0	-	0
Dec-13	30		0	-	0
Jan-14	30		713	53,475	1783
Feb-14	30		755	56,625	1888
Mar-14	30		789	59,175	1973
Apr-14	30		1886	141,450	4715
May-14	30		1241	93,075	3103
Jun-14	31		995		
Jul-14	30				
Aug-14	31				
Sep-14	31				
Oct-14	30				
Nov-14	31				
Dec-14	30				
Jan-15	31				
Feb-15	31				
Mar-15	28				
Apr-15	31				
May-15	30				
Maximum			1,886	141,450	4,715
Average			945	70,850	2,334
Minimum			-	-	-

Annual Totals					
			Gallons	gpd	AFY
Total Usage, Jun 2009 - May 2010			869,475	2,382	2.67
Total Usage, June 2010 - May 2011			974,475	2,670	2.99
Total Usage, June 2011 - May 2012			748,350	2,050	2.30
Total Usage, June 2012 - May 2013			883,800	2,421	2.71
Total Usage, June 2013 - May 2014			774,900	2,123	2.38
Average			850,200	2,329	2.61

### Appendix C. Comparison to the Site's 2012 Water Use Survey

We were provided a recent Water Use Survey Report (Survey) for the site by MST, as a point of comparison to the current Study. The Survey was completed by WaterWise Consulting, Inc. in early 2012 for California American Water. The annual metered water use used for the Survey was 2.33 AFY.

Table 7, below, is adapted from Appendix A of the Survey. The Survey does not describe how the individual water uses on the site were estimated, and therefore we are not able to comment on the accuracy of the estimated break-down. Table A2 provides the direct comparison to the estimates provided in the Survey, and those used in this Study.

Table A1. Existing Water Use Estimate from the 2012 Water Use Survey  
(adapted from Appendix A of the Water Use Survey)

Existing Site Uses	Number	Demand	Annual Use (gallons)	Annual Use (AFY)
<b>Interior Uses</b>			<b>209,665</b>	<b>0.64</b>
Tank Toilet	2	1.6 gpf	16,007	0.05
Flush Valve Toilet	4	1.6 gpf	37,849	0.12
Waterless Urinal	2	0	0	0.00
Regular Showerhead	2	2.5 gpm	10,023	0.03
Lavatory Faucet Aerator	1	2.0 gpm	10,921	0.03
Lavatory Faucet Aerator	3	2.2 gpm	39,943	0.12
Lavatory Faucet Aerator	2	3.5 gpm	21,019	0.06
Drinking Fountain	1	1.0 gpm	5,460	0.02
Bathroom Cleaning Activities	-	-	3,291	0.01
Breakroom Faucet	3	2.2 gpm	12,043	0.04
Eye Wash Stations	4	3.0 gpm	150	0.00
Shop/Utility Faucets	2	7.0 gpm	25,582	0.08
Shop Handwash Basin	1	5.0 gpm	27,377	0.08
<b>Landscape Irrigation</b>	-	-	<b>32,014</b>	<b>0.10</b>
<b>Other</b>			<b>517,541</b>	<b>1.59</b>
Steam Sprayer	1	0.5 gpm	43,833	0.13
Bus Washer	1	42.5 gpm	421,124	1.29
Hose Spigots (with positive shut-off nozzles)	4	3.0 gpm	52,584	0.16
<b>Total</b>			<b>759,220</b>	<b>2.33</b>

Table A2. Comparison of Results

Existing Site Uses	2012 Water Use Survey (AFY)	Existing Use in This Study (AFY)
Interior Uses	0.64	1.27
Landscape Irrigation	0.10	0.32
Other	1.59	1.02
<b>Total</b>	<b>2.33</b>	<b>2.61</b>

**Appendix D. MPWMD Water Use calculation based on building and irrigated areas**

Table D1, below, provides the site's Water Use Capacity based on MPWMD Water Use factors alone. Note that the estimated 1.58 AFY Water Use Capacity is significantly less than the 2.61 AFY actually used at the site, but correlates well to the 1.59 AFY estimated for the existing Interior (domestic) and Exterior (irrigation) Uses.

*Table D1. MPWMD Water Use Calculation for Existing Conditions*

<b>Category</b>	<b>Area (SF)</b>	<b>Factor (AFY/SF)</b>	<b>Total (AFY)</b>
Interior Non-Residential Water Demand, Group I	18,000	0.000070	1.26
Exterior Non-Residential Water Demand, Group III			
Lawn (Sprinkler Irrigated)	1,800	See	0.32
Other Areas (Drip Irrigated)	6,000	App. A	
<b>Total</b>			<b>1.58</b>