Appendix 3.7-A

1998 Water System Improvement Study

BUTTONWILLOW COUNTY WATER DISTRICT

1998 WATER SYSTEM IMPROVEMENT STUDY

January 15, 1999

Revised
July 7, 1999

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July 7, 1999

The Honorable Board of Directors
Buttonwillow County Water District
P.O. Box 274
Buttonwillow, California 93206

Re: Study for Water System Improvements

Gentlemen:

Herewith are the results of our 1998 water systems study. The study analyzes the existing system's capability to provide municipal water service to the community of Buttonwillow and proposes improvements which will improve the system. A preliminary engineer's estimate for the proposed improvements is also included.

Very truly yours,

Dee Jaspar

Overview of the Existing System

The existing system consists of three water supply wells, two 40,000 gallon storage tanks and booster pumps (located at two well sites), eight-inch, six-inch and four-inch water distribution pipes. See excerpt from USGS Quadrangle map "Buttonwillow", Exhibit 1, and system map, Exhibit 3. There are approximately 420 customers. There is a mix of residential, commercial, and industrial land uses. Residential uses are generally located north of First Street. There are commercial users located on the north side of Highway 58 and along Main Street. There is a motel on the north side of Highway 58, west of Willow Avenue. Industrial users are located south of Highway 58. These are agricultural industries, including a cotton warehouse and gin, and agricultural chemical suppliers. Buttonwillow School is located west of Buttonwillow Avenue and north of Highway 58. See land use map, Exhibit 2.

Water Supply Standards

The Kern County Development Standards set forth the flow requirements for municipal water systems. The County standards for flow demand are the standards of the California Public Utilities Commission as published in General Order 103. The Buttonwillow County Water District ("BCWD") system is a flat rate system and therefore its demands are calculated by the formula $Q = NCF$, where Q is the maximum flow rate in gpm, N is the number of customers, C is 5 (bottom of range) or 9 (top of range), and F is a diversity factor (=0.37 for our study). Therefore BCWD's flows should fall within the range of 777 gpm to 1,399 gpm (1.85 gpm/customer to 3.33 gpm/customer).

Experience has shown that the peak summer demands are somewhat flat. That is, once the summer months arrive the daily water demand tends to stay up, with about a ten percent increase from "average day" to "peak day". The "peak hour" tends to be about one-third higher than the "average" day. The peak months are June, July, and August. The lowest months are December and January.

Graph 1 is a peak day in June, 1996, taken from a water company on the west side of Bakersfield, representative of a water utility serving about 5,000 connections. There are two pronounced peaks. The first, from about 2:30 am to 9:00 am (6½ hours) and the second, from about 5:30 p.m. to 9:00 p.m. (3½ hours). This graph is representative of summer days from June through August. There are about ten hours per day with demands greater than eighty percent of the peak.

Graph 2 is a representation of the demand data of Graph 1 applied to the BCWD system using 1,399 gpm as the peak hour demand. The average flow rate for the peak demand hours is 1,288 gpm and this demand was used to run the system hydraulics for the BCWD system.

Table 1 presents the calculated municipal demands for the BCWD system.

Required fire flows are set by the County of Kern Fire Chief. These are published in the Development Standards for the County, and are tabulated in Table 2.

Table 1

MUNICIPAL DEMANDS FOR THE TOWN OF BUTTONWILLOW

June through August	
Classification	**Flow**
Peak hourly	1,399 gpm[1]
Peak day	1,065 gpm[1]
Average day (June-August)	968 gpm[2]
Average day (Jan.-Dec.)	479 gpm[3]

[1] From Graph 2

[2] 90% of peak day

[3] 45% of peak day

Table 2

District Classification	Minimum Fire Flow	Minimum Duration
Residential	500 gpm	1 hour
Commercial	1,000 gpm	2 hours
Industrial	1,500 gpm	4 hours

Sources of Water

Buttonwillow County Water District has three wells. Two of these wells are located in the eastern portion of the District, one is located at the extreme northwest portion of the District. The source details are tabulated below. See Exhibit 1.

Table 3

Buttonwillow County Water District				
Source	Nominal Capacity	Storage at Well Site	Nominal Booster Capacity at Well Site	Location
Well 2	800 gpm	40,000 gal	800 gpm	Miller Avenue at Milo Avenue
Well 3	800 gpm	40,000 gal	500 gpm	Miller Avenue at Highway 58
Well 4	650 gpm	--	--	Williams Street
Totals	2,250 gpm	80,000 gal	1,300 gpm	

One of the wells (Well 2) is an older well drilled in the 1950's or 1960's. We have no information on this well. The second well (Well 3) is a newer well, drilled in 1977, and its driller's log indicates that it is 510-feet deep, cased to 443-feet deep, perforated from 353-feet to

433-feet deep. It has a cement seal down to 350-feet. The casing is 10-inch diameter. The well screen is stainless steel Johnson well screen. Well 4 is a new well, drilled in 1991. This well is 520-feet deep with 12-inch PVC casing. It is perforated from 410-feet to 500-feet.

Well 2 has been producing some sand. The storage tank requires periodic cleaning. It is uncertain if there has been damage to the well casing; however the pumping rate is unchanged. There is concern that this well may fail in the not too distant future.

Distribution System

The water distribution system is shown on Exhibit 3. The "east zone", which is the area east of Miller Avenue, is mainly 6-inch pipe with a short segment of 8-inch pipe in Miller Avenue. The "west zone", or everything west of Miller Avenue, is mainly 6-inch pipe, with a few segments of 4-inch. There is a 1¼-inch pipe installed south of Highway 58 serving industrial areas. There is a 2-inch pipe installed in Buttonwillow Avenue that serves one customer north of the Main Drain Canal and another that serves a customer located about one-half mile south of Highway 58, east of Mirasol Avenue.

