Appendix A: DWR Annual Summary Reports

State of California | Department of Water Resources | The Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2001

San Bernardino, City of
William Bryden Dir. Of Water Utility
PO BOX 710
SAN BERNARDINO, CA 92402
3610039 SD

1. General Information

Please follow the guidelines on the back of this form.

Contact : W. William Bryden, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: bryden_bi@ci.san-bernardino.ca.us
Website: www.ci.san-bernardino.ca.us
Communities served:
City of San Bernardino
County: San Bernardino
Population served 140,000

2. Active Service Connections

Customer Class	Recycled Water	Potable Water		Complete this portion if the system serves all or part of an incorporated city			
				Inside City Limits		Outside City Limits	
		Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
Single Family Residential		34,123					
Multi-family Residential		2,965					
Commercial/Institutional		3,651					
Industrial							
Landscape Irrigation		1,029					
Other		130					
Agricultural Irrigation							
TOTAL		41898		N/A	N/A	N/A	N/A

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2,622	2,256	2,612	2,971	4,503	5,086	5,550	5,707	4,839	4,372	3,233	2,705	46456
	Surface	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Purchased [1/]													
	Total Potable	2622	2256	2612	2971	4503	5086	5550	5707	4839	4372	3233	2705	46456
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Single Family Residential	647,222	433,892	402,222	510,690	708,495	988,513	1,289,050	1,059,529	952,895	872,107	707,759	558,824	9131198
B. Multi-family Residential	233,889	186,538	185,289	192,289	218,922	275,852	350,189	313,994	310,059	252,760	231,216	221,390	2972387
C. Commercial/Institutional	231,164	195,789	192,436	186,467	208,994	252,934	329,276	312,954	298,704	254,555	233,740	216,525	2913538
D. Industrial													
E. Landscape Irrigation	160,966	95,663	71,994	115,853	163,151	253,284	327,420	290,097	276,051	240,913	207,367	139,352	2342111
F. Other	37,585	34,050	61,326	30,494	47,240	83,380	109,729	104,415	105,167	75,030	87,994	41,356	817766
Total Urban Retail (A thru F)	1310826	945932	913267	1035793	1346802	1853963	2405664	2080989	1942876	1695365	1468076	1177447	18177000
Agricultural Irrigation													
Wholesale(*to other agencies*)	43,061	49,861	42,067	45,963	58,255	74,653	110,127	162,627	139,554	44,834	17,118	12,193	800313

State of California | Department of Water Resources | The Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2001

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William Bryden Dir. Of Water Utility
PO BOX 710
SAN BERNARDINO, CA 92402
3610039 SD

1. General Information

Please follow the guidelines on the back of this form.

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Title: Director of Water Utility
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Fax: (909) 384-5532
E-mail: bryden_bi@ci.san-bernardino.ca.us
Website: www.ci.san-bernardino.ca.us
Communities served:
City of San Bernardino
County: San Bernardino
Population served 140,000

2. Active Service Connections

Customer Class	Recycled Water	Potable Water		Complete this portion if the system serves all or part of an incorporated city			
				Inside City Limits		Outside City Limits	
		Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
Single Family Residential		34,123					
Multi-family Residential		2,965					
Commercial/Institutional		3,651					
Industrial							
Landscape Irrigation		1,029					
Other		130					
Agricultural Irrigation							
TOTAL		41898		N/A	N/A	N/A	N/A

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2,622	2,256	2,612	2,971	4,503	5,086	5,550	5,707	4,839	4,372	3,233	2,705	46456
	Surface	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Purchased [1/]													
	Total Potable	2622	2256	2612	2971	4503	5086	5550	5707	4839	4372	3233	2705	46456
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Single Family Residential	647,222	433,892	402,222	510,690	708,495	988,513	1,289,050	1,059,529	952,895	872,107	707,759	558,824	9131198
B. Multi-family Residential	233,889	186,538	185,289	192,289	218,922	275,852	350,189	313,994	310,059	252,760	231,216	221,390	2972387
C. Commercial/Institutional	231,164	195,789	192,436	186,467	208,994	252,934	329,276	312,954	298,704	254,555	233,740	216,525	2913538
D. Industrial													
E. Landscape Irrigation	160,966	95,663	71,994	115,853	163,151	253,284	327,420	290,097	276,051	240,913	207,367	139,352	2342111
F. Other	37,585	34,050	61,326	30,494	47,240	83,380	109,729	104,415	105,167	75,030	87,994	41,356	817766
Total Urban Retail (A thru F)	1310826	945932	913267	1035793	1346802	1853963	2405664	2080989	1942876	1695365	1468076	1177447	18177000
Agricultural Irrigation													
Wholesale(*to other agencies*)	43,061	49,861	42,067	45,963	58,255	74,653	110,127	162,627	139,554	44,834	17,118	12,193	800313

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PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2002

San Bernardino, City of
William Bryden
PO Box 710
SAN BERNARDINO, CA 92402
PWS# 3610039 SD

1. General Information

Please follow the guidelines on the back of this form.

Contact : W. William Bryden, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: bryden_bi@sbcitywater.org
Website: www.ci.san-bernardino.ca.us
Communities served:
City of San Bernardino
County: San Bernardino
Population served 140,000

2. Active Service Connections

Customer Class	Recycled Water	Potable Water		Complete this portion if the system serves all or part of an incorporated city			
				Inside City Limits		Outside City Limits	
		Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
Single Family Residential		33,610					
Multi-family Residential		2,849					
Commercial/Institutional		3,789					
Industrial							
Landscape Irrigation		1,009					
Other		64					
Agricultural Irrigation							
TOTAL		41321		N/A	N/A	N/A	N/A

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2,864	2,999.20	3,379.50	3,670.40	4,582.60	5,162.90	5,724.30	5,448.90	4,822.60	4,005.50	3,155.70	2,689.20	48504.4
	Surface	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Purchased [1/]													
	Total Potable	2863.6	2999.2	3379.5	3670.4	4582.6	5162.9	5724.3	5448.9	4822.6	4005.5	3155.7	2689.2	48504.4
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Single Family Residential	584,253	551,397	666,333	578,885	796,933	1,103,212	1,186,007	1,240,231	1,002,768	1,035,155	663,434	610,354	10018962
B. Multi-family Residential	235,690	205,756	246,205	208,176	227,473	292,312	309,957	346,905	259,044	296,592	237,278	225,231	3090619
C. Commercial/Institutional	260,191	229,878	290,676	250,664	233,713	378,732	351,243	477,349	268,409	421,261	282,542	249,506	3694164
D. Industrial													
E. Landscape Irrigation	99,512	87,589	125,459	109,125	136,760	206,411	227,017	262,910	194,572	236,284	139,631	131,500	1956770
F. Other	30,544	25,761	35,802	35,771	53,431	81,612	91,685	91,919	82,503	80,006	51,756	40,280	701070
Total Urban Retail (A thru F)	1210190	1100381	1364475	1182621	1448310	2062279	2165909	2419314	1807296	2069298	1374641	1256871	19461585
Agricultural Irrigation													
Wholesale(*to other agencies)*	7,666	7,826	12,298	43,983	14,568	87,375	80,442	122,667	112,638	48,144	7,895	9	545511

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PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2003

San Bernardino, City of
William Bryden
PO Box 710
SAN BERNARDINO, CA 92402
PWS# 3610039 SD

1. General Information

Please follow the guidelines on the back of this form.

Contact :	W. William Bryden, P.E.
Title:	Director of Water Utility
Phone:	(909) 384-5107
Fax:	(909) 384-5532
E-mail:	bryden_bi@sbcitywater.org
Website:	www.ci.san-bernardino.ca.us
Communities served:	
City San Bernardino	
County:	San Bernardino
Population served	180,131

2. Active Service Connections

Customer Class	Recycled Water	Potable Water		Complete this portion if the system serves all or part of an incorporated city			
				Inside City Limits		Outside City Limits	
		Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
Single Family Residential		33745					
Multi-family Residential		2905					
Commercial/Institutional		3818					
Industrial							
Landscape Irrigation		1015					
Other		93					
Agricultural Irrigation							
TOTAL		41576		N/A	N/A	N/A	N/A

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3,249	2,635	3,063	3,509	3,935	4,797	5,706	5,725	5,264	4,549	3,204	2,886	48521.56
	Surface													
	Purchased [1/]													
	Total Potable	3248.924	2634.834	3062.592	3509.359	3934.756	4797.394	5705.937	5724.808	5264.199	4548.969	3203.877	2885.915	48521.56
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Single Family Residential	621,648	556,175	482,872	642,046	636,058	906,683	1,222,082	1,162,632	1,231,457	929,243	802,484	656,850	9,850,230
B. Multi-family Residential	260,588	181,410	218,940	206,956	219,246	241,166	344,435	278,300	337,148	265,937	291,427	243,123	3,088,676
C. Commercial/Institutional	253,079	220,122	229,717	246,459	242,994	266,449	421,408	310,574	414,755	332,089	335,455	279,854	3,552,955
D. Industrial													
E. Landscape Irrigation	92,066	94,903	198,713	113,741	123,380	164,209	254,654	229,892	255,315	199,678	168,777	117,153	2,012,481
F. Other	25,772	27,658	24,122	29,907	41,518	54,219	73,080	72,473	92,358	67,980	54,827		563,914
Total Urban Retail (A thru F)	1,253,153	1,080,268	1,154,364	1,239,109	1,263,196	1,632,726	2,315,659	2,053,871	2,331,033	1,794,927	1,652,970	1,296,980	########
Agricultural Irrigation													
Wholesale(*to other agencies*)	4	17,810	6,145	5,142	68,214	17,009	18,900	34,162	66,154	37,473			271,013

State of California | Department of Water Resources | The Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2004

San Bernardino, City of
William Bryden, Director Of Water Utility
PO Box 710
San Bernardino, CA 92402
PWS# 3610039 SD

1. General Information

Please follow the guidelines on the back of this form.

Contact : W. William Bryden, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: bryden_bi@sbcitywater.org
Website: www.sbcitywater.org
Communities served:
San Bernardino
County: San Bernardino
Population served 173,359

2. Active Service Connections

Customer Class	Recycled Water	Potable Water		Complete this portion if the system serves all or part of an incorporated city			
				Inside City Limits		Outside City Limits	
		Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
Single Family Residential		34389					
Multi-family Residential		2926					
Commercial/Institutional		3841					
Industrial							
Landscape Irrigation		1086					
Other		112					
Agricultural Irrigation							
TOTAL		42354		N/A	N/A	N/A	N/A

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2948.888	2588.387	3567.691	3909.605	5021.661	5212.257	6018.726	5913.953	5399.105	3864.988	2890.035	2887.644	50222.94
	Surface													
	Purchased [1/]													
	Total Potable	2948.888	2588.387	3567.691	3909.605	5021.661	5212.257	6018.726	5913.953	5399.105	3864.988	2890.035	2887.644	50222.94
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Single Family Residential	623149	541313	554210	757288	940151	1065039	1146706	1250727	1176189	975203	541669	585893	10157537
B. Multi-family Residential	250025	208007	216592	271013	251385	296894	302736	345322	303656	293467	231171	225394	3195662
C. Commercial/Institutional	270001	224516	248789	280692	294477	357572	369017	384113	361921	362741	314803	238264	3706906
D. Industrial													
E. Landscape Irrigation	102228	90194	78365	138432	172430	226899	230492	259017	253121	189986	98642	109055	1948861
F. Other	26747	18060	19286	33875	47628	82929	74625	89618	83074	71042	40176	23117	610177
Total Urban Retail (A thru F)	1272150	1082090	1117242	1481300	1706071	2029333	2123576	2328797	2177961	1892439	1226461	1181723	19619143
Agricultural Irrigation													
Wholesale(*to other agencies)*						2	46	20151	9242	25860	8230	5513	69044

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State of California | Department of Water Resources | The Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2005

William Bryden, Director of Water Utility
San Bernardino Municipal Water
Department P.O. Box 710
San Bernardino,CA 92402
WS#3610039 SD

1. General Information

Please follow the guidelines on the back of this form.

Contact : W.William Bryden, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: bryden_bi@sbcitywater.org
Website: www.sbcitywater.org
Communities served:
San Bernardino
County: San Bernardino
Population served 173359

2. Active Service Connections

Customer Class	Recycled Water	Potable Water		Complete this portion if the system serves all or part of an incorporated city			
				Inside City Limits		Outside City Limits	
		Metered	Unmetered	Metered	Unmetered	Metered	Unmetered
Single Family Residential		34697		34685		12	
Multi-family Residential		2927		2923		4	
Commercial/Institutional		3938		3930		8	
Industrial							
Landscape Irrigation		1054		1054			
Other		112		112			
Agricultural Irrigation							
TOTAL		42728		42704	N/A	24	N/A

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2537.429	2322.098	2821.636	3641.418	4429.274	4950	5923.058	5839.728	4856.742	3951.455	3393.014	3472.328	48138.18
	Surface													
	Purchased [1/]													
	Total Potable	2537.429	2322.098	2821.636	3641.418	4429.274	4950	5923.058	5839.728	4856.742	3951.455	3393.014	3472.328	48138.18
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Single Family Residential	543804	415,834	520,724	683,060	694,908	1,043,712	1,173,535	1,215,117	1,202,089	907,564	726,486	726,898	9853731
B. Multi-family Residential	235965	187,681	231,659	228,622	218,344	309,732	310,387	324,838	304,581	282,999	242,382	268,845	3146035
C. Commercial/Institutional	230773	171,798	243,258	299,818	240,510	399,268	390,120	396,598	355,127	348,513	290,077	336,633	3702493
D. Industrial													
E. Landscape Irrigation	94608	60,191	75,389	110,337	139,735	219,560	242,278	265,856	225,725	205,728	158,322	153,180	1950909
F. Other	24530	15,169	21,831	31,737	38,466	81,891	75,518	87,200	76,033	70,570	41,663	46,930	611538
Total Urban Retail (A thru F)	1129680	850,673	1,092,861	1,353,574	1,331,963	2,054,163	2,191,838	2,289,609	2,163,555	1,815,374	1,458,930	1,532,486	19264706
Agricultural Irrigation													
Wholesale(*to other agencies)*	6108	5,394	6,545	5,170	6,201	5,040	8,085	5,322	5,269	5,175	5,653	5,201	69163

State of California | Department of Water Resources | The Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2006

Matthew H. Litchfield
Director Of Water Utility
San Bernardino Municipal Water Dept
PO Box 710
San Bernardino, CA 92402
PWS #3610039 SD

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: litchfield_ma@sbcitywater.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **173,359**
Names of communities served: 1

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35,853			
Multi-family Residential	2,952			
Commercial/Institutional	4,129			
Industrial				
Landscape Irrigation	1,076			
Other	121			
Agricultural Irrigation				
TOTAL	44,131			

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3437.599	3483.196	2954.556	3076.415	4723.462	6058.398	7155.632	6735.957	6446.132	5085.461	4425.980	3808.794	57391.582
	Surface													
	Purchased 1/													
	Total Potable	3437.599	3483.196	2954.556	3076.415	4723.462	6058.398	7155.632	6735.957	6446.132	5085.461	4425.98	3808.794	57391.58
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

If recycled is included, ✓box ↓	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential ☐	674,141	625,998	588,441	480,260	770,461	1,098,376	1,407,849	1,254,389	1,187,955	977,563	816,148	696,998	10,578,579
B.Multi-family Residential ☐	241,925	221,357	224,126	197,332	238,720	293,019	355,070	583,189	574,261	511,952	457,191	455,074	4,353,216
C.Commercial/Institutional ☐	253,536	261,763	260,532	246,385	251,472	340,561	395,623	422,311	382,202	335,868	317,234	278,423	3,745,910
D.Industrial ☐													
E.Landscape Irrigation ☐	124,332	135,574	125,007	77,205	143,809	260,053	257,299	279,539	278,832	225,578	185,752	169,453	2,262,433
F.Other ☐	36,905	33,987	30,052	22,819	38,511	65,204	94,061	91,117	90,699	68,766	63,100	49,038	684,259
Total Urban Retail (A thru F)	1,330,839	1,278,679	1,228,158	1,024,001	1,442,973	2,057,213	2,509,902	2,630,545	2,513,949	2,119,727	1,839,425	1,648,986	21,624,397
Agricultural Irrigation ☐													
Wholesale(*to other agencies*) ☐	5,547	6,160	5,024	5,633	5,650	5,506	5,793	90,089	13,492	239,840	78,346	61,112	522,192

State of California | Department of Water Resources | The Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2007

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
P.O. Box 710
San Bernardino, Ca 92402
PWS #3610039 SD

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: litchfield_ma@sbcitywater.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **173,359**
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35,360			
Multi-family Residential	2,927			
Commercial/Institutional	4,666			
Industrial	0			
Landscape Irrigation	1,075			
Other	11			
Agricultural Irrigation				
TOTAL	44039			

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3765.979	3223.798	3770.598	4291.801	5663.42	6405.739	6756.617	6640.142	5794.138	5188.877	4610.576	3482.512	59594.2
	Surface													
	Purchased 1/													
	Total Potable	3765.979	3223.798	3770.598	4291.801	5663.42	6405.739	6756.617	6640.142	5794.138	5188.877	4610.576	3482.512	59594.2
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):
Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

If recycled is included, ✓box ↓	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential ☐	706,599	571,130	693,142	732,150	859,407	1,056,518	1,239,920	1,241,235	1,144,618	854,653	872,056	573,838	10545266
B.Multi-family Residential ☐	253,448	207,335	220,250	234,308	238,115	293,541	319,242	306,699	326,305	261,656	245,351	219,664	3125914
C.Commercial/Institutional ☐	290,984	271,078	263,100	284,906	340,934	416,277	385,675	428,712	399,709	323,566	316,858	263,389	3985188
D.Industrial ☐	0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation ☐	130,386	104,967	121,185	149,288	189,291	249,776	271,359	281,266	292,795	215,076	168,837	120,072	2294298
F.Other ☐	43,156	22,236	34,664	46,796	55,291	81,255	92,567	92,244	87,387	65,320	56,311	36,389	713616
Total Urban Retail (A thru F)	1424573	1176746	1332341	1447448	1683038	2097367	2308763	2350156	2250814	1720271	1659413	1213352	20664282
Agricultural Irrigation ☐													
Wholesale(*to other agencies*) ☐	207,540	188,483	27,828	189,059	276,287	375,610	320,521	341,722	450,844	379,646	372,026	213,151	3342717

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State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year 2008

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
P.O. Box 710
San Bernardino, CA 92402
PWS #3610039 SD

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: litchfield_ma@sbcitywater.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **173,359**
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35,172			
Multi-family Residential	2,856			
Commercial/Institutional	4,716			
Industrial	0			
Landscape Irrigation	1,149			
Other	11			
Agricultural Irrigation	0			
TOTAL	43904			

3. Total Water Into the System - Units of production:

☑ acre-feet ☐ million gallons ☐ hundred cubic feet

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3322.512	2948.823	3996.15	4797.785	5328.844	5589.075	6473.435	6450.333	5732.572	5167.388	4176.031	3254.433	57237.381
	Surface													
	Purchased 1/													
	Total Potable	3322.512	2948.823	3996.15	4797.785	5328.844	5589.075	6473.435	6450.333	5732.572	5167.388	4176.031	3254.433	57237.381
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):
Level of treatment:

4. Metered Water Deliveries - Units of delivery:

☐ acre-feet ☐ million gallons ☑ hundred cubic feet

If recycled is included, ✓box ↓	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential ☐	618,748	462,037	546,193	773,058	881,492	948,155	1,139,010	1,078,878	1,062,266	1,009,011	763,925	614,902	9897675
B.Multi-family Residential ☐	238,441	193,041	191,692	242,282	255,458	270,665	297,062	303,990	299,838	272,291	240,423	223,970	3029153
C.Commercial/Institutional ☐	241,185	210,229	216,982	278,125	305,503	353,661	325,100	356,297	351,071	301,402	322,099	247,746	3509400.1
D.Industrial ☐	0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation ☐	120,704	72,836	77,150	197,624	207,547	245,470	264,037	307,878	298,177	262,247	217,412	151,962	2423044
F.Other ☐	34,016	19,001	19,808	48,346	62,070	78,433	92,797	91,145	92,779	76,650	60,180	47,670	722895
Total Urban Retail (A thru F)	1253094	957144	1051825	1539435	1712070	1896384	2118006	2138188	2104131	1921601	1604039	1286250	19582167
Agricultural Irrigation ☐													
Wholesale(*to other agencies*) ☐	256,745	151,651	195,855	309,565	282,815	277,933	382,905	391,288	319,892	206,198	225,763	190,621	3191231

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State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year **2009**

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
Post Office Box 710
San Bernardino, CA 92402
PWS #3610039 SRO

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: litchfield_ma@sbcitywater.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **180,315**
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35,077			
Multi-family Residential	2,855			
Commercial/Institutional	4,704			
Industrial	0			
Landscape Irrigation	1,162			
Other	11			
Agricultural Irrigation				
TOTAL	43809			

3. Total Water Into the System - Units of production: AF

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3474.318	2746.783	3566.419	4276.03	5260.067	5024.051	6254.787	5941.53	5662.725	4640.527	3844.59	2797.154	53488.981
	Surface													
	Purchased 1/													
	Total Potable	3474.318	2746.783	3566.419	4276.03	5260.067	5024.051	6254.787	5941.53	5662.725	4640.527	3844.59	2797.154	53488.981
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):
Level of treatment:

4. Metered Water Deliveries - Units of delivery: CCF

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

If recycled is included, X box↓		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential		613,582	489,824	513,269	681,601	873,868	857,197	1,092,672	1,094,511	1,065,111	885,815	702,577	581,603	9,451,630
B.Multi-family Residential		232,896	199,760	185,335	210,352	242,708	244,432	283,035	280,077	275,248	242,771	209,895	202,909	2,809,418
C.Commercial/Institutional		225,614	224,752	193,210	212,345	264,534	279,128	307,088	322,900	320,790	310,737	216,982	233,472	3,111,552
D.Industrial		0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation		107,491	94,910	124,341	162,433	215,224	224,662	270,664	299,688	303,021	250,162	176,041	137,494	2,366,131
F.Other		22,152	19,715	20,746	35,753	62,509	69,386	88,010	89,864	98,753	73,228	55,303	41,534	676,953
Total Urban Retail ***(A thru F)***		1,201,735	1,028,961	1,036,901	1,302,484	1,658,843	1,674,805	2,041,469	2,087,040	2,062,923	1,762,713	1,360,798	1,197,012	18,415,684
Agricultural Irrigation														
Wholesale(*to other agencies)*		220,629	171,370	200,218	192,432	312,276	377,477	401,377	401,308	380,488	291,509	214,637	80,688	3,244,409

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year **2010**

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
Post Office Box 710
San Bernardino, CA 92402
PWS #3610039 SRO

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5532
E-mail: litchfield_ma@sbcity.org
Website: www.sbcitywater.org
County: San Bernardino
Population served: 188,931
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	34,886			
Multi-family Residential	2,833			
Commercial/Institutional	4,663			
Industrial	0			
Landscape Irrigation	1,144			
Other	13			
Agricultural Irrigation				
TOTAL	43,539			

3. Total Water Into the System - Units of production: AF

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2555.905	2070.489	2796.463	3017.276	4248.848	5339.047	5799.205	5906.222	5395.192	4272.413	3452.978	2967.773	47821.811
	Surface													
	Purchased 1/													
	Total Potable	2555.905	2070.489	2796.463	3017.276	4248.848	5339.047	5799.205	5906.222	5395.192	4272.413	3452.978	2967.773	47821.811
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):
Level of treatment:

4. Metered Water Deliveries - Units of delivery: CCF

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

If recycled is included, X box ↓		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential		589,126	401,755	445,633	628,934	680,907	889,262	1,042,280	1,040,808	1,040,561	782,282	603,045	501,713	8,646,306
B.Multi-family Residential		217,140	156,902	160,895	203,487	209,548	234,897	265,726	275,040	293,425	241,337	207,713	189,582	2,655,692
C.Commercial/Institutional		212,441	163,155	169,696	225,904	219,341	261,628	286,935	303,347	322,030	282,368	232,896	217,840	2,897,581
D.Industrial		0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation		94,181	54,532	57,631	144,278	166,972	221,010	344,991	358,626	385,759	286,546	211,215	142,342	2,468,083
F.Other		5,896	2,797	2,622	3,076	1,905	2,315	2,918	2,645	1,947	6,271	57,362	2,464	92,220
Total Urban Retail (A thru F)		1,118,785	779,141	836,477	1,205,679	1,278,673	1,609,112	1,942,850	1,980,466	2,043,722	1,598,804	1,312,231	1,053,941	16,759,882
Agricultural Irrigation										19,145,403				19,145,403
Wholesale *(to other agencies)*		26,226	18,776	46,155	3,119	148,406	399,559	355,241	329,537	354,029	309,751	209,792	184,931	2,385,521

San Bernardino Municipal Water Dept.