Hydraulics of the Existing System

Analyses of the existing system are attached as Appendix A. These analyses model the system for peak flow with no fire flow and for peak flow plus fire flow. The fire flows were placed at all theoretical points of use ("junction nodes") within the District's system. Certain of these junction nodes are displayed on Exhibit 3. The results of these analyses are tabulated in Table 4 (page 8). The existing system can meet peak municipal demand (no fire flow) with residual pressures of about 60 psig.

Residential fire flow capability appears adequate. The system is capable of delivering greater than 500 gpm to the residential areas. Commercial fire flow capability is marginal. The system can deliver 1,000 gpm fire flow along Highway 58 east of Buttonwillow Avenue, however, it cannot deliver this flow west of Mirasol Avenue to commercial properties or to the

school, nor the required flow to commercial properties along Main Street. Industrial fire flows of 1,500 gpm cannot be delivered by the existing system.

The piping system needs two major improvements: 1) Tie the north end of the existing system together with a pipeline of adequate size to act as a manifold along the north side of town, 2) Add sufficient pipe capacity along the west side of town to meet commercial flow requirements and thereby improve the system's fire flow capability.

Storage

There are two, 40,000 gallon (nominal) storage tanks, thus there is 80,000 gallons of above-ground storage in the system. There are several methods used to determine the net volume of above-ground storage recommended for a system. The minimum amount of storage recommended is the average day. This amounts to about 690,000 gallons. It is not proposed to add storage to the system at this time, but rather to add replacement source capacity. A storage tank and booster pumping facility will be added in the future.

Recommended Improvements

The two areas of deficiency are in piping size and new/replacement capacity when Well No. 2 needs replacement. The proposed improvements are therefore to increase the hydraulic capacity of the piping system and to add storage capacity. See Exhibit A.

Piping Improvements

It is proposed to install a new ten-inch connector pipe along the Main Drain Canal from near Buttonwillow Avenue to near Miller Avenue. This runs along the north side of town. Interties to the existing system will be made at the north/south streets, and near the east end of Second Street and at the alley between First and Second Streets. The connector pipeline extends west of Buttonwillow Avenue for about 300 feet, then is routed southerly to intertie with existing

pipelines at the west extension of Fourth Street and Third Street. A pipeline also extends west from the south end of Dunsford Street to the west boundary of the Buttonwillow School. This pipeline then extends south along the west boundary of the school to tie into the existing pipeline along Highway 58.

New Well

It is proposed to construct a 1,000 foot-deep municipal well (1,000 - 1,500 gpm) on District property near Buttonwillow Avenue and Fourth Street. This well will discharge directly into the new ten-inch pipeline along the Main Drain Canal.

Water Meters

Approximately 100 existing services are metered. It is proposed to add meters to the remaining 320 services. These are included in the project estimate.

Table 4

EXISTING SYSTEM FIRE FLOW SUMMARY								
JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
1	35.4	65.8	1	535.4	1325.7	20	20	41
2	0	65.8	1	500	1483.2	20	20	1
3	17.7	66	1	517.7	1550.4	20	20	43
4	17.7	65.1	1	517.7	1330.9	20	20	5
5	8.9	62.8	1	508.9	889.3	20	27.6	6
6	17.7	62.8	1	517.7	1023	20	20	5
7	35.4	62.9	1	535.4	1090	20	20	5
8	0	64.1	1	500	1102	20	21.4	10
9	35.4	64.2	1	535.4	1118.4	20	20.2	8
10	16.6	63.2	1	516.6	1030.3	20	20.9	12
11	17.7	62.6	1	517.7	990.4	20	21	13
12	35.4	62.9	1	535.4	1014.3	20	20.9	37
13	35.4	62.5	1	535.4	979.5	20	21.1	39
14	35.4	62.3	1	535.4	928.9	20	20.8	15
15	17.7	62.3	1	517.7	924.5	20	21.2	45
16	17.7	62.2	1	517.7	924.7	20	20	45
17	35.4	62.4	1	535.4	1011.8	20	22.3	26
18	35.4	62.3	1	535.4	1024.5	20	20.8	40
19	35.4	62.2	1	535.4	998.1	20	20	40
20	35.4	62.2	1	535.4	985.3	20	20.3	21
21	17.7	62.2	1	517.7	951.1	20	20	203
22	17.7	62.2	1	517.7	940.2	20	22.7	23
23	35.7	62.2	1	535.7	969.5	20	20.6	22
24	17.7	62.2	1	517.7	974.3	20	20.8	25
25	17.7	62.2	1	517.7	928.3	20	20.4	26
26	17.7	62.2	1	517.7	863.1	20	25.1	25
27	17.7	62.3	1	517.7	787.8	20	28.1	28

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
28	17.7	62.3	1	517.7	913.6	20	20	27
29	8.9	62.4	1	508.9	873	20	23.7	27
30	17.7	63.8	1	517.7	728.6	20	36	29
31	17.7	66.5	1	517.7	757.8	20	28.7	36
32	0	67.9	1	500	756.7	20	30.4	31
33	0	68.9	1	500	929.7	20	20.5	34
34	8.9	68.5	1	508.9	836.8	20	22.3	35
35	17.7	68.1	1	517.7	799.8	20	23.7	36
36	8.9	67.3	1	508.9	636.6	20	37.1	31
37	2.8	62.8	1	502.8	239.8*	20	56.2	26
38	17.7	62.8	1	517.7	1008	20	20	37
39	17.7	62.4	1	517.7	979.6	20	21.2	13
40	17.7	62.2	1	517.7	799.5	20	31.1	19
41	0	65.8	1	500	18.5*	18.8	58.9	42
42	0	65.8	1	500	52.0*	20	20	41
43	17.7	66	1	517.7	998.2	20	40	45
44	0	66	1	500	1557.6	20.6	20	45
45	27.7	62.2	1	527.7	772.6	20	29.4	204
50	0	67.5	1	500	1566.1	20.3	20	54
51	23.4	67	1	523.4	1416.2	20	20	63
52	46.8	66.7	1	546.8	1074	20	21.2	53
53	23.4	66.6	1	523.4	947.2	20	21.2	55
54	46.8	66.6	1	546.8	866.5	20	26.1	55
55	23.4	66.6	1	523.4	904.3	20	22.6	54
56	23.4	66.5	1	523.4	1540.5	20	20	57
57	46.8	66.3	1	546.8	1199.2	20	24.1	58
58	23.4	66.2	1	523.4	1140.4	20	20.9	61
59	23.4	66.3	1	523.4	1479.4	20	20.2	60
60	46.8	66.2	1	546.8	1220.4	20	23.6	61

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
61	23.4	66.2	1	523.4	1141.3	20	20.8	58
62	41.5	67	1	541.5	1548.9	20.4	20	54
63	0	67	1	500	1111.6	20	34.1	52
64	0	66.3	1	500	1535.7	20	20	59
65	0	65.9	1	500	1524.7	20.5	20	45
80	0	71.7	1	500	1332.5	20	20.3	81
81	69.1	70.8	1	569.1	1197.6	20	22.3	33
100	0	66.3	1	500	1456.9	20	43.9	45
102	0	68.9	1	500	1361.1	20	38.8	54
104	0	72	1	500	1251.1	20	46	80
203	0	62.2	1	500	948.6	20	20.1	21
204	0	62.2	1	500	922	20	20	45

Hydraulics of the Proposed System

Analyses of the proposed system are attached as Table 5. These analyses modeled the system for peak flow plus fire flows at various locations. Peak flow was combined with a residential (500 gpm) and commercial (1,000 gpm), depending on location. In all cases a fire flow of 1,000 gpm was achieved, therefore commercial fire flow requirements were met. Refer to Table 5 for the analyses results. Exhibit 4 shows these results. All residential and commercial fire flow scenarios for the improved system work.

Table 5

PROPOSED SYSTEM

FIRE FLOW SUMMARY

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
1	35.4	68.7	1	535.4	1277.3	20	20	41
2	0	68.7	1	500	1621.7	20	20	1
3	17.7	68.7	1	517.7	1311	20	20	43
4	17.7	68.7	1	517.7	1329	20	20	54
5	8.9	68.4	1	508.9	1252.7	20	34.3	6
6	17.7	68.4	1	517.7	1330.2	20	20	5
7	35.4	68.4	1	535.4	1312.1	20	20.1	11
8	0	68.3	1	500	1241.1	20	21.4	9
9	35.4	68.3	1	535.4	1244.1	20	20.6	8
10	16.6	68.2	1	516.6	1232.5	20	22.5	12
11	17.7	68.3	1	517.7	1236.1	20	20.5	13
12	35.4	68.1	1	535.4	1234.9	20	22.2	10
13	35.4	68.2	1	535.4	1214.5	20	24.3	39
14	35.4	68.3	1	535.4	1305.9	20	23.5	15
15	17.7	68.2	1	517.7	1319.7	20	20.5	14
16	17.7	68.3	1	517.7	1333.1	20	20.2	45
17	35.4	68.1	1	535.4	1276.2	20	22.1	37
18	35.4	68.1	1	535.4	1302.6	20	21.2	17

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
19	35.4	68.2	1	535.4	1325.3	20	20.7	18
20	35.4	68.2	1	535.4	1326.7	20	21.3	19
21	17.7	68.2	1	517.7	1336.4	20	20.2	203
22	17.7	68.2	1	517.7	1338.7	20	20.4	309
23	35.7	68.2	1	535.7	1332.5	20	20.6	24
24	17.7	68.2	1	517.7	1321.3	20	20.4	25
25	17.7	68.1	1	517.7	1282.1	20	20.5	26
26	17.7	68.1	1	517.7	1233.3	20	30.3	25
27	17.7	68.2	1	517.7	1335	20	24	30
28	17.7	68.2	1	517.7	1340.1	20	21.6	27
29	8.9	68.2	1	508.9	1330.3	20	23.6	28
30	17.7	68.3	1	517.7	1356.8	20	24.1	27
31	17.7	68.5	1	517.7	1383.9	20	21.8	36
32	0	69.3	1	500	1089.6	20	42	35
33	0	70	1	500	1179.3	20	24	34
34	8.9	69.7	1	508.9	1167.9	20	27.5	35
35	17.7	69.3	1	517.7	1188	20	28.9	34
36	8.9	68.6	1	508.9	1232.6	20	38.5	31
37	2.8	68.1	1	502.8	265.8*	20	63.7	38
38	17.7	68.1	1	517.7	1239.9	20	20	37
39	17.7	68.2	1	517.7	1148	20	37.3	13
40	17.7	68.2	1	517.7	1308.6	20	23.1	15
41	0	68.7	1	500	18.9*	19.9	61.7	42
42	0	68.7	1	500	54.0*	20	20	41
43	17.7	68.7	1	517.7	1145.9	20	47.8	3
44	0	68.7	1	500	1310.9	20	20	43
45	27.7	68.2	1	527.7	1214	20	41.2	204
50	0	68.9	1	500	800	59	59	4
51	23.4	68.7	1	523.4	1294.4	20	20	63
52	46.8	68.4	1	546.8	1188.6	20	21.5	53