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year **2011**

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
Post Office Box 710
San Bernardino, CA 92402
PWS #3610039 SRO

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5980
E-mail: litchfield_ma@sbcity.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **188,931**
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35085			
Multi-family Residential	2821			
Commercial/Institutional	4701			
Industrial	0			
Landscape Irrigation	1143			
Other	13			
Agricultural Irrigation	0			
TOTAL	43763			

3. Total Water Into the System - Units of production: **AF**

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3289.388	2916.323	3005.069	3449.629	4394.838	5028.952	5629.854	5526.854	5168.824	4284.123	2986.751	3085.915	48766.52
	Surface													
	Purchased [1/]													
	Total Potable	3289.388	2916.323	3005.069	3449.629	4394.838	5028.952	5629.854	5526.854	5168.824	4284.123	2986.751	3085.915	48766.52
Untreated Water														
Recycled [2/]														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery: **CCF**

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

If recycled is included, X box ↓		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential		497422	503734	530192	540334	671091	811183	1039294	1000873	1048639	742011	598822	511681	8495276
B.Multi-family Residential		197684	183776	194586	196335	203765	223610	279504	265697	291287	229737	198790	186917	2651688
C.Commercial/Institutional		216782	221996	232541	224550	273979	293827	373228	379112	408510	322914	271609	236013	3455061
D.Industrial		0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation		64155	93958	86479	112032	171097	225126	277977	288361	305816	213752	160149	117380	2116282
F.Other		14053	4238	9349	8803	4261	2900	3329	5497	28160	6639	3815	11535	102579
Total Urban Retail (A thru F)		990096	1007702	1053147	1082054	1324193	1556646	1973332	1939540	2082412	1515053	1233185	1063526	16820886
Agricultural Irrigation		0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale *(to other agencies)*		278174	256198	179434	170743	316720	310689	299426	279847	346173	283621	182406	180078	3083509

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State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year **2012**

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
Post Office Box 710
San Bernardino, CA 92402
PWS #3610039 SRO

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director of Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5980
E-mail: litchfield_ma@sbcity.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **188,931**
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35261			
Multi-family Residential	2850			
Commercial/Institutional	4734			
Industrial	0			
Landscape Irrigation	1147			
Other	12			
Agricultural Irrigation	0			
TOTAL	44004			

3. Total Water Into the System - Units of production: AF

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	3306.663	3039.94	3327.149	3383.862	4656.689	5185.14	5353.106	5586.892	5039.042	4132.3	3318.626	2428.07	48757.479
	Surface													
	Purchased 1/													
	Total Potable	3306.663	3039.94	3327.149	3383.862	4656.689	5185.14	5353.106	5586.892	5039.042	4132.3	3318.626	2428.07	48757.479
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery: CCF

(Select: **AF**=acre-feet; **MG**=million gallons; **CCF**=hundred cubic feet)

If recycled is included, X box ↓		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential		627162	509652	536034	548233	663033	988169	1052218	1073976	1038415	813599	720339	454346	9025176
B.Multi-family Residential		210096	181563	185157	183960	194541	269699	280646	277626	294862	239057	231563	182092	2730862
C.Commercial/Institutional		232914	236849	208210	226736	271619	360263	446291	364028	427551	368566	320715	271112	3734854
D.Industrial		0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation		130968	123478	122398	130145	163109	266649	302091	299215	304670	240143	216148	114328	2413342
F.Other		13058	35144	174502	5167	85931	4729	5876	5178	4704	7404	5419	5501	352613
Total Urban Retail (A thru F)		1214198	1086686	1226301	1094241	1378233	1889509	2087122	2020023	2070202	1668769	1494184	1027379	18256847
Agricultural Irrigation		0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale *(to other agencies)*		176426	163063	21980	171942	251200	298866	200198	169512	188495	36305	15665	11562	1705214

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

PUBLIC WATER SYSTEM STATISTICS

Calendar Year **2013**

Matthew H. Litchfield, P.E.
Director of Water Utility
San Bernardino Municipal Water Dept.
Post Office Box 710
San Bernardino, CA 92402
PWS #3610039 SRO

1. General Information

Please follow the provided instructions.

Contact : Matthew H. Litchfield, P.E.
Title: Director, Water Utility
Phone: (909) 384-5107
Fax: (909) 384-5980
E-mail: Matt.Litchfield@sbmwd.org
Website: www.sbcitywater.org
County: **San Bernardino**
Population served: **188,931**
Names of communities served: City of San Bernardino

2. Active Service Connections

Customer Class	Potable Water		Recycled Water	
	Metered	Unmetered	Metered	Unmetered
Single Family Residential	35491			
Multi-family Residential	2856			
Commercial/Institutional	4798			
Industrial	0			
Landscape Irrigation	1119			
Other	12			
Agricultural Irrigation	0			
TOTAL	44276			

3. Total Water Into the System - Units of production: AF

(Select: **AF**=acre-feet; **MG**=million gallons;**CCF**=hundred cubic feet)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Potable	*Wells*	2507.37	2308.416	2935.251	3481.243	4292.101	5031.644	5295.647	5324.828	4917.7	3888.484	3078.223	2774.424	45835.33
	Surface													
	Purchased 1/													
	Total Potable	2507.37	2308.416	2935.251	3481.243	4292.101	5031.644	5295.647	5324.828	4917.7	3888.484	3078.223	2774.424	45835.33
Untreated Water														
Recycled 2/														

1/ Potable wholesale supplier(s):

2/ Recycled wholesale supplier(s):

Level of treatment:

4. Metered Water Deliveries - Units of delivery: CCF

(Select: **AF**=acre-feet; **MG**=million gallons;**CCF**=hundred cubic feet)

If recycled is included, X box↓		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A.SingleFamilyResidential		480962	469927	501050	652218	797875	926721	1027954	993164	1011821	812303	676787	498899	8849681
B.Multi-family Residential		186551	181961	176793	201229	220268	257258	261579	267691	275960	238178	215004	179493	2661965
C.Commercial/Institutional		158123	218756	197302	236945	311585	394363	362601	373334	411999	354920	292931	244980	3557839
D.Industrial		0	0	0	0	0	0	0	0	0	0	0	0	0
E.Landscape Irrigation		80108	86125	102675	161282	218309	260546	295717	298166	292338	247951	194975	124055	2362247
F.Other		6157	3724	4516	7199	5159	5563	2987	2875	2888	3888	11808	3703	60467
Total Urban Retail(A thru F)		911901	960493	982336	1258873	1553196	1844451	1950838	1935230	1995006	1657240	1391505	1051130	17492199
Agricultural Irrigation		0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale*(to other agencies)*		11011	9614	9878	14104	16192	145281	169832	179662	129616	19635	13923	16567	735315

Appendix B: TM1 - Weather/Economic Analysis of Historical Water Use

4 October 2013

Memorandum

To: Miguel Guerrero, Greg Gage

From: Roger Null; Ganesh Rajagopalan

Subject: Potable Water Demand Analysis: Effects of the Economy and Climate on Historical Water Demands
K/J 1283002*00

Water use by residential, commercial and other water customers can be affected by weather (e.g. evapotranspiration (ET), precipitation) and economic factors. While it is commonplace to consider the effects of weather on water use, the relatively poor economic conditions in recent years has also . Also, time periods characterized by good economic conditions are often associated with higher water use than time periods when economic conditions are poor.

The extent of these effects may vary based on local conditions and can be significant. For example, Kennedy/Jenks Consultants has found in some other Southern California communities that enhanced economic conditions could result in a ten (10) to twenty (20) percent increase in water demands. Increased demands may result in the need for additional system capacities, enhanced water conservation efforts in order to comply with state mandates, and/or need for additional water supply sources. From these recent studies, it is essential to evaluate the effect of these factors for San Bernardino Municipal Water Department (SBMWD or Department) as a component of the larger master planning effort.

Effects of Economy and Weather on Water Demands

Water use data for over 45,650 accounts were received from the SBMWD. After reconciling duplicate data, accounts with missing or irregular Assessor Parcel Numbers (APNs) and other data reduction issues, over 41,300 accounts were selected for further analyses.

Regression analyses were subsequently performed to evaluate the correlation between water use among various customer types and weather (ET, precipitation) and economic (unemployment rate) factors. Like most agencies, SBMWD has several different potable water customer classes, including single family residential (SFR), multi-family residential (MFR), duplexes (MFR-2), commercial, non-residential, municipal, assessment district, and public education. The SFR customer class represents approximately 80% of the accounts served by SBMWD. Given the high percentage of SFR accounts, additional evaluations were performed on this class. Of particular significance was the identification of a considerable range in SFR lot sizes. These lot sizes ranged from less than 2,500 square feet to over 25,000 square feet.

Due to this significant variation and the assumption that there may be a correlation between lot size and income/irrigation demand, the SFR accounts were broken down into five categories based on lot size. MFR, commercial, non-residential, municipal, assessment district, and public education accounts remained unchanged for a total of 13 different customer categories for further evaluation. Of note, the Golf Course and Hydrants customer classes were excluded from further analysis as there was a minimal number of accounts and/or very low water usage. The water use customer categories selected for further analyses are shown in Table 1.

Table 1: Water Use Customer Categories

Water Use Type	Number of Accounts
SFR	**-**
Up to 2,500 sq.ft[(a)]	237
2,500 to 5,000 sq.ft[(a)]	1,117
5,000 to 7,500 sq.ft[(a)]	15,933
7,500 to 10,000 sq. ft[(a)]	9,635
10,000 to 25,000 sq.ft[(a)]	5,378
Larger than 25,000 sq.ft[(a)]	752
All SFR Together	33,052
MFR	1,568 (19,170 dwelling units)
MFR-2	1,420[(b)]
Commercial	833
Non-Residential	3,991
Municipal	243
Assessment District	117
Education Public	87

Note:
(a) Landscape Area = Parcel Area – Built Area
(b) MFR-2 water use data was not normalized for the number of dwelling units; analysis was performed on a per account basis.

Evapotranspiration data for these analyses were obtained from the California Irrigation Management Information System (CIMIS) database. Data from Station #117 (Victorville) was used for the ET regression analysis. Precipitation data for San Bernardino was provided by the Department. Unemployment data for the City of San Bernardino was obtained from the State of California Employment Development Department database. Water use data for the years 2002 through 2012 was also provided by the City's Water Department.

Results of the regression analyses indicated that the water use for MFR, MFR-2, commercial, non-residential, public education and SFR accounts of all lot sizes correlate better with unemployment rate (R^2 of 0.65 to 0.85) than weather related variables. A significant correlation between water usage and unemployment was not observed for the municipal and assessment

district customer categories rate (R^2 of 0.04 and 0.08, respectively). Similarly, no significant correlation was observed with ET or precipitation (R^2 of 0.25 to 0.5 and less than 0.2, respectively) for any of the customer categories.

Table 2 shows the equations developed for the correlation of the 13 customer categories with unemployment. Graphical results of the economic and weather related water demand analysis are provided in Appendix A of this Technical Memorandum.

Table 2: Regression Equations Used for Each Water Use Type

Water Use Type	Correlation Equation with Unemployment[(a)]
SFR	
Up to 2,500 sq.ft[(b)]	y = -0.2721x + 17.985
2,500 to 5,000 sq.ft[(b)]	y = -0.2378x + 19.16
5,000 to 7,500 sq.ft[(b)]	y = -0.2853x + 23.938
7,500 to 10,000 sq. ft[(b)]	y = -0.3497x + 28.296
10,000 to 25,000 sq.ft[(b)]	y = -0.4167x + 36.462
Larger than 25,000 sq.ft[(b)]	y = -0.7758x + 54.447
MFR	y = -0.1566x + 13.842
MFR-2	y = -0.6806x + 38.153
Commercial	y = -2.4313x + 243.15
Non-Residential	y = -1.0882x + 93.314
Municipal	NA
Assessment District.	NA
Education Public	Y = -24.693x + 1067.2

Notes:
(a) y = Water use (AF/Connection); x = Unemployment rate (%)
(b) Lot Area

The equations in Table 2 were used to determine the coefficients of determination (R^2) for each water use type. Higher values of R^2 (1 being the maximum), indicate that the regression line fits the data set well. For this data set, it is assumed that R^2 values higher than 0.6 indicate a significant relationship between the data set and the correlating factor (i.e. unemployment rate, ET). The resulting R^2 values for these data are provided in Table 3.

Table 3 also displays additional information, such as the 2012 water use and the percentage of use for each customer category. The “Adjustment Factor for Good Economic Conditions” column shows approximately how much the water use would increase if the unemployment rate were to decrease from the 16 percent actual value in 2012 to the 10th percentile unemployment rate (i.e. the unemployment rate will be lower than this value at 90% of the time) of 7.2 percent. Depending on the type of water user, 2012 demands would be expected to increase 10 to 33 percent under good economic conditions. The weighted adjustment factor considering all the

customer classes used in the analyses is 12.8%. This value suggests that the overall 2012 water use is expected to increase by approximately 12.8% under good economic conditions. It is important to note that this increase in projected water usage is based on the current accounts and a change in economic factors. Additional water usage from new accounts and service area growth are not included in this account analysis and change in water demands.

In addition to the adjustment for a good economy at a 10th percentile unemployment rate, an Adjustment Factor for 50th Percentile Unemployment Rate" was also derived and shown in Table 3. This adjustment value reflects how much water use would increase if the unemployment rate were to decrease from 16 % in 2012 to the 50th percentile rate of 8.3 %. In this scenario, the 2012 demands would be expected to increase 9 to 29 %, depending on the specific customer category; the weighted overall adjustment factor is 11.2%. Given the strong correlation between water use and the level of unemployment, both of these analyses suggest the need to incorporate this finding in the long-range water demand projections for SBMWD. To support the potential need to correlate water usage with other regional population or dwelling unit planning data sets, a similar analyses using SBWMD's 2010 water usage data and an unemployment rate of 18% was performed and is provided in Appendix B.

It should be noted that during discussions with staff on draft materials, SBMWD requested an additional review of historical unemployment conditions. The analyses determined there was no material difference in the derived adjustment factors using the additional unemployment data for the County. This analyses is provided in Appendix C.

Summary and Recommendation

Results of the demand analyses indicate that water demands correlate with economic conditions within SBWMD's service area. When the economy is "good" and unemployment low, water usage increases. The analyses suggests that under good economic conditions the 2012, water usage would increase as much as 10 to 33 percent, depending upon the customer type,. The correlation between water demand and economic conditions is strong for most of SBMWD's customer categories with R^2 values ranging from 0.6 to 0.9. The exception to this finding is the municipal and assessment districts classes as these customers did not show a strong correlation with economic conditions.

Due to the level of statistical significance between unemployment rates and water usage, it appears appropriate to factor in a return to a good economy in SBMWD's water demand projections. However, given the implications of this fining on future capital and managerial elements, resolution and final direction regarding the use of these factors will be derived following direction by SBWMD.

Memorandum

Miguel Guerrero, Greg Gage
San Bernardino Municipal Water Department
4 October 2013

Table 3: Water Use, R^2 Values, and Adjustment Factors by Customer Category (2012)

Water Use Type	2012 Water Use (HCF)	R^2 Value for Unemployment	Adjustment Factor for Good Economic Conditions (Unemployment Rate = 7.2%)[a]	Adjustment Factor for 50th Percentile Unemployment Rate of 8.3%[b]
Residential	-	-	-	
Up to 2,500 sq.ft[c]	32,348 (0.2%)	**0.735**	17.6%	15.4%
2,500 to 5,000 sq.ft[c]	184,004 (1.11%)	**0.851**	13.2%	11.6%
5,000 to 7,500 sq.ft[c]	3,463,214 (20.9%)	**0.834**	13%	11.3%
7,500 to 10,000 sq.ft[c]	2,469,260 (14.9%)	**0.808**	13.6%	11.9%
10,000 to 25,000 sq.ft[c]	1,753,651 (10.6%)	**0.73**	12.3%	10.8%
Larger than 25,000 sq.ft[c]	318,307 (1.92%)	**0.645**	16.2%	14.2%
All SFR Together	8,220,784 (49.6%)			
MFR	2,300,989 (13.9%)	**0.84**	12.2%	10.6%
MFR-2	412,720 (2.49%)	**0.859**	22%	19.2%
Commercial	1,531,780 (9.24%)	**0.639**	10.5%	9.2%
Non-Res.	2,434,694 (14.7%)	**0.871**	12.6%	11%
Municipal	730,994 (4.41%)	**0.04**	0%	0%
Assess. Dist.	302,000 (1.82%)	**0.075**	0%	0%
Public Ed.	635,372 (3.83%)	**0.86**	32.3%	28.3%
Non Applicable Usage	1,687,514			
Totals	**18,256,847**	-	**12.8%**	**11.2%**

Notes:
(a) Adjustment Factor for Good Economic Conditions = Percent Change in water use relative to 2012 use if the unemployment rate were to decrease to the 10th percentile unemployment rate (i.e. unemployment rate will be lower than this value at 90% of the time) of 7.2% from the 16% in 2012.
(b) Adjustment Factor for 50th Percentile Unemployment Rate = Percent Change in water use relative to 2012 use if the unemployment rate were to decrease to 50th percentile unemployment rate of 8.3% from the 16% in 2012.
(c) Lot Area

Economic Analysis TM Appendix A

Water Use Figures

Figure A1. Correlation between Unemployment Rates and water use for SFR units

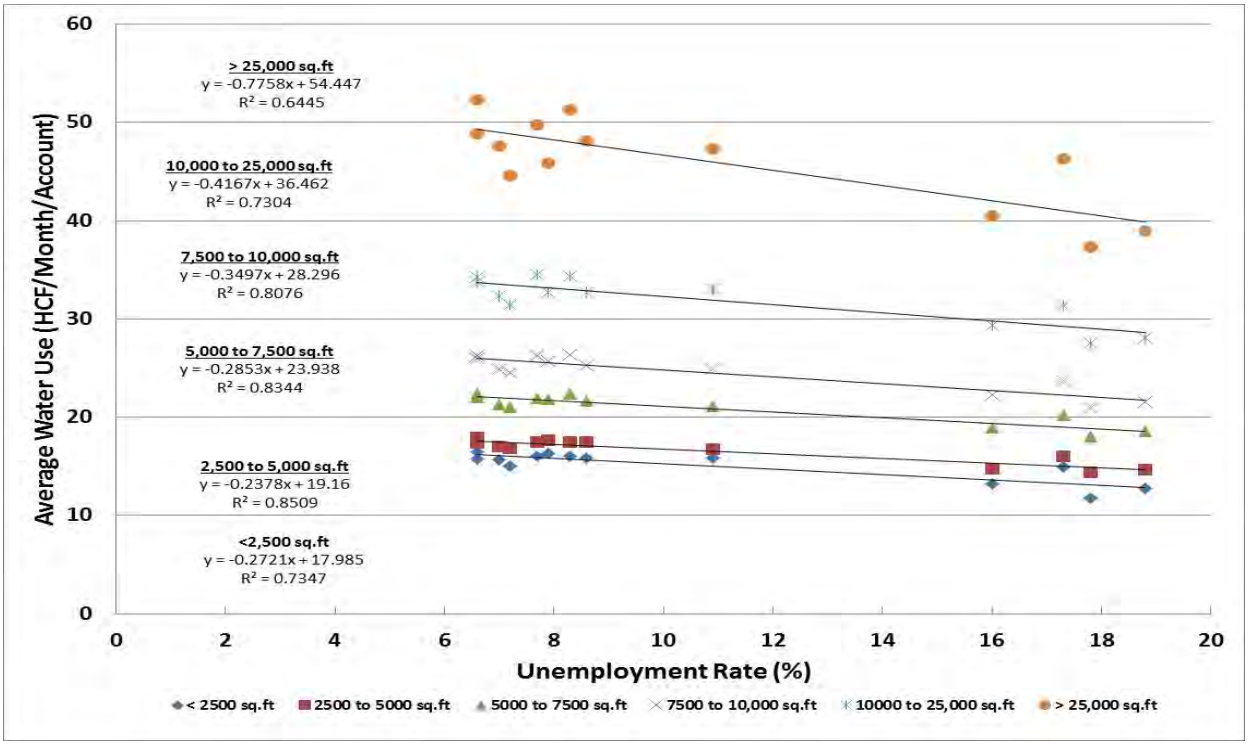


Figure A2. Correlation between Unemployment Rates and water use for MFR units

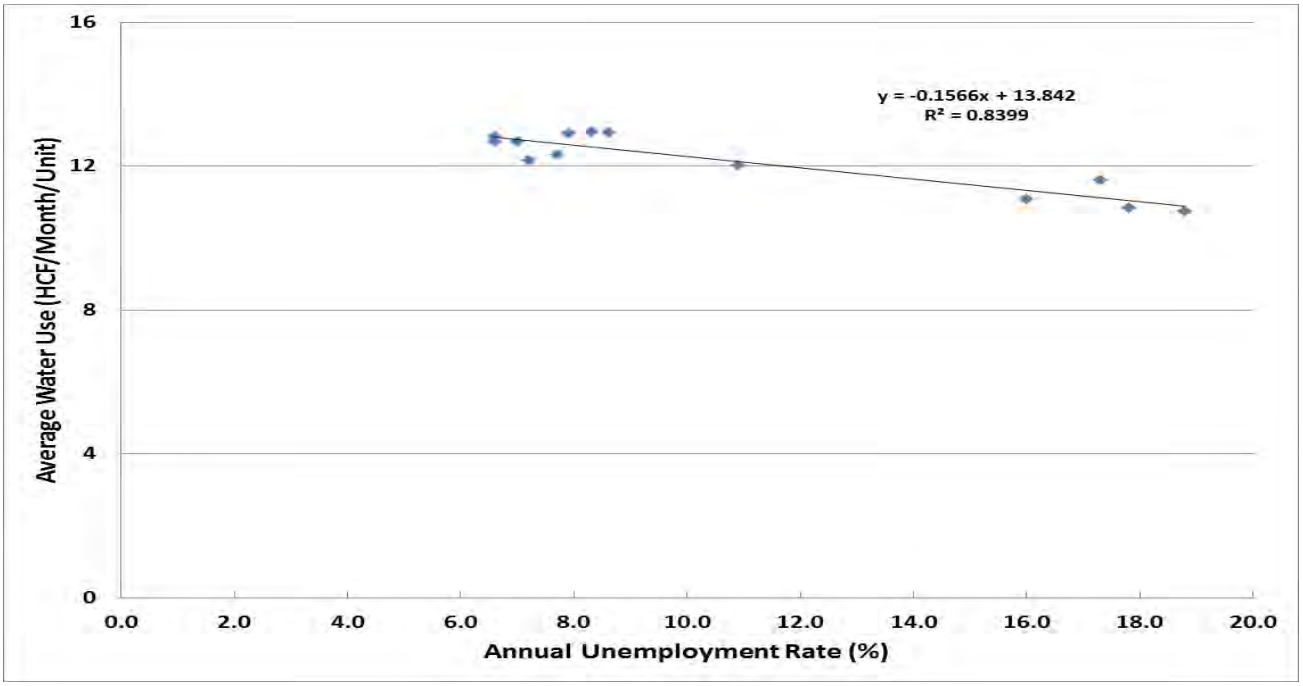


Figure A3. Correlation between Unemployment Rates and water use for MFR-2 units

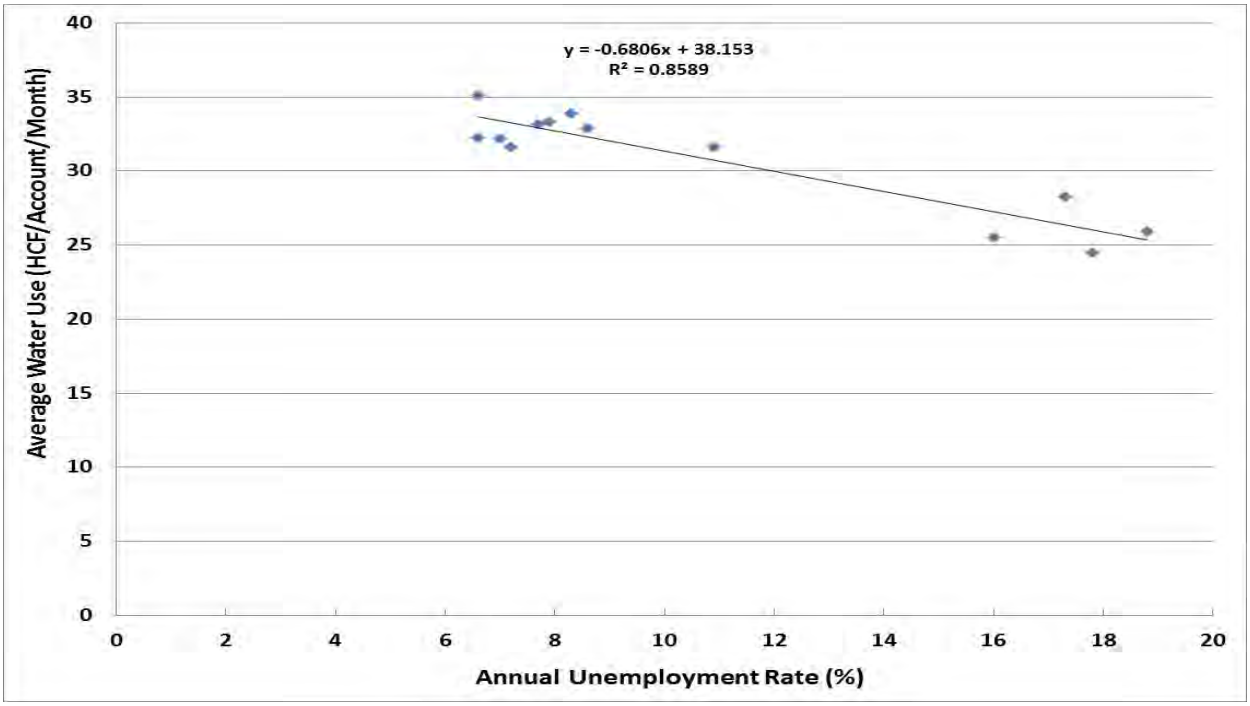


Figure A4. Correlation between Unemployment Rates and water use for Commercial units