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
53	23.4	68.3	1	523.4	1125.1	20	21.7	55
54	46.8	68.3	1	546.8	1072.4	20	29	55
55	23.4	68.3	1	523.4	1098.6	20	23.7	54
56	23.4	68.7	1	523.4	1316.9	20	20	57
57	46.8	68.5	1	546.8	1235.2	20	24.1	58
58	23.4	68.5	1	523.4	1211.6	20	20.9	61
59	23.4	68.6	1	523.4	1284.1	20	20.7	60
60	46.8	68.5	1	546.8	1232.8	20	24.3	61
61	23.4	68.5	1	523.4	1211.5	20	21	58
62	41.5	68.7	1	541.5	1322.2	20	19.6	54
63	0	68.7	1	500	1202.9	20	36.3	51
64	0	68.7	1	500	1318.1	20	20	59
65	0	68.7	1	500	1321.2	20	20.1	60
80	0	72.1	1	500	1617.5	20	22.4	81
81	69.1	71.4	1	569.1	1256.2	20	20	300
102	0	76.3	1	500	2000	61.4	61	54
104	0	72.3	1	500	1251.2	20	62.9	80
203	0	68.2	1	500	1337.1	20	20	21
204	0	68.3	1	500	1333.8	20	20	45
300	0	71.4	1	500	1065.7	20	21.2	81
305	0	68.2	1	500	1340	20	20	308
306	0	68.4	1	500	1331.1	20	20	5
307	0	68.7	1	500	1329.8	20	19.8	54
308	0	68.2	1	500	1337.9	20	20.1	309
309	0	68.2	1	500	1337.2	20	20.4	308
310	0	68.2	1	500	2000	55.7	55.4	14
311	0	68.2	1	500	750	60.1	59	4
312	0	68.8	1	500	1957.7	20	20.3	1
313	0	68.7	1	500	1329.1	20	19.9	54

Cost Estimate
Buttonwillow County Water District
1999 Improvement Project

Connections and Interties

200' south of Main Drain Canal 400' west of Buttonwillow Ave. (extension of Fourth Street)	3,000
Buttonwillow Ave. at Main Drain Canal	5,000
Lux Ave. at Main Drain Canal	3,000
Main St. at Main Drain Canal	5,000
Mirasol Ave. at Main Drain Canal	3,000
Second St. at Main Drain Canal	3,000
Alley between First and Second Sts. at Main Drain Canal	3,000
800' west of Buttonwillow Ave. and Third St.	3,000
Connection at Fourth St. and Buttonwillow Ave.	5,000
Connection at west end of Dunford St.	3,000
Connection 300' west of south end of Dunford St.	3,000
Connection at west end of Milo Ave.	3,000
Connections at west end of Buttonwillow School (northeast and southeast corners of the school)	6,000
	$48,000

Road Bores

Buttonwillow Avenue	$20,000
Main Street	20,000
	$40,000

Pipe Installation

10" PVC in open ground	$172,500
10" PVC in pavement	14,850
6" PVC in open ground	70,000
	$257,350

Canal Crossings

1 at $30,000 each	$30,000

Right-of-Way

3 acres at $5,000	$15,000

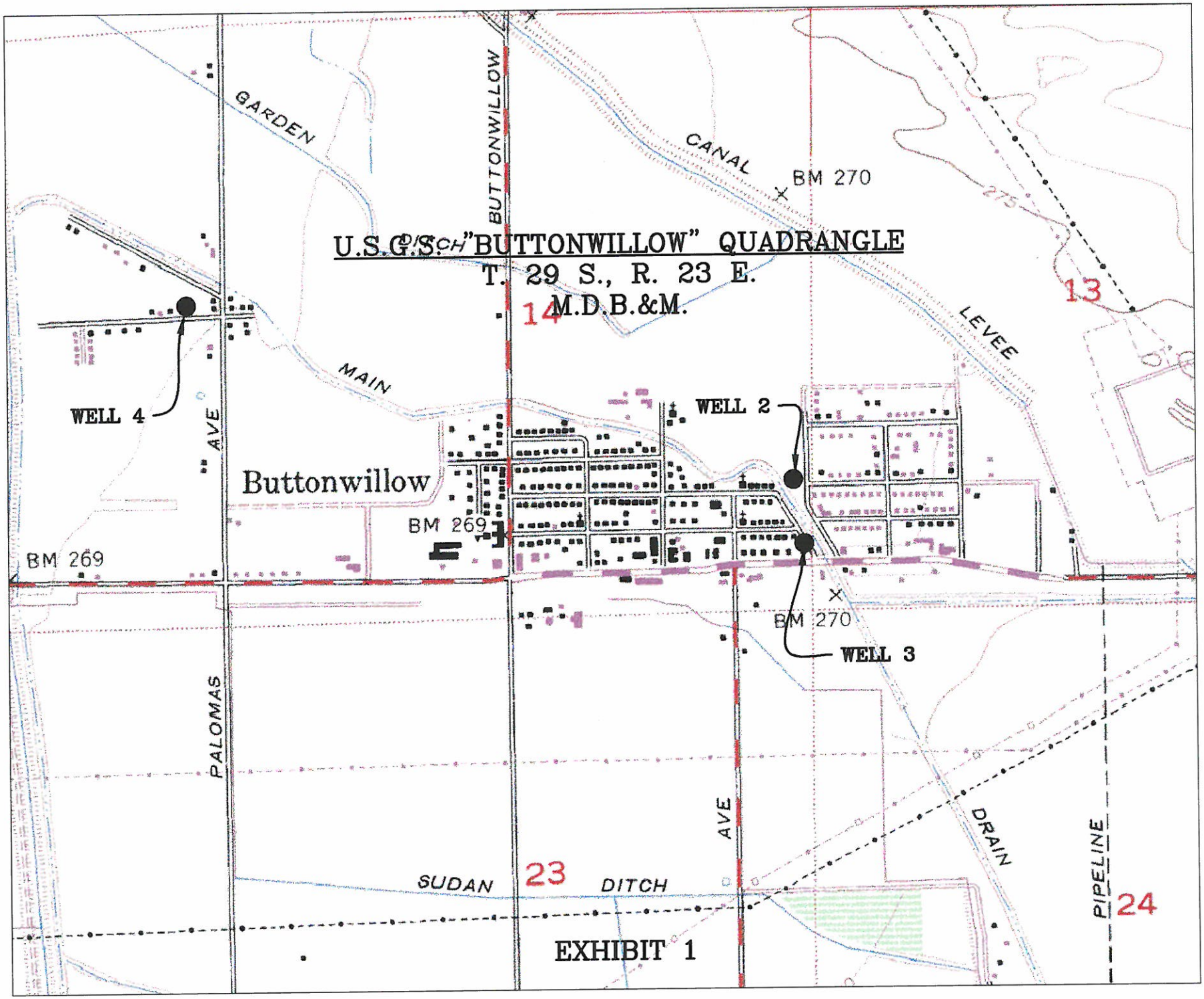
Water Meters

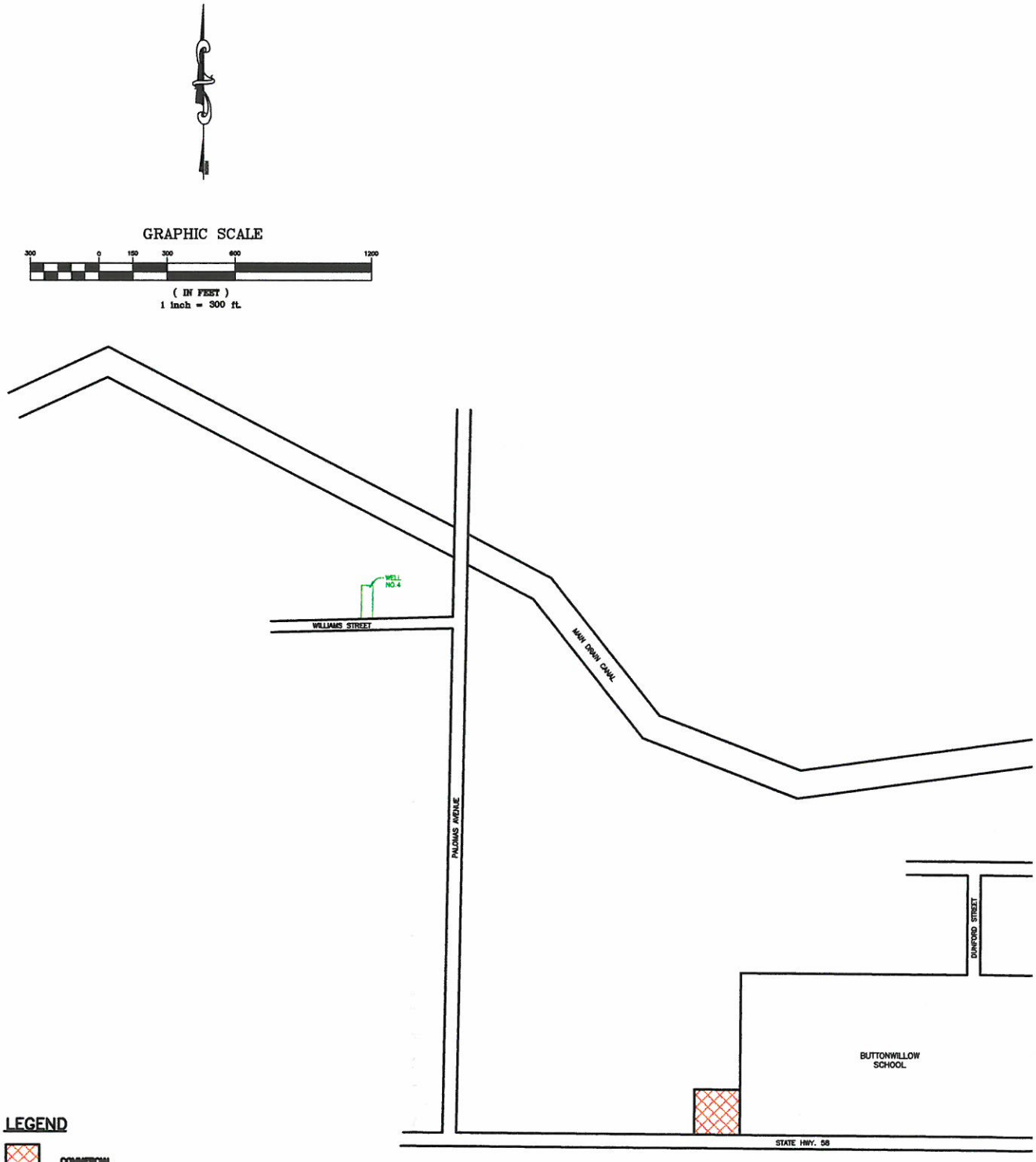
320 at $600 each	$192,000

Biota Report	$5,000
Bond Counsel	$40,000
Well, Pump and Appurtenances (see itemized list)	$570,000
Subtotal	$1,197,350
20% Contingency	239,470
15% Engineering and Legal	179,602
	$1,616,422
TOTAL ESTIMATE	$1,620,000

Buttonwillow County Water District
Well and Associated Equipment
Engineer's Estimate

Item No.	Estimated Quantity	Unit of Measure	Item	Cost Estimate
1.	1,100	LF	Drilling of well hole, including zone testing.	$385,000
2.	400	LF	Pump discharge column, shaft enclosing tube, line shaft.	$18,384
3.	1	Lump Sum	Bowl assembly with 10' suction pipe and stainless steel cone strainer.	$7,800
4.	1	Lump Sum	Vertical hollow shaft electric motor.	$14,160
5.	1	Lump Sum	Pump head.	$1,980
6.	1	Lump Sum	Concrete base with reinforcing steel.	$3,000
7.	25	LF	Above-ground discharge piping with valves and appurtenances.	$24,090
8.	100	LF	Underground pipeline with valves and appurtenances and intertie.	$12,000
9.	100	LF	Trenching, laying pipe, backfilling, testing.	$5,940
10.	1	Lump Sum	Hydropneumatic Vessel	$24,000
11.	25	LF	Painting pump and motor, piping, valves and appurtenances.	$1,800
12.	1	Lump Sum	Fencing.	$6,000
13.	1	Lump Sum	Site grading with 1-1/2" crushed rock surface.	$7,800
14.	1	Lump Sum	Electrical controls.	$45,600
15.	1	Lump Sum	Mobilization/De-mobilization, bonds, permits, insurance.	$12,000
Total				*$569,554*
Total Estimate				***$570,000***