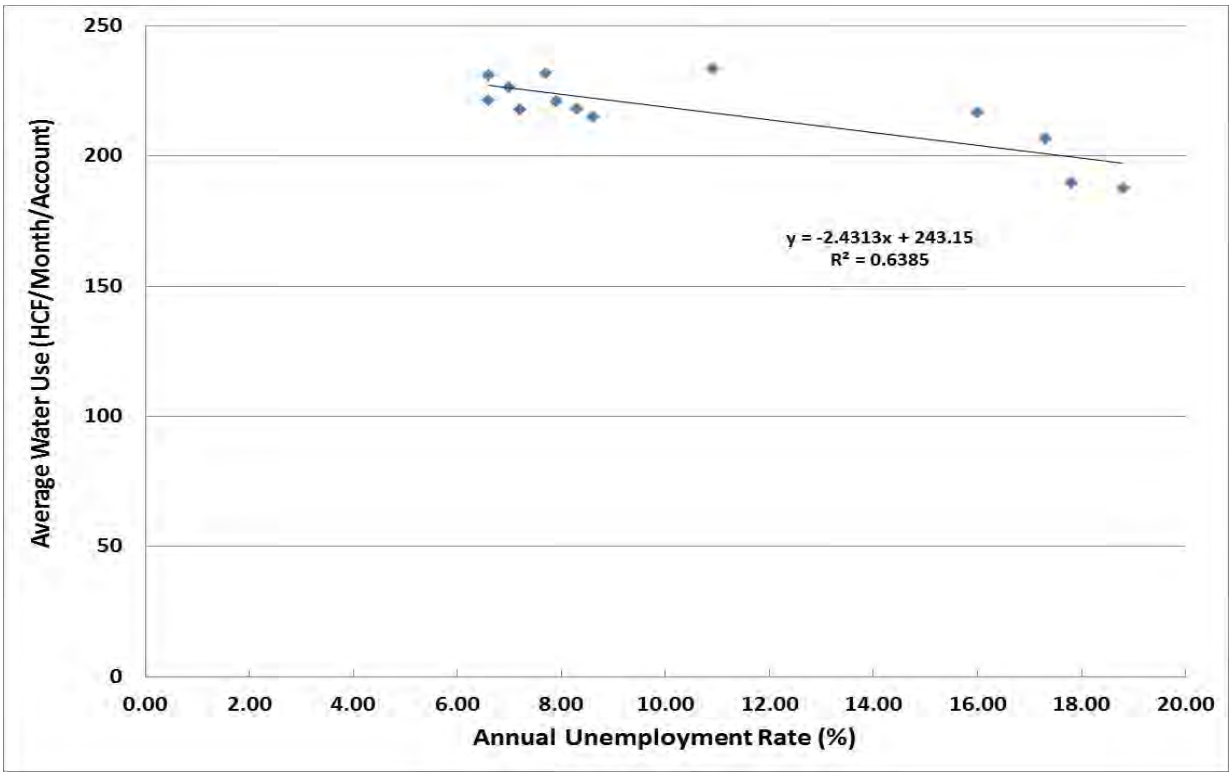


Figure A5. Correlation between Unemployment Rates and water use for Non-Residential units

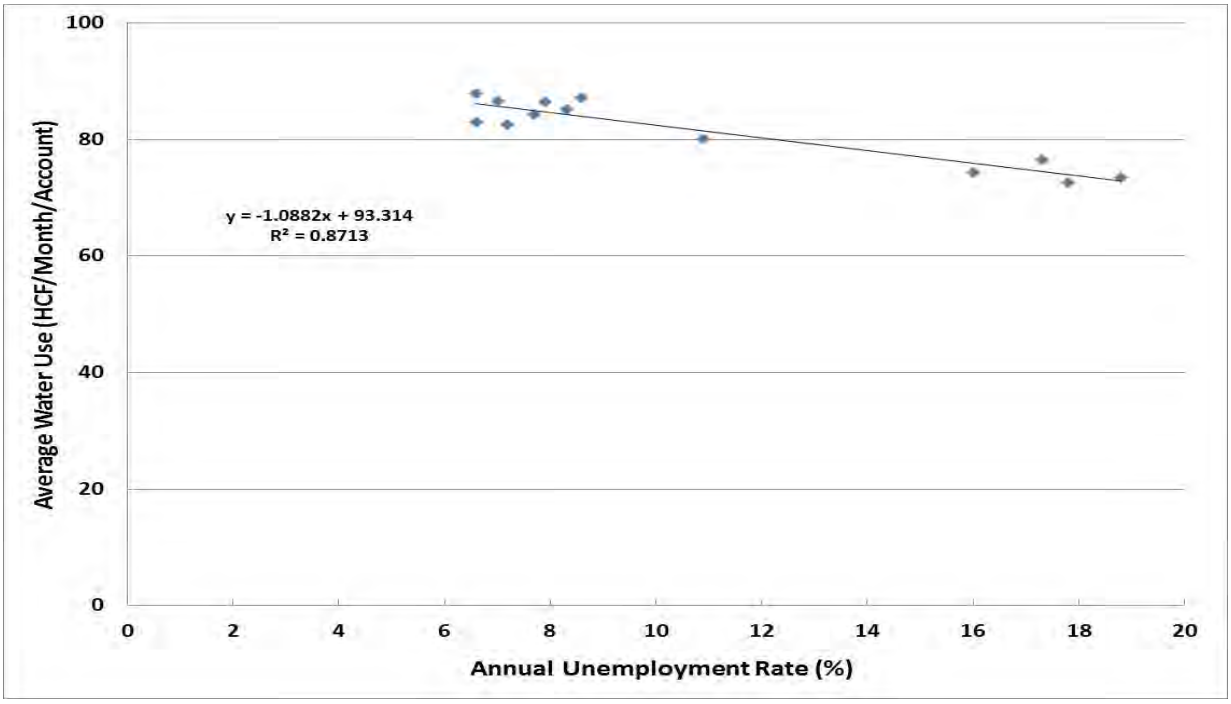


Figure A6. Correlation between Unemployment Rates and water use for Municipal Accounts

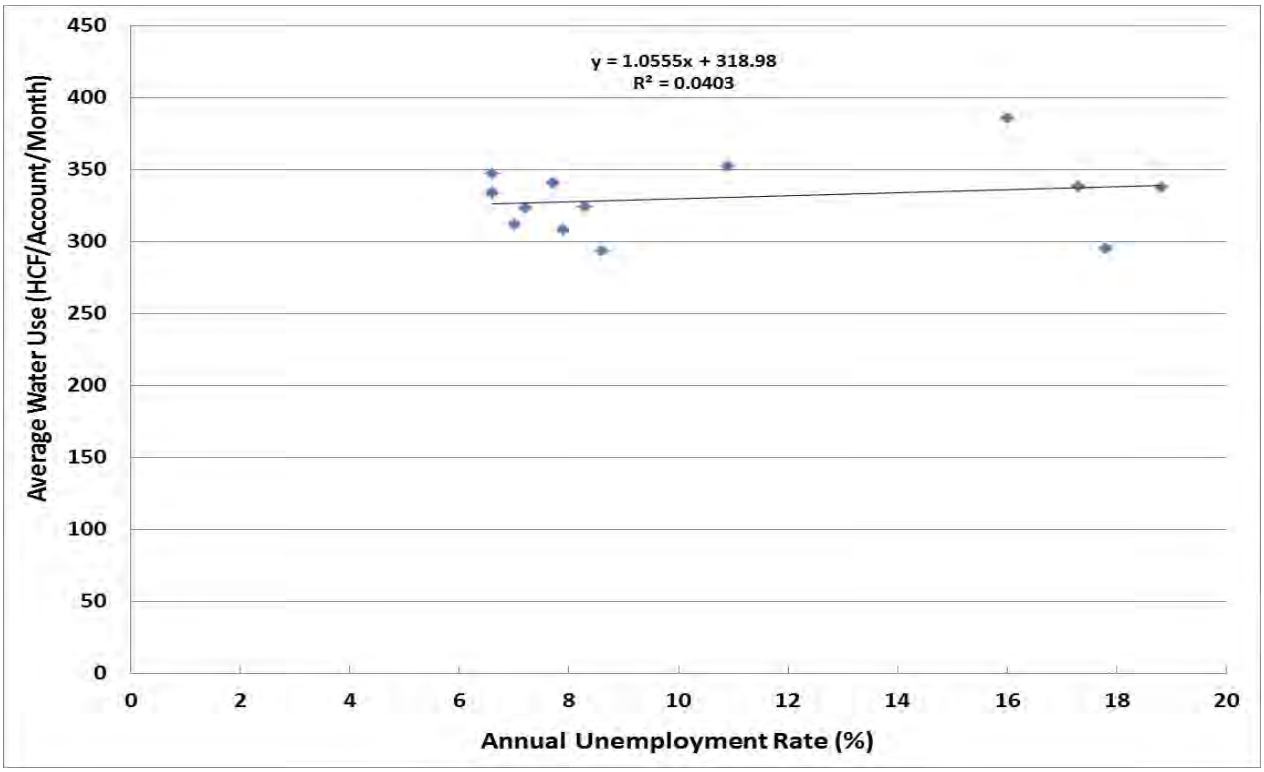


Figure A7. Correlation between Unemployment Rates and water use for Assessment District accounts

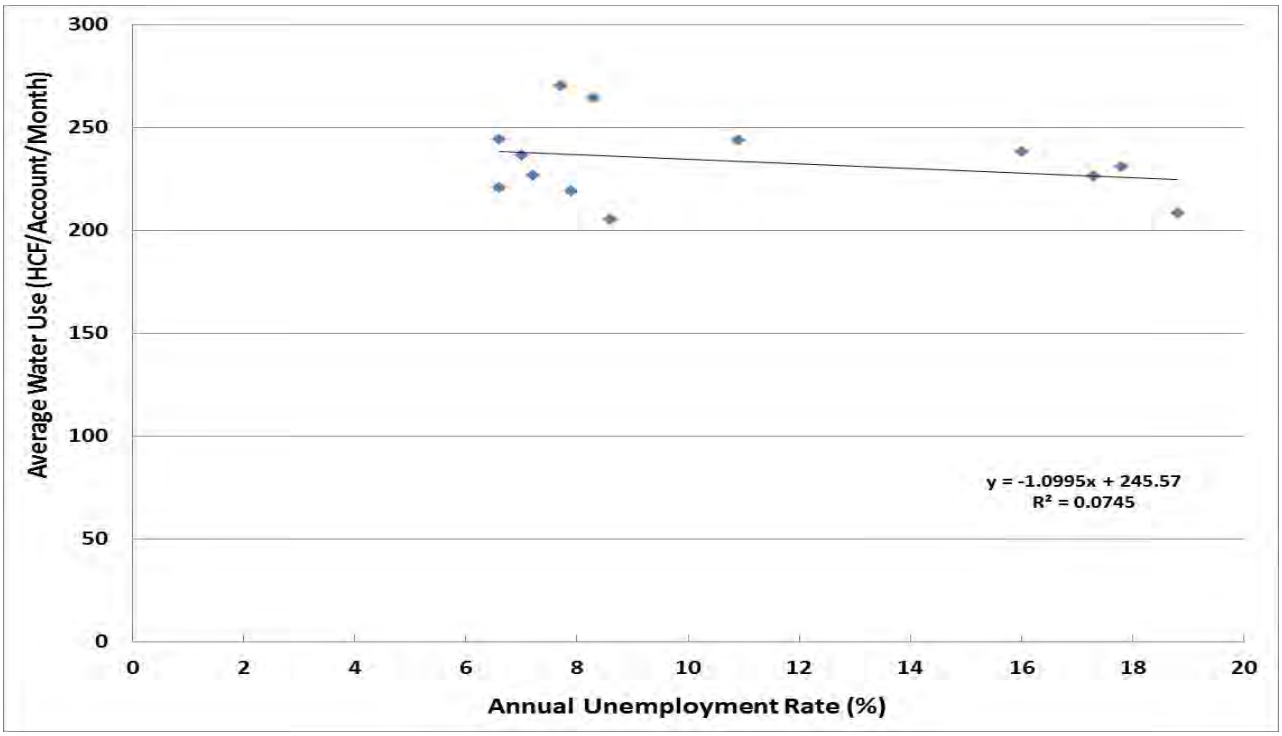
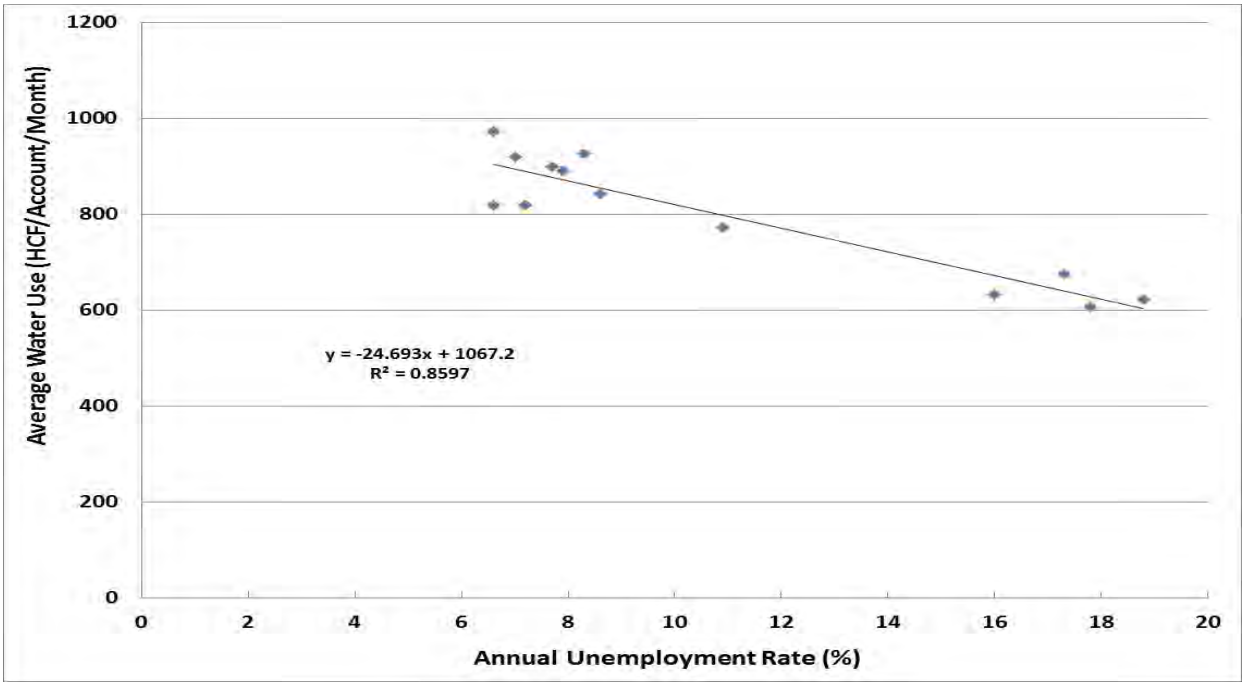


Figure A8. Correlation between Unemployment Rates and water use Public Education accounts



Kennedy/Jenks Consultants

Economic Analysis TM Appendix B

Adjustment Factor Data for 2010 Water Use

Water Use Type	2010 Water Use (HCF)	R^2 Value for Unemployment	Adjustment Factor for 50th Percentile Unemployment Rate (8.3%)[a]	Adjustment Factor for 90th Percentile Unemployment Rate (7.2%)[b]	Adjustment Factor for Best Case Economic Conditions (Unemployment Rate = 6.6%)[c]
Residential	-	-		-	-
Up to 2,500 sq.ft[d]	28,949 (0.18%)	**0.735**	22%	24.50%	25.8%
2,500 to 5,000 sq.ft[d]	181,962 (1.16%)	**0.851**	16.5%	18.20%	19.20%
5,000 to 7,500 sq.ft[d]	3,350,886 (21.3%)	**0.834**	16.1%	18%	18.7%
7,500 to 10,000 sq.ft[d]	2,370,558 (15.1%)	**0.808**	16.9%	18.70%	19.6%
10,000 to 25,000 sq.ft[d]	1,659,234 (10.6%)	**0.73**	15.3%	16.90%	17.8%
Larger than 25,000 sq.ft[d]	302,019 (1.92%)	**0.645**	20.4%	22.60%	23.7%
All SFR Together	7,893,608 (50.2%)				
MFR	2,223,245 (14.2%)	**0.84**	15.1%	16.70%	17.5%
MFR-2	413,328 (2.63%)	**0.859**	28.2%	31%	32.7%
Commercial	1,270,027 (8.08%)	**0.639**	12.9%	14.30%	15.0%
Non-Res.	2,401,457 (15.3%)	**0.871**	15.7%	17.30%	18.20%
Municipal	647,454 (4.12%)	**0.04**	0%	0%	0%
Assess. Dist.	250,840 (1.60%)	**0.075**	0%	0%	0%
Public Ed.	301,458 (3.41)	**0.86**	43%	47.50%	50%
Non Applicable Usage	**1,043,7799**				
Totals	**16,759,882**	**-**	**16.2%**	**17.9%**	**18.8%**

Notes:

(a) Adjustment Factor for 50th Percentile Unemployment Rate = Percent Change in water use relative to 2010 use if the unemployment rate were to decrease to 50th percentile unemployment rate of 8.3% from the 18.8% in 2010.

(b) Adjustment Factor for 90th Economic Conditions = Percent Change in water use relative to 2010 use if the unemployment rate were to decrease to the 10th percentile unemployment rate (i.e. unemployment rate will be lower than this value at 90% of the time) of 7.2% from the 18.8% in 2010.

(c) Adjustment Factor for Best Case Economic Conditions = Percent Change in water use relative to 2010 use at the lowest unemployment rate of 6.6% compared to that of 18.8% in 2010.

(d) Lot Area

Kennedy/Jenks Consultants

Economic Analysis TM Appendix C

Sensitivity Analyses of 2012 Water Use Adjustment Factor Using San Bernardino County Unemployment Rates

Appendix C

Unemployment Rate Data for San Bernardino

This analysis was performed at the request of San Bernardino Municipal Water Department (SBMWD) staff regarding the use of unemployment rate information from California Employment Development Department (CA EDD) (http://www.edd.ca.gov/Unemployment/), which provided unemployment data only for the past 13 years (years 2000 to 2012). The SBMWD staff requested Kennedy/Jenks Consultants identify long term unemployment rate data from an alternate source, and evaluate the impact of using this supplemental data in the water demand evaluation. To this end, unemployment data for the County of San Bernardino (County) was obtained from the US Bureau of Labor (http://www.bls.gov/lau/#tables) which provided information on the County's unemployment rate dating back to 1990. A summary of the components of the available data sources is provided in Table 1.

The annual data unemployment data from the two data sources is provided in Table 2. The data indicated that, while there were some differences in the unemployment rate for the City of San Bernardino obtained from CA EDD and the unemployment rate obtained for the County of San Bernardino obtained from the Bureau of Labor, the overall trends were similar (Figure 1).

To integrate the two data sets, a correlation equation was developed to adjust the County unemployment data for years 1990 to 1999 to an "equivalent" unemployment data for the City of San Bernardino (Figure 2). Using this equation, the unemployment rates were projected for the City of San Bernardino for the years 1990 to 1999 (Table 3).

Finally, water use adjustment factors were derived for the 50^{th} percentile unemployment rates using CA EDD data from years 2000 to 2012, and for the combined projected data (for years 1990 to 1999) and CA EDD data (for years 2000 to 2012) (Table 4). The results indicated that the adjustment factor did not vary significantly (0.8%) between the two approaches. Hence, the analyses based on CA EDD data for the City is recommended to be used in the development of the demand factor adjustment in this study.

Table 1. Summary of Available Data

Data Source	Area Covered	Years
California Employment Development Department	San Bernardino City	2000 to 2012
US Bureau of Labor	San Bernardino County	1990 to 2012

Table 2. Annual Unemployment Rate (%) Data for San Bernardino City and County

Year	San Bernardino City	San Bernardino County
2012	16	12
2011	17.8	13.4
2010	18.8	17.2
2009	17.3	12.9
2008	10.9	8
2007	7.7	5.6
2006	6.6	4.8
2005	7.2	5.2
2004	7.9	5.8
2003	8.6	6.3
2002	8.3	6
2001	7.0	5.1
2000	6.6	4.8
1999		4.9
1998		5.7
1997		6.5
1996		7.4
1995		7.9
1994		8.7
1993		10
1992		9.7
1991		8.3
1990		5.6

Comparison of Unemployment Rates in the City and County of San Bernardino

Figure 1. Historic unemployment rates for the City and County of San Bernardino

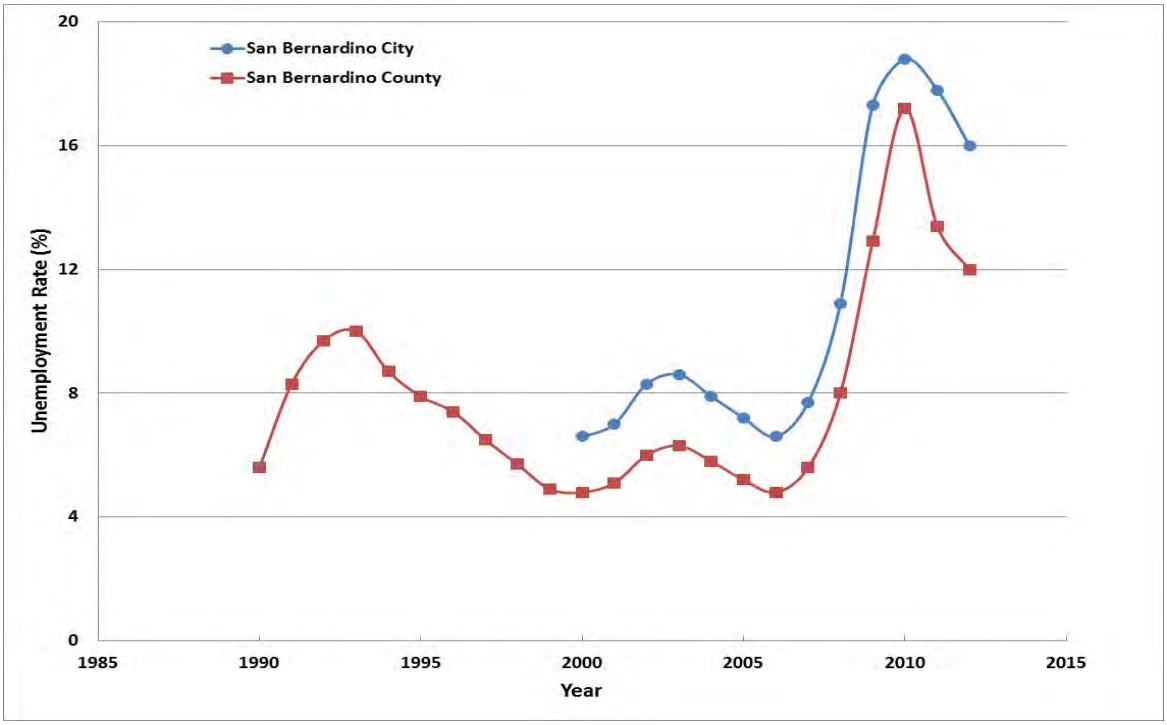


Figure 2. Correlation between Unemployment Rates for the City and County of San Bernardino based on data from 2000 to 2012

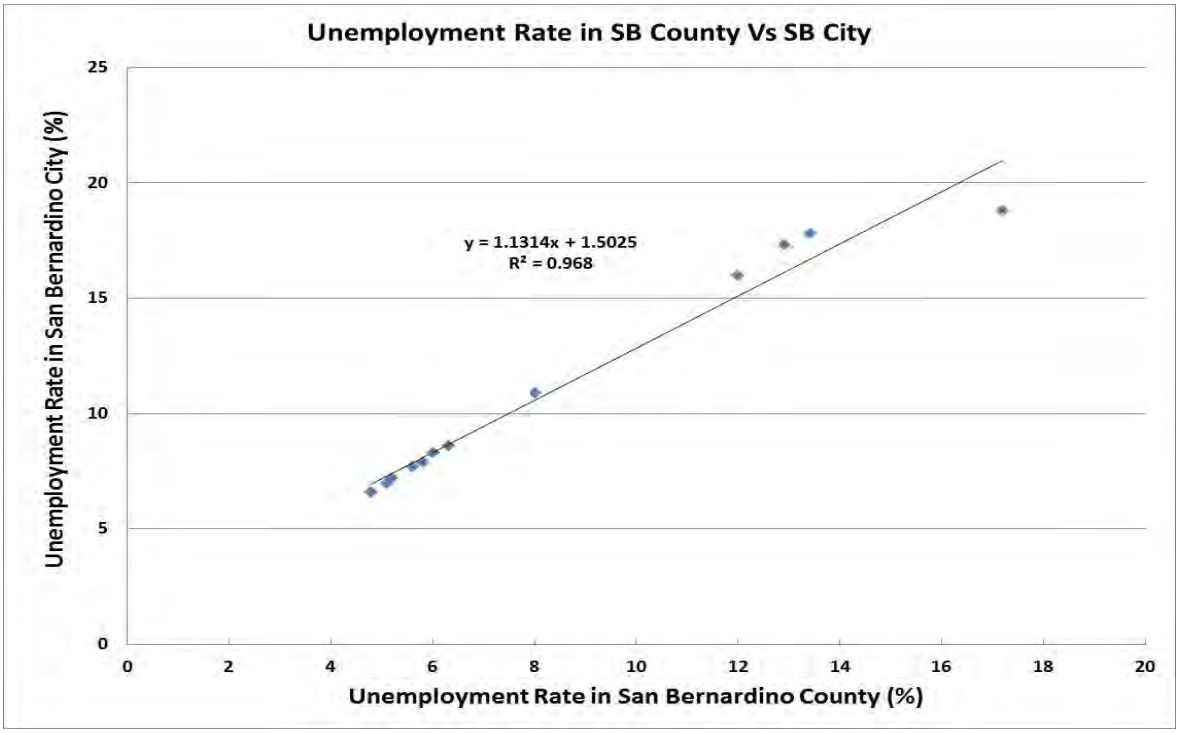


Table 3. Projected Unemployment Data for San Bernardino City for years 1990 to 1999 based on the correlation equation