U.S.G.S. "BUTTONWILLOW" QUADRANGLE
T. 29 S., R. 23 E.
M.D.B.&M.
GARDEN
BUTTONWILLOW
CANAL
BM 270
275
LEVEE
MAIN
WELL 4
WELL 2
WELL 3
AVE
Buttonwillow
BM 269
BM 269
BM 270
PALOMAS
AVE
SUDAN
DITCH
DRAIN
PIPELINE
13
14
23
24
EXHIBIT 1


GRAPHIC SCALE
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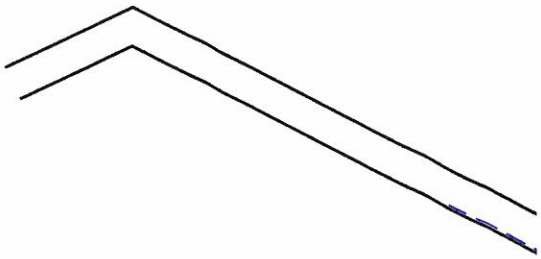
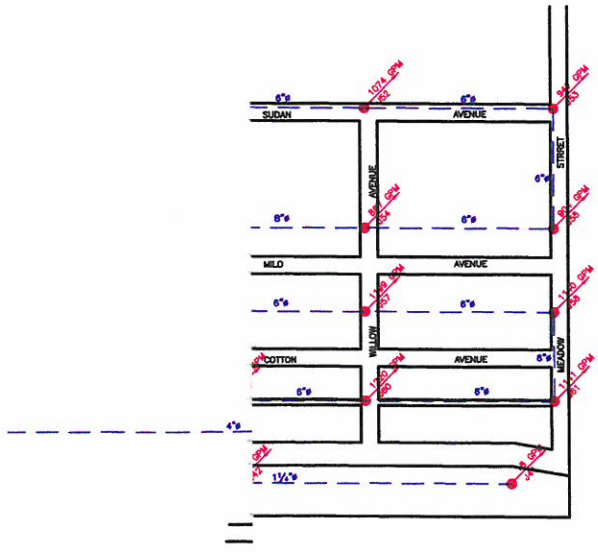
(IN FEET)
1 inch = 300 ft.
WELL NO.4
WILLIAMS STREET
MAIN DRAIN CANAL
PALOMAS AVENUE
DUNFORD STREET
BUTTONWILLOW SCHOOL
STATE HWY. 58
LEGEND
COMMERCIAL
INDUSTRIAL
RESIDENTIAL/OTHER

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.





LEGEND

EXISTING PIPELINE

PROPOSED PIPELINE

FIRE FLOW JUNCTION NO.

REVISION	BY
4 DEC 98	PG

CHEE JASPAR & ASSOCIATES, INC.
CIVIL ENGINEERS

TOWN OF BUTTONWILLOW

EXISTING SYSTEM

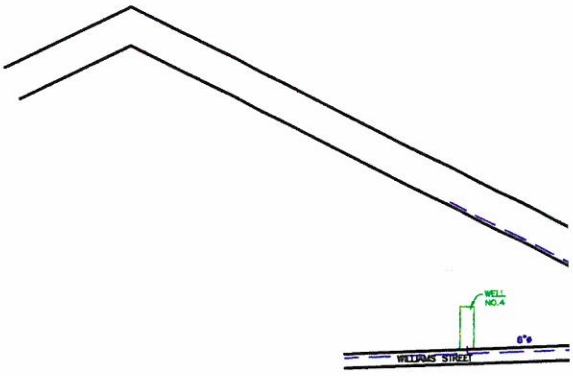
BUTTONWILLOW COUNTY WATER DISTRICT

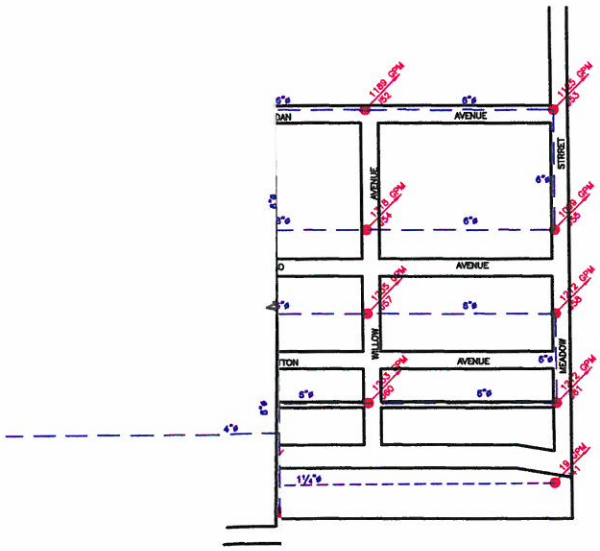
DRAWN	GONZALES
CHECKED	JASPAR
DATE	13 NOV 98
SCALE	1"=300'
FILE	
JOB NO.	
SHEET	EXHIBIT 3
OF	SHEETS

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.





LEGEND

EXISTING PIPELINE

PROPOSED PIPELINE

FIRE FLOW JUNCTION NO.

REVISION	BY
4 DEC 98	PG

DEE JASPAR & ASSOCIATES, INC.
CIVIL ENGINEERS

TOWN OF BUTTONWILLOW

PROPOSED SYSTEM

BUTTONWILLOW COUNTY WATER DISTRICT

DRAWN	GONZALES
CHECKED	JASPAR
DATE	13 NOV 98
SCALE	1"=300'
FILE	
JOB NO.	
SHEET	EXHIBIT 4
OF	SHEETS

Appendix 3.7-B

Unavoidable Background Leakage Calculation

APPENDIX 3.7-B: UNAVOIDABLE BACKGROUND LEAKAGE CALCULATION

Unavoidable Background Leakage (UBL)

UBL [Kgal/d] = (0.20Lm + 0.008Nc + 0.34Lc) x (Pav/70)^1.5

Total length of water mains (Lm) =	2.5	mi
Number of service connections (Nc) =	268	
Total length of private pipes, curb stop to meter (Lc) =	0.0125	mi (0.5% x Lm)
Average system pressure (Pav) =	68	psi

UBL =	2.5	Kgal/d
UBL =	923.6	Kgal/yr
UBL =	**2.8**	**af/yr**

Appendix 3.7-C

CA Single Family Water Use Efficiency

CALIFORNIA SINGLE FAMILY WATER USE EFFICIENCY STUDY

Prepared by:
William B. DeOreo, M.S., P.E. Principal Investigator,
with
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2709 Pine Street
Boulder, CO 80302

James Henderson, Bob Raucher
Stratus Consulting

Peter Gleick, Matt Heberger
Pacific Institute

Sponsored by:
California Department of Water Resources

Primary Project Grantee, Manager and Participating Agency:
Irvine Ranch Water District
Fiona Sanchez, Project Manager
Amy McNulty, Project Coordinator

Participating Agencies: San Diego County Water Authority, City of San Diego, Los Angeles Department of Water and Power, Las Virgenes Municipal Water District, East Bay Municipal Utility District, City of Davis, San Francisco Public Utilities Commission, City of Redwood City, Sonoma County Water Agency.

Report Date: April 20, 2011

maximum water allowance virtually nonexistent" and "few developers and contractors were even aware of the Model Ordinance. This lack of awareness, in a setting where water for the most part is still very cheap and agency monitoring nonexistent, makes wasteful irrigation virtually inevitable."

The landscape ordinance, which goes by the balky acronym MWELO, was developed by the Department of Water Resources at the direction of the legislature. AB 1881, signed into law in 2006, was designed to hold local agencies to tighter standards for outdoor water use. The law also required the California Energy Commission to adopt performance standards for irrigation equipment. It also contained a provision designed to prevent "common interest developments" (such as condominiums) from restricting the use of low water-using plants. (This was designed to counter the problem of homeowner associations that require lawns, in conflict with the state's water-saving goals.)

Cities and counties can use the state ordinance as a model, and must have adopted a local ordinance at least as effective by January 2010 (although delays in the program have slowed its full implementation). The most important effect is on new landscapes and major renovations, and mostly covers large landscapes: 2,500 square feet (0.06 acres), or for homeowners 5,000 square feet. According to our calculations, this law will cover approximately 30% of California single-family homes (see the section on Outdoor Water Use for details). Critics of the law contend that it is overly complicated for most laymen to understand and that it can unfairly burden homeowners: in some instances, re-landscaping will be required if a homeowner applies for a permit for an unrelated project such as renovating a bathroom. Supporters note that outdoor use comprises more than half of household water use, and a landscape ordinance is a fair approach that reduces waste while permitting green and attractive landscapes.

Residential Water Metering

Research by the Sacramento-based nonprofit Public Policy Institute of California has found that, in cities with meters, water use is about 15% less than in unmetered cities. Among cities where users pay volumetric rates, those with a tiered structure have water use that is 10% lower. A 2004 study by Aquacraft demonstrated water savings of 15.3 percent when comparing submetered to non-submetered properties. An earlier study by Industrial Economics in 1999 estimated savings of 18 to 39 percent. There are no reliable estimates for how many of California's homes are unmetered, but our interpretation of the 2006 California Water Rate Survey suggests that up to 6% of the state's water providers charge a bulk rate, which would imply an absence of meters.

The state has recently passed three different laws that will eventually result in universal metering, where every household has a water meter. Since 1992, state law has required the installation of water meters on all new construction. For meter-less cities like Sacramento, this meant that new homes had meters but customers still paid a flat rate. The law required utilities to begin charging volumetric "commodity" rates to all customers with meters beginning on January 1, 2010. (Before this, Sacramento customers with a meter had an option of paying an average flat rate or being billed according to their meter.) AB 975, signed into law in 2009, re-affirmed the state's intention to move to universal metering. Before this, existing law said that private utilities

regulated by the Public Utilities Commission should not install meters unless they showed that metering will be cost effective, reduce water consumption, and not impose an unreasonable financial burden on customers. The new law removed this hurdle to metering by requiring meters for all connections, even if it resulted in increased costs to customers.

The state has also mandated that all California cities must be metered by 2025 (AB 2572 passed in 2004). The 20x2020 taskforce has recommended that this target be accelerated to occur by 2020. Another law states that cities that get federal water via the Central Valley Project must have meters installed by 2013.

The Graywater Law

Reuse of graywater water is a very powerful way to reduce demands because the act of reusing the water essentially eliminates the demand for fresh water equal to the amount of reuse. There are a number of obstacles, howver, to fully implementing these systems. In the summer of 2008, the California Senate passed SB 1258 requiring the state to revise building codes "to conserve water by facilitating greater reuse of gray water in California." Prior to August 2009, when drought prompted emergency adoption of the new codes, re-use of residential graywater from sinks, showers, and washing machines for irrigation, was limited. Although the systems were legal, they required a detailed design and permit. In fact, it is estimated that in 2009 there were fewer than a dozen fully-permitted systems in the state, while some residents opted to install unpermitted graywater systems.