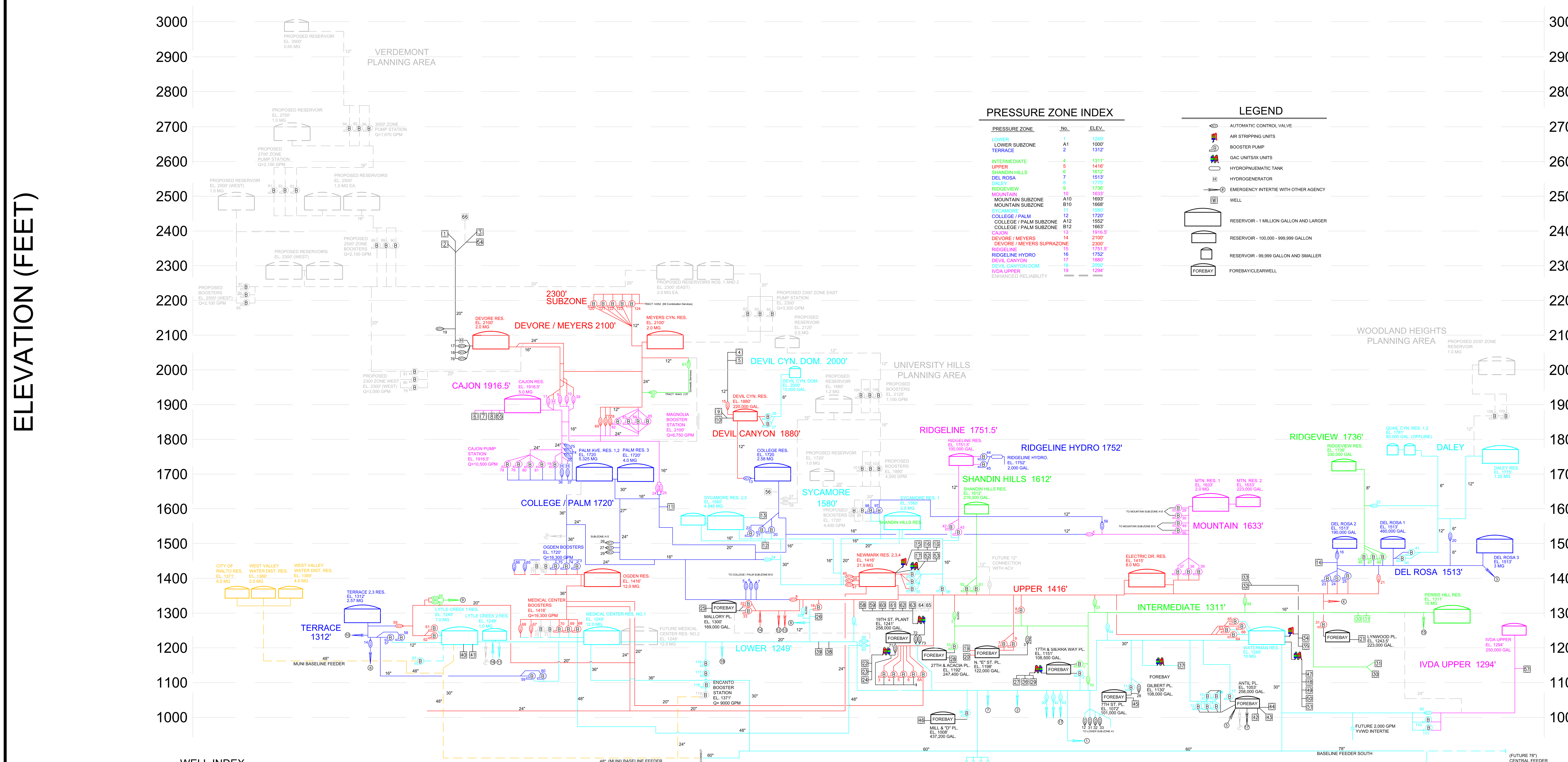
Year	EDD Reported Actual Unemployment Rate for San Bernardino City	Projected Unemployment Rate for San Bernardino City
2012	16	
2011	17.8	
2010	18.8	
2009	17.3	
2008	10.9	
2007	7.7	
2006	6.6	
2005	7.2	
2004	7.9	
2003	8.6	
2002	8.3	
2001	7.0	
2000	6.6	
1999		7.0
1998		8.0
1997		8.9
1996		9.9
1995		10.4
1994		11.3
1993		12.8
1992		12.5
1991		10.9
1990		7.8

Table 4. 50th percentile Unemployment rate data and adjustment factor using the EDD reported value from 2000 to 2012 and that using combined projected and reported values for years 1990 to 2012

Data Type	50th Percentile Unemployment Rate	% Adjustment Factor relative to 2012 water use
Using EDD reported actual values from 2000 to 2012	8.3%	11.2%
Using combined projected and reported actual values from 1990 to 2012	8.86%	10.4%
Difference derived from the two data sources	0.56%	0.8%

Appendix C: System Schematic and Facility Inventory

SBMWD SYSTEM SCHEMATIC



PRESSURE ZONE INDEX

PRESSURE ZONE	No.	ELEV.
LOWER	1	1249'
LOWER SUBZONE	A1	1000'
TERRACE	2	1312'
INTERMEDIATE	4	1311'
UPPER	5	1416'
SHANDIN HILLS	6	1612'
DEL ROSA	7	1513'
DALEY	8	1775'
RIDGEVIEW	9	1736'
MOUNTAIN	10	1633'
MOUNTAIN SUBZONE	A10	1693'
MOUNTAIN SUBZONE	B10	1668'
SYCAMORE	11	1580'
COLLEGE / PALM	12	1720'
COLLEGE / PALM SUBZONE	A12	1552'
COLLEGE / PALM SUBZONE	B12	1663'
CAJON	13	1916.5'
DEVORE / MEYERS	14	2100'
DEVORE / MEYERS SUPRAZONE		2300'
RIDGELINE	15	1751.5'
RIDGELINE HYDRO	16	1752'
DEVIL CANYON	17	1880'
DEVIL CANYON DOM.	18	2000'
IVDA UPPER	19	1294'
ENHANCED RELIABILITY		

LEGEND

- AUTOMATIC CONTROL VALVE
- AIR STRIPPING UNITS
- BOOSTER PUMP
- GAC UNITS/IX UNITS
- HYDROPNUEMATIC TANK
- HYDROGENERATOR
- EMERGENCY INTERTIE WITH OTHER AGENCY
- WELL
- RESERVOIR - 1 MILLION GALLON AND LARGER
- RESERVOIR - 100,000 - 999,999 GALLON
- RESERVOIR - 99,999 GALLON AND SMALLER
- FOREBAY/CLEARWELL

WELL INDEX

WELL NO.	NAME OF WELL	PRESSURE ZONE	AVG. SUMMER CAPACITY (GPM)
	CAJON ZONE		
6	CAJON NO. 1	1913'	INACTIVE
7	CAJON NO. 2	1913	809
8	CAJON NO. 3	1913	792
55	CAJON NO. 4	1913	2,225
	DEVIL CANYON DOMESTIC ZONE		
4	D.C. NO. 6	2041	240
5	D.C. NO. 7	2041	209
	DEVIL CANYON ZONE		
9	D.C. NO. 3	1880	160
10	D.C. NO. 4	1880	87
	COLLEGE ZONE		
11	D.C. NO. 2	1720	995
56	FUT. CAMPUS PKWY WELL	1720	TBD
	DEL ROSA ZONE		
14	40TH & VALENCIA	1513	583
	DEVORE ZONE		
1	CAJON CANYON	2100	667
2	VINCENT	2100	1,391
3	KENWOOD #1	2100	792
54	KENWOOD #2	2100	1,500
66	KENWOOD #3 (FUTURE)	2100	2,000
	INTERMEDIATE ZONE		
* 27	17TH STREET #1	1312	INACTIVE
* 28	27TH & ACACIA	1312	758
29	17TH STREET #2	1312	1,100
30	PERRIS HILL NO. 4	1312	INACTIVE
31	PERRIS HILL NO. 5	1312	INACTIVE
	IVDA UPPER		
57	IVDA WELL # 11	1294	INACTIVE
	LOWER ZONE		
* 26	BASELINE & CALIFORNIA	1415	564
* 32	31ST & MT. VIEW	1249	1,738
* 33	30TH & MT. VIEW	1249	2,579
* 34	LEROY	1249	2,488
* 35	WATERMAN	1249	1,753
* 36	16TH STREET	1249	2,296
37	GILBERT	1249	2,700
38	10TH & "J"	1249	2,536
39	OLIVE & GARNER	1249	2,210
40	LYTLE CREEK NO. 1	1249	INACTIVE
41	LYTLE CREEK NO. 2	1249	1,798
42	ANTIL NO. 4	1249	INACTIVE
43	ANTIL NO. 5	1249	INACTIVE
44	ANTIL NO. 6	1249	1,982
45	7TH STREET	1249	INACTIVE
46	MILL & "D"	1249	319
* 47	EPA-1	1249	1,255
* 48	EPA-2	1249	1,074
* 49	EPA-3	1249	1,753
* 50	EPA-4	1249	1,301
* 51	EPA-5	1249	1,346
* 58	EPA-108	1249	1,480
* 59	EPA-108S	1249	603
* 60	EPA-109	1249	1,267
* 61	EPA-110	1249	1,798
* 62	EPA-111	1249	2,013
* 63	EPA-112	1249	1,561
64	EPA-109S (FUTURE)	1249	600
65	EPA-112S (FUTURE)	1249	600
	SYCAMORE ZONE		
12	D.C. NO. 1	1580	1,268
13	D.C. NO. 5	1580	563
	UPPER ZONE		
* 15	NEWMARK NO. 1	1415	961
* 16	NEWMARK NO. 2	1415	1,379
* 17	NEWMARK NO. 3	1415	974
* 18	NEWMARK NO. 4	1415	1,764
* 19	No. "E" STREET	1415	INACTIVE
* 20	23RD STREET	1415	INACTIVE
21	LYNWOOD	1415	2,121
* 22	MT. VERNON	1415	1,989
* 23	19TH ST. NO. 1	1415	INACTIVE
* 24	19TH ST. NO. 2	1415	1,255
25	MALLORY	1415	168
* 52	EPA-6	1415	475
* 53	EPA-7	1415	1,074

NOTE: WELLS SHOWN W/ "*" ARE CONTAMINATED AND CURRENTLY RECEIVE WELLHEAD TREATMENT.

RESERVOIR INDEX

Zone / Plant	Elevation	Capacity MG	Dimensions (L x W x H)	High Level	Low Level	Operating Level	Type Const
Lower Pressure Zone							
Lytle Creek No. 1	1248'	3.042	195'x195'x8'	14	6	11	Concrete
Lytle Creek No. 2	1248'	7.500	294'x213'x16'	14	6	11	Concrete
Waterman Ave.	1249'	10.000	354'x234'x16'	14.5	7	12	Concrete
Medical Ctr. Dr.	1249'	12.000	320' H X 20' Dia.	19	4	15	Concrete
Terrace Pressure Zone							
Terrace No. 2	1312'	1.160	36' H x 76' Dia.	32	12	28	Steel Tank
Terrace No. 3	1312'	1.285	36' H x 80' Dia.	32	12	28	Steel Tank
Intermediate Pressure Zone							
Perris Hill (Dam)	1311'	10.000	340'x150'x30'	26	17	24	Concrete
Upper Pressure Zone							
Newmark No. 2	1416'	7.500	294'x214'x16'	14	7	10	Concrete
Newmark No.3	1416'	5.500	214'x214'x16'	14	7	10	Concrete
Newmark No. 4	1416'	8.900	294'x254'x16'	14	7	10	Concrete
Electric Dr.	1415'	8.000	34'x204'22'	20	11	14	Concrete
Ogden	1415'	12.000	27' H x 292' Dia.	23	6	20	Concrete
Shandin Hills Pressure Zone							
Shandin Hills	1612'	0.219	50'x50'x12'	11	6	10	Concrete
Del Rosa Pressure Zone							
Del Rosa No.1	1513'	0.460	18' H x 44' Dia.	33	17	25	Steel Tank
Del Rosa No.2	1513'	0.190		16	3	12	Steel Tank
Del Rosa No. 3	1513'	3.000	32' H x 130' Dia.	29	14	22	Steel Tank
Daley Canyon Pressure Zone							
Daley Caynon	1775'	1.500	114'x94'x16'	13.5	6	11	Concrete
Quail Cyn. No. 1	1785'	0.040	18' H x 20' Dia.	NA	NA	NA	Offline
Quail Cyn. No. 2	1785'	0.040	18' H x 20' Dia.	NA	NA	NA	Offline
Ridgeview Pressure Zone							
Ridgeview	1736'	0.330	24' H x 50' Dia.	20	12	18	Steel Tank
Mountain Pressure Zone							
Mountain No. 2	1633'	0.233	10' H x 64' Dia.	8	1	6	Concrete
Mountain No. 3	1633'	2.000	24' H x 133' Dia.	22	12	18	Steel Tank
Sycamore Pressure Zone							
Sycamore No. 1	1576'	2.500	40' H x 105' Dia.	35	17	25	Steel Tank
Sycamore No. 2	1576'	0.448	32' H x 50' Dia.	27	12	20	Steel Tank
Sycamore No. 3	1576'	6.000	32' H x 180' Dia.	27	12	20	Steel Tank
College / Palm Pressure Zone							
Palm 1	1720'	0.325	24' H x 48' Dia.	22	12	18	Steel Tank
Palm 2	1720'	5.000	24' H x 192' Dia.	22	12	18	Steel Tank
Palm 3	1720'	4.000	26' H x 175' Dia.	22	12	18	Concrete
College	1720'	2.580	32' H x 120' Dia.	29	13	22	Steel Tank
Cajon Pressure Zone							
Cajon	1916'	5.000	32' H x 166' Dia.	29	15	24	Steel Tank
Devore / Myers Pressure Zone							
Devore	2100'	2.000	24' H x 120' Dia.	21	12	18	Steel Tank
Meyers Cyn.	2100'	2.000	24' H x 135' Dia.	22	12	20	Concrete
Ridgeline Pressure Zone							
Ridgeline	1751.5'	0.100	8' H x 50' Dia.	7	2.5	5	Steel Tank
Ridgeline Hydro.	1752'	0.001	10' L x 4' Dia.	NA	NA	NA	Steel Tank
Devil Canyon Pressure Zone							
Devil Canyon	1880'	0.220	76' x 42' x 11'	10	5	8	Concrete
Devil Cyn. Dom.	2011'	0.001	8' H x 30' Dia.	7.5	4	6	Steel Tank
IVDA Upper Pressure Zone							
IVDA Upper	1294'	0.250	_' H x __' Dia.	__	__	__	Concrete

FOREBAY INDEX

Zone / Plant	Elevation	Capacity MG	Dimensions (L x W x H)	High Level	Low Level	Operating Level	Type Const
Forebays in the Lower Pressure Zone							
Mill & "D"	1003'	0.437	100'x50'x12'	10	4	7	Concrete
Antil	1053'	0.258	73x43.4x11.8	11	4.5	8	Concrete
7th Street	1151'	0.101	10' H x 48' Dia.	9.5	3.5	5	Concrete
17th & Sierra Way	1064'	0.108	45'x27'x13.6'	11.5	5.5	8.5	Concrete
Forebays in the Intermediate Pressure Zone							
27th & Acacia	1192'	0.247	28'x15.4'x13'	10.5	6.5	9	Concrete
Forebays in the Upper Pressure Zone							
Lynwood	1243'	0.233	10' H x 64' Dia.	9	3.5	6	Concrete
No. "E" (25th St.)	1198'	0.122	10' H x 50' Dia.	NA	NA	NA	Concrete
Mallory	1300'	0.169	32' H x 30' Dia.	28	8	24	Steel Tank
19th Street	1241'	0.258	72'x42.4'x13'	12.5	4	10	Concrete

AUTOMATIC CONTROL VALVE (ACV) INDEX

No.	Name	Location	Zone To Zone	Status
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PUMP/BOOSTER STATION INDEX

No.	Name	Location	Cap.	HP	Zone To Zone			Status
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
92		Future				-		Future
93		Future				-		Future
94		Future				-		Future
95		Future				-		Future
96		Future				-		Future
97	College 4	Sycamore Reservoir 1	1100	75	1580	-	1720	In-place
98	College 5	Sycamore Reservoir 1	1100	75	1580	-	1720	In-place
99		Future				-		Future
100		Future				-		Future
101		Future				-		Future
102		Future				-		Future
103		Future				-		Future
104		Future				-		Future
105		Future				-		Future
106		Future						Future
107	Magnolia	Future (MAGNOLIA)						Future
108	Woodland Heights	Future (WOODLAND HEIGHTS)						
109	Woodland Heights	Future (WOODLAND HEIGHTS)						
110	IVDA Upper	Perimeter Road	2200	75	1249	-	1294	In use
111	IVDA Upper	Perimeter Road	2200	75	1249	-	1294	In use
112								
113								
114								
115		Future				-		Future
116	Encanto 1	Encanto Park (9th & Davidson)	2500	125	1249'	-	VD	In use
117	Encanto 2	Encanto Park (9th & Davidson)	2500	125	1249'	-	VD	In use
118	Encanto 3	Encanto Park (9th & Davidson)	2500	125	1249'	-	VD	In use
119	Encanto 4	Future				-		Future
120	Melvin Booster 1	Melvin Booster Station	90	7.5	2100'	-	2300'	In use
121	Melvin Booster 2	Melvin Booster Station	90	7.5	2100'	-	2300'	In use
122	Melvin Booster 3	Melvin Booster Station	90	7.5	2100'	-	2300'	In use
123	Melvin Booster 4	Melvin Booster Station	1200	60	2100'	-	2300'	In use
124	Melvin Booster 5	Melvin Booster Station	1200	60	2100'	-	2300'	In use

AGENCY INTERTIE INDEX

NO.	AGENCY	TO/FROM	SIZE/CAPACITY	LOCATION	SCADA
1	City of Loma Linda	To	8" @ 1,450 gpm	Redlands Blvd. w/o Tippecanoe	No
2	City of Loma Linda	To	12" @ 3,100 gpm	Richardson St. s/o Cooley	Yes
3	East Valley Water District	To	12" @ 3,100 gpm	Reservoir Rd. e/o Sterling	No
4	East Valley Water District	To	8" @ 1,450 gpm	Lynwood Dr. w/o Mountain	No
5	East Valley Water District	From	12" @ 3,100 gpm	6th St. w/o Pedley Rd. From EVWD Well 11A (inact.)	Yes
6	City of Colton	To/From	6" @ 950 gpm	Ellen St. e/o Macy	No
7	City of Colton	To	8" @ 1,450 gpm	Hunts Lane s/o Commercial Drive	No
8	City of Rialto	To	12" @ 3,100 gpm	Baseline St. w/o California Nonfunctional - Rialto Pressure is Higher	No
9	City of Rialto	To	8" @ 1,450 gpm	Southwest Corner Etiwanda Ave. and Pepper Ave. Nonfunctional - Rialto Pressure is Higher	No
10	Riverside-Highland Water	To	8" @ 1,450 gpm	Rancho Ave. n/o Spring Mtn. Trail	No
11	Riverside-Highland Water	To	12" @ 3,100 gpm	Baseline St. w/o California	No
12	Muscoy Mutual Water Co.	To	6" @ 950 gpm	First Ave. w/o Nolan	No
13	Muscoy Mutual Water Co.	To	8" @ 1,450 gpm	Gray St. @ Reservoir St.	No
14	Muscoy Mutual Water Co.	From	6" @ 950 gpm	Mallory St. n/o Mallory Plant	No
15	Baseline Gardens Mutual Water Co.	To	6" @ 950 gpm	Baseline St. e/o Waterman	No
16	West Valley Water District	To/From	12" @ 3,100 gpm	Lytle Creek Plant	No
17	City of Riverside	To/From	12" @ 3,100 gpm	6th St. at Antil Plant	No
18	San Bernardino Valley Municipal Water District	To	20" @ 2,970 gpm or 5,940 gpm or 8,910 gpm	Encanto Park	Yes
19	Yucaipa Valley Water District (FUTURE)	To	12" @ 2,000 gpm	Mountain View Ave. and San Bernardino Ave.	TBD

REVISIONS

01-05-10	Revised Agency Intertie Index	
12-21-09	Updated Proposed Zones	
05-01-07	Updated per Draft Master Plan	
10-28-05	Added Future Facilites	
06-21-04	Added Proposed Zones	
06-16-04	Added Booster Index	
03-10-03	Added Elevations C.C.	3-15-15 2015 WFMP REVISIONS

CITY OF SAN BERNARDINO
MUNICIPAL WATER DEPARTMENT
397 CHANDLER PLACE, SAN BERNARDINO, CA. 92408 * (909) 522-3403

SYSTEM HYDRAULIC SCHEMATIC

3/15/15 W:\System Maps\system-schematic2015.dwg

Appendix D: TM2 – Model Development and Calibration

1 July 2014

Memorandum

To: Miguel Guerrero, Principal Engineer, San Bernardino Municipal Water Department

From: Paul Tinhpheng, Tarun Gill and Roger Null, Kennedy/Jenks Consultants

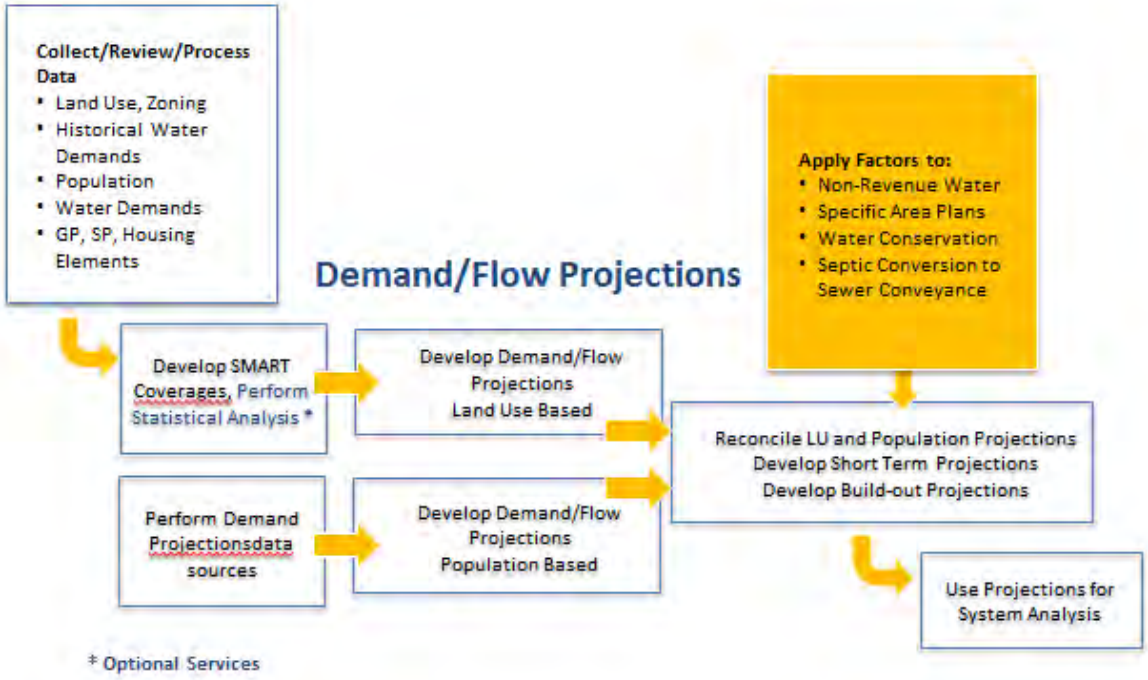
Subject: Hydraulic Model Construction and Model Calibration
K/J 1383002*00

Section 1: Introduction

Hydraulic distribution models are frequently used for the planning, design and operational management of water distribution systems. In order to evaluate distribution system hydraulics, computerized modeling software is used to develop hydraulic models that represent actual distribution system infrastructure and its operation using complex mathematical equations. These models serve as tools to identify potential deficiencies in the system, size future facilities and develop long range planning studies. This technical memorandum describes development of the hydraulic model of the San Bernardino Municipal Water Department's (Department) distribution system and the calibration methodology and results. As described above, the hydraulic model is the primary analytical tool used to determine facility sizing, capacity needs and fire flow requirements and a comprehensive calibration process is integral to increasing its ability to accurately mimic actual field conditions. The calibration process of water distribution system models allows for accurate and reliable hydraulic analysis results and thus, is of utmost importance.

The methods used to develop the Department's water system hydraulic model are described in the section that follows, including model creation and model calibration. The model will subsequently be used to identify deficiencies within the existing and the future system in meeting water demand conditions. This evaluation will guide the development of a Capital Improvement Program (CIP) for the distribution system under existing and future conditions.

The figure below shows the basic workflow for the hydraulic model development and calibration process.