The revised rules have made it a great deal easier for residents to install a simple low-tech way to reuse water for landscape irrigation. While widespread public acceptance of graywater reuse appears to be low, there is a great deal of interest and enthusiasm from some quarters. The ability to re-use water could have a significant impact on household water use.

Clothes Washer Standards

Statistics from CHAPTER 7 showed that the second biggest use of water in most homes, after toilets, came from washing machines. It was also noted that the water-efficient models, while they cost somewhat more, used around 20 gallons per wash, compared to typical models that averaged closer to 40 gallons per wash. For a typical household, the indoor use model shows that the presence of a high efficiency clothes washer translates to savings of 6,200 gallons per year.

In 2002, the state legislature passed a law requiring the California Energy Commission to create washing machine efficiency standards. In 2006, the Department of Energy denied the state's request to institute standards more stringent than the federal government. The state filed suit in 2007, and in October of 2009, the Ninth Circuit Court of Appeals overturned DOE's ruling, and ordered DOE to re-consider its ruling.

As of this writing, it remains to be seen whether the federal government will allow California to put in place stricter clothes washer standards, or will create national standards similar to those proposed in the state. If such standards are allowed, they will go a long way to saving water in residences throughout the state.

Appendix 3.7-D

BCWD Cost Estimate

BUTTONWILLOW COUNTY WATER DISTRICT
WATER MAIN REPLACEMENT AND METER INSTALLATION PROJECT

ENGINEER'S OPINION OF PROBABLE PROJECT COST

Construction Cost Estimate:

ITEM NO.	ESTIMATED QUANTITY Qty.	Unit	ITEM DESCRIPTION	UNIT PRICE		SUBTOTAL
Water Main Replacement						
1	1	LS	Mobilization, Demobilization, Bonds, Insurance	$ 215,000 / LS	$	215,000
2	1	LS	SWPPP Implementation	$ 20,000 / LS	$	20,000
3	1	LS	Traffic Control	$ 30,000 / LS	$	30,000
4	1	LS	Dust Control	$ 14,000 / LS	$	14,000
5	1	LS	Worker Protection	$ 20,000 / LS	$	20,000
6	1	LS	Clearing & Grubbing	$ 25,000 / LS	$	25,000
7	1	LS	Abandon Existing Water System	$ 50,000 / LS	$	50,000
8	20	EA	Tie In To Existing Water Main	$ 4,000 / EA	$	80,000
9	4	EA	2" Blow-Off Assembly	$ 3,000 / EA	$	12,000
10	4,000	LF	8" PVC C-900 Water Main	$ 65 / LF	$	260,000
11	9,434	LF	6" PVC C-900 Water Main	$ 45 / LF	$	424,530
12	25	EA	Fire Hydrant Assembly	$ 4,500 / EA	$	112,500
13	20	EA	6" Gate Valve (Fire Hydrants)	$ 1,200 / EA	$	24,000
14	1	LS	Trench Shoring	$ 50,000 / LS	$	50,000
15	1	LS	Trench Protection	$ 4,000 / LS	$	4,000
16	3,000	LF	Temporary Trench Resurfacing	$ 10 / LF	$	30,000
17	13,434	LF	Permanent Trench Resufacing	$ 30 / LF	$	403,020
18	100	LF	Bore & Jack 18" Casing Across HWY 58	$ 550 / LF	$	55,000
19	65	EA	Compaction Tests	$ 250 / EA	$	16,250
20	3	EA	Water Sampling Station	$ 2,500 / LS	$	7,500
21	1	LS	Potholing Existing Utilities	$ 6,500 / LS	$	6,500
					$	*1,859,300*
Meter Installation						
22	391	EA	Furnish and install 3/4" Water Meter	$ 700 / EA	$	273,700
23	39	EA	Furnish and install 1" Water Meter	$ 900 / EA	$	35,100
24	10	EA	Furnish and install 2" Water Meter	$ 1,800 / EA	$	18,000
25	1	EA	Furnish and install 3" Water Meter	$ 5,400 / EA	$	5,400
26	1	EA	Furnish and install 4" Water Meter	$ 8,900 / EA	$	8,900
27	2	EA	Furnish and install 6" Water Meter	$ 16,000 / EA	$	32,000
28	268	EA	Christy Box, New Service Line	$ 1,600 / EA	$	428,800
29	1	LS	Radio Read AMR Unit	$ 14,000 / EA	$	14,000
30	1	LS	Purchase, Install Billing Software	$ 6,000 / EA	$	6,000
					$	*821,900*
				Construction Cost Subtotal	$	2,681,200
				Contingency (15%)	$	402,180
				Construction Cost Total	**$**	**3,083,380**

Project Cost Estimate:

DWR Category (a): Direct Project Administration		
Tasks 1 - Administration	$	72,400
Tasks 2 - Labor Compliance	$	18,100
Tasks 3 - Reporting	$	36,200
Category (a) Total:	$	126,700
DWR Category (b): Land Purchase/Easement		
Task 4 - Land Acquisition - N/A	$	0
DWR Category (c): Planning/Design/Engineering/Environmental Documentation		
Task 5 - Assessment and Evaluation		
5.1 - Feasibility Study	$	25,000
5.2 - Rate Study, Outreach, and Prop 218 Proceedings	$	20,000
Task 6 - Final Design		
6.1 - Survey and Utility Investigation	$	30,000
6.2 - Geotechnical Investigation	$	5,000
6.3 - Project Design	$	247,000
Task 7 - Environmental Documentation	$	2,000
Task 8 - Permitting	$	25,000
Category (c) Total:	$	354,000
DWR Category (d) - Construction/Implementation Costs		
Task 9 - Construction Contracting	$	7,000
Task 10 - Construction (from construction estimate above)	$	3,083,380
Task 11 - Environmental Compliance/Mitigation/Enhancement	$	20,000
Task 12 - Construction Administration	$	155,000
Category (d) Total:	$	3,265,380
TOTAL PROJECT COST	**$**	**3,746,080**