Collect/Review/Process Data
• Land Use, Zoning
• Historical Water Demands
• Population
• Water Demands
• GP, SP, Housing Elements
Demand/Flow Projections
Apply Factors to:
• Non-Revenue Water
• Specific Area Plans
• Water Conservation
• Septic Conversion to Sewer Conveyance
Develop SMART Coverages, Perform Statistical Analysis *
Develop Demand/Flow Projections Land Use Based
Perform Demand Projectionsdata sources
Develop Demand/Flow Projections Population Based
Reconcile LU and Population Projections
Develop Short Term Projections
Develop Build-out Projections
Use Projections for System Analysis
* Optional Services

Section 2: Hydraulic Model Development Approach

In agreement with the Department over the needs and goals for the modeling task and how it fits in the Master Planning project, K/J's modeling team selected Innovyze's *InfoWater* (version 10.5) software to use for this project. The previous hydraulic model used in the 2007 Master Plan was also developed using the *InfoWater* software, a fully integrated Geographic Information System (GIS) hydraulic modeling software package. The software is capable of transferring data to and from the Department's water system GIS, which is integrated using *ArcMap GIS* as part of this Water Master Plan. The model includes all water facilities in the distribution system including water pipelines 2-inch in diameter and greater, groundwater wells, storage tanks, booster stations, inter-tie connections, pressure regulating valves, and other infrastructure within the system. Water pipelines and their associated parameters (e.g. diameter, year of installation, material, lengths, etc.) are imported from the Department's GIS into *InfoWater* to form the initial pipe network. Spatial data such as location of valves, hydrants, billing meters, ground elevations (based on LIDAR data) was provided by the Department as part of this Master Plan project. Water demands and other necessary modeling data like operating conditions, control sets, system curves, etc. are also incorporated into the model using both *ArcMap GIS* and *InfoWater*. *InfoWater* uses Innovyze's proprietary hydraulic engine, which provides a fully dynamic solution for modeling distribution systems. The program has a GIS-based model interface and features many useful add-on tools for model development, calibration, and simulation results analysis.

2.1 Data Sources and Integration of GIS Data

InfoWater uses a GIS based interface integrated with ESRI's ArcGIS platform. In order to accurately construct the model, the Department provided several pieces of vital GIS information that were used as the basis of the model. The Department provided detailed information with comprehensive attribute data that was required for the development of the hydraulic model for this master planning effort. In addition, data collected during the previous master planning effort was referred to where applicable. Additionally, PDFs of Land Use maps were provided by San Bernardino County and City of San Bernardino Information Technology Department and were used to help determine properties of the Unincorporated Area and vacant land inside the Department's service area. The following data sources were used in the development of the hydraulic model:

- Land Use and Zoning data from San Bernardino County and City of San Bernardino
- Baseline GIS data (including water system facilities, street centerlines, contours, parcels, etc.)
- Specific plans for new development areas
- Historical water production and metered billing records (HTE data)

- As-built drawings for new facilities/pipelines not shown on GIS
- Water system hydraulic schematic
- Pump curves and performance test reports (performed by Southern California Edison (SCE))
- Water level and drawdown elevations at wells
- Inlet/outlet level, high water level, bottom elevations of storage tanks
- Pump controls and settings of pressure regulating valves
- Well and booster operational controls
- SCADA information for system facilities
- Department's design standards
- Parcel level data
- Street Grid
- LIDAR data in the form of Digital Elevation Model (DEM)
- City Boundaries
- Current and Historic Water Usage Data
- Census Population Data
- SCAG Data
- Aerial GIS Coverage
- DWR water reports

Additional data have been gathered over the course of the project as needed for the model development and calibration. These data include drawings and reports for projects currently under planning, design, or construction.

Necessary updates to the Department's existing GIS were performed to allow for easy transfer and compatibility to the *InfoWater* hydraulic modeling program. Items addressed within the Department's GIS database included:

Geocoding HTE Records

It is noted that approximately 95% of the Department's billing data from the HTE program has been correlated to the assessor parcel number (APN). Geocoding of the remaining accounts (up to 97%) was performed based on physical address information. Records that do not have a spatial correlation were flagged in the GIS database.

GIS Pipeline Attribute Data Update

The key GIS feature attributes that were populated include diameter, material, and age of installation. As noted by the Department, the original GIS database had some missing information for age of pipelines, material, and diameter data. Per discussions with staff, resolution of the missing data was made based on a desktop analysis and other data provided by the Department.

Identify Data Gaps and Correct Connectivity Issues

A variety of desktop analysis tools were used to perform this analysis. These tools include: spatial analysis, database queries, topographical relationship, and logical population of attributes by use of existing data, relational queries, creation of spatial overlays to identify gaps, and populated feature attributes. Minor connectivity issues were corrected as part of the hydraulic modeling task.

The initial pipe network was created by importing the updated network data from the Department's GIS to *InfoWater*. The network was reviewed and updated for completeness and correctness prior to adding facilities and controls in the model. The review tasks included checking of pipeline information (e.g. location, year of installation, material and diameter) and fixing of pipeline connectivity errors. Often time's gaps in pipeline connectivity were found near the facility pipeline because of abandonment of the facility (or parts) or near new facilities that were added to the system recently. Developed from the Department's GIS data, the model is projected to the same coordinate system (NAD 83, California State Plane Zone V) as the GIS database. This makes it possible to overlay the GIS layers from the Department and those created in the model either in *InfoWater* or *ArcMap GIS*.

2.2 Model Construction

The following sections describe the model building process and software terminology. As discussed in the earlier sections, the information required for the model (pipe diameters and lengths, facilities, control settings, curves, etc.) was obtained from the Department's GIS database and validated to ensure the information was comprehensive enough to support this planning effort.

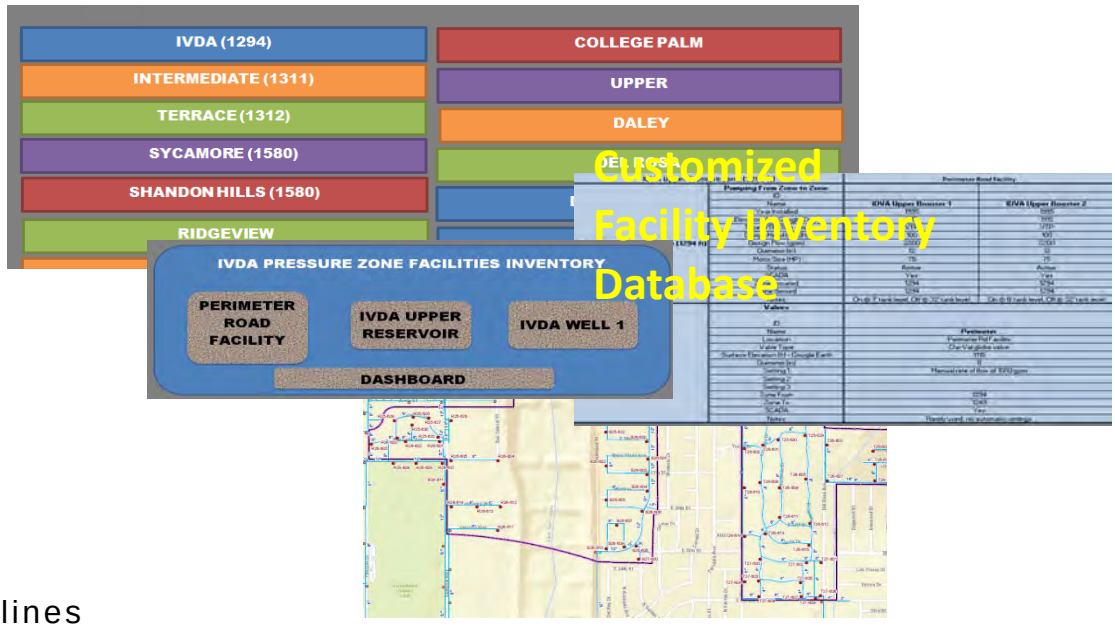
The following is a chronological order of steps taken to create the model from the Department's updated GIS:

- The pipeline shapefile from the Department's GIS containing only the potable water mains and their attribute information, including diameter, year of installation, material, and zone, are imported into *InfoWater* to form the initial pipe network.
- Junctions are added at both ends of pipelines by importing the processed Junction shapefile and then using the "Append Nodes" feature of *InfoWater.* This automated process creates a junction joining any pipeline endpoints within a 0.001 feet radius of one another.
- Overlapped junctions and/or those within a five feet radius are merged into a single junction (and resulting "orphan" pipelines are deleted).

- Overlapping pipelines are identified using the “parallel pipes” process in *InfoWater*. One of the pipelines is deleted if they represent the same pipeline.
- Missing pipelines are added based upon information provided by Department staff.
- The zone designation provided in the GIS files for pipelines is reviewed and verified based upon known pressure zone boundaries and the location of pump stations. Appropriate zone designations are assigned to all created nodes based upon the pipelines they are connected to.
- Other facilities (wells, booster pumps, valves, and tanks) are added to the model based on the GIS and data collected from the Department.
- Special queries and query-sets are created to help with various selection processes.
- Pump curves and control settings are added to the facilities as provided by the Department and prior hydraulic model used as part of the 2007 Master Plan.

2.2.1 Distribution System

A customized our “Valve Added” features we provide several tools tailored specifically for your needs which help in integrating various elements of the Master Plan. One such module is a Customized Facilities Inventory Database. This database is developed using a Visual Basic /Excel Macro VBA platform and captures comprehensive information on all system facilities. The information captured includes infrastructure details organized by pressure zone, summarizing the existing facilities including pump stations, wells, reservoirs, tanks and pressure reducing stations etc. Details pertaining to the facility footprint/photo, age, material, capacities, pressure zone summaries, condition, manufacturer, mechanical, electrical, and structural data, observations, and other criteria as identified by the Department and as available in the GIS and SCADA are captured. This database is eventually linked to the GIS and hydraulic model through hot-links to be able to facilitate with automatic update to the model. Also, depending upon the needs this database can be linked with SCADA/ Asset Management interface to help with system integration.



Pipelines

As previously discussed, the Department's distribution system network was created using the GIS converted into an *InfoWater* network. The updated distribution system model contains a total of approximately 30,400 pipe segments, totaling approximately 770 miles. The hydraulic model includes all potable water mains 2-inches in diameter and greater. **Table 1** presents the total length of pipes by diameter. The Department may use this table to verify the pipe diameters.

Table 1: Pipeline Summary

Diameter (inches)*	Length (miles)
2	4.7
2.5	0.9
3	5.3
4	60.6
4.5	1.9
5	0.4
5.5	1.1
6	171.6
8	178.0
10	3.8
12	159.0
14	1.7
16	55.3

Diameter (inches)*	Length (miles)
20	25.6
22	1.7
24	20.7
26	0.5
30	10.7
36	8.6
42	1.3
48	2.8
51	11.1
60	1.5
72	11.1
78	6.7
108	19.8

Source*: Department GIS database

A comprehensive exercise for locating isolation pipelines/valves was performed as part of the hydraulic model construction task. Pipes with closed isolation valves in the distribution system are identified in the model using the GIS information. Some of these pipes with closed isolation valves were also assumed based on zoning boundaries.

Water Facilities

The Department's water distribution system consists of pipelines, storage tanks, pumping stations, hydroelectric generating stations, manual and automatic control valves, fire hydrants, and water billing meters located throughout 19 individual pressure zones. The Department has pipelines varying in size from 2 inches to 78 inches in diameter, approximately 45,000 metered water services, 13,800 valves, and about 4,000 fire hydrants. The Department has 31 water storage tanks containing a total of 112 million gallons of domestic water storage capacity. These tanks vary in size from 40,000 gallons to 12 million gallons and are located throughout many of the 19 pressure zones.

Pressure zone tank elevations range from 1,249 feet to 2,100 feet mean sea level (msl) and are located at appropriate elevations necessary to provide adequate water pressure from 40 pounds per square inch (psi) to 120 psi throughout the pressure zone service area. The Department's pumping stations capacities range from 1,500 gpm to 14,000 gpm. In addition, many pressure zones have automated inter-zonal water transfer capabilities. These water facilities are modeled based upon the GIS data and additional information provided by the Department. Additional information gathered includes piping schematics, the location and settings of valves, outlet elevations of tanks, and the operational controls for booster stations and wells. A detailed description of the modeled facilities is included in a Customized Infrastructure Inventory Database developed as part of this project. A brief description is provided below.

Wells

The Department has 110 active groundwater production wells and 115 active monitoring wells. The Department's production wells are included in the hydraulic model. Each well is represented as a reservoir and a pump. The reservoirs represent the groundwater aquifer and are modeled as fixed grade reservoirs with an initial water level equal to the pumping groundwater level. These pumping levels are obtained from recent Department well reports, which are developed on a monthly basis. The pumps are modeled with multiple point curves, which are based upon the original pump curve modified to reflect the SCE test flows. Many of the pump curves in the system have been imported from the 2007 Master Plan's hydraulic model as suggested by the Department.

Booster Pumping Stations

All 31 of the booster pumping stations are included in the hydraulic model database. The database information for each booster pumping station includes head-capacity curve information for each pump that is developed from the actual pump manufacturer's curve data (if available), or from the SCE pumping test results. The SCE pump test results are also used to update the pump curve data to account for the decrease in mechanical performance associated with age. The pump controls have been added to the hydraulic model database, based on information provided by the Department.

Tanks

All 35 tanks in the distribution system are included in the hydraulic model. The model parameters of each tank (ground elevation, height, and diameter) are determined from the Department's GIS files and verified with the hydraulic model created for the previous master plan and data collected from Water Operations as part of the Customized Infrastructure Inventory Database developed. The tanks are modeled as cylindrical tanks. Multiple tanks at a site are modeled as a single tank with an equivalent diameter. Non-cylindrical tanks are modeled as variable area tanks.

Pressure Regulating Stations and Transfer Valves

All pressure regulating stations and zone transfer valves within the Department's distribution system are included in the hydraulic model. Adjustments are made to the location of the stations so that they are consistent with the pressure zone boundaries. The pressure regulating valve and transfer valve settings and initial status (open/closed) are included in the model database.

Pressure Zones

There are 19 primary pressure zones within the Department's water distribution system. The Department's GIS was updated to incorporate zone designations for each pipeline which are transferred to the model in the creation process. These zone designations are reviewed for accuracy and modified where necessary. Pressure zone designations are added to all model nodes based upon the pipelines they are connected to. Pipes connecting two pressure zones are closed to prevent flow from the upper to lower zone. Table 2 below presents the various pressure zones included as part of the hydraulic model.

Table 2: Pressure Zone Summary

Number	Pressure Zone	Elevation (ft.)
1	Lower	1249
2	Terrace	1312
3	Intermediate	1311
4	Upper	1416
5	Shadin Hills	1612
6	Del Rosa	1513
7	Daley	1775
8	Ridgeview	1736
9	Mountain	1633
12	Sycamore	1680
13	College/Palm	1720
14	Cajon	1916
15	Devore/Meyers	2100
16	Ridgeline	1751
17	Ridgeline Hydro	1752
18	Devil Canyon	1880
19	IVDA	2000

2.2.2 Elevation Allocation

The elevations of all nodes in the model are established from the Department's elevation contours provided in GIS shapefile format using Light Detection and Ranging (LIDAR) data survey conducted by the San Bernardino County. The elevations for the model nodes are interpolated from the contours by using the "elevation extraction" feature in *InfoWater.*

2.2.3 Demand Allocation

The existing water demands in the hydraulic model are allocated using actual water usage information obtained from the Department's fiscal year (FY) 2012 customer billing records.
The future water demands are allocated using the year demand projections calculated based upon specific plan and land use information. The allocation of both existing and future water demands to the model nodes is described below.

Allocation of Existing Demands

The water demands for existing conditions are based on actual customer usage information (HTE billing data) provided by the Department. The billing data covers the water usage of approximately 45,000 accounts for the FY 2012. The average water usage for each account for the calendar year is calculated and scaled to the water production of the same year to include

unaccounted for water in the model. Each billing record is geographically located in GIS by comparing the parcel's APN included in the billing data with a parcel's polygon in the shapefile provided by the Department. There are several instances where relatively new parcels identified in the billing data are not shown in the parcel shapefile. These are situations where parcels have been subdivided into smaller parcels. In these instances, the account is manually added to the shapefile by using the street address of the customer. The end product of this process is a GIS shapefile with each of the account represented as a point, which can be imported into *InfoWater*.

To allocate the water demands in the hydraulic model, demand nodes are selected that include all model nodes except those connected to water facilities or large transmission pipes. After the selection of demand nodes, each of the point demands corresponding to the HTE meter data, is allocated to its nearest demand node in the model using the GIS Demand Allocation workflow developed by Kennedy/Jenks. The demand allocator workflow uses an advanced algorithm to locate and allocate point demands from meter/billing data to the nearest model junction.

The large demand customers are individually checked to verify that these large demands are assigned to the correct location. This procedure is used to verify the spatial accuracy of the demand allocation, since these customers sometimes have different billing addresses than their physical locations (i.e., corporate offices different from physical operations). Adjustments are made when the meter locations/addresses and the billing addresses do not correspond.

Allocation of Future Demands

The allocation of future demands is split into five categories: specific plans, area plans, infill, vacant housing and undeveloped parcels. The allocation of specific plans and area plans is performed manually on a development by development basis. For each of the proposed developments, a single demand node is manually input into the model for each zone in the development.

Infill (vacant parcel located in-between developed parcels) and undeveloped (large undeveloped areas generally at the outskirts of the City boundaries) demands are input into the model using a similar process as the existing demands. A point GIS shapefile is created, with each point representing a vacant parcel in a developed region with an associated demand (calculated by multiplying the acreage of the vacant parcel with the water duty factor). These point demands are then assigned to the model using the Demand workflow methodology.

Vacant housing parcel demands are added to the demand set into the model by manually identifying the Department's existing developed lots for the year 2012 which did not show water usage. Average values of demands from previous years were calculated and assigned to these nodes to account for future demands when their lots get occupied again.

2.3 Model Calibration

During the process of developing a hydraulic model for the Department's existing water distribution system, the model was calibrated for the majority of the pressure zones within the Department's distribution system except for sub-zones or smaller zones which were relatively newer construction. The goal of calibration was to develop a computational model that closely represents actual conditions in the distribution system. Part of the calibration process involves collecting flow-test data obtained from several fire hydrants throughout the water service area. This data was then used to adjust modeling parameters e.g. friction factors, roughness coefficients etc. In accordance with the Scope of Work for the Water Facilities Master Plan, a flow-test protocol was prepared for use by the Department to provide calibration data. This memo describes the recommended locations for flow testing, as well as the procedures that should be followed while performing the tests. It also included maps showing locations where fire flow testing was recommended. In addition, the Department maintains a comprehensive data base of all fire flow tests performed as part of routine operational protocols. This database was used during the calibration of the majority of the pressure zone in the system.

Once all of the significant issues with model settings and input errors have been addressed, further model calibration was performed to fine tune the model to field conditions. Fire hydrant data was collected from the hydrant tests performed and from the Department's fire hydrant test database. The results of the actual field tests are compared to the model runs. The hydrant test points with the test data and model results are summarized in **Table 3. Figure 1** and **Figure 2** graphically depict the calibration results for Lower and Intermediate pressure zones, two of the biggest pressure zones in the system, respectively. The results in the table below show that most of the field conditions were replicated in the hydraulic model with a good confidence level. The deviations between field data and model results range from 0.2 to 9.8 percent for residual pressures, and range from 0.2 to 16.8 percent for static pressures.

Table 3: Steady State Calibration Results

Pressure Zone	Field Residual Pressure (psi)	Modeled Residual Junction Pressure (psi)	% Difference	Field Static Junction Pressure (psi)	Modeled Static Junction Pressure (psi)	% Difference
Cajon	109.0	103.9	-4.7%	119.0	105.8	-11.1%
College/Palm	94.0	94.0	0.0%	104.0	104.2	0.2%
Daley	118.0	108.8	-7.8%	130.0	110.4	-15.1%
Del Rosa	54.0	53.1	-1.7%	64.0	70.8	10.6%
Devore Meyer	110.0	116.9	6.3%	120.0	122.7	2.2%
Devore Meyer	114.0	120.0	5.3%	124.0	125.8	1.4%
Intermediate	26.0	26.5	2.1%	79.0	79.5	0.7%
IVDA	32.00	34.3	7.3%	62.0	53.5	-13.7%
Lower	84.0	84.2	0.2%	94.0	95.1	1.2%
Mountain	55.0	52.3	-4.9%	93.0	90.7	-2.5%
Mountain Sub Zone A	42.0	45.9	9.4%	73.0	74.2	1.6%

Pressure Zone	Field Residual Pressure (psi)	Modeled Residual Junction Pressure (psi)	% Difference	Field Static Junction Pressure (psi)	Modeled Static Junction Pressure (psi)	% Difference
Ridgeview	60.0	65.9	9.8%	72.0	75.1	4.2%
Sycamore	50.0	54.6	9.2%	60.0	70.1	16.8%
Terrace	52.0	52.0	0.0%	62.0	59.4	-4.2%
Upper	42.0	45.0	7.1%	56.0	54.9	-2.0%

For the pressure zones with variations more than 10% between field and model results for either static or residual pressures, multiple hydrant tests were simulated to rule out the possibility of errors in performing the tests. Initial results were shared with the Department to go over the operational controls, flow data and tank levels and verify the settings in the model. Once these are confirmed by the Department, edits/updates to the settings will be performed in the model to replicate field results. In case of outstanding discrepancies between the field and model results, the Department will provide directions on assumptions to be made for these pressure zones for the hydraulic analysis.

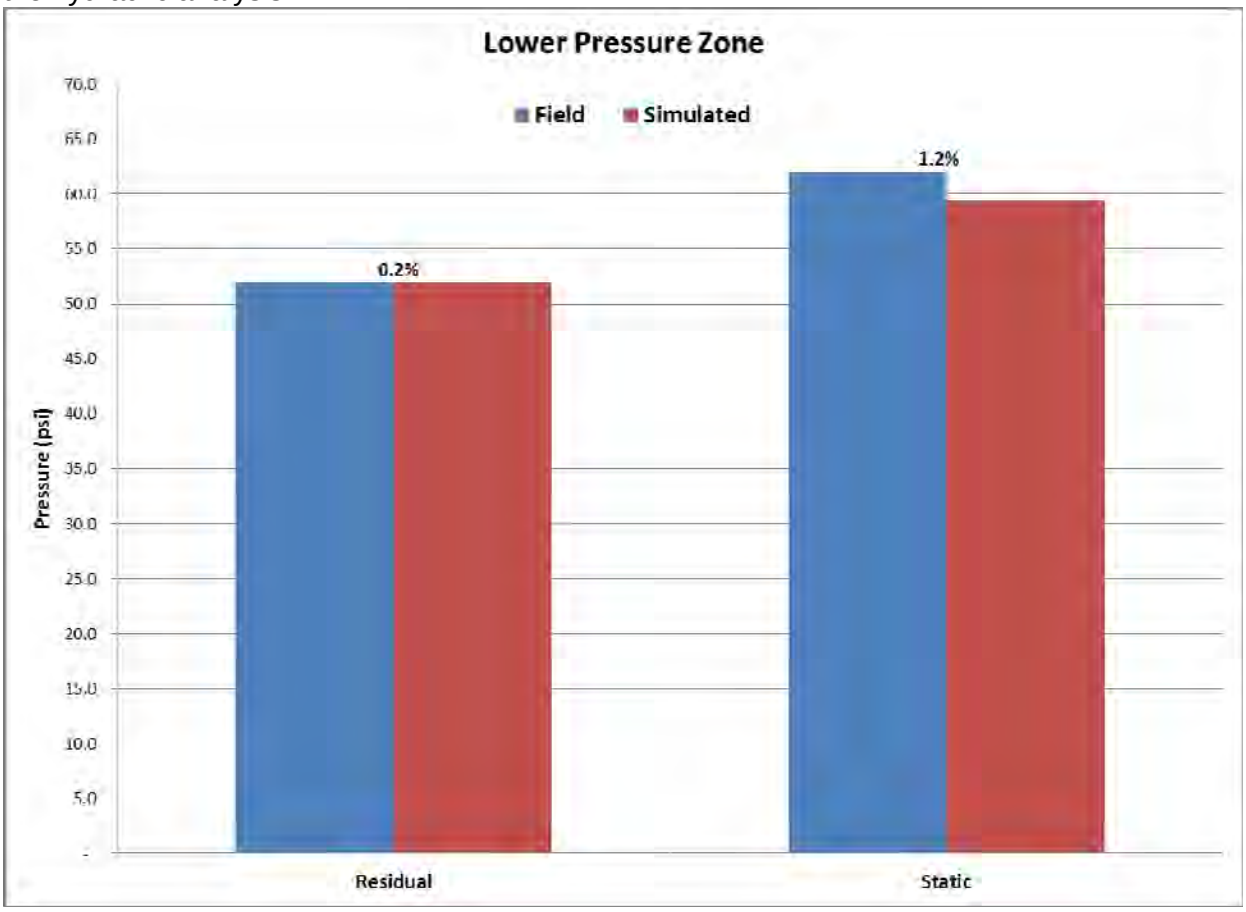


Figure 1: Lower Pressure Zone Calibration Results

Figure 1 above compares the residual and static pressures for the Lower pressure zone. As shown on the plot, both these match up well with the field measurements.

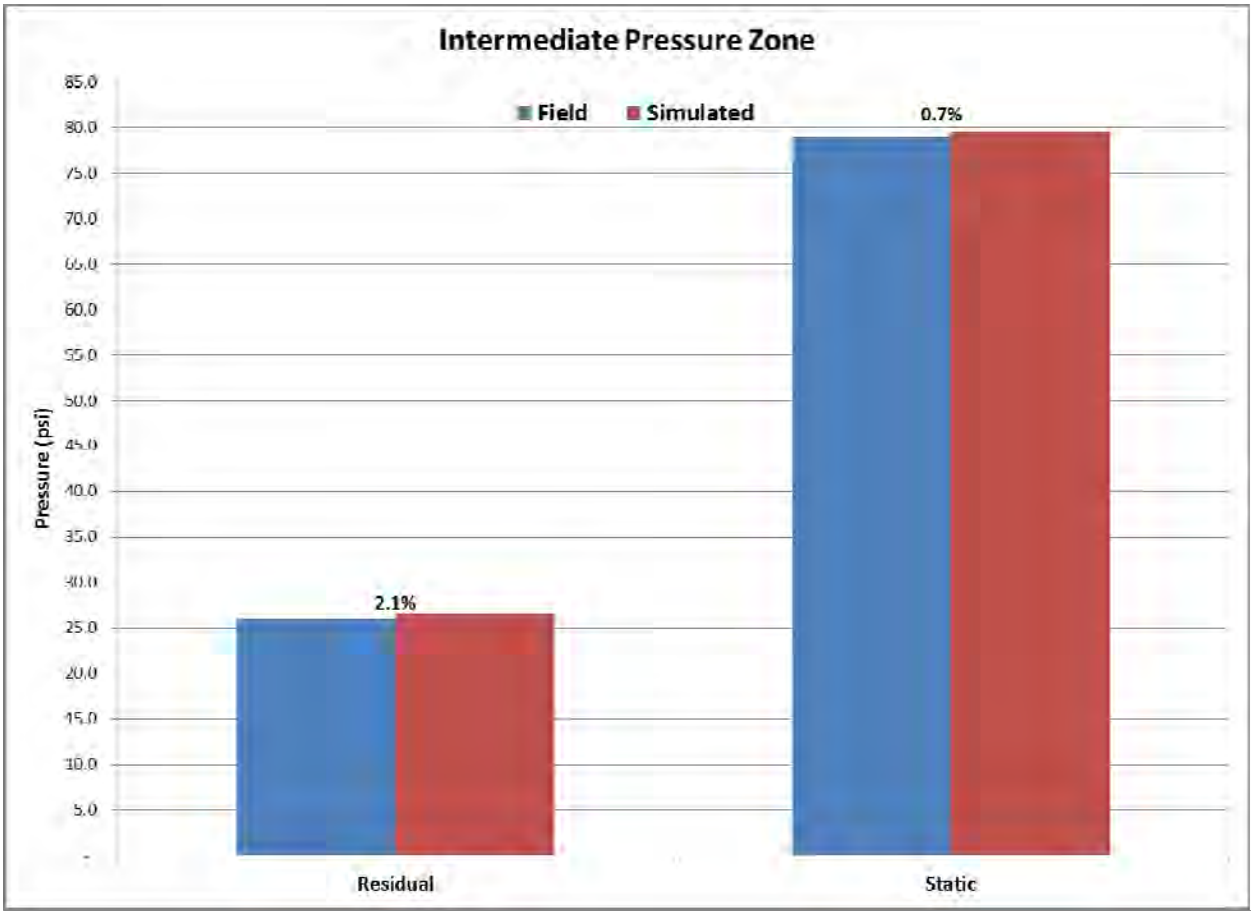


Figure 2: Intermediate Pressure Zone Calibration Results

Figure 2 above compares the residual and static pressures for the Intermediate pressure zone. Both of the values match up well with the field measurements.

As shown on the table and figures, the results of the field data versus the modeled data are within an acceptable degree of accuracy with the exception of Cajon, Del Rosa, Sycamore, Daley and IVDA. For the fire flow tests, the model results vary from the field measurements by an average of 5.8 percent for static pressures and 5.1 percent for residual pressures.

Field and Model Discrepancies

There are several possible causes of the discrepancies between the model results and field data observed during calibration which are seen in the tables and graphs above. Some of these include:

• Fire flow tests in the model are based on flow at the nearest model node. The hydrant piping branch run and losses through the hydrant are not included in the model.

• Pressure meters and flow meters used for the fire flow testing have some level of inaccuracy, both in the actual measuring and reading of such meters.

• Demand varies temporally between various days. The diurnal curve created for calibration is used to determine demand at each hour for the fire flow tests. However, the actual demand pattern varies from day to day.

• Demand varies spatially between different times. The demand allocation spatially distributes the demand using annual average billing data. All demand nodes are assigned the same diurnal curve.

• The elevation data contains possible inaccuracies, both in the source contours and the interpolation process.

• Groundwater levels fluctuate. A nominal groundwater level is used in the model, which may not accurately represent the level the day the field data was obtained.

• Not all facility settings are captured by SCADA data. One example is a closed isolation valve that is normally open.

- Limitation in the model software to represent exact field conditions i.e. automatic settings, etc..

Pipeline Roughness Coefficients

Calibration of the model is achieved by adjusting the roughness coefficients of the pipeline elements to match the pressures recorded in the field data. The InfoWater Calibrator tool is utilized to iteratively adjust pipeline roughness coefficients to optimize the model to reflect the field data. Each pressure zone is calibrated individually. Each pipeline element is assigned to a pipeline group that is categorized by pipeline material. The Calibrator tool adjusts the pipeline roughness coefficients by pipeline group.

Figure 3 and show the results of the pipeline roughness coefficient assignments based on the calibration analysis. In general, the roughness coefficient values skew lower than expected. Pipelines with low roughness coefficient values will be evaluated further and discussed with the Department.

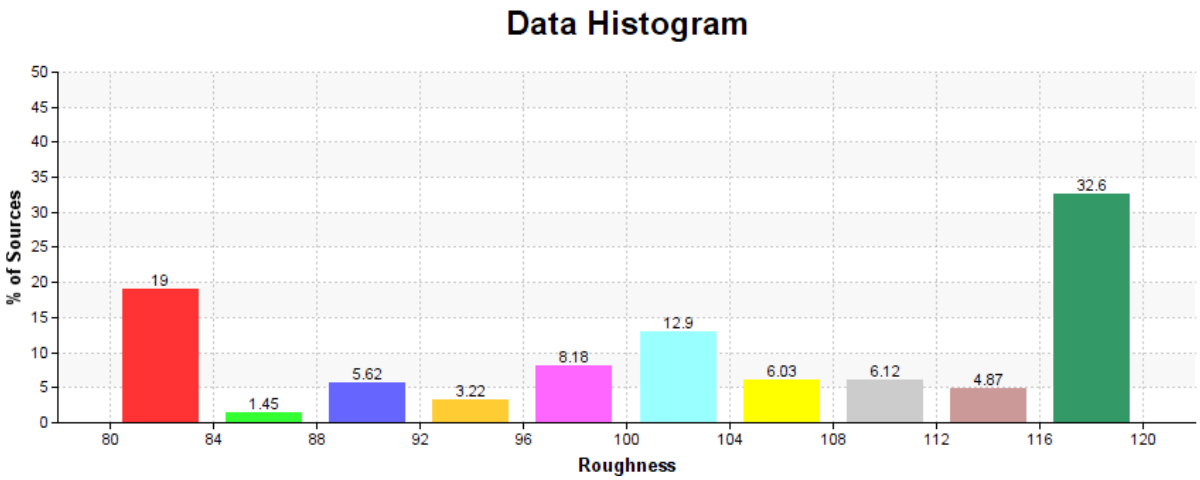


Figure 3: Pipeline Roughness Coefficient Histogram

Section 3: Conclusion

As discussed in this memorandum, good calibration results are produced for most of the pressure zones in the distribution system. We are coordinating with the Department on the pressure zones with poorer calibration results. The final calibration results will be included in the Final Master Plan Report.

Appendix E: Hydraulic Analysis Tables for Pumping and Storage

Existing Conditions Storage Analysis

Pressure Zone	Facility	Elevation (Ft)	Year of Installation	Material	Shape Type	Capacity (Gallons)	MDD (gpm)	Operational Storage (25%)	Emergency Storage (30%)	FF Storage	Storage Surplus/Deficit
Cajon	Cajon	1916	1982	Steel	Cylindrical	5,000,000	1,564	563,212	675,854	480,000	3,280,934
College/Palm	Palm 1	1720	1980	Steel	Cylindrical	325,000					
	Palm 2	1720	1982	Steel	Cylindrical	5,000,000					
	Palm 3	1720	2010	Concrete	Cylindrical	4,000,000					
	College	1720	1964	Steel	Cylindrical	2,580,000	5,081	1,829,327	2,195,192	480,000	7,400,481
Devil Canyon	Devil Canyon	1880	1932	Concrete	Rectangular	220,000					
	Devil Canyon Domestic	1880	-	Steel	Cylindrical	10,000	0	0	0	180,000	50,000
Daley	Daley Canyon	1775	1972	Concrete	Rectangular	1,500,000	197	70,863	85,036	300,000	1,044,101
Del Rosa	Del Rosa 1	1513	1956	Steel	Cylindrical	460,000					
	Del Rosa 2	1513	1957	Steel	Cylindrical	190,000					
	Del Rosa 3	1513	1982	Steel	Cylindrical	3,000,000	1,118	402,418	482,901	480,000	2,284,681
Devore/Meyers	Devore	2100	1982	Steel	Cylindrical	2,000,000					
	Meyers Canyon	2100	1992	Steel	Cylindrical	2,000,000	1,057	380,642	456,771	480,000	2,682,587
Intermediate	17th and Sierra Way Forebay	1311	1938	Concrete	Rectangular	108,500					
	Perris Hill	1311	1962	Concrete	Rectangular	10,000,000					
	27th and Acacia Forebay	1311	1956	Concrete	Rectangular	247,000	3,145	1,132,057	1,358,468	480,000	7,384,975
IVDA	IVDA Elevated	1294	1958	Steel	Spherical	250,000	84	30,089	36,107	300,000	-116,196
Lower	Mills and D Street	1000-1249	1934	Concrete	Rectangular	437,000					
	Antil	1053	1953	Concrete	Rectangular	258,000					
	Lytle Creek 1	1000-1249	1903	Concrete	Rectangular	3,500,000					
	Lytle Creek 2	1000-1249	1957	Concrete	Rectangular	7,500,000					
	7th Street	1000-1249	1965	Concrete	Cylindrical	101,000					
	17th and Sierra Way	1000-1249	1948	Concrete	Rectangular	108,500					
	Waterman	1000-1249	1948	Concrete	Rectangular	10,000,000					
	Medical Center Reservoir	1000-1249	2006	Concrete	Cylindrical	12,000,000	13,878	4,995,916	5,995,099	480,000	22,433,486
Mountain	Mountain 2	1633	1952	Concrete	Cylindrical	233,000					
	Mountain 3	1633	1964	Steel	Cylindrical	2,000,000	1,564	563,183	675,820	300,000	693,997
RidgeView	Ridgeview	1736	1963	Steel	Cylindrical	330,000	74	26,800	32,160	180,000	91,040
Ridgeline	Ridgeline	1751-52	1990	Steel	Cylindrical	100,000					
	Ridgeline Hydro	1751-52	1990	Steel	Cylindrical	2,000	85	30,663	36,796	180,000	-145,459
Shandin Hills	Shandin Hills	1612	1933	Concrete	Rectangular	219,000	43	15,483	18,579	180,000	4,938
Sycamore	Sycamore 1	1580	1959	Steel	Cylindrical	2,500,000					
	Sycamore 2	1580	1965	Steel	Cylindrical	448,000					
	Sycamore 3	1580	1985	Steel	Cylindrical	6,000,000	1,694	609,822	731,786	480,000	7,126,392
Terrace	Terrace 2	1312	1955	Steel	Cylindrical	1,160,000					
	Terrace 3	1312	1958	Steel	Cylindrical	1,285,000	2,733	983,723	1,180,467	300,000	-19,190
Upper	Newmark 2	1416	1955	Concrete	Rectangular	7,500,000					
	Newmark 3	1416	1963	Concrete	Rectangular	5,500,000					
	Newmark 4	1416	1968	Concrete	Rectangular	8,900,000					
	Ogden	1416	2013	Concrete	Cylindrical	12,000,000					
	Electric Dr.	1416	1937	Concrete	Rectangular	8,000,000					
	Lynwood	1416	1955	Concrete	Cylindrical	233,000					
	Mallory	1416	1959	Steel	Cylindrical	169,000					
	19th St.	1416	1952	Concrete	Rectangular	258,000	9,328	3,357,954	4,029,545	480,000	34,692,502

Future Conditions Storage Analysis

Pressure Zone	Facility	Elevation (Ft)	Year of Installation	Material	Shape Type	Capacity (Gallons)	MDD (gpm)	Operational Storage (25%)	Emergency Storage (30%)	FF Storage	Storage Surplus/Deficit
Cajon	Cajon	1916	1982	Steel	Cylindrical	5,000,000	2,946	1,060,467	1,272,560	480,000	2,186,973
College/Palm	Palm 1	1720	1980	Steel	Cylindrical	325,000					
	Palm 2	1720	1982	Steel	Cylindrical	5,000,000					
	Palm 3	1720	2010	Concrete	Cylindrical	4,000,000					
	College	1720	1964	Steel	Cylindrical	2,580,000	9,230	3,322,937	3,987,524	480,000	4,114,539
Devil Canyon	Devil Canyon	1880	1932	Concrete	Rectangular	220,000					
	Devil Canyon Domestic	1880	-	Steel	Cylindrical	10,000	0	0	0	180,000	50,000
Daley	Daley Canyon	1775	1972	Concrete	Rectangular	1,500,000	550	198,064	237,676	300,000	764,260
Del Rosa	Del Rosa 1	1513	1956	Steel	Cylindrical	460,000					
	Del Rosa 2	1513	1957	Steel	Cylindrical	190,000					
	Del Rosa 3	1513	1982	Steel	Cylindrical	3,000,000	1,394	501,829	602,195	480,000	2,065,976
Devore/Meyers	Devore	2100	1982	Steel	Cylindrical	2,000,000					
	Meyers Canyon	2100	1992	Steel	Cylindrical	2,000,000	4,386	1,578,922	1,894,706	480,000	46,372
Intermediate	17th and Sierra Way Forebay	1311	1938	Concrete	Rectangular	108,500					
	Perris Hill	1311	1962	Concrete	Rectangular	10,000,000					
	27th and Acacia Forebay	1311	1956	Concrete	Rectangular	247,000	3,929	1,414,353	1,697,224	480,000	6,763,923
IVDA	IVDA Elevated	1294	1958	Steel	Spherical	250,000	84	30,151	36,181	300,000	-116,332
Lower	Mills and D Street	1000-1249	1934	Concrete	Rectangular	437,000					
	Antil	1053	1953	Concrete	Rectangular	258,000					
	Lytle Creek 1	1000-1249	1903	Concrete	Rectangular	3,500,000					
	Lytle Creek 2	1000-1249	1957	Concrete	Rectangular	7,500,000					
	7th Street	1000-1249	1965	Concrete	Cylindrical	101,000					
	17th and Sierra Way	1000-1249	1948	Concrete	Rectangular	108,500					
	Waterman	1000-1249	1948	Concrete	Rectangular	10,000,000					
	Medical Center Reservoir	1000-1249	2006	Concrete	Cylindrical	12,000,000	26,222	9,439,852	11,327,822	480,000	12,656,826
Mountain	Mountain 2	1633	1952	Concrete	Cylindrical	233,000					
	Mountain 3	1633	1964	Steel	Cylindrical	2,000,000	2,738	985,850	1,183,021	300,000	-235,871
RidgeView	Ridgeview	1736	1963	Steel	Cylindrical	330,000	157	56,546	67,855	180,000	25,600
Ridgeline	Ridgeline	1751-52	1990	Steel	Cylindrical	100,000					
	Ridgeline Hydro	1751-52	1990	Steel	Cylindrical	2,000	183	65,794	78,953	180,000	-222,748
Shandin Hills	Shandin Hills	1612	1933	Concrete	Rectangular	219,000	178	64,059	76,871	180,000	-101,930
Sycamore	Sycamore 1	1580	1959	Steel	Cylindrical	2,500,000					
	Sycamore 2	1580	1965	Steel	Cylindrical	448,000					
	Sycamore 3	1580	1985	Steel	Cylindrical	6,000,000	3,871	1,393,691	1,672,429	480,000	5,401,880
Terrace	Terrace 2	1312	1955	Steel	Cylindrical	1,160,000					
	Terrace 3	1312	1958	Steel	Cylindrical	1,285,000	4,850	1,746,077	2,095,292	300,000	-1,696,369
Upper	Newmark 2	1416	1955	Concrete	Rectangular	7,500,000					
	Newmark 3	1416	1963	Concrete	Rectangular	5,500,000					
	Newmark 4	1416	1968	Concrete	Rectangular	8,900,000					
	Ogden	1416	2013	Concrete	Cylindrical	12,000,000					
	Electric Dr.	1416	1937	Concrete	Rectangular	8,000,000					
	Lynwood	1416	1955	Concrete	Cylindrical	233,000					
	Mallory	1416	1959	Steel	Cylindrical	169,000					
	19th St.	1416	1952	Concrete	Rectangular	258,000	12,023	4,328,106	5,193,727	480,000	32,558,166

Existing Conditions Pumping Analysis

Existing Pumping Analysis								
					Existing Pumping Capacity			
Discharge Zone	Zone Located In/From	Booster Pumping Station	HP	Design Flow GPM	Total (mgd)	Firm (mgd)	Required Firm Pumping Capacity (mgd)	Additional Firm Capacity Needed (mgd)
IVDA (1294)	IVDA (1294)	**IDVA Upper Booster 1**	75	2200	3.17	3.17		
IVDA (1294)	IVDA (1294)	**IDVA Upper Booster 2**	75	2200	3.17	0.00		
Zone IVDA (1294) Total						**3.17**	**0.12**	**0.00**
Mountain Sub-Zone A (1668)	Mountain (1663)	Sepulveda Booster 1	15	700	1.01	1.01		
Mountain Sub-Zone A (1668)	Mountain (1663)	Sepulveda Booster 2	15	700	1.01	0.00		
Mountain Sub-Zone (1668) Total						**1.01**	**0.08**	**0.00**
Mountain Sub-Zone B (1693)	Mountain (1663)	Hill Drive 1	15	350	0.50	0.50		
Mountain Sub-Zone B (1693)	Mountain (1663)	Hill Drive 2	15	350	0.50	0.00		
Mountain Sub-Zone (1693) Total						**0.50**	**0.04**	**0.00**
Mountain (1663)	1416	Mountain Booster 1	60	700	1.01	1.01		
Mountain (1663)	1416	Mountain Booster 2	60	650	0.94	0.94		
Mountain (1663)	1416	Mountain Booster 3	150	1500	2.16	0.00		
Mountain (1663) Total						**1.94**	**2.25**	**0.31**
Devil's Canyon Domestic (2000)	Devil's Canyon (1880)	DC Domestic Booster 1	15	150	0.22	0.22		
Devil's Canyon Domestic (2000)	Devil's Canyon (1880)	DC Domestic Booster 2	20	150	0.22	0.00		
Devils Canyon Domestic (2000) Total						**0.22**		**0.00**
Shandin Hills (1612)	Upper (1416)	Shandin Hill booster 1	25	300	0.43	0.43		
Shandin Hills (1612)	Upper (1416)	Shandin Hill booster 2	25	300	0.43	0.00		
Shandin Hill (1612) Total						**0.43**	**0.06**	**0.00**
College/Palm (1720)	Sycamore 1580	College Booster 4	75	1100	1.58	1.58		
College/Palm (1720)	Sycamore 1580	College Booster 5	75	1100	1.58	1.58		
College/Palm (1720)	Upper (1416)	Ogden Booster 1	250	4075	5.87	5.87		
College/Palm (1720)	Upper (1416)	Ogden Booster 2	250	4075	5.87	5.87		
College/Palm (1720)	Upper (1416)	Ogden Booster 3	250	4075	5.87	0.00		
College/Palm (1720)	Sycamore 1580	College Booster 1	150	2200	3.17	3.17		
College/Palm (1720)	Sycamore 1580	College Booster 2	100	3100	4.46	4.46		
College/Palm (1720)	Sycamore 1580	College Booster 3	200	2750	3.96	3.96		
College/Palm (1720) Total						**26.50**	**7.32**	**0.00**
Ridgeview (1736)	Del Rosa (1513)	Ridgeview Booster 2	40	450	0.65	0.00		
Ridgeview (1736)	Del Rosa (1513)	Ridgeview Booster 2	20	240	0.35	0.35		
Ridgeview (1736)	Del Rosa (1513)	Ridgeview Booster 3	15	183	0.26	0.26		
Ridgeview (1736) Total						**0.61**	**0.11**	**0.00**
Ridgeline (1751)	Sycamore 1580	Ridgeline Lower Booster 1	50	600	0.86	0.86		
Ridgeline (1751)	Sycamore 1580	Ridgeline Lower Booster 2	50	600	0.86	0.00		
Ridgeline (1751) Total						**0.86**	**0.12**	**0.00**
Terrace (1312)	Terrace (1312)	Terrace booster 3	75	1475	2.12	2.12		
Terrace (1312)	Terrace (1312)	Terrace booster 4	75	1500	2.16	2.16		
Terrace (1312)	Lower (1249)	Terrace booster 1	75	1750	2.52	2.52		
Terrace (1312)	Lower (1249)	Terrace booster 2	40	1800	2.59	0.00		
Terrace(1312) Total						**6.80**	**3.93**	**0.00**
Del Rosa (1513)	Mountain (1663)	Del Rosa Booster 1	60	1200	1.73	1.73		
Del Rosa (1513)	Mountain (1663)	Del Rosa Booster 2	60	1700	2.45	0.00		
Del Rosa (1513)	Mountain (1663)	Del Rosa Booster 4	60	1300	1.87	1.87		
Del Rosa (1513) Total						**3.60**	**2.00**	**0.00**

Existing Conditions Pumping Analysis

Existing Pumping Analysis								
					Existing Pumping Capacity			
Discharge Zone	Zone Located In/From	Booster Pumping Station	HP	Design Flow GPM	Total (mgd)	Firm (mgd)	Required Firm Pumping Capacity (mgd)	Additional Firm Capacity Needed (mgd)
Daley (1775)	Del Rosa (1513)	Daley Booster 1	60	500	0.72	0.72		
Daley (1775)	Del Rosa (1513)	Daley Booster 2	50	500	0.72	0.00		
Daley (1775) Total						**0.72**	**0.28**	**0.00**
Intermediate (1311)	17th and Sierra Way Forebay	16th Street Booster	125	2300	3.31	0.00		
Intermediate (1311)	27th and Acacia Forebay	27th Street Booster	75	1300	1.87	1.87		
Intermediate (1311) Total						**1.87**	**4.53**	**2.66**
Lower (1249)	17th and Sierra Way Forebay	17th Street and Sierra Booster	25	2100	3.02	0.00		
Lower (1249)	Lower (1249)	Mill & D Street Booster	100	700	1.01	1.01		
Lower (1249) Total						**1.01**	**19.98**	**18.98**
Upper (1416)	Lower (1249)	Baseline and California Booster	150	1695	2.44	2.44		
Upper (1416)	Upper (1416)	Lynwood	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	19th Street 1	150	2350	3.38	3.38		
Upper (1416)	Upper (1416)	19th Street 2	100	1400	2.02	2.02		
Upper (1416)	Upper (1416)	19th Street 3	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	19th Street 4	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	19th Street 5	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	Mallory 1	15	500	0.72	0.72		
Upper (1416)	Upper (1416)	Mallory 2	15	500	0.72	0.72		
Upper (1416)	Lower (1249)	Medical Center 1	250	4075	5.87	0.00		
Upper (1416)	Lower (1249)	Medical Center 2	250	4075	5.87	5.87		
Upper (1416)	Upper (1416)	Waterman Booster 1	125	2000	2.88	2.88		
Upper (1416)	Upper (1416)	Waterman Booster 2	150	2767	3.98	3.98		
Upper (1416)	Upper (1416)	Waterman Booster 3	125	2227	3.21	3.21		
Upper (1416)	Upper (1416)	Waterman Booster 4	125	2000	2.88	2.88		
Upper (1416) Total						**42.50**	**13.43**	**0.00**
Cajon (1916)	College/Palm (1720)	Cajon Booster 2	300	3500	5.04	5.04		
Cajon (1916)	College/Palm (1720)	Cajon Booster 3	300	3500	5.04	5.04		
Cajon (1916)	College/Palm (1720)	Cajon Booster 4	300	3500	5.04	5.04		
Cajon (1916)	College/Palm (1720)	Cajon Booster 5	300	3500	5.04	0.00		
Cajon (1916) Total						**15.12**	**2.25**	**0.00**
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 3	200	2500	3.60	3.60		
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 4	200	2500	3.60	3.60		
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 5	200	2500	3.60	3.60		
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 6	200	2500	3.60	0.00		
Devore/Meyers (2100) Total						**10.80**	**1.34**	**0.00**
Devore/Meyers Subzone (2300)	Devore/Meyers (2100)	Melvin Booster 1	7.5	90	0.13	0.13		
Devore/Meyers Subzone (2300)	Devore/Meyers (2100)	Melvin Booster 2	7.5	90	0.13	0.13		
Devore/Meyers Subzone (2300)	Devore/Meyers (2100)	Melvin Booster 3	7.5	90	0.13	0.13		
Devore/Meyers Subzone (2300) Total						**0.39**	**0.09**	**0.00**
Sycamore (1580)	Upper (1416)	Sycamore Booster 1	100	1670	2.40	2.40		
Sycamore (1580)	Upper (1416)	Sycamore Booster 2	125	2000	2.88	2.88		
Sycamore (1580)	Upper (1416)	Sycamore Booster 3	200	2500	3.60	3.60		
Sycamore (1580)	Upper (1416)	Sycamore Booster 4	200	2500	3.60	0.00		
Sycamore (1580) Total						**8.88**	**2.56**	**0.00**

Future Conditions Pumping Analysis

Future Pumping Analysis								
					Existing Pumping Capacity			
Discharge Zone	Zone Located In/From	Booster Pumping Station	HP	Design Flow GPM	Total (mgd)	Firm (mgd)	Required Firm Pumping Capacity (mgd)	Additional Firm Capacity Needed (mgd)
IVDA (1294)	IVDA (1294)	**IDVA Upper Booster 1**	75	2200	3.17	3.17		
IVDA (1294)	IVDA (1294)	**IDVA Upper Booster 2**	75	2200	3.17	0.00		
Zone IVDA (1294) Total						**3.17**	**0.12**	**0.00**
Mountain Sub-Zone A (1668)	Mountain (1663)	Sepulveda Booster 1	15	700	1.01	1.01		
Mountain Sub-Zone A (1668)	Mountain (1663)	Sepulveda Booster 2	15	700	1.01	0.00		
Mountain Sub-Zone (1668) Total						**1.01**	**0.21**	**0.00**
Mountain Sub-Zone B (1693)	Mountain (1663)	Hill Drive 1	15	350	0.50	0.50		
Mountain Sub-Zone B (1693)	Mountain (1663)	Hill Drive 2	15	350	0.50	0.00		
Mountain Sub-Zone (1668) Total						**0.50**	**0.06**	**0.00**
Mountain (1663)	1416	Mountain Booster 1	60	700	1.01	1.01		
Mountain (1663)	1416	Mountain Booster 2	60	650	0.94	0.94		
Mountain (1663)	1416	Mountain Booster 3	150	1500	2.16	0.00		
Mountain (1663) Total						**1.94**	**3.94**	**2.00**
Devil's Canyon Domestic (2000)	Devil's Canyon (1880)	DC Domestic Booster 1	15	150	0.22	0.22		
Devil's Canyon Domestic (2000)	Devil's Canyon (1880)	DC Domestic Booster 2	20	150	0.22	0.00		
Devils Canyon Domestic (2000) Total						**0.22**		**0.00**
Shandin Hills (1612)	Upper (1416)	Shandin Hill booster 1	25	300	0.43	0.43		
Shandin Hills (1612)	Upper (1416)	Shandin Hill booster 2	25	300	0.43	0.00		
Shandin Hill (1612) Total						**0.43**	**0.26**	**0.00**
College/Palm (1720)	Sycamore 1580	College Booster 4	75	1100	1.58	1.58		
College/Palm (1720)	Sycamore 1580	College Booster 5	75	1100	1.58	1.58		
College/Palm (1720)	Upper (1416)	Ogden Booster 1	250	4075	5.87	5.87		
College/Palm (1720)	Upper (1416)	Ogden Booster 2	250	4075	5.87	5.87		
College/Palm (1720)	Upper (1416)	Ogden Booster 3	250	4075	5.87	0.00		
College/Palm (1720)	Sycamore 1580	College Booster 1	150	2200	3.17	3.17		
College/Palm (1720)	Sycamore 1580	College Booster 2	100	3100	4.46	4.46		
College/Palm (1720)	Sycamore 1580	College Booster 3	200	2750	3.96	3.96		
College/Palm (1720) Total						**26.50**	**13.29**	**0.00**
Ridgeview (1736)	Del Rosa (1513)	Ridgeview Booster 1	40	450	0.65	0.00		
Ridgeview (1736)	Del Rosa (1513)	Ridgeview Booster 2	20	240	0.35	0.35		
Ridgeview (1736)	Del Rosa (1513)	Ridgeview Booster 3	15	183	0.26	0.26		
Ridgeview (1736) Total						**0.61**	**0.23**	**0.00**
Ridgeline (1751)	Sycamore 1580	Ridgeline Lower Booster 1	50	600	0.86	0.86		
Ridgeline (1751)	Sycamore 1580	Ridgeline Lower Booster 2	50	600	0.86	0.00		
Ridgeline (1751) Total						**0.86**	**0.26**	**0.00**
Terrace (1312)	Terrace (1312)	Terrace booster 3	75	1475	2.12	2.12		
Terrace (1312)	Terrace (1312)	Terrace booster 4	75	1500	2.16	2.16		
Terrace (1312)	Lower (1249)	Terrace booster 1	75	1750	2.52	2.52		
Terrace (1312)	Lower (1249)	Terrace booster 2	40	1800	2.59	0.00		
Terrace(1312) Total						**6.80**	**6.98**	**0.18**
Del Rosa (1513)	Mountain (1663)	Del Rosa Booster 1	60	1200	1.73	1.73		
Del Rosa (1513)	Mountain (1663)	Del Rosa Booster 2	60	1700	2.45	0.00		
Del Rosa (1513)	Mountain (1663)	Del Rosa Booster 4	60	1300	1.87	1.87		
Del Rosa (1513) Total						**3.60**	**3.03**	**0.00**

Future Conditions Pumping Analysis

Future Pumping Analysis								
					Existing Pumping Capacity			
Discharge Zone	Zone Located In/From	Booster Pumping Station	HP	Design Flow GPM	Total (mgd)	Firm (mgd)	Required Firm Pumping Capacity (mgd)	Additional Firm Capacity Needed (mgd)
Daley (1775)	Del Rosa (1513)	Daley Booster 1	60	500	0.72	0.72		
Daley (1775)	Del Rosa (1513)	Daley Booster 2	50	500	0.72	0.00		
Daley (1775) Total						**0.72**	**0.79**	**0.07**
Intermediate (1311)	17th and Sierra Way Forebay	16th Street Booster	125	2300	3.31	0.00		
Intermediate (1311)	27th and Acacia Forebay	27th Street Booster	75	1300	1.87	1.87		
Intermediate (1311) Total						**1.87**	**5.66**	**3.79**
Lower (1249)	17th and Sierra Way Forebay	17th Street and Sierra Booster	25	2100	3.02	0.00		
Lower (1249)	Lower (1249)	Mill & D Street Booster	100	700	1.01	1.01		
Lower (1249) Total						**1.01**	**37.76**	**36.75**
Upper (1416)	Lower (1249)	Baseline and California Booster	150	1695	2.44	2.44		
Upper (1416)	Upper (1416)	Lynwood	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	19th Street 1	150	2350	3.38	3.38		
Upper (1416)	Upper (1416)	19th Street 2	100	1400	2.02	2.02		
Upper (1416)	Upper (1416)	19th Street 3	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	19th Street 4	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	19th Street 5	200	2500	3.60	3.60		
Upper (1416)	Upper (1416)	Mallory 1	15	500	0.72	0.72		
Upper (1416)	Upper (1416)	Mallory 2	15	500	0.72	0.72		
Upper (1416)	Lower (1249)	Medical Center 1	250	4075	5.87	0.00		
Upper (1416)	Lower (1249)	Medical Center 2	250	4075	5.87	5.87		
Upper (1416)	Upper (1416)	Waterman Booster 1	125	2000	2.88	2.88		
Upper (1416)	Upper (1416)	Waterman Booster 2	150	2767	3.98	3.98		
Upper (1416)	Upper (1416)	Waterman Booster 3	125	2227	3.21	3.21		
Upper (1416)	Upper (1416)	Waterman Booster 4	125	2000	2.88	2.88		
Upper (1416) Total						**42.50**	**17.31**	**0.00**
Cajon (1916)	College/Palm (1720)	Cajon Booster 2	300	3500	5.04	5.04		
Cajon (1916)	College/Palm (1720)	Cajon Booster 3	300	3500	5.04	5.04		
Cajon (1916)	College/Palm (1720)	Cajon Booster 4	300	3500	5.04	5.04		
Cajon (1916)	College/Palm (1720)	Cajon Booster 5	300	3500	5.04	0.00		
Cajon (1916) Total						**15.12**	**4.24**	**0.00**
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 3	200	2500	3.60	3.60		
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 4	200	2500	3.60	3.60		
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 5	200	2500	3.60	3.60		
Devore/Meyers (2100)	Cajon (1917)	Meyers Booster 6	200	2500	3.60	0.00		
Devore/Meyers (2100) Total						**10.80**	**4.00**	**0.00**
Devore/Meyers Subzone (2300)	Devore/Meyers (2100)	Melvin Booster 1	7.5	90	0.13	0.13		
Devore/Meyers Subzone (2300)	Devore/Meyers (2100)	Melvin Booster 2	7.5	90	0.13	0.13		
Devore/Meyers Subzone (2300)	Devore/Meyers (2100)	Melvin Booster 3	7.5	90	0.13	0.13		
Devore/Meyers Subzone (2300) Total						**0.39**	**0.52**	**0.00**
Sycamore (1580)	Upper (1416)	Sycamore Booster 1	100	1670	2.40	2.40		
Sycamore (1580)	Upper (1416)	Sycamore Booster 2	125	2000	2.88	2.88		
Sycamore (1580)	Upper (1416)	Sycamore Booster 3	200	2500	3.60	3.60		
Sycamore (1580)	Upper (1416)	Sycamore Booster 4	200	2500	3.60	0.00		
Sycamore (1580) Total						**8.88**	**5.84**	**0.00**

Appendix F: Department 5-Year CIP

Table WF 1.1

Capital Improvement Program

City of San Bernardino Municipal Water Department - Water Utility Division Projects

Summary of Budget Requirements - 5 Year Look Ahead

PROJECT NO.	PROJECT TITLE	Estimated Cumm Cost To-Date**	Current Year 2014/15	FY 1 Projected 2015/16	FY 2 Projected 2016/17	FY 3 Projected 2017/18	FY 4 Projected 2018/19	FY 5 Projected 2019/20	FY 6 Projected 2020/21	FY 1-6 Total
	REPLACEMENT/REHABILITATION ASSETS									
1	Annual Well R/R	0	435,000	500,000	500,000	500,000	500,000	500,000	0	2,500,000
2	Annual Well R/R - Geothermal	0	0	90,000	0	90,000	0	90,000	0	270,000
3	19th Street Well No. 1 Replacement	0	0	0	150,000	1,000,000	0	0	0	1,150,000
4	Annual R/R - Booster Pumps	0	120,000	120,000	120,000	120,000	120,000	120,000	0	600,000
5	Annual R/R - ACV Rehabilitation	0	57,000	30,000	30,000	30,000	30,000	30,000	0	150,000
6	Annual R/R - SCADA & Metering to Non-Metered Pumps/ACV's	0	28,000	28,000	28,000	28,000	28,000	28,000	0	140,000
7	Production Well Replacement	0	0	0	0	1,400,000	0	1,400,000	0	2,800,000
8	Mountain Zone Pump Station Upgrade	0	0	0	165,000	2,000,000	0	0	0	2,165,000
9	Sycamore Pump Station Upgrade	0	0	0	0	110,000	1,000,000	0	0	1,110,000
10	Bond Street ACV Rehabilitation	0	0	140,000	0	0	0	0	0	140,000
11	Reservoir Seismic Upgrades*	555,000	0	1,500,000	5,000,000	0	5,000,000	0	0	11,500,000
12	Electric Drive Reservoir Roof Replacement	0	0	110,000	1,000,000	0	0	0	0	1,110,000
13	Lower Zone 2012 Pipeline Replacement*	85,000	0	1,500,000	0	0	0	0	0	1,500,000
14	System Wide Pipeline Replacements Project	2,867,200	~~2,867,200~~	0	0	0	0	0	0	0
15	I-210 Main Replacement*	60,000	0	0	1,000,000	0	0	0	0	1,000,000
16	Belleview and Vine Streets Alley Main Replacement*	42,000	0	0	0	600,000	0	0	0	600,000
17	Sheridan Road Main Replacement*	45,000	0	850,000	0	0	0	0	0	850,000
18	Shandin Hills Transmission Main Replacement*	0	0	335,000	0	0	0	0	0	335,000
19	Irvington Ave Transmission Main Replacement	302,000	~~330,000~~	0	0	0	0	0	0	0
20	I-215/Devore Interchange Transmission Main Replacement	1,200,000	1,115,000	0	0	0	0	0	0	0
21	Kenwood Well Field 20" Transmission Main Extension*	46,000	0	350,000	0	0	0	0	0	350,000
22	Upper Zone Replacements - Meridian Ave 16" Main Replacement*	45,000	0	0	880,000	0	0	0	0	880,000
23	Annual R/R - Pipeline Miscellaneous Projects	0	200,000	200,000	200,000	200,000	200,000	200,000	0	1,000,000
24	Wier and Tungsten Main Replacements	0	280,000	0	0	0	0	0	0	0
25	Mountain Pressure Zone Main Replacements Phase 2	0	85,000	0	0	500,000	0	0	0	500,000
26	Upper Zone Replacements - Mallory, Shandin Hills Area Main Replacements	0	0	0	150,000	0	1,650,000	0	0	1,800,000
27	Future Master Plan Pipeline Replacements	0	0	0	250,000	1,250,000	1,250,000	2,500,000	0	5,250,000
28	Fremontia Main Replacement*	0	0	0	225,000	0	0	0	0	225,000
29	Waterman Ave 20" Transmission Main Replacement*	0	0	0	150,000	0	0	0	0	150,000
30	Highland Avenue Main Replacement*	0	0	225,000	0	0	0	0	0	225,000
31	Water Quality Sample Stands Replacement Phase III	164,000	~~175,000~~	0	0	0	0	0	0	0
32	Annual R/R - Large Meter Vault Lid Replacement	0	168,000	168,000	168,000	168,000	168,000	168,000	0	840,000
33	Annual R/R - Water Meter Capital	0	333,000	333,000	333,000	333,000	333,000	333,000	0	1,665,000
34	Annual R/R - System Valve Replacement	0	350,000	350,000	350,000	350,000	350,000	350,000	0	1,750,000
35	Annual R/R - Fire Hydrant Replacement	0	86,000	86,000	86,000	86,000	86,000	86,000	0	430,000
36	Annual R/R - City Backflow Device	0	57,000	57,000	57,000	57,000	57,000	57,000	0	285,000
37	Waterman Plant Aerator Tower Packing Material Replacement	324,000	~~335,000~~	0	0	0	0	0	0	0
38	Annual R/R - System Wide Electrical Panel Upgrades	0	85,000	85,000	0	0	0	0	0	85,000
39	Annual R/R - Plant Valve Replacement	0	169,000	175,000	175,000	175,000	175,000	175,000	0	875,000
40	Irvington Ave 16" Main Replacement (Pine Ave to Little League)	0	0	0	150,000	2,350,000			0	2,500,000
41	Meyers Road 20" Main Replacement (Little League to End of Meyers)						350,000	1,400,000		1,750,000
	REPLACEMENT/REHABILITATION ASSETS SUBTOTAL	**5,735,200**	**7,275,200**	**7,232,000**	**11,167,000**	**11,347,000**	**11,297,000**	**7,437,000**	**0**	**48,480,000**

PROJECT NO.	PROJECT TITLE	Estimated Cumm Cost To-Date**	Current Year 2014/15	FY 1 Projected 2015/16	FY 2 Projected 2016/17	FY 3 Projected 2017/18	FY 4 Projected 2018/19	FY 5 Projected 2019/20	FY 6 Projected 2020/21	FY 1-6 Total
	NEW SYSTEM ASSETS									
42	DC-8 Production Well	0	0	0	0	0	150,000	1,400,000	0	1,550,000
43	1720 Zone East 1 MG Reservoir	0	150,000	0	1,500,000	0	0	0	0	1,500,000
44	Mountain Zone 2 MG Reservoir	0	0	0	150,000	0	3,000,000	0	0	3,150,000
45	Mountain View 12" Water Main Extension @Mission Creek	5,000	479,000	0	0	0	0	0	0	0
46	Mountain Zone 12" Transmission Main*	84,000	0	650,000	0	0	0	0	0	650,000
47	1720 Zone East 16" Transmission Main	0	130,000	0	750,000	0	0	0	0	750,000
48	Intermediate Zone 24" Transmission Main	0	250,000	0	3,000,000	0	0	0	0	3,000,000
49	Water System Geographical Information Systems (GIS) Upgrades	0	100,000	120,000	120,000	120,000	120,000	120,000	0	600,000
50	397 Chandler Place Improvements	391,000	425,000	0	0	0	0	0	0	0
51	SBMWD Administration Facility - Chandler Place ****	0	0	0	500,000	3,500,000	3,500,000	0	0	7,500,000
52	Meyers Road 20" Transmission Main Replacement	0	0	0	750,000	0	0	0	0	750,000
53	2300 Zone Pump Station***	0	0	0	0	1,800,000	0	0	0	1,800,000
54	2300 Zone 20" Transmission Main (Offsite - Verdemont & Magnolia)***	0	0	0	1,645,000	0	0	0	0	1,645,000
55	2300 Zone 2.0 MG Reservoir (Reservoir No. 1)***	0	0	0	0	2,500,000	0	0	0	2,500,000
56	Annual R/R - Water System Security Upgrades	1,200	100,000	100,000	100,000	100,000	100,000	100,000	0	500,000
57	Annual R/R - WU Plants Electrical Reconfig for Generators	0	0	50,000	0	0	0	0	0	50,000
58	Annual R/R - Plant Site Improvements	0	50,000	100,000	100,000	100,000	100,000	100,000	0	500,000
59	Annual R/R - SCADA and Telemetry Upgrades	0	75,000	75,000	75,000	75,000	75,000	75,000	0	375,000
60	Materials Storage Bins - B. Warren Cocke Plant	0	0	250,000	0	0	0	0	0	250,000
61	Waterman Turnout Hydroelectric Facility*****	0	0	200,000	1,850,000	0	0	0	0	2,050,000
	NEW SYSTEM ASSETS SUBTOTAL	**481,200**	**1,759,000**	**1,545,000**	**10,540,000**	**8,195,000**	**7,045,000**	**1,795,000**	**0**	**29,120,000**
	NEW SYSTEM ASSETS - OTHER FUNDING SOURCES									
62	Enhancement of the San Bernardino Basin Area Groundwater Flow Model	565,000	1,470,000	0	0	0	0	0	0	0
63	Cal-Trans I-10 at Tippecanoe Water Facility Relocations	307,000	348,300	0	0	0	0	0	0	0
64	Downtown San Bernardino Passenger Rail Project	3,000	253,000	200,000	0	0	0	0	0	200,000
65	SB County General Aviation Project Water Infrastructure	184,000	450,000	150,000	0	0	0	0	0	150,000
66	Unplanned Public Works	27,000	100,000	100,000	100,000	100,000	100,000	100,000	0	500,000
67	Muscoy - EPA #109 Shallow Well	0	100,000	1,500,000	0	0	0	0	0	1,500,000
68	Muscoy - EPA #112 Shallow Well	0	125,000	0	1,250,000	0	0	0	0	1,250,000
69	Annual R/R - EPA Extraction Wells (Newmark)	0	450,000	450,000	300,000	300,000	300,000	300,000	0	1,650,000
70	Annual R/R - EPA Extraction Wells (Muscoy)	0	200,000	200,000	300,000	300,000	300,000	300,000	0	1,400,000
71	Annual R/R - EPA Monitoring Wells (Site Wide)	0	100,000	100,000	100,000	100,000	100,000	100,000	0	500,000
72	Annual R/R - EPA Treatment Plant Vessels and Plant Piping/Valves	0	100,000	200,000	200,000	200,000	200,000	200,000	0	1,000,000
73	Downtown San Bernardino Passenger Rail Project - SB to Redlands	0	0	200,000	350,000	0	0	0	0	550,000
	NEW SYSTEM ASSETS OTHER FUNDING SOURCES SUBTOTAL	**1,086,000**	**3,696,300**	**3,100,000**	**2,600,000**	**1,000,000**	**1,000,000**	**1,000,000**	**0**	**8,700,000**
	VERDEMONT PHASE 2 WATER INFRASTRUCTURE - DEVELOPER FUNDED									
73	2300 Zone 2.0 MG Reservoir (Reservoir No. 2)	0	0	0	0	1,600,000	0	0	0	1,600,000
74	2500 Zone Pump Station	0	0	0	0	1,600,000	0	0	0	1,600,000
75	2500 Zone 20" Transmission Main	0	0	0	0	700,000	0	0	0	700,000
76	2500 Zone 0.5 MG Reservoir	0	0	0	0	1,000,000	0	0	0	1,000,000
77	2700 Zone Pump Station	0	0	0	0	0	1,600,000	0	0	1,600,000
78	2700 Zone 20" Transmission Main	0	0	0	0	0	300,000	0	0	300,000
79	2700 Zone 0.9 MG Reservoir	0	0	0	0	0	900,000	0	0	900,000
80	3000 Zone Pump Station	0	0	0	0	0	0	1,600,000	0	1,600,000
81	3000 Zone 20" Transmission Main	0	0	0	0	0	0	300,000	0	300,000
82	3000 Zone 0.9 MG Reservoir	0	0	0	0	0	0	900,000	0	900,000
83	2300 to 2100 Meyers Road Pressure Reducing Station	0	0	0	200,000	0	0	0	0	200,000
	VERDEMONT PHASE 2 WATER INFRASTRUCTURE SUBTOTAL	**0**	**0**	**0**	**200,000**	**4,900,000**	**2,800,000**	**2,800,000**	**0**	**10,700,000**
	TOTAL CIP BUDGET	**7,302,400**	**12,730,500**	**11,877,000**	**24,307,000**	**20,542,000**	**19,342,000**	**10,232,000**		**86,300,000**
	Debt Funding								**Debt Funding**	**41,330,000**
	Cash Funding								**Cash**	**36,270,000**
	Other Funding Sources								**Other**	**8,700,000**

** Project design complete and ready for construction.*

*** Estimated costs are based off of latest cost summaries as of 1/2/15.*

**** 2300 Zone cost estimates are TOTAL construction costs and being updated to 2015 levels by Black & Veatch. Developer cost participation agreements will reduce the Departments cost by an estimated $3.0 M.*

Project highlighted in purple are candidates for debt funding

Projects highlighted in orange are to be funded by developer funding (i.e, Spring Trails, if development is approved). Other known developer required and funded projects not shown for clarity - University Hills, Shandin Hills, etc.

Other water projects to be funded by Developers are University Hills, Shandin Hills and additional Verdemont development if it occurs, not shown here for clarity

***** SBMWD Administration Facility will be shared cost 50-50 between Water and Sewer Funds. Cost shown in this budget as debt funded. 50% of the costs shown for Water Fund only. Total Cost including soft costs estimated to be $15M.*

****** Waterman Turnout Hydroelectric Facility will be funded by a low-interest loan from Valley District. Potential terms are 10 year payback with % rate set at the LAIF rate. 10 annual payments with total principal is estimated to be $2.0M (50% cost share with Valley District)*

Table WF 1.0

Capital Improvement Program

City of San Bernardino Municipal Water Department - Water Utility Division Projects

Summary of Budget Requirements - 5 Year Look Ahead

Table WF-1.1 Line No.	Project Description	Estimated 5 Year Total	FY(s)	Project Classification	Project Notes
	Replacement/Rehabilitation of System Assets				
1	**Annual Well Rehablitation Project**- Rehabilitation of groundwater production wells. SBMWD's water source is 100% groundwater.	$ 2,500,000	1, 2, 3, 4, 5	1, 2, 3, 4	Project Description: Project involves either the replacement of groundwater production wells or the rehabiliation of wells as a result of mechanical or electrical equipment failure. It is anticipated that six (6) production wells will need to be rehabilitated during each FY period. Other wells will be rehabilitated if mechanical or electrical failure occurs.
2	**Annual Geothermal Well Rehablitation/Replacement Project**- Rehabilitation of geothermal groundwater production wells. The geothermal wells are not potable and are distributed to commercial and industrial users.	$ 270,000	1, 2, 3, 4, 5	1, 2, 3, 4	Project Description: Project involves either the replacement of groundwater production wells or the rehabiliation of wells as a result of mechanical or electrical equipment failure. It is anticipated that six (6) production wells will need to be rehabilitated during the FY period. The following wells will be rehabilitated to take advantage of SCE rebates for replacing low efficiency equipment: 31st & Mtn View Well, 40th St Well, and Norton 11. Other wells will be rehabilitated if mechanical or electrical failure occurs.
3	**19th Street Well Replacement**	$ 1,150,000	2,3		Project Description: Project involves the replacement of the 19th Street groundwater well.
4	**Annual Booster Pump Rehablitation/Replacement Project**- Rehabilitation of pumping units at various pump stations.	$ 600,000	1, 2, 3, 4, 5	3, 4	Project Description: Project involves either the replacement of groundwater production wells or the rehabiliation of wells as a result of mechanical or electrical equipment failure. It is anticipated that seven (7) booster pumps will need to be rehabilitated during the FY period. The following booster pumps will be rehabilitated due to failure and/or to take advantage of SCE rebates for replacing low efficiency equipment: Quail 1, Mallory 1, Mallory 2, Ridgeline Up 1, Ridgeline Up 2 Shandin Hills 1 and Shandin Hills 2. Other booster pumps will be rehabilitated if mechanical or electrical failure occurs.
5	**Annual Booster Automatic Control Valve (ACV) Rehablitation/Replacement Project**- Rehabilitation of pressure reducing units at various pump stations and distibution locations.	$ 150,000	1, 2, 3, 4, 5	2	Project Description: Project involves either the replacement of automatic control valves (ACV's) or the rehabiliation of automatic control valves as a result of mechanical failure or age. It is anticipated that seven (7) ACV's will need to be rehabilitated during the FY period. The following ACV's will be rehabilitated due to failure and/or past useful design life. Other ACV's will be rehabilitated if failure occurs.
6	**Annual Booster SCADA and Metering to non-metered or SCADA Facilities**- some SBMWD facilities still do not have SCADA or	$ 140,000	1, 2, 3, 4, 5	1, 4	Project Description: Project involves either the installation of SCADA facilities on non-monitored pumps or wells. This allows staff to monitor flow rates remotely via SCADA network and gather real time data.
7	**Production Well Replacement -** SBMWD has 55 groundwater production wells that have 50-75 year design life each.	$ 2,800,000	2, 4	1, 2, 3, 4	Project Description: Project necessary to replace aging wells within SBMWD service area. Many wells are 50+ years old with casings that have failed (out of service) or are near failure. Once casings fail, a new well is required to be drilled/developed and equipped with pump, motor, well seal and column pipe to bring well up to indusry standard. SBMWD estimates that 1 well every 2 years will require replacement in order to maintain compliance with Waterworks Standards required in SWRCB DDW Sanitary Survey.
8	**Mountain Zone Pump Station Upgrad**e - Exisitng pump station's capacity is less than needed and station is beyond its useful design life	$ 2,165,000	2, 4	3, 4	Project Description: Project involves the design of the master-planned replacement pump station located at the Electric Drive 10 MG Reservoir. Currently, the pump station experiences NPSHR problems and impeller changeouts are frequent due to cavitation. Project will replace horizontal split case pumps with vertical turbine pumps and increase pump station capacity by 2,900 gpm as well as upgrade an antiquated pump station
9	**Sycamore Pump Station Upgrad**e - Exisitng pump station's capacity is less than needed	$ 1,110,000	1, 3	3, 4	Project Description: Project involves the design of the master-planned replacement pumps station located at the Newmark Treatment Plant to increase pumping capacity to the Sycamore Pressure Zone (1580). These pumps currently have two large and two small units. Project will replace the two smaller pumping units with larger vertical turbine pumps and increase pump station capacity by 1,600 gpm.

10	**Bond Street ACV Rehabilitatin** - Large pressure reducing valve in deep vault requires autmation and SCADA.	$	140,000	1	4	Project Description: Project involves the rehabilitation of the existing two Cla-Vals as well as equiping the valves with automated solenoids for remote monitoring and control by Operations. Project will also improve accessibility to the Cla-Vals due to their depth in the exisitng vault. Will require the installation of SCE power and SCADA at the site.
11	**Reservoir Seismic Upgrades** - Upgrade select large concrete and steel reservoirs to resist failure in order to maintain water pressure for fire fighting purposes and for domestic water supply following a significant seismic event. California has a 99.7% chance of having a magnitude 6.7 or larger earthquake during the next 30 years. The likelihood of an even more powerful quake of magnitude 7.5 or greater in the next 30 years is 46%. Such a quake is more likely to occur in the southern half of the state (37% chance in 30 years) than in the northern half (15% chance in 30 years).	$	11,500,000	1, 3, 5	1, 2, 4	Project Description: Project involves the seismic retrofiting of the Department's multiple reinforced concrete and welded steel water storage tanks. In 2003, a vulnerability assessment was performed by a consultant that identified deficiences that could lead to catastrophic failure of the reservoirs due to a significant seismic event. Maintaining pressure in the water distribution system is a vital component to responding to the public's needs after a seismic event including fire suppression and drinking water. If reservoirs fail, water system pressure loss is sure to occur prompting boil alerts and significantly decreasing ability to fight structure fires after a seismic event. This project is a planned multi-year project due to the extensive scope and cost. The first phase will include the Department's large reinforced concrete reservoirs - Lytle Creek, Newmark 1, 2 and 3 and Perris Hill. Second and third phase includes more costly retrofits for steel reservoirs: Cajon, Palm, Sycamore, College, Terrace, Ridgeline, Devore, and Del Rosa 3.
12	**Electric Drive Reservoir Roof Replacement** - Replacement of old redwood truss roof system with structural steel roof on 10MG reservoir supporting one of the largest pressure zones in the SBMWD system (Upper Zone)	$	1,110,000	2, 4	2, 4	Project Description: Project involves the replacement of the10 MG Electric Reservoir redwood roof with structural steel. The redwood roof's design life is expired and requires replacement to improve reservoir performance and improve security.
13	**Lower Zone 2012 Pipeline Replacement** - Replacement of various undersized pipeline in the Lower Pressure Zone	$	1,500,000	1	3, 4	Project Description: Project involves the replacement of various small diameter pipelines as a result of leak records research with 8" and 12" diameter ductile iron pipe in various locations within the Lower Pressure Zone.
14	**System Wide Pipeline Replacements Project** - Replacement of undersized, leaking pipelines in various locations throughout service area.	$	-	FY 14/15	3, 4	Project completed in FY 14/15.
15	**I-210 Main Replacement** - Pipelines are located just south of the I-210 in the SBMWD's Upper Pressure Zone and have numerous leak histories.	$	1,000,000	3	1, 3, 4	Project Description: Project involves the replacement of various small diameter pipelines as a result of leak records research with 8" and 12" diameter ductile iron pipe in various locations within the Upper Pressure Zone.
16	**Belleview and Vine Streets Alley Main Replacement** - Old, undersized water mains currently exist in unaccessible alley ways in the City.	$	600,000	4	1, 3, 4	Project Description: Remove and replace 4" water main located in inaccessible alley way and install 8" water main in the street fronting the parcels. Requires relocation of the individual water service meters from back of houses to the front of houses.
17	**Sheridan Road Main Replacement** - Remove and replace various aged pipelines.	$	850,000	1	3, 4	Project Description: Remove and replace aged pipelines that currently require reduced pressures through PRV's. New pipeline will be able to deliver higher water pressure to customers.
18	**Shandin Hills Transmission Main Replacement** - Replace 2" pipeline installed in unaccessible easement in Shandin Hills. Pipeline serves top of Beverly Drive and the pipeline is subject to air locking from time to time.	$	335,000	FY 14/15, 1	3, 4	Project Description: Replacement of 2-inch "transmission main" that is currently running down Shandin Hills. Its location, size and age warrant its replacement. In additon, the new 8-inch main will be tied into the Upper Pressure Zone in an area that is fire sensitive and relatively weak. Future construction of a pressure sustaining station/vault will be required for tie-in to Upper Zone. Possible condemnation of vacant parcels necessary- pushed construction to FY 16/17 as a result.
19	**Irvington Ave Transmission Main Replacement** - Replace old 16" steel main with 16" ductile iron main in location where City PW plans to pave. Requires replacement prior to paving.	$	-	FY 14/15	3, 4	Project completed in FY 14/15.
20	**I-215/Devore Interchange Transmission Main Replacement** - CALTRANS interchange requires relocation of existing 16" Kenwood Well Field pipeline. SBMWD entered into agreement to fund extension of 20" to Kenwood Ave.	$	-	FY 14/15	3, 4	Project will be completed in FY 14/15
21	**Kenwood Well Field 20" Transmission Main Extension** - Extension of 20" installed by CALTRANS to the Cajon, Vincent and Kenwood Wells in Cajon Wash.	$	350,000	FY14/15, 1	3, 4	Project Description: Remove and replace 16" steel pipeline in wash subject to wash out and major main breaks due to flooding in wash. New pipeline will extend into the Cajon Boulevard and connect with the new 20" main installed by CALTRANS as a result of the Devore/I-15 Interchange Project. This will completely remove the entire pipeline out of the Cajon Wash, improving reliability and safety of staff. Condmenation of temporary and permanent easement necessary to cross private parcel. Easements cross So. Cal Gas property as well.
22	**Upper Zone Replacements - Meridian Ave 16" Main Replacement** - Replace 12" main in Meridian with 16" main between Baseline and Etiwanda	$	880,000	1	3, 4	Project Description: Remove and replace 12" steel pipeline 16" ductile iron pipeline in Meridian south as identified in the 2007 Master Plan.

23	**Annual Pipeline Rehablitation/Replacement Project**- Replacment/Rehabilitation of undersized and/or corroded system pipelines.	$	1,000,000	1,2,3,4,5	3,4	Project Description: Rehabiliation/Replacement of system pipelines constructed by Department WU Distribution Section crews (when crews are fully funded, contracted until then). Also to solve minor system deficiencies - elimination of deadends, install of main in streets where mains were not installed in the distant past for unknown reasons.
24	**Weir and Tungsten Main Replacements**	$	-	FY 14/15	3,4	Project will be completed in FY 14/15
25	**Mountain Pressure Zone Main Replacements Phase 2** - Replace undersized water mains with 12" ductile iron pipe to improve fire flow capabilities. Phase 1 completed in prior FY's.	$	500,000	FY 14/15, 3	3, 4	Project Description: Project involves the replacement of various small diameter pipelines and replace with a 12" diameter ductile iron pipe in various locations within the Upper Pressure Zone to improve fire flow capabilities in the Mountain Pressure Zone.
26	**Upper Zone Replacements - Mallory, Shandin Hills Area Main Replacements** - Remove and replace aging pipelines.	$	1,800,000	2,4	4	Project Description: Project involves the replacement of various small diameter pipelines as a result of leak records research with 8" and 12" diameter ductile iron pipe in various locations within the Upper Pressure Zone.
27	**Future Master Plan Pipeline Replacements** - SBMWD is currently developing the 2014 Master Plan Update for the Water Utility Division.	$	5,250,000	1,2, 3, 4, 5	3, 4	Project Description: Project is a place holder for future, unidentified water main replacements that will be identified in the upcoming 2014/2015 Master Plan update for the Water Utility Division.
28	**Fremontia Dr Main Replacement** - Replace undersize, aged mains with 8" DIP.	$	225,000	2	3, 4	Project Description: Project involves the replacement of 1,700 feet of underzied, aged mains with 8" DIP along Fremontia Dr.
29	**Waterman Ave 20" Transmission Main Replacement** - Replace aged, leak prone main with 20" DIP.	$	150,000	2	3, 4	Project Description: Project involves the replacement of 700 feet of aged 20" main with 20" DIP along Waterman Ave. from 6th St. to 7th St.
30	**Highland Ave Main Replacement** - Replace aged main with 12" DIP.	$	225,000	1	3, 4	Project Description: Project involves the replacement of 1,300 feet of aged 12" steel main with 12" DIP along Highland Ave. from E St. to G St.
31	**Water Quality Sample Stands Replacement Phase III** - Replace existing damaged and/or aging water quality sample stands in the distribution system - Phase III/IV.	$	-	FY 14/15	1, 4	Project completed in FY 14/15.
32	**Annual R/R - Large Meter Vault Lid Replacement** - Meter vault lids are subjected to traffic loading on occasion and damaged and/or are beyond their useful design life and require replacement on an ongoing basis.	$	840,000	1, 2, 3, 4, 5	1, 2, 4	Project Description: Meter vault lids are subjected to traffic loading on occasion and are damaged and/or are beyond their useful design life, posing a risk to public safety in public right of way.
33	**Annual R/R - Water Meter Capital** - Remove and replace aging, inefficient water meters on an ongoing basis.	$	1,665,000	1, 2, 3, 4, 5	1, 2, 4	Project Description: Water meters require replacement due to increased inefficiencies as the meters age. A meter replacement program ensures that water produced is accounted for through service meters, reducing "water loss" reported to the State on an annual basis. Improves revenues for the SBMWD.
34	**Annual R/R - System Valve Replacement**- Replacement of water system valves on an ongoing basis.	$	1,750,000	1, 2, 3, 4, 5	1, 2, 4	Project Description: Valves require replacement due to valve failure or exceeding their design life. Replacing valve improves water system reliability and improves staff's ability to operate the system and minimizing the amount of customers who experience service interruptions during normal maintenance or emergency situations.
35	**Annual R/R - Fire Hydrant Replacement** - Replacement of wet barrel and dry barrel fire hydrants on an ongoing basis.	$	430,000	1, 2, 3, 4, 5	1, 2, 4	Project Description: Fire hydrants require replacement due to failure, exceeding their design life or are sheared off in vehicular accidents. Replacing hydrant improves water system reliability and improves staff's ability to operate the system and provides improved fire fighting capabilities for the Fire Department during emergency situations.
36	**Annual R/R - City Backflow Device** - Replacement of City-owned backflow devices on an ongoing, as-needed basis.	$	285,000	1, 2, 3, 4, 5	1, 2, 4	Project Description: In order to maintain compliance with State backflow requirements and to protect the water system from any cross-contamination due to back-siphonage, Water Department is funding City-owned backflow device replacements when they are either vandalized or require replacement due to malfunctioning parts or annual test failures.
37	**Waterman Plant Aerator Tower Packing Material Replacement**	$	-	FY 14/15		Project completed in FY 14/15.
38	**Annual R/R - System Wide Electrical Panel Upgrades** - Replace electrical panels to meet NEC code.	$	85,000	1	1, 3, 4	Project Description: SBMWD has been replacing antiquated electrical panels for the past 6-7 years and is almost complete. One additional year is anticipated and all panels will meet the current NEC codes.
39	**Annual R/R - Plant Valve Replacement** - Replacement of valves that are withing pump stations, wells or treatment plants	$	875,000	1, 2, 3, 4, 5	1, 2, 4	Project Description: Valves require replacement due to valve failure or exceeding their design life. Replacing valve improves water system reliability and improves staff's ability to operate the system and minimizing the amount of customers who experience service interruptions during normal maintenance or emergency situations. Plant valve replacement program began in FY 10/11.
40	**Irvington Ave Transmission 16" Main Replacement** - Replace 16" steel main with 16" ductile iron main from Pine Avenue to Little League Drive	$	1,750,000	2, 3	1, 2, 4	Project Description: Old 16" steel main has significant leak history especially along Cable Creek. Steel main is corroded and at the end of its design life
41	**Meyers Road 20" Transmission Main Replacement** - Replace 16" steel main with 20" ductile iron main fromLittle League Drive Drive to end of Meyers Road.	$	1,750,000	4, 5	1, 2, 4	Project Description: Replace 3700 lf of old 16" steel main with 20" ductile Iron Pipe. This 20" main will be required to be constructed and operational prior to transferring Meyers Road customers from 2100 zone pressure to higher 2300 zone pressure. Requires Verdemont Phase 2 infrastructure to be operational.

	Replacement/Rehabilitation of System Assets Subtotal:	$	48,480,000			
	New System Assets					
42	**DC-8 Production Well** - Construct a new groundwater well in the Devil's Canyon area.	$	1,550,000	2,4		Project Description: Design, CEQA, and construction of a groundwater well in the Devil's Canyon area to augment water supply in the upper pressure zones. Water produced anticipated to be uncontaminated and is attractive high elevation water.
43	**1720 Zone East 1 MG Reservoir** - 1 MG reservoir to float the eastern end of the 1720 Pressure Zone	$	1,500,000	1, 3	3, 4	Project Description: Project involves the CEQA, design and construction of a 1 MG reservoir to be constructed on San Bernardino County Flood Control District Property in the vicinity of the Badger Spreading Basins. Purpose of the project is to provide floating storage on the eastern end of the 1720 Pressure Zone as well as provide primary pump control for the 1720 Zone Pump Station located at Sycamore No. 1 Reservoir plant site. This reservoir would also serve as a primary point of water supply for the future University Hills Development located upgradient and above CSUSB.
44	**Mountain Zone 5 MG Reservoir** - Design/construction of 5 MG prestressed concrete reservoir in the Mtn Pressure Zone	$	3,150,000	2, 4	1, 3	Project Description: Project involves the CEQA, design and construction of a 5MG reservoir to be constructed on the existing Mountain Pressure Zone Reservoir plant site.
45	**Mountain View 12" Water Main Extension @Mission Creek** - 12" main extension in Mtn View Ave from Couston north.	$	-	FY 14/15		Project will be completed in FY 14/15
46	**Moutain Pressure Zone 12" Transmission Main** - Extension of new 12" transmission main per 2007 Master Plan.	$	650,000	1	3, 4	Project Description : Project involves the installation of 12" transmission main in the Mountain Pressure Zone to improve fire flow capabilities within a pressure zone susceptible to wildfires.
47	**1720 Zone East 16" Transmission Main** - Extension of 16" main east in the 1720 Pressure Zone.	$	750,000	1, 3	3, 4	Project Description: Project involves the CEQA, design and constrution of a 16" water main connecting the proposed 1720 Zone 1MG Reservoir with the 1720 Zone Pump Station located at Sycamore No. 1 Plant site as well as extending the 1720 Zone to the east to moth ball the Sepulveda and Hill hydropneumatic below-grade pump stations. Removes small subzones and places them on floating storage.
48	**Intermediate Zone 24" Transmission Main** - 24" Transmission Main to support growth on the eastern end of the old Norton AFB.	$	3,000,000	FY 14/15, 2	3, 4	Project Description: Project involves the CEQA, design and construction of a 24" transmission main in the Intermediate Zone east to the eastern end of the old Norton AFB. Significant development is anticipated as part of the IVDA master plan including the County of SB airport. Large developments such as these require large fire flows and adequate fire flow storage. The Intermediate Zone is supported by a 10 MG buried concrete reservoir that has excess capacity for this purpose, thereby eliminating the need to construct a new reservoir. This will be partially funded by developers.
49	**Water System Geographical Information Systems (GIS) Implementation** - Ongoing updates to the GIS Database form of asset management.	$	600,000	FY 14/15, 2, 4	1, 2, 3, 4	Project Description: Project involves the continuing development of the GIS database and field applications for improved staff efficiencies. Scope of work includes integrating Water Quality daily work flows into electronic format utilizing either hand held tablets or ruggedized laptops. Data includes water quality data, water level data, etc. Primarily, the scope outlines a plan to for the Department's replacement of Groundwater DataManager (GWDM) database application to a Sequel Server Application (SQL). The SQL server application will transform all existing reports created into GWDM to SQL Server format allowing easier uploading of data from field maplets as well as automated regulatory reports.
50	**Improvements to 397 Chandler Place** - Security, painting, flooring, etc.	$	-	FY 14/15	3, 4	Project to be completed in FY 14/15.
51	**SBMWD Administration Facilities - 397 Chandler Place**	$	7,500,000	FY 14/15, 2	3, 4	Project Description: Design, CEQA and construction of SBMWD administration facilities. Project will relocate a majority of SBMWD to one location at the Chandler Place SBMWD property.
52	**Meyers Road 20" Transmission Main Replacement** - When Meyers Road customers west of Little League Drive are put on 2300 Zone pressure, the existing 16" water main will require replacment to handle the higher water pressures.	$	750,000	2	2, 3 4	Project Description: Project involves the CEQA, design and construciton of a new 20" main to be extended in Meyers Road from Little League to the proposed Spring Trails Development (formerly Martin Ranch) to replace an exisitng 16" main due to higher pressues resulting from the addition of the 2300 pressure zone. Residents at the top of Meyers Road experience less than desirable static water pressures and have been informed that development in the area will improve their water pressure. Will be partially developer funded.
53	**2300 Zone Pump Station** - Verdemont Phase 2 Water System Improvements	$	1,800,000	3	3	Project Description: Project involves the construction of a new pump station to be located at the exisitng Meyers Reservoir. Station will pump from the 2100 Zone to the new 2300 Zone. Will be partially developer funded.

54	**2300 Zone 20" Transmission Main** - Verdemont Phase 2 Water System Improvements	$	1,645,000	2	3, 4	Project Description: Project involves the construction of a 20" transmission main from the Meyers Reservoir through proposed GFR tract to Meyers Road and Little League Drive . Will be partially developer funded.
55	**2300 Zone 2.0 MG Reservoir** - Verdemont Phase 2 Water System Improvements	$	2,500,000	3	3, 4	Project Description: Project involves the construction of a 2.0 MG welded steel reservoir (knuckle design) on SBMWD property above Meyers Reservoir. Future master planned capacity is 4.0 MG with additional 2.0 MG to be constructed in the future as needed. Will be partially developer funded.
56	**Annual R/R - Water System Security Upgrades**	$	500,000	1,2,3,4,5	4	Project Description: Project involves the installation of security cameras, video recording DVR's, fencing, locking hardware, intrusion alarms and other miscellaneous security hardening devices to improve security at operations plant site. Most plant sites including all wells, pump station and reservoirs are in remote locations with operators visiting these sites only twice per 24 hour period. Installation of these security measures allow operations staff to monitor the sites from the SCADA monitoring room. Cameras with recordable DVR's allow staff to provide video coverage to law enforcement if a trespass and/or theft occurs at the plant sites.
57	**Annual R/R - WU Plants Electrical Reconfig for Generators**	$	50,000	1	3, 4	Project Description: Project involves reconfiguration of portable generator hook-ups at several Department plant sites.
58	**Annual R/R - Plant Site Improvements**	$	500,000	1, 2, 3, 4, 5	4	Project Description: Project involves the construction of miscellaneous plant site improvements including, but not limited to, the following: walls, fencing, landscaping, lighting, etc. Purpose is to improve the aesthetic appearance of plant sites as well as improve accessbility by staff.
59	**Annual R/R - SCADA and Telemetry Upgrades**	$	375,000	1, 2, 3, 4, 6	3, 4	Project Description: Project involves the installation of SCADA instrumentation at plant sites that currently do not have the capability of remote montioring/operating and are currently monitored/operated locally. Project will phase out in upcoming budget cycles once all plant sites have been upgraded and are connected to the SCADA network.
60	**Materials Storage Bins - B. Warren Cocke Plant**	$	250,000	1	3, 4	Project Description: Project involves the architectural design, construction and any tenant improvements necessary to relocate staff from the 5th floor of City Hall to the 1397 Chandler Ave facility. New facility(s) will be tilt up construction of a two story building and all associated site improvements.
61	**Waterman Turnout Hydroelectric Facility**	$	2,050,000			Hydroelectric facility to be constructed and maintained by SBVMWD. Agreement between Department and SBVMWD would outline 50% share in capital and O&M costs. Capital funding by low-interest loan from SBVMWD over 10 years. Anticipated power revenue into the SCE grid is estimated to be on the order of $300K to $350K per year to be split 50-50 assuming 10,000 AFY is delivered into Waterman Basins.
	New System Assets Subtotal:	**$**	**29,120,000**			
	New System Assets - Other Funding Sources					
	Enhancement of the San Bernardino Basin Area Groundwater Flow Model	$	-			To be completed in FY 14/15. EPA grant funded update to GW model as the primary
62						institutional control too for the Newmark Groundwater Superfund Site
63	**Cal-Trans I-10 at Tippecanoe Water Facility Relocations**	$	-			Project completed in FY 14/15.
64	**Downtown San Bernardino Passenger Rail Project**	$	200,000			To be completed in FY 14/15.
65	**SB County General Aviation Project Water Infrastructure**	$	150,000			To be completed in FY 14/15.
	Unplanned Public Works	$	500,000			Poject Description: Public Works requests for relocation of water facilities to support street
66						improvement projects throughout the city.
	Muscoy - EPA #109 Shallow Well	$	1,500,000			EPA and DTSC directed SBMWD to install to improve PCE and TCE contamination capture
67						performance in shallow and intermediate aquifer
	Muscoy - EPA #112 Shallow Well	$	1,250,000			EPA and DTSC directed SBMWD to install to improve PCE and TCE contamination capture
68						performance in shallow and intermediate aquifer
69	**Annual R/R - EPA Extraction Wells (Newmark)**	$	1,650,000			Annual rehabilitations necessary for well performance improvement and failures
70	**Annual R/R - EPA Extraction Wells (Muscoy)**	$	1,400,000			Annual rehabilitations necessary for well performance improvement and failures
71	**Annual R/R - EPA Monitoring Wells (Site Wide)**	$	500,000			Annual rehabilitations necessary for well performance improvement and failures
72	**Annual R/R - EPA Treatment Plant Vessels and Plant Piping/Valves**	$	1,000,000			
73	**Downtown San Bernardino Passenger Rail Project - SB to Redlands**	$	550,000			
	New System Assets - Other Funding Sources Subtotal:	**$**	**8,700,000**			
	Verdemont Phase 2 Water Infrastructure - Developer Installed					
74	**2300 Zone 2.0 MG Reservoir (Reservoir No. 2)**	$	1,600,000			Developer funded facility - Spring Trails Development
75	**2500 Zone Pump Station**	$	1,600,000			Developer funded facility - Spring Trails Development
76	**2500 Zone 20" Transmission Main**	$	700,000			Developer funded facility - Spring Trails Development

77	**2500 Zone 0.5 MG Reservoir**	$	1,000,000	Developer funded facility - Spring Trails Development
78	**2700 Zone Pump Station**	$	1,600,000	Developer funded facility - Spring Trails Development
79	**2700 Zone 20" Transmission Main**	$	300,000	Developer funded facility - Spring Trails Development
80	**2700 Zone 0.9 MG Reservoir**	$	900,000	Developer funded facility - Spring Trails Development
81	**3000 Zone Pump Station**	$	1,600,000	Developer funded facility - Spring Trails Development
82	**3000 Zone 20" Transmission Main**	$	300,000	Developer funded facility - Spring Trails Development
83	**3000 Zone 0.9 MG Reservoir**	$	900,000	Developer funded facility - Spring Trails Development
84	**2300 to 2100 Meyers Road Pressure Reducing Station**	$	200,000	Developer funded facility - Spring Trails Development
	Verdemont Phase 2 Water Infrastructure - Developer Installed Subtotal:	**$**	**10,700,000**	
	Total 5 Year Anticipated Capital Encumbrances:	**$**	**86,300,000**	

Notes: