CALTRANS
BMP RETROFIT PILOT PROGRAM

DISTRICT 7, LOS ANGELES

BMP OPERATION, MAINTENANCE, AND MONITORING

STATUS REPORT

BROWN AND CALDWELL

June 1999

RETROFIT PILOT PROGRAM
CALTRANS DISTRICT 7

BEST MANAGEMENT PRACTICES OPERATION, MAINTENANCE, AND MONITORING STATUS REPORT

1.0 BMP WATER QUALITY MONITORING

This summary report encapsulates the 1998/1999 water quality monitoring at a portion of District 7 sites involved in the Caltrans Best Management Practices (BMP) Retrofit Pilot Program. Stormwater monitoring occurred as BMP construction was completed, which initiated on March 20, 1999.

This report addresses District 7 BMP locations that were monitored under the responsibility of Brown and Caldwell. Montgomery Watson and Law/Crandall also share the BMP Pilot Program monitoring responsibility in District 7, and it is suggested that the corresponding synopsis authored by these consultants be reviewed to gain a full perspective of the District 7 BMP effort.

The data presented in this document is preliminary and has not been subject to full-scale validation and quality-control review. It is presented as summary information only as an indicator to stormwater monitoring characteristics, which is not intended as an analytical assessment. Final review and decisions regarding the validity of storm results are expected to be detailed in further reports that will be prepared during summer 1999.

It is important to note that the results presented here are based on early field exposures of newly constructed BMP treatment units, and, as such, should be judged as undergoing early "break in" conditions. During these first exposures, structural, instrumental, mechanical, and aesthetic adjustments were made to improve operation. In particular, flow measurement instruments at several locations were not accurate when exposed to real field conditions. Based on the knowledge gained in these early exposures, BMP performance, monitoring instrument accuracy, and hydraulic functions (pumping schemes, etc.) will be improved for the 1999/2000 monitoring season.

For ease of presentation, refer to the end of each respective section for all referenced figures.

1.1 Hydrology

The sections that follow describe BMP and site hydrological characteristics as observed during storm monitoring events and maintenance inspections during 1998/1999.

1.1.1 Precipitation During the 1998/1999 Water Year (Indicator Sites and BMPS)

The indicator site for District 7 correlation was the Civic Center in downtown Los Angeles. Although weather conditions and patterns were significantly different between this "reference" location the data gathered did offer some correlating information. This indicator site does reflect similar rainfall occurrences during wet season monitoring at Brown and Caldwell District 7 BMP sites. Refer to the summary tabulation below (Tables 1.1.1.1 through 1.1.1.5) for comparison of these sites relative to the indicator location. Measured rainfall values have been bolded for ease of reference.

Table 1.1.1.1
Measured Rainfall, Los Angeles Civic Center, March 1 through April 16, 1999.

March 1999 Los Angeles Civic Center				April 1—16, 1999 Los Angeles Civic Center			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	1	0.0	16	0.0
2	0.0	17	0.0	**2**	**0.03**	17	
3	0.0	18	0.0	3	0.0	18	
4	0.0	19	0.0	4	0.0	19	
5	0.0	**20**	**0.22**	5	0.0	20	
6	0.0	21	0.0	**6**	**0.73**	21	
7	0.0	22	0.0	**7**	**0.39**	22	
8	0.0	23	0.0	8	0.0	23	
9	**0.10**	24	0.0	**9**	**0.08**	24	
10	0.0	25	0.0	10	0.0	25	
11	**T**	**26**	**0.08**	**11**	**0.28**	26	
12	0.0	27	0.0	**12**	**1.06**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	**T**	30	0.0	15	0.0	30	
		31	0.0				

The data presented here is as a reference only. The actual rainfall at individual BMP sites will vary from the values given in the table. The data presented above for Los Angeles is as of 4:00 p.m. is for the preceding 24 hours on the date indicated.

Table 1.1.1.2
Measured Rainfall, 5/605 Extended Detention Basin, March 1 through April 16, 1999.

March 1999 **5/605 Extended Detention Basin**				April 1—16, 1999 **5/605 Extended Detention Basin**			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.17**	16	0.0
2	0.0	17	0.0	2	0.0	17	
3	0.0	18	0.0	3	0.0	18	
4	**0.03**	19	0.0	4	0.0	19	
5	0.0	**20**	**0.17**	5	0.0	20	
6	0.0	21	0.0	**6**	**0.57**	21	
7	**0.01**	22	0.0	**7**	**0.2**	22	
8	0.0	23	0.0	**8**	**0.04**	23	
9	0.0	24	0.0	**9**	**0.01**	24	
10	0.0	**25**	**0.04**	10	0.0	25	
11	0.0	26	0.08	**11**	**1.03**	26	
12	0.0	27	0.0	**12**	**0.02**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	0.0	30	0.0	15	0.0	30	
		31	0.0				

Table 1.1.1.3
Measured Rainfall, 605/91 Extended Detention Basin, March 1 through April 16, 1999.

March 1999 **605/91 Extended Detention Basin**				April 1—16, 1999 **605/91 Extended Detention Basin**			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.17**	16	0.0
2	0.0	17	0.0	**2**	**0.01**	17	
3	**0.01**	18	0.0	**3**	**0.03**	18	
4	**0.03**	19	0.0	4	0.0	19	
5	0.0	**20**	**0.14**	5	0.0	20	
6	0.0	21	0.0	**6**	**0.44**	21	
7	0.0	22	0.0	**7**	**0.31**	22	
8	0.0	23	0.0	8	0.0	23	
9	**0.04**	24	0.0	**9**	**0.04**	24	
10	0.0	**25**	**0.58**	10	0.0	25	
11	**0.03**	26	0.0	**11**	**1.36**	26	
12	0.0	27	0.0	**12**	**0.29**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	**0.64**	30	0.0	15	0.0	30	
		31	0.0				

Table 1.1.1.4
Measured Rainfall, Eastern Regional MS Sand Filter, March 1 through April 16, 1999.

March 1999 **Eastern Regional MS Sand Filter**				April 1—16, 1999 **Eastern Regional MS Sand Filter**			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.14**	16	ND
2	0.0	17	0.0	2	0.0	17	
3	**0.05**	18	0.0	3	0.0	18	
4	0.0	19	0.0	4	0.0	19	
5	0.0	20	0.22	5	0.0	20	
6	0.0	21	0.0	**6**	**0.58**	21	
7	0.0	22	0.0	**7**	**0.28**	22	
8	0.0	23	0.0	**8**	**0.09**	23	
9	**0.04**	24	0.0	9	ND	24	
10	0.0	**25**	**0.14**	10	ND	25	
11	0.0	26	0.08	11	ND	26	
12	0.0	27	0.0	12	ND	27	
13	0.0	28	0.0	13	ND	28	
14	0.0	29	0.0	14	ND	29	
15	**0.5**	30	0.0	15	ND	30	
		31	0.0				

ND = No data.

Table 1.1.1.5
Measured Rainfall, Foothill MS Sand Filter, March 1 through April 16, 1999.

March 1999 **Foothill MS Sand Filter**				April 1—16, 1999 **Foothill MS Sand Filter**			
Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)	Day	Precip. (Inches)
1	0.0	16	0.0	**1**	**0.07**	16	0.0
2	0.0	17	0.0	2	0.0	17	
3	0.0	18	0.0	3	0.0	18	
4	0.0	19	0.0	4	0.0	19	
5	0.0	20	ND	5	0.0	20	
6	0.0	21	0.0	**6**	**1.12**	21	
7	0.0	22	0.0	**7**	**0.34**	22	
8	0.0	23	0.0	**8**	**0.12**	23	
9	0.0	24	0.0	9	0.0	24	
10	0.0	**25**	**0.01**	10	0.0	25	
11	0.0	**26**	**0.25**	**11**	**0.68**	26	
12	0.0	27	0.0	**12**	**0.18**	27	
13	0.0	28	0.0	13	0.0	28	
14	0.0	29	0.0	14	0.0	29	
15	0.0	30	0.0	15	0.0	30	
		31	0.0				

ND = No data.

1.1.2 Precipitation during Monitored Events

Precipitation was measured at all sites with a tipping rain-gauge bucket, capable of measuring every 0.01 inches of rainfall. Precipitation during the monitored events varied from storm event and BMP site. For all events, rainfall ranged from a low of 0.57 inches to 1.62 inches. Brown and Caldwell mobilized for four storm events during the 1998/1999 season, however the first storm event (of March 20, 1999) did not produce enough rainfall and, therefore, is not represented in the report. Three storm events were successfully captured to varying degrees. The types of BMPs monitored during the 1998/1999-storm season were two extended detention basins (EDB) and two sand filters (SF). The storms and BMP sites that were monitored include:

- **Event 1** March 20, 1999 – Cancelled due to insufficient rainfall (no monitoring),
- **Event 2**: March 25, 1999 - EDB Site 74102 (I-605/SR-95),
- **Event 3**: April 6, 1999 - EDB Site 74101 (I-5/I-605), EDB Site 74102 (I-605/SR-95), SF Site 74202 (Eastern Regional Maintenance Station), and SF Site 74203 (Foothill Maintenance Station), and
- **Event 4**: April 11, 1999 - EDB Site 74101 (I-5/I-605), EDB Site 74102 (I-605/SR-95), and SF Site 74203 (Foothill Maintenance Station).

Summary statistics for storm events are summarized in Table 1.1.2.1 (rainfall) and Table 1.1.2.2 (flow).

1.1.2.1 Rainfall Data – Event 1 (March 20, 1999)

This storm monitoring event was cancelled due to an insufficient amount of rainfall. Therefore, no data was collected for this event.

1.1.2.2 Rainfall Data - Event 2 (March 25, 1999)

During the first monitored storm event of March 25, 1999, the I-605/SR-91 EDB received 0.57 inches of rainfall from 08:00 PST to 17:30 PST (9.5 hours). The rainfall had a maximum intensity of 0.12 inches/hour. No other sites were successfully monitored. The rainfall began at approximately 08:00 PST and ended around 17:30 PST. The last rainfall, previous to this storm, was 4.9 days with a rainfall amount of 0.13 inches (the aborted Event 1).

Table 1.1.2.1
Summary of Storm Rainfall Statistics, District 7 BMPs, Brown and Caldwell

	Event Rainfall Data						
Site/Event	**Start (date / time)**	**Stop (date / time)**	**Duration (hh:mm)**	**Total (inches)**	**Maximum Intensity (inches/hour)**	**Antecedent (days)**	**Antecedent (inches)**
Event 2							
I-605/SR-91	3/25/99 8:00	3/25/99 17:30	9:30:00	0.57	0.12	4.9	0.13
Event 3							
I-5/I-605-Inf	4/6/99 7:00	4/7/99 10:45	27:45:00	0.77	0.32	4.5	0.17
I-605/SR-91-Inf	4/6/99 7:00	4/7/99 14:00	31:00:00	0.71	0.16	11.6	0.17
Eastern-Inf	4/6/99 7:30	4/7/99 11:06	27:36:00	0.86	0.16	11.6	0.14
Foothill-Inf	4/6/99 7:00	4/7/99 11:00	28:00:00	1.45	0.60	11.0	0.07
Event 4							
I-5/I-605-Inf	4/11/99 11:05	4/12/99 0:07	13:02:00	1.48	0.32	4.0	0.77
I-605/SR-91-Inf	4/11/99 13:00	4/12/99 1:28	12:28:00	1.62	0.36	4.0	0.71
Foothill-Inf	4/11/99 13:00	4/12/99 2:51	13:51:00	0.85	0.24	4.1	0.25

Table 1.1.2.2
Summary of Storm Flow Statistics, District 7 BMPs, Brown and Caldwell

	Event Flow Data							
Site/Event	**Start (date / time)**	**Stop (date / time)**	**Duration (hh:mm)**	**Retention (hh:mm)**	**Total (cf)**	**Peak (cfs)**	**Estimated Capture (percent)**	**Peak Capture (Y/N)**
Event 2								
I-605/SR-91-Inf	3/25/99 11:31	3/25/99 16:57	5:26:00	6:06:00	1,402	0.36	100	Y
I-605/SR-91-Eff	3/25/99 12:04	3/25/99 17:37	5:33:00		680	0.06	100	Y
Event 3								
I-5/I-605-Inf	4/6/99 8:48	4/7/99 13:49	29:01:00	55:04:00	6,511	0.41	100	Y
I-5/I-605-Eff	4/6/99 12:07	4/8/99 15:52	51:45:00		1,109	0.01	99	Y
I-605/SR-91-Inf	4/6/99 9:08	4/7/99 11:01	25:53:00	28:04:00	2,216	0.64	100	Y
I-605/SR-91-Eff	4/6/99 10:18	4/7/99 13:12	26:54:00		510	0.55	100	Y
Eastern-Inf	4/6/99 8:19	4/7/99 12:22	28:03:00	45:26:00	4,374	0.15	95	Y
Eastern-Eff	4/6/99 10:34	4/8/99 5:45	43:11:00		8,196	0.23	79	Y
Foothill-Inf	4/6/99 9:42	4/7/99 11:13	25:31:00	44:20:00	6,883	0.59	99	Y
Foothill-Eff	4/6/99 10:27	4/8/99 6:02	43:35:00		22,805	0.23	95	Y
Event 4								
I-5/I-605-Inf	4/11/99 14:46	4/11/99 21:58	7:12:00	121:09:00	12,084	0.98	87	Y
I-5/I-605-Eff	4/11/99 17:01	4/16/99 15:55	118:54:00		13,796	0.13	75	Y
I-605/SR-91-Inf	4/11/99 14:34	4/11/99 21:48	7:14:00	15:46:00	7,160	1.40	70	Y
I-605/SR-91-Eff	4/11/99 15:28	4/12/99 6:20	14:52:00		1,964	1.02	97	Y
Foothill-Inf	4/11/99 13:27	4/12/99 2:51	13:24:00	33:35:00	4,381	0.41	100	Y
Foothill-Eff	4/11/99 15:17	4/12/99 23:02	31:45:00		17,995	0.21	99	Y

1.1.2.3 Rainfall Data - Event 3 (April 6, 1999)

For the second monitored storm event of April 6, 1999, samples were collected at all four of the online sites. Rainfall amounts ranged from 0.71 inches, at the I-605/SR-91 EDB, to 1.45 inches at the Foothill Maintenance Station SF. Rain intensity ranged from 0.16 inches/hour at the I-605/SR-91 EDB and the Eastern Regional Maintenance Station SF to 0.60 inches/hour at the Foothill Maintenance Station SF. Rainfall duration ranged from approximately 27.5 hours to 31 hours at Eastern Maintenance Station SF and I-605/SR-91 EDB, respectively. The previous rainfall, for all stations, occurred on April 1, 1999, approximately 4.5 days before this storm event. The previous rain was insufficient to warrant a mobilization effort (0.07 inches to 0.17 inches).

1.1.2.4 Rainfall Data - Event 4 (April 11, 1999)

The third and last storm event of the 1998/1999-storm season occurred on April 11, 1999. This storm represented the largest amount of rainfall for the three monitored storms this season. Samples were collected at three sites (I-5/I-605 EDB, I-605/SR-91 EDB, and Foothill Maintenance Station SF). Rainfall totals ranged from 0.85 inches at Foothill Maintenance Station SF to 1.62 inches at I-605/SR-91 EDB. Rain intensity ranged from 0.24 inches/hour to 0.36 inches/hour at Foothill Maintenance Station SF. Duration of the rainfall ranged from approximately 12.5 hours to 13.9 hours at I-605/SR-91 EDB and Foothill Regional Maintenance Station SF, respectively.

1.1.3 Storm Water Runoff During Monitored Events

The flow data reported in this section are from the storm events that were sampled during the 1998/1999-storm season. The two EDBs and the two sand filters were equipped with area-velocity flow meters and bubblers (AVB) to calculate the influent flow. The effluent at the EDBs used a bubbler and a V-notch weir to calculate the flow. The effluent at the sand filters was measured exclusively with a bubbler to calculate the flow through the sump pumps.

The detention times presented in the sections below have been calculated from when the influent flow begins to enter the detention basin and finishes when the effluent flow has stopped. Therefore, detention times are greater than the duration of the effluent flow (effluent flow typically lags several hours behind influent flow).

1.1.3.1 Flow Data – Event 1 (March 20, 1999)

This storm monitoring event was cancelled due to an insufficient amount of rainfall. Therefore, no data was collected for this event.

1.1.3.2 Flow Data - Event 2 (March 25, 1999)

For Event 2, on March 25, 1999, samples were collected at the influent and effluent site of I-605/SR-91 EDB. Samples could not be collected at other operational sites due to light rainfall and runoff, and various equipment malfunctions.

I-605/SR-91 EDB

On March 25, 1999, the influent flow at I-605/SR-91 EDB occurred from approximately 11:31 PST through 16:57 PST, for a duration of 5.4 hours. The reported flow peaked at 0.36 cubic feet/second (cfs) early in the storm immediately following an increase in rainfall intensity (Figure 1.1.3.1) for a total storm volume of 1,402 cubic feet (cf). Flow peaked early during the storm and stopped for a short period, before resuming, briefly. The estimated composite sample captured was 100 percent of the stormwater volume.

The effluent flow occurred from approximately 12:04 PST through 17:37 PST, for a duration of 5.6 hours. The flow peaked at 0.06 cfs for a total volume of 680 cf. This represents a detention time of 6.1 hours. The flow characteristics were similar to those of the influent. The estimated representative storm volume sample captured was 100 percent.

1.1.3.3 Flow Data - Event 3 (April 6, 1999)

For Event 3, on April 6, 1999, samples were collected at the influent and effluent sites of I-5/I-605 EDB, I-605/SR-91 EDB, Eastern Maintenance Station SF, and Foothill Regional Maintenance Station SF.

I-5/I-605 EDB

On April 6, 1999, the influent flow at I-5/I-605 EDB occurred from approximately 0848 PST through 13:49 the following day (April 7, 1999) for a duration of 29 hours. The influent flow responded quickly to rainfall and lack of rainfall (Figure 1.1.3.2). The flow peaked at 0.41 cfs for a total storm volume of 6,511 cf. The estimated representative storm volume sample captured was 100 percent.

The effluent flow occurred from 12:07 PST April 6, 1999, through 15:52 PST April 8, 1999, for a duration of 51.8 hours. The flow of the effluent exiting the EDB was slow, and trailed the influent reactions by several hours and appeared to buffer the actions of the influent. The flow peaked at 0.01 cfs for a total volume of 1,109 cf. The detention time was approximately 55.1 hours. An apparent problem with the effluent site was the inability of the basin to properly drain because of the small slope of the effluent discharge pipe and the damming action of the weir. Once the level of the water dropped below the V-notch on the weir it became necessary to remove the drain plug (located at the bottom of the weir), to drain the remaining water. Some unknown amount of stormwater was not sampled due to the loss of flow data. The estimated representative storm volume sample captured was 99 percent of the measured effluent flow.

The discrepancy between influent and effluent volumes has two potential causes: (1) The basin did not completely drain due to standing water that had accumulated behind the weir; and (2) the inherent inaccuracies of the Sigma flow meters that were experienced during low flow conditions.

I-605/SR-91 EDB

The influent flow occurred at I-605/SR-91 EDB between 09:08 PST April 6, 1999, and 11:01 PST April 7, 1999, for a duration of approximately 25.9 hours. The flow peaked twice during the storm with a lull between peaks lasting most of a 24-hour day (Figure 1.1.3.3). The peak flow of the entire storm was 0.64 cfs with a total storm volume of 2,216 cf, of which a representative stormwater sample was captured at approximately 100 percent.

The effluent flow occurred between 10:18 PST April 6, 1999 and 13:12 PST April 7, 1999, for a duration of almost 26.9 hours. The flow characteristics were similar to the influent with a lull between two peaks. The flow peaked at 0.55 cfs for a total storm volume of 510 cf. The detention time was approximately 28.1 hours. The representative captured sample was estimated to be 100 percent of the stormwater.

Eastern Regional Maintenance Station SF

The influent flow occurred at Eastern Regional Maintenance Station SF between 08:19 PST April 6, 1999 and 12:22 PST April 7, 1999, for a duration of approximately 28.1 hours. As noted with the EDBs the storm was quiet for several hours, halfway through the storm. As the intensity of the rain increased, influent flow increased (Figure 1.1.3.4). The flow peaked at 0.15 cfs for a total stormwater influent volume of 4,374 cf. The captured sample, a representative volume of the total stormwater, was estimated at 95 percent.

The effluent flow occurs at the Eastern Maintenance Station SF when the sump level rises to a pre-determined level causing a float switch to activate the sump pump. The level at which this occurs is approximately 3.5 feet. The combination of the sediment basin and the sand media appeared to buffer the effects of the influent stormwater upon the effluent discharge. The peak effluent flow (0.23 cfs) is driven by the pump rate and generally will not vary significantly. Total stormwater volume was reported as 8,196 cf. The detention time was approximately 45.4 hours. The representative storm volume sample captured was estimated at 79 percent.

It should be noted that the algorithm used to calculate pump discharge rates failed to consider the frictional losses attributed to the discharge pipes. This was corrected immediately after the 1998/1999 storm season.

Foothill Maintenance Station SF

The influent flow occurred at Foothill Maintenance Station SF between 09:42 PST April 6, 1999 and 11:13 PST April 7, 1999, for a duration of approximately 25.5 hours. As with the previous stations the influent reacted quickly to rainfall intensity (Figure 1.1.3.5). Most of the flow

occurred during the beginning with periods of activity during infrequent showers. The peak influent flow was 0.59 cfs, with a stormwater volume of 6,883 cf. The representative storm volume sample captured was estimated at 99 percent.

The effluent flow occurs at the Foothill Regional Maintenance Station SF operates exactly as the Eastern Maintenance Station SF. The level at which the sump pump is triggered is approximately 4.5 feet. The combination of the sediment basin and the sand media appeared to buffer the effects of the influent stormwater upon the effluent discharge. The peak effluent flow (0.23 cfs) is driven by the pump rate and generally will not vary significantly. Total stormwater volume was reported as 22,805 cf. The detention time was approximately 44.3 hours. The representative storm volume sample captured was estimated at 95 percent.

It should be noted that the algorithm used to calculate pump discharge rates failed to consider the frictional losses attributed to the discharge pipes. This was corrected immediately after the 1998/1999 storm season.

1.1.3.4 Flow Data - Event 4 (April 11, 1999)

For Event 4, on April 6, 1999, samples were collected at the influent and effluent stations of the I-5/I-605 EDB, I-605/SR-91 EDB, and Foothill Maintenance Station SF.

I-5/I-605 EDB

On April 11, 1999, the influent flow at I-5/I-605 EDB occurred from approximately 14:46 PST through 21:58 PST, for a duration of 7.2 hours. The intensity of the rainfall was low at the beginning of the storm and the influent flow built up correspondingly (Figure 1.1.3.2 – Note that the figures for cumulative rainfall and influent flow have a different timeline than the one used for the effluent flow). The flow peaked at 0.98 cfs for a total storm volume of 12,084 cf. The estimated representative storm volume sample captured was 87 percent.

The effluent flow occurred from 17:0 PST April 11, 1999, through 15:55 PST April 16, 1999, for a duration of approximately 118.9 hours. The flow of the effluent exiting the EDB was slow, and trailed the influent reactions by several hours buffering the actions of the influent. In order to drain the basin and measure the flow, effectively, the bubbler was removed from upstream of the weir once the stage had dropped to the bottom of the V-notch. The bubbler was than attached downstream of the weir and the drain plug was removed at approximately 09:45 PST on April 15, 1999. Appropriate modifications to the software allowed for the different calculations. Therefore the data, represented in Figure 1.1.3.6, has a significant increase in flow several days after the end of the storm. The flow first peaked at 0.07 cf while the drain plug remained in the weir. After it was removed the flow reached a peak of 0.13 cfs for a total volume of 13,796 cf. The detention time was approximately 121.2 hours. The estimated representative storm volume sample captured was 75 percent of the measured flow.

I-605/SR-91 EDB

The influent flow occurred at I-605/SR-91 EDB between 14:34 PST April 11, 1999, and 21:48 PST April 11, 1999, for a duration of approximately 7.2 hours. The flow gradually increased as the storm intensified (Figure 1.1.3.7). The peak flow of the entire storm was 1.40 cfs with a total storm volume of 7,160 cf, of which a representative stormwater sample was captured at approximately 70 percent.

The effluent flow occurred between 15:28 PST April 11, 1999 and 06:20 PST April 12, 1999, for a duration of 14.9 hours. The flow peaked at 1.02 cfs for a total storm volume of 1,964 cf. The detention time was approximately 15.8 hours. The representative captured sample was estimated to be 97 percent of the stormwater.

Foothill Maintenance Station SF

The influent flow occurred at Foothill Maintenance Station SF between 13:27 PST April 11, 1999 and 02:51 PST April 12, 1999, for a duration of approximately 13.4 hours. As before the influent reacted quickly to rainfall intensity (Figure 1.1.3.8). The peak influent flow was 0.41 cfs, with a stormwater volume of 4,381 cf. The representative storm volume sample captured was estimated at 100 percent.

The peak effluent flow (0.21 cfs) is driven by the pump rate and generally will not vary significantly. It appeared that the pump stayed on for long periods of time as the level of the sump reached equilibrium. Apparently the inflow into the sump was great enough that it the pump never discharged enough water to cause the lower limit float switch to trigger off. Total stormwater volume was reported as 17,995 cf. The detention time was approximately 33.6 hours. The representative storm volume sample captured was estimated at 99 percent.

It should be noted that the algorithm used to calculate pump discharge rates failed to consider the frictional losses attributed to the discharge pipes. This was corrected immediately after the 1998/1999 storm season.

Summary

Throughout these first events, many flow-measuring anomalies were recorded. Factors that contributed to erroneous volume calculations or results included infiltration, structural leakage, instrumentation inaccuracies under low flow and turbulent conditions, and hydraulic interferences.

As discussed at length in the sections that follow, corrective action, adjustments, and calibrations are currently underway to maximize flow-measuring accuracy and will be in place for 1999/2000 monitoring events.

1.2 Water Quality Analyses

All stormwater analyses were conducted by a certified laboratory under the California Environmental Laboratory Accreditation Program (ELAP). The analyses were performed in substantial accordance with the methods and procedures as outlined in the *Operation, Maintenance, and Monitoring Plan, District 7, Volume II* (i.e., OMM Guidance - Quality Assurance Project Plan) and as specified by applicable EPA methods. Table 1.2.1 summarizes the laboratory analyses performed on stormwater samples collected from the four BMPs that operated during the latter months of the 1998/1999 rain season (March-April). Analytical results are discussed in Section 1.3

Table 1.2.1
Analytical Methods Summary, District 7 BMPs, Brown and Caldwell

Analyte	Sample Type	Analytical Method
Conventionals		
pH	Composite	EPA 150.1
Specific Conductance	Composite	EPA 120.1
Hardness	Composite	EPA 130.2
TSS	Composite	EPA 160.2
Nutrients		
Nitrate-N	Composite	EPA 300
TKN	Composite	EPA 351.1
Total Phosphorous	Composite	EPA 365.3
Total/Dissolved Metals		
Copper	Composite	EPA 200.8
Lead	Composite	EPA 200.8
Zinc	Composite	EPA 200.8
Organics		
TPH -diesel	Grab	EPA 8015M
TPH -oil	Grab	EPA 8015M
TPH-gasoline	Grab	EPA 8015M
Bacteria		
Fecal Coliform	Grab	SM 9221E

1.2.1 Quality Assurance/Quality Control Procedures

Quality Assurance/Quality Control (QA/QC) procedures were followed and performed by field and laboratory personnel to provide quality control checks on the representativeness of the environmental samples (i.e., stormwater) collected, the precision of sample collection and

handling procedures, and the precision and accuracy of the laboratory procedures. The following section provides a summary of these procedures.

1.2.1.1 Data Quality Control (QC) Overview

Sample and data quality control (QC) measures consisted of the following elements:

- Standard procedures were followed for sample collection, identification, labeling and packaging.
- Blind field QC samples were collected for each type of sample analyzed (if applicable) for each storm event. These samples included field blanks and field duplicates. Additionally, sufficient sample volumes were submitted to the laboratory to ensure that at least one set of matrix spikes (MS/MSD) and laboratory split sample analyses was performed for each storm event.
- Customized chain-of-custody forms listing the specific analyses and method required for each BMP type were used which documented the transfer of samples from the field to the laboratory.
- Standard procedures were followed for sample compositing, splitting, preparation and analysis.
- Quality control measurements were performed by the laboratory in accordance with the OMM Guidance - Quality Assurance Project Plan specifications. These measurements includes the analyses of blanks (i.e., method blanks, filter blanks, equipment blanks, and bottle blanks), laboratory control sample (LCS), MS and MSD samples, and surrogate spikes, if applicable. Note that MS/MSD analyses were always performed on a project sample.
- Pre-defined standards were in place for all QC measurements in accordance with the data quality objectives outlined in the OMM Guidance - Quality Assurance Project Plan.
- Final data packages were submitted by the laboratories and reviewed by Brown and Caldwell project staff. These packages included final analysis results as well as electronic data deliverables (EDDs) in a format consistent with the 1998-99 Data-Reporting Protocols.
- Second-party review was completed of all results and calculations prior to reporting from the laboratory.
- Brown and Caldwell project staff review was completed for all results and supporting QC measurements submitted by the laboratories.
- One hundred percent verification of all data presented in the report against the hard copy laboratory report and EDD was completed by Brown and Caldwell project staff.

The implementation of these procedures was monitored during each storm event to ensure compliance with the requirements specified in OMM Guidance - Quality Assurance Project Plan. Field activities were monitored through the use of field QC samples and evaluation of field documentation, which included the use of field notebooks and monitoring forms. Laboratory data

quality was assessed using laboratory QC samples and measurements, and the data were assessed for conformance with project-specific standards. The results of this evaluation are presented in Section 1.3.1.

1.3 Water Quality Results

Water Quality Results for the four BMP sites monitored to date are presented in Table 1.3.1. Although Brown and Caldwell staff has mobilized for a total of four separate storm events (March 20, March 25, April 6, and April 11), the first storm did not generate sufficient runoff to allow the collection of paired stormwater samples. As indicated in Table 1.3.1, the subsequent events were to some extent successful in that at least one or more BMP sites could be evaluated with respect to water quality data.

In general monitoring results for effluent samples collected from the four BMP sites show a decrease in concentration for most analytes. However, some exceptions were noted in the data where higher concentrations of some analytes (i.e., diesel and oil) have been observed (Table 1.3.1) in the effluent sample. No evidence of equipment, field and/or laboratory contamination that could have contributed to the higher concentrations at the effluent station was noted in the blank sample analyses performed by the laboratory. Refer to the following sections for further discussion on quality control sample results and water quality data interpretation.

1.3.1 Assessment of Quality Assurance/Quality Control Results

The following sections provide a summary of the QA/QC review for field and laboratory analytical data generated during the latter months of the 1998/1999 rain season. This review as presented below represents the first step (data verification) in the data validation process by which results are validated for overall accuracy, precision, and representativeness to establish data quality and usability. The approach used in the validation process involves the review of chain-of-custody forms, preparation, and use of checklists, which detail the required QC for each respective analytical method; verification and documentation of compliance with the applicable criteria; and, finally, assignment of qualifiers to sample results associated with QC samples that did not meet the validation criteria.

The assessment below is intended to provide a synopsis of any significant problems identified during the data verification step that may lead to data qualification (i.e., assignment of qualifiers) during the latter portion of the validation process. The evaluation on whether or not qualification of the data is deemed necessary will follow the basic guidelines from the United States Environmental Protection Agency (EPA) for evaluating inorganic and organic analysis (EPA February 1994a; EPA, 1994b). A comprehensive discussion of this evaluation and the data validation results will be presented in a later comprehensive report.

Table 1.3.1
BMP Retrofit Pilot Study District 7, Stormwater Analytical Data

									Total (mg/L)			Dissolved (mg/L)									
Sample Date	Location	Site ID	BMP Type	% Storm Capture	pH	Specific Conductance (mmhos/cm)	Hardness (mg/L)	TSS (mg/L)	Cu	Pb	Zn	Cu	Pb	Zn	Nitrate Nitrogen(1) (mg/L)	TKN(1) (mg/L)	Total P(1) (mg/L)	Fecal Coliform (MPN/100mL)	TPH Diesel (mg/L)	TPH Gasoline (mg/L)	TPH Oil (mg/L)
25-Mar-99	I-5/I-605 Intersection	074101	EDB (2) - Influent	100	NR	NR	—	—	—	—	—	—	—	—	NR	—	—	1600(3)	—	—	—
25-Mar-99	I-5/I-605 Intersection	074101	EDB (2) - Effluent	0	—	—	—	—	—	—	—	—	—	—	—	—	—	900(3)	—	—	—
25-Mar-99	I-605/SR-91 Intersection	074102	EDB (2) - Influent	100	7.7	110	76	85	56.0	190.0	390.0	15.0	6.2	130.0	1.00	1.8	0.330	900	2900	<50	1300
25-Mar-99	I-605/SR-91 Intersection	074102	EDB (2) - Effluent	100	7.5	190	62	59	37.0	120.0	260.0	14.0	2.0	130.0	2.10	3.4	0.780	500	2900	<50	1100
25-Mar-99	Foothill Maintenance Station	074203	Media Filter - Influent	100	NR	NR	—	—	—	—	—	—	—	—	NR	—	—	>1600(3)	—	—	—
25-Mar-99	Foothill Maintenance Station	074203	Media Filter - Effluen	0	—	—	—	—	—	—	—	—	—	—	—	—	—	<2(3)	—	—	—
6-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Influent	100	7.2	160	48	71	34.0	88.0	200.0	17.0	5.5	72.0	0.84	2.0	0.410	1600	2200	<50	1300
6-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Effluent	99	7.3	190	44	44	30.0	63.0	140.0	19.0	2.5	68.0	0.81	2.0	0.450	300	3000	<50	1300
6-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Influent	100	7.4	120	38	80	50.0	250.0	310.0	13.0	11.0	73.0	0.88	2.4	0.170	>1600	3900	<50	2000
6-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Effluent	100	7.3	200	62	49	30.0	140.0	220.0	12.0	3.5	88.0	2.00	2.9	0.860	>1600	5200	<50	3800
6-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Influent	95	6.9	85	24	57	19.0	37.0	130.0	10.0	2.1	37.0	0.68	0.9	0.150	900	1200	<50	640
6-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Effluen	79	7.1	82	24	20	11.0	11.0	36.0	7.8	1.4	12.0	0.77	1.0	0.088	110	1100	<50	450
6-Apr-99	Foothill Maintenance Station	074203	Media Filter - Influent	99	6.6	49	22	120	42.0	45.0	340.0	19.0	1.3	110.0	0.37	1.4	0.320	500	1000	<50	320
6-Apr-99	Foothill Maintenance Station	074203	Media Filter - Effluen	95	7.0	80	26	21	18.0	6.4	45.0	14.0	<1.0	21.0	0.43	0.6	0.090	<2	500	<50	<200
11-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Influent	87	7.2	79	24	48	21.0	60.0	140.0	8.7	3.6	40.0	0.52	1.5	0.210	500	2000	<50	1200
11-Apr-99	I-5/I-605 Intersection	074101	EDB (2) - Effluent	75	7.4	86	24	12	11.0	17.0	41.0	8.1	1.5	53.0	0.56	1.0	<0.03	2	1200	<50	510
11-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Influent	70	7.5	63	21	61	30.0	99.0	240.0	7.4	3.8	56.0	0.44	1.8	0.029	110	3600	<50	2100
11-Apr-99	I-605/SR-91 Intersection	074102	EDB (2) - Effluent	97	7.5	95	28	94	19.0	47.0	99.0	6.7	2.0	43.0	0.74	1.6	0.340	500	3900	<50	2200
11-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Influent	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	900	1300	<50	670
11-Apr-99	Eastern Regional Maintenanc	074202	Media Filter - Effluen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90	630	<50	210
11-Apr-99	Foothill Maintenance Station	074203	Media Filter - Influent	100	7.1	59	16	68	28.0	21.0	220.0	24.0	2.9	120.0	0.37	1.2	0.180	>1600	940	<50	560
11-Apr-99	Foothill Maintenance Station	074203	Media Filter - Effluen	99	7.2	88	30	11	17.0	3.7	33.0	15.0	<1.0	21.0	0.35	0.7	0.080	>1600	570	<50	<200

(1) Analysis requested for samples from drain inlet inserts beginning on 3/25/99 by Caltrans but not required as part of OMM Plan. These analyses will be required in a revised OMM plan before the next wet season.
(2) Extended Detention Basin.
(3) Although event was not successful, analyses were performed to comply with holding time requirements.

NR - Not Reported. Analysis was performed to comply with holding time requirements. However, paired samples were not successfully collected.
NA - Not Analyzed

1.3.1.1 Summary of QA/QC Review

As previously mentioned QC samples were collected during each storm event. Prior to each event a QC schedule was developed to determine the type of QC samples to be collected at each site in a manner to satisfy the requirements outlined in the OMM Guidance – Quality Assurance Project Plan. Given the constraints associated with the collection of stormwater samples, the QC schedule was designed to accommodate at least four separate plans in case sufficient sample volume was not obtained from the designated QC station. Table 1.3.1.1 presents a summary of the actual QC schedule applied during the three storm events monitored.

Table 1.3.1.1
Quality Control Sample Schedule, 1998/1999 Wet Season

Site	March 25, 1999	April 6, 1999	April 11, 1999
I-5/I-605 EDB	None	None	Field Duplicate; MS/MSD
I-605/SR-91 EDB	Field Duplicate; MS/MSD; Field Blank	Field Blank	Lab Split
Eastern Regional SF	Lab Split	Lab Split	Field Blank
Foothill SF	None	Field Duplicate; MS/MSD	None

In general, QC sample measurements were of sufficient quality to meet the data quality objectives of the project except as discussed below.

Holding Times

Holding times were met for all samples except for bacteriological analyses (fecal coliform) performed on samples collected during the March 25 storm event. During that event, samples from all four BMPs were analyzed beyond the six-hour allowable holding time but within the twenty four-hour technical holding time in accordance with *the Standard Methods for the Examination of Water and Wastewater, 18th Edition*. Although, the few hours exceedance do not affect the overall data interpretation in this report, the results associated with these samples should be considered as an approximation of actual concentrations and therefore will be qualified as estimated quantities during the latter portion of the validation process.

Project Detection Limits

Table 1.3.1.2 provides the RDLs achieved by the laboratory, which are compared to the target RDLs proposed by LWA.

Blank Sample Analyses

All blanks were prepared in accordance with the project specifications as outlined in the OMM Guidance – Quality Assurance Project Plan. Blank sample results were evaluated to determine whether contamination was introduced as a result of sample equipment contribution (sampling hose and tubing blanks, and composite bottle blanks) and/or field and analytical procedures (field blanks, trip blanks, filter blanks and method blanks). A preliminary review of these blank data does not indicate any systematic contamination problems. In general, field- and laboratory-generated blanks were free of any target analytes. However, the detection of concentrations near the RDLs for metals (i.e., lead and zinc) in some of the sample equipment blanks may result in the addition of qualifiers to associated sample results. The determination of whether data will be qualified on the basis of blank contamination will depend on the evaluation of blank concentrations with respect to concentrations detected in the associated environmental samples. Associated positive sample results that are less than 5 times or 10 times (10 times is only applicable to metals or any common laboratory contaminants) the amount found in the blank will be qualified accordingly to avoid the potential positive bias. It is anticipated that the detection of metals in some of the blanks will affect results for the dissolved fraction.

Precision, Accuracy, and Representativeness

While the results of field duplicates analysis are used to measure field and laboratory precision, the analysis of split samples are used to measure the reproducibility of laboratory replicates under a given set of conditions. Precision is expressed in terms related to the mean concentration (relative percent difference - RPD) for field duplicates, laboratory splits and MS/MSD analysis. Preliminary review of the data generated during the 1998/1999 rain season indicated that MS/MSD RPD values were all within the acceptance criteria for precision. In general, field duplicates and laboratory splits are within these criteria. However, a through evaluation and interpretation of these results will be presented in a later comprehensive report.

Table 1.3.1.2
Reporting Detection Limits, Caltrans District 7 Retrofit Pilot Program

Analysis	Units	Method	BMP Required Reporting Limits (LWA 1997)	Del Mar Analytical Reporting Limits	Comment
pH	Unit	EPA 150.1	0.1	0.1	
Specific Conductance	umhos/cm	EPA 120.1	1	1	
Hardness	mg/L	EPA 130.2	2	2	
TSS	mg/L	EPA 160.2	1	1	1 mg/L provided that sample volume equals 1 liter. Otherwise, reporting limit will default to 10 mg/L.
Nitrate-Nitrogen	mg/L	EPA 300	0.01	0.11	Variability of method prohibits RL of 0.01.
TKN	mg/L	EPA 351.3	0.1	0.1	
Total P	mg/L	EPA 365.3	0.002	0.03	Variability of method prohibits RL of 0.002.
Copper	ug/L	EPA 200.8	1	1	
Lead	ug/L	EPA 200.8	1	1	
Zinc	ug/L	EPA 200.8	1	5	Method blank contamination at <5 ug/L is very possible and may render data to be flagged during the validation process.
TPH-Gasoline	ug/L	EPA 8015M	50	50	
TPH-Diesel	ug/L	EPA 8015M	100	100	
TPH-Oil	ug/L	EPA 8015M	200	200	
Oil & Grease	mg/L	EPA 413.2	5	5	
Fecal Coliform	mpn/100mL	SM 9221E	200	200	

Accuracy is expressed as the percent recovery for both laboratory control samples (LCS), matrix spikes (MS/MSD), and surrogate spikes (where applicable). The laboratory control sample serves as a monitor of the overall performance of all steps in the analysis, including sample preparation. Matrix spike sample analysis provides information about the effect of each sample matrix on the sample preparation and determination methodology. Surrogate spike recovery measures accuracy in terms of sample extraction efficiency (organic compounds only). In general, all accuracy values were within the acceptance criteria, except for surrogate recoveries associated with total petroleum hydrocarbon (TPH) analyses for diesel and oil. Percent recoveries for some of these analyses were reported above the laboratory upper control limit. This problem is believed to be the result of matrix interference caused by elevated TPH concentrations in the samples. In fact, the high TPH concentrations detected in some samples caused the surrogate spike to be diluted out. A detailed evaluation of surrogate spike recoveries in conjunction with other data accuracy measurements (i.e., matrix spikes and LCS data) will be performed to determine whether data qualification is deemed necessary. Results of this evaluation will be presented in a later comprehensive report.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter, variations at a sampling point, a process condition or an environmental condition. Sample identity and integrity were maintained using the documentation and custody procedures, and by adhering to the preservation, storage, and holding times specified in the OMM Guidance.

1.3.1.2 Trace Metals and Hardness

Results for trace metal analyses are generally showing a decrease in concentration at the effluent sampling point at all four BMP sites. Some exceptions have been observed at the two EDBs during the last monitoring event where zinc concentrations actually increased after treatment. This increase, however, does not appear to effect the overall data interpretation. In general, metal concentrations were higher during the first two storms (March 25 and April 6).

Hardness results are generally less variable than the metals, showing nearly no decrease in concentration at the effluent sampling point. Data collected during the April 6 event at the I-605/SR-91 EDB and the April 11 event at Foothill MS SF show an increase in concentration at the effluent sampling point. Additional monitoring data may help identified, if any, data trends for this analyte.

1.3.1.3 Conventional and Other Contaminants

Except for total phosphorous, the data do not show any significant decrease in concentration after treatment for nutrient analyses. Total phosphorous results associated with three of the BMP sites (I-5/I-605 Intersection, Foothill MS, and Eastern Regional MS) monitored, show a significant decrease in concentration after treatment (i.e., one order of magnitude). This decrease in concentration is not observed for the I-605/SR-91effluent samples collected from any of the three monitoring events.

TPH diesel and oil have been observed at all BMP sites with concentrations ranging from lowest at the Foothill MS to highest at the I-605/SR-91 Intersection. Increased in TPH concentrations (diesel and oil) at the effluent sampling point have been detected at the two EDB sites. At I-605/SR-91, this increase in concentration is shown in samples collected during all three monitoring events. Generally the detection of TPH at all four BMPs is consistent with oil sheen observed at these sites.

Fecal coliform results are scattered and varied significantly among BMPs and the different monitoring events. No concentration pattern is observed at this time. Future monitoring data may help in the interpretation of bacteriological data.

1.3.2 Preliminary BMP Performance Evaluations

Plot diagrams of metals, TPH (diesel and oil), and bacteriological data are shown on Figures 1.3.2.1 through 1.3.2.20. As indicated by a consistent pattern observed in these plots, there is an overall reduction in concentration of metals after treatment at all BMPs. Among the BMP types monitored to date, metals concentrations appear to have decreased the most at the Foothill MS BMP (Figures 1.3.2.7 through 1.3.2.9). Between the two EDB BMPs, however, I-605/SR-91 appears to be more efficient in reducing the metals at this time.

In contrast with the metals data, elevated TPH results for both diesel and oil fractions have been detected in samples collected after treatment (effluent sample) during most of the monitoring events at the I-605/SR-91 (Figure 1.3.2.19). Eastern Regional MS (Figure 1.3.2.15) and Foothill MS (Figure 1.3.2.17) are showing reductions of TPH (diesel and oil), but this trend is based only two storm events. TPH gasoline fraction has not been detected in any of the BMPs.

As previously mentioned, bacteriological data collected to date (Figures 1.3.2.14, 1.3.2.16, 1.3.2.18, and 1.3.2.20) do not show a trend in concentrations to support an evaluation of any of the BMPs at this time. Among the nutrient analysis results, with the exception of I-605/SR-91, total phosphorous appears to be the only analyte where significant reduction concentration is occurring. At I-605/SR-91, total phosphorous concentrations have consistently increased after treatment. It is not clear at this time why this is occurring.

In summary, the data collected during the latter portion of the 1998/1999 rain season indicates that all four BMPs monitored to date are performing as anticipated in the reduction of metals. However, these BMPs do not appear to be performing as well with respect to the other constituents. Additional monitoring data will be used to drawn final performance evaluation regarding the different BMP types.

2.0 BMP OPERATIONS

Operational parameters of BMPs were recorded on field log sheets in accordance with prescribed guidance presented in the *Operation, Maintenance, and Monitoring Plan, District 7, Volume II* (i.e., OMM Guidance). Assessment of BMP operational performance was determined using empirical observations (Form H of the OMM Guidance). Empirical observations were taken at variable times for each monitored event, which were sometimes hampered by traffic, weather, and insufficient light.

2.1 Introduction and Methods

Under the scope of this program, Brown and Caldwell is responsible for monitoring 10 BMP facilities in District 7, which include:

- Two extended detention basins (EDB), sites 74101 & 74102,
- One oil/water separator (OWS), site 74201,
- Four sand filters (SF), sites 74104, 74202, 74203, 74204, and
- Three multi-chambered treatment trains (MCTT), sites 74103, 74206 and 74207.

Monitoring of BMP operations began with the satisfactory completion of construction, and after automated monitoring instrumentation was adequately installed. During the latter months of the 1998/1999 rain season (March—April), monitoring of BMP operations were initiated at the following District 7 locations:

1. SF Site 74202 (Eastern Regional Maintenance Station), which was operational the week of February 8, 1999,
2. EDB Site 74102 (I-605/SR-95), which was operational the week of February 15, 1999,
3. EDB Site 74101 (I-5/I-605) , which was operational the week of February 15, 1999, and
4. SF Site 74203 (Foothill Maintenance Station), which was operational the week of March 1, 1999.

Operational dates provided above denote periods when monitoring instrumentation was largely complete and event monitoring was initiated. However, adjustments to equipment programming and instrumentation continued throughout the wet-season period. Through this initial break-in period, various adjustments or modifications became necessary to optimize or correct BMP performance. These situations are described in more detail in the sections that follow.

Empirical observations that were recorded for the four BMPs that operated during the late 1998/1999 storm season, included:

- Meteorological characteristics (rainfall presence and intensity [refer to Section 1]),
- Hydrological and hydraulic characteristics,
- Inlet conditions,
- Water quality appearance,
- Solids deposition and re-suspension,
- Outlet conditions,

- Mosquitoes and other vectors,
- Structural condition of the facility, and
- Monitoring equipment conditions.

In addition, other site-specific BMP observations recorded included:

- Erosion and vegetation conditions at EDBs (I-5/I-605 and I-605/SR-91), and
- Treatment medium (sand) conditions at sand filters (Eastern Regional and Foothill Maintenance Stations).

Four additional BMP facilities that came online after the 1998/1999 wet season, for which no storm monitoring data has been collected, included:

5. SF Site 74204 (Termination Park and Ride) operational the week of April 19, 1999,
6. OWS Site 74201 (Alameda Maintenance Station), operational the week of April 26, 1999,
7. MCTT Site 74206 (Via Verde Park and Ride) operational the week of May 3, 1999, and
8. MCTT Site 74208 (Lakewood Park and Ride) operational the week of May 3, 1999.

Two additional BMPs are expected to be completed in early 2000, which include:

9. SF Site 74103 (Paxton Park and Ride) and
10. MCTT Site 74104 (Metro Maintenance Station).

2.2 Summary of Empirical Observations and BMP Methods

Empirical observations were collected in accordance with established OMM guidance (Form H). Synoptic discussions of these observations by Brown and Caldwell during the 1998/1999-storm season are discussed in the sections below.

2.2.1 Extended Detention Basin

The results of empirical observations at operational EDB sites during the 1998/1998-rain season are summarized for sites 74101 (I-5/I-605) and 74102 (I-605/SR-91).

2.2.1.1 Site 74101 – Extended Detention Basin, I-5/I-605

Hydraulic Characteristics

Water flow into and out of the basin occurred as designed. However, standing water tends to accumulate in the discharge outlet structure. Adjustments to the outlet structure are necessary to eliminate standing water and discharge pipe characteristics need modification to improve suitable outlet flow monitoring under low-flow conditions. Detention characteristics were

otherwise normal and the basin functioned properly. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

Flow entering the facility was observed to occur as designed. On occasion, water backed up into the inlet structure during periodic runoff peaks, but was not sufficient to induce inflow bypassing. The immediate inlet structure area was found to accumulate varying degrees of trash, which usually consisted of cigarette butts and organic debris.

Water Quality

Storm water in the basin was generally a translucent greenish-brown with some cloudiness. Surface films were common, ranging from dust and organic material (plant matter) on the water surface to petroleum sheens. An oily sheen was evident during most storm events, particularly earlier in the season.

Trash tended to concentrate around the inlet structure rip-rap, whereas organic material was apparent over the entire basin (straw, grass cuttings, etc.). Flotsam was noted on several events. No odor was detected.

Solids Deposition and Resuspension

Due to the short operational life of this facility, sedimentation has been light and is concentrated near the downgradient discharge structure. Resuspension of sediment has not typically occurred due to the distance from the inlet and accumulated sediment near the outlet area.

Erosion

Concrete lining of the basin floor and inside slopes minimizes erosion potential. There was no apparent erosion observed at this site. The operational integrity of this EDB will not be significantly jeopardized by site erosion.

Vegetation Conditions

The hydroseeded vegetation took hold over the course of the season and provided good ground-cover protection. Some bare spots were noted throughout monitoring. Vegetation will be cut in June 1999, with seasonal growth expected to return with wet weather conditions.

Outlet Conditions

Flow from the outlet structure occurred as designed. Some minor standing water collects in the concrete discharge structure.

Attempts to monitor discharge flow during light storm events proved difficult due to very shallow flow over electronic flow sensors. Therefore, a V-notch weir was installed in the discharge pipe to promote greater water depth over the flow sensor during light outflow, which improved accuracy of instrumentation readings. Consequently, water retained behind the weir caused standing water in the basin due to the extremely flat topography of this site. In turn, the weir drain plug was removed (after several days) to allow the basin to completely drain, which compromised outflow measurement accuracy. Flow measurement configuration is currently under re-design, and will be incorporated for the 1999/2000-storm season.

Mosquitoes and Other Vectors

There have been minor occurrences of mosquito egg rafts and other mosquito activity noted by vector experts. Upon notification, areas of standing water were pumped out to mitigate vector breeding. There were no vector problems evident during monitoring events. Waterfowl (ducks) were observed in the basin on one occasion.

Structural Integrity

There were no structural issues at this concrete-lined detention basin. However, there are minor drainage problems downgradient of the BMP discharge outfall. Improvements to stormwater conveyance and overland flow are being implemented over the dry season.

Graffiti was observed near the site, but not within the facility.

2.2.1.2 Site 74102 – Extended Detention Basin, I-605/SR-91

Hydraulic Characteristics

Based on visual characteristics and sampling results, flow through this earthen basin is occurring too quickly. Detention times in the basin ranged from 6.27 hours to 28.07 hours for rainfalls ranging between 0.58 inches and 1.62 inches, which indicates that the basin is draining quicker than desired (based upon a 72-hour design). The design engineer is being consulted to improve the efficiency of the basin. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

The inlet structure functioned properly during each monitored storm event. Sediment accumulation within the inlet pipe was noted, which may require maintenance attention during the next monitoring season. No abnormalities with inlet conditions were noted.

There were varying degrees of trash entering the basin. Usually consisting of cigarette butts and floating paper trash. The majority of trash usually collected at the inlet rip-rap and did not spread over the entire basin. The entrapment of flotsam at the inlet was observed to partially backup inflow. Trash management during significant storms may be an issue at this EDB.

Water Quality

Oily sheens were noted, but did not appear to be persistent throughout the storms monitored (more noticeable at the onset of the wet season and less noticeable later in the season). Storm water in the basin was generally brown and cloudy, but transparent under light flow conditions. No odor was detected.

Solids Deposition and Resuspension

Because this facility is an earthen basin, the deposition of sediment is not readily apparent without monitoring accumulation relative to gauging stakes. During the short monitoring season, no significant buildup of sediment was measured.

Resuspension at this EDB may be a concern with larger storms than were experienced during the 1998/1999 monitoring year. The largest storms that occurred (around 1 inch of accumulation) were found to induce a slight scouring effect along the longitudinal flow path from inlet to outlet, which appears to promote sedimentation in effluent samples.

Erosion

As noted above, some degree of erosion was evident in the bottom of the basin, where the incoming water "channels" towards the outlet. However, soil stabilization throughout the basin inner and outer slopes was good. No rilling was apparent, but sedimentation on the driveway below the BMP was observed.

It is important to note that this site serves as a construction storage area, as well as a BMP facility. Throughout the life to this BMP, various construction contractors have occupied the right-of-way area west of the BMP. During recent maintenance surveys, outer and inner slope rutting was found, which is suspected to be from vehicle activity in and around the EDB. Further hydroseeding may be necessary in fall to repair and cover exposed areas.

Vegetation Conditions

The hydroseeded vegetation took hold over the course of the wet season and provided good ground-cover protection. However, some bare spots were noted throughout monitoring. Vegetation will be cut in June 1999, with seasonal growth expected to return with wet weather conditions.

Outlet Conditions

The outlet functioned properly and did not experience any fouling or blockages, but rather appeared to allow water to pass through the facility too rapidly. Although stormwater flows through the basin and discharge structure occurred as designed, the drainage standpipe weep

holes may need modification to reduce flow-through and increase residence time. This condition will be addressed and corrected before the onset of the 1999/2000 wet season.

Mosquitoes and Other Vectors

There were no vector problems noted during 1998/1999 monitored storms.

Structural Integrity

During the 19998/1999 storm events, no structural problems were noted. However, recent vehicle traffic in and on this BMP is of concern (see Erosion section above).

2.2.2 Oil/Water Separator

2.2.2.1 Site 74201 – Oil/Water Separator, Alameda Maintenance Station

The OWS at Alameda Maintenance Station came online during the week of April 26, 1999, and was not monitored during the 1998/1999-storm season. No data is available to report.

2.2.3 Sand Filter Type I

Brown and Caldwell monitored two sand filters during the 1998/1999 rain season: site 74202 (Eastern Regional Maintenance Station) and site 74203 (Foothill Maintenance Station). Two other sand filters, site 74103 (Paxton Park and Ride) and site 7204 (Termination Park & Ride), will be reported following 1999/2000 monitoring events.

2.2.3.1 Site 74103 (Paxton Park and Ride)

This facility has not been constructed. No data is available to report.

2.2.3.2 Site 74202 – Sand Filter, Eastern Regional Maintenance Station

Hydraulic Characteristics

Empirical observations have been collected for four principal storms during the 1998/1999 wet season. For each of these events, hydraulic flow from the sediment chamber through the weep pipe to the sand filter weir appeared consistent. On all occasions, overflow from the weir plate to the sand bed was mostly limited to the area closest to the inflow junction of the sediment chamber weep pipe (west end of weir plate). However, the weir was designed to distribute the flow evenly over the adjacent gravel rip-rap before sheet flowing over the sand. Because overflow was not uniform along the entire weir plate, overflow tended to follow a natural, but limited, pathway toward the collection pump well. Broad and uniform flow over the sand media did not occur, but was rather limited to a narrow tributary directed toward the pump well. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

The inlet structure functioned properly during each monitored storm event. No problems were noted. However, electronic flow monitoring at this facility experienced uncontrollable and unforeseen faults that compromised flow data.

Water Quality

The water, in the basin, generally was brown with heavy, opaque cloudiness. Resuspension of accumulated sediment contributed to the apparent opaqueness of the sediment chamber water. A greenish-yellow surface scum was observed in the sedimentation chamber during all monitored events. Petroleum sheens were observed during each event. There was very little trash or organic material entering the basin, a few paper cups, leaves, etc. A chlorine odor was detected at the inflow structure during one event. There was no readily apparent source of the chlorine odor.

Solids Deposition and Resuspension

Slight but consistent sedimentation was observed to build up over time in the sediment chamber. During inflow, sediment that had settled on the chamber floor appeared to be redistributed from inflow agitation in the vicinity of the inflow downspout. This likely attributed to opaque coloration in the sediment chamber water.

Erosion

There are no erosion concerns at this SF facility. The entire site is paved and impervious to rainfall.

Vegetation Conditions

There are no vegetation concerns at this SF facility. The entire site is paved and provides no opportunity for significant vegetative growth. However, as this BMP ages, maverick seeds, spores, or other windblown plant cuttings may find growth opportunity in the sand bed media. There is currently no invasive growth in the sand bed.

Outlet Conditions

This facility is equipped with a submerged sump beneath the sand bed filter. Discharge from the sand bed collection sump is pumped mechanically to a neighboring stormwater conveyance ditch on site. There are no discharge outlet structures other than piping associated with the sump pump. No irregularities were noted with these devices.

Mosquitoes and Other Vectors

Due to impervious surfaces and persistent onsite activity, no vector problems were evident during the storm events monitored. To date, there has been no mosquito breeding concerns noted at this facility.

Structural Integrity

Due to the uneven distribution of water flow over the weir plate to the sand bed at this facility, "v" notches were cut into the weir to promote outflow opportunities along the length of the weir. This structural modification corrected the concentrated flow problem (see Section 3, Maintenance).

During the first monitored storm event at this facility on March 20 1999, it was evident that structural problems were affecting hydraulic flow-through: there was no discharge from the BMP following the first storm of its operation. The construction contractor was notified and a repair initiated. During the investigation it was found that the sump floor of the sand filter was leaking and filtered stormwater was being lost to the substrate.

2.2.3.3 Site 74203 – Sand Filter, Foothill Maintenance Station

Hydraulic Characteristics

As with the Eastern Regional Maintenance Station SF noted above, empirical observations were collected for four principal 1998/1999 storms at this facility. During each event, hydraulic flow from the sediment chamber through the weep pipe to the sand filter weir appeared consistent. However, overflow from the weir plate to the sand bed was confined to the area in front of the weep pipe discharge outlet (north end of weir plate), which resulted in a concentrated flow to the adjacent gravel rip-rap at this location. Hence, overflow to the sand bed tended to follow a naturally defined gradient toward the collection pump well. Broad and uniform flow over the sand media did not occur, but was rather limited to a narrow tributary directed toward the pump well. See Section 1.1.3 for additional details and discussion on other hydraulic characteristics.

Inlet Conditions

The inlet structure functioned properly during each monitored storm event. No problems were noted. On one occasion the water in the sediment basin backed up into the inlet invert but did not cause bypass.

Water Quality

Trash and organic material were observed entering the basin on all occasions. Storm water collected in the sedimentation basin generally was an opaque brown with heavy cloudiness. An oily surface sheen was observed during each event. No odor was detected.

Solids Deposition and Resuspension

Various non-stormwater flows at this location contribute to sediment buildup in the sediment chamber.

During stormwater inflow, inflow agitation redistributes sediment settled on the chamber floor in the vicinity of the downspout. This likely attributed to opaque coloration in the sediment chamber water.

Erosion

There are no erosion concerns at this SF facility. The entire site is paved and impervious to rainfall.

Vegetation Conditions

There are no vegetation concerns at this SF facility. The entire site is paved and provides no opportunity for significant vegetative growth. However, as this BMP ages, maverick seeds, spores, or other windblown plant cuttings may find growth opportunity in the sand bed media. There is currently no invasive growth in the sand bed.

Outlet Conditions

This facility is equipped with a submerged sump beneath the sand bed filter. Discharge from the sand bed collection sump is pumped mechanically to a neighboring stormwater conveyance ditch on site. There are no discharge outlet structures other than piping associated with the sump pump. No irregularities were noted with these devices, except for flow metering malfunctions that were inherent to electronic instrumentation. These problems have been repaired.

Mosquitoes and Other Vectors

Due to impervious surfaces and persistent onsite activity, no vector problems were evident during the storm events monitored. However, due to persistent influx of non-stormwater discharge, this facility is prone to harboring standing water and the potential for mosquito breeding. SGV VCD has identified mosquito presence in this BMP but has not treated standing water because of access limitations.

Structural Integrity

Due to the uneven distribution of water flow over the weir plate to the sand bed at this facility, "V" notches were cut into the weir to promote outflow opportunities along the length of the weir. This structural modification corrected the concentrated flow problem (see Section 3, Maintenance).

2.2.3.4 Site 74204 – Sand Filter, Termination Park and Ride

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.2.4 Multi-chambered Treatment Trains

Brown and Caldwell will be monitoring three MCTT facilities during the 1999/2000 wet season. These include site 74104 (Metro Maintenance Station), site 74206 (Via Verde Park and Ride), and site 74208 (Lakewood Park and Ride).

2.2.4.1 Site 74104 – Multi-chambered Treatment Train, Metro Maintenance Station).

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.2.4.2 Site 74206 – Multi-chambered Treatment Train, Via Verde Park and Ride

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.2.4.3 Site 74208 - Multi-chambered Treatment Train, Lakewood Park and Ride

This facility was not online during the 1998/1999-storm season. No data is available for reporting.

2.3 BMP Operations Summary

Brown and Caldwell operated four BMP facilities during four storm events for the 1998/1999 monitoring season:

1. I-5/I-605 Extended Detention Basin (Site 74101),
2. I-605/SR-95 Extended Detention Basin (Site 74102),
3. Eastern Regional Maintenance Station Sand Filter (Site 74202), and
4. Foothill Maintenance Station Sand Filter (Site 74203).

In general, all BMPs performed as designed, although minor design modifications have been necessary. Design features that have required minor modifications during this first monitoring year include:

1. I-5/I-605 Extended Detention Basin (Site 74101)
    a. Reconfigure discharge outlet flow monitoring configuration
        i. Remove V-notch weir to promote thorough drainage and reduce standing water
        ii. Install H-flume for high-accuracy, low-flow discharge monitoring

b. Improve site drainage conveyance to reduce onsite ponding outside of BMP

2. I-605/SR-91 Extended Detention Basin (Site 74102)
   a. Increase residence time by modifying discharge weep pipe

3. Eastern Regional Maintenance Station Sand Filter (Site 74202)
   a. Repair leakage from sand filter sump
   b. Modify sand filter weir plate to promote improved distribution of stormwater flow over the sand filter bed
   c. Modify electronic flow instrumentation to improve flow monitoring accuracy

4. Foothill Maintenance Station Sand Filter (Site 74203)
   a. Modify sand filter weir plate to promote improved distribution of stormwater flow over the sand filter bed
   b. Modify electronic flow instrumentation to improve flow monitoring accuracy

As expected, each BMP that began operation this first year required some level of "fine tuning" to optimize performance.

3.0 BMP AND SITE MAINTENANCE

3.1 Introduction and Methods

The primary objective of BMP maintenance is to ensure the each site is properly maintained to achieve optimum performance. Both preventive and corrective maintenance measures that may be necessary to achieve this objective, can include:

- Removal of standing water,
- Sediment erosion, control, and removal,
- Structural integrity,
- Landscape management,
- Graffiti removal,
- Trash and debris removal,
- Mosquito and vector control, and
- General facility maintenance.

To date, maintenance has been conducted on four of the eight constructed BMPs that were operational during the wet season (I-5/I-605 and I-605/91 EDBs, and the Eastern Regional and Foothill Maintenance Station sand filters). Four additional sites are now operational and will be incorporated into the June 1999 maintenance inspections (Alameda Maintenance Station OWS, Termination Park and Ride SF, and Lakewood and Via Verde Park and Ride MCTTs).

Regularly scheduled maintenance inspections are conducted monthly, with weekly surveys being performed during extended periods of wet weather. Maintenance visits are also conducted after each large storm event (greater than 0.5 inches). During the visits, maintenance observations and needs were documented on the "BMP Site Inspection Checklist" (Form C). Based on this documentation, any immediate maintenance needs were arranged. Maintenance activities conducted between initial operation dates (beginning in February 1999) and present are summarized below.

3.2 Summary of Inspection and Maintenance Activities

Activities associated with inspection and maintenance visits conducted to date are described below in terms of each operational BMP type.

3.2.1 Extended Detection Basins

3.2.1.1 Site 74101—Extended Detention Basin, I-5/I-605

Removal of Standing Water

Following storm events, the EDBs are allowed to drain over a period of 48 to 72 hours, after which time site visits are made to check if standing water is present to control mosquito breeding. On several occasions, standing water has been observed inside the concrete discharge

outlet structure that accepts flow from the associated weep pipe. Standing water has been routinely removed using a sump pump, which was allowed to discharge through the effluent pipe to promote drainage away from the basin and into the neighboring conveyance system.

Sediment Erosion, Control, and Removal

EDB slope erosion is not a particular concern at this site due to the concrete lining design, and no erosion has been noted during site visits. Basin slopes and the immediate area surrounding the BMP have been hydroseeded to control and prevent erosion.

Since beginning operation in February 1999, sediment accumulation from stormwater runoff has not been significant due to the few storm events that occurred during the 1998/1999 wet season. Accordingly, sediment removal, testing, and disposal has not been required at this site. It is anticipated that sediment will not need to be removed prior to the end of the 1999/2000 storm season. However, at any time should basin sediment accumulate to a depth of 18 inches, appropriate sediment management actions will be implemented.

Structural Integrity

As this facility is only several months old, no structural problems have been observed during the maintenance visits or stormwater monitoring events. However, there are some related structural features at this location that are being modified to improve site drainage that is not associated with BMP operation. The following structural modifications are expected during the summer of 1999:

- The discharge outlet will be modified to include an H-flume to improve flow monitoring capabilities during low flow, while promoting complete drainage of the BMP
- The drainage gradient to the nearby stormwater conveyance system will be improved to eliminate onsite ponding.
- The drainage channel that bisects this site will be improved to reduce ponding and allow vehicle crossings along a newly constructed gravel driveway exit to the east.

Landscape Management

Vegetation has established well along the outside slopes of the basin. The hydroseed applied in February 1999 took several months to establish, and has grown to completely cover this site with grass and wildflowers. Weeds are also present.

In accordance with the revised vegetation guidelines specified in the Maintenance Indicator Document (MID), vegetation is allowed to grow to approximately 18 inches before cutting to a 12-inch maintenance height. On May 28, 1999, the contracted landscape-management company prepared the site for vegetation management (scheduled for June 8, 1999). All vegetation management work is being limited to using string trimmers so the basin slopes are not damaged from lawn mower wheel ruts. All cuttings along the inside basin sidewalls (down to the where the concrete lining starts) will be removed from the site and properly disposed. In addition to

cutting the grass, the landscaping contractor will remove any weeds that threaten the growth of the desired vegetation.

Graffiti Removal

To date graffiti at this site has not been an issue. If graffiti is encountered at this site, the graffiti will be removed to maintain the appearance of the facility.

Trash and Debris Removal

Accumulated trash near the influent rip-rap has been removed during each maintenance inspection. Routing trash accumulation around the influent structure has been mostly floatable materials such as cigarette butts, plastic cups, paper, and styrofoam debris.

Mosquito and Vector Control

The Greater Los Angeles County Vector Control District (GLACVCD) has been conducting vector control inspections at this basin. To date, there have been no mosquito or vector treatments necessary at this location. Mosquito egg rafts have been observed at this BMP, but standing water management has precluded the need for chemical treatment. No other vector problems have been noted at this site.

General Facility Maintenance

General facility maintenance that has occurred to date at this EDB location included aesthetics management and improvements to minimize vandalism. Since this site is located along an interstate freeway and there is no perimeter security fencing, it is accessible to the public. Therefore, extra precautions are appropriate to prevent equipment theft and vandalism. The installation of a driveway gate is being arranged to limit unwanted vehicle access to the site. Steel, low-profile equipment enclosures are maintained at this site to help to secure instrumentation.

3.2.1.2 Site 74102: Extended Detention Basin, I-605/SR-91

Removal of Standing Water

To date, there has been no standing water observed at this earthen basin facility following storm events. However, this is particularly due to the short residence times observed at this EDB. Storm water tends to flow through the basin with very little detention. This is apparent by the short amount of time is takes for the basin to drain following the abatement of rain. Based on the storm events that have occurred this year, the basin appears to be retaining the water for less than 24 hours. The design engineer is being consulted on ways to improve the detention time of this basin.

Sediment Erosion, Control, and Removal

Due to the young age of this EDB, no erosion of the basin slopes by stormwater runoff has been observed. Hydroseeded vegetation has established well throughout this site. However, on May 28, 1999, it was noted that contractors who also occupy a portion of the site are impacting the stability of this earth EDB. The BMP is being used as a staging area for light standards and other equipment. The outer basin slopes have been used as a staging area, and construction debris has been noted in several areas in and near the basin. Caltrans has been notified of this problem and is in the process of correcting the problem. Continued misuse of the basin by construction contractors could result in soil erosion and slope stability problems within this basin.

Since this EDB only became operational in February 1999, very little sediment has accumulated as a result of stormwater runoff. Therefore, sediment removal, characterization, and disposal have not been necessary at this site. It is anticipated that sediment will not need to be removed prior to the end of the 1999/2000 storm season. Once 18 inches of sediment has accumulated, arrangements will be made for sediment removal and disposal.

Structural Integrity

Other than impacts associated with independent contractors driving in and around this BMP, there are no structural issues that have required maintenance, which are associated with stormwater monitoring.

Landscape Management

Vegetation has established well in the basin and basin slopes. The vegetation was put in place using a hydroseed mixture in February 1999. Although the hydroseed took several months to get established, the site is currently completely covered.

In accordance with newly proposed maintenance threshold guidelines, grass and weeds will be allowed to grow to approximately 18-inches prior to being cut. On May 28, 1999, a landscaping contractor was onsite to prepare for maintaining vegetation back to 12 inches. Only string trimmers will be used to maintain vegetation so the basin slopes are not damaged from lawn mower wheel ruts. All cuttings from inside basin will be removed from the site and properly disposed. Cuttings on outside slopes will remain in place as thatch to further control erosion potential. Weeds that threaten the growth of the desired vegetation will be removed. The work is currently scheduled for June 8, 1999.

Graffiti Removal

To date graffiti at this site has not been an issue at this facility. However, this site has a strong potential for vandalism. Other contractors utilizing this right-of-way have had significant theft activity. This site may require above average maintenance to correct for theft and graffiti damage.

Trash and Debris Removal

During storms, trash has routinely been observed collecting in and around the rip-rap at the inlet structure. Trash that has been encountered includes cigarette butts, plastic cups, respirator masks, aluminum cans, paper, and styrofoam. Trash and debris were removed during each site visit.

Mosquito and Vector Control

GLACVCD has been conducting vector control inspections at this site. No vector issues have been noted at this site by the GLACVCD. However, Brown and Caldwell has noted the presence of gopher holes along the basin slopes. Remedial action to control burrowing animals is currently being proposed. It is expected that corrective action will occur once a biological assessment has been made regarding threatened, endangered, or protected species has been made.

General Facility Maintenance

General facility maintenance conducted to date has mostly included aesthetic management and security control. This site is enclosed with a fence to limit public access. However, non-BMP contractor activity at this site continues to affect aesthetics and security. On several visits to the site, the gate has been found unlocked, off its hinges, or torn down. The security gate at this site is in need of total replacement. Although the fence is not associated with the detention basin construction or operation, Caltrans has been notified of the situation so that the right-of-way security fence may be repaired.

During each visit, all locks are checked to make sure that they are secure and working and all equipment is checked to make sure that it is present and has not been damaged by vandalism.

3.2.2 Sand Filter Type I

The following discussion summarizes maintenance activities at sand filter BMPs that operated during the 1998/1999 wet season.

3.2.2.1 Site 74202: Sand Filter, Eastern Regional Maintenance Station

Removal of Standing Water

Standing water has occurred at this sand filter site. Currently standing water accumulates in the weir and the sand filter chamber sump. Water from the sump and sediment chamber was removed by running the sump pump and discharging the water to the storm drain associated with the sand filter. Water within the weir is allowed to remain until it evaporates.

To prevent the standing water from becoming a vector control issue with respect to mosquitoes, standing water is treated by the Greater Los Angles County Vector Control District (GLACVCD) during their weekly site visits. The water is treated by placing briquettes, which

float in the water and prevent the hatching of mosquito larvae. Screening has been applied to the sump well structure to limit vector access and is expected to reduce GLACVCD treatment needs.

Sediment Control and Removal

Since this site only became operational in February of 1999, sediment accumulation within the sediment chamber has not been that significant. Currently there is approximately 0.25 to 0.5 inches of sediment that has accumulated along the sediment chamber floor. It is anticipated that sediment will be removed from the sediment chamber following the 1999/2000-storm season, unless the sediment begins to clog the orifices of the perforated riser or fills 25% of the storage volume.

The accumulation of sediment on the sand filter has not been significant this year. Sediment will be removed from the sand filter when sediment appears to be clogging or impairing the performance of the filter bed.

Structural Integrity

Leakage from the sand filter sump of this BMP has been a water-containment integrity issue. The construction contractor was notified of the problem and has made one attempt to repair a leak in the sump. The repair was successful only in slowing the leak but did not completely seal the sump. The contractor has scheduled further repairs to begin approximately June 3, 1999.

There are no other structural integrity issues at this site. No problems were noted during the maintenance visits or stormwater observation visits.

Landscape Management

No landscaping is present at this site, and landscape management is not required. However, if weeds are noted at this site they will be removed during maintenance visits to keep the site aesthetically pleasing.

Graffiti Removal

To date graffiti at this site has not been an issue. If graffiti is encountered at this site, the graffiti will be removed to improve the appearance of the facility.

Trash and Debris Removal

Minor amounts of trash associated with stormwater runoff have been noted at this site within the sediment chamber. Trash that has been observed includes plastic cups and styrofoam. Trash and debris are removed during each site visit.

Mosquito and Vector Control

GLACVCD also conducts vector control inspections at this site. No vector issues have been present at this site. However, measures have been taken to prevent problems. Mosquito netting has been placed over the sump area to prevent mosquitoes from breeding in standing water. In addition, netting has also been installed over the air vents associated with each sampling shed to prevent bees from building hives in the sheds.

General Facility Maintenance

Other general facility maintenance has been minimal at this facility, and has mostly involved aesthetic management. This site is enclosed with a fence and is located on an active maintenance facility so it is not readily accessible to the public. During each visit, all locks are checked to make sure that they are secure and working and all equipment is checked for damage or vandalism. All fences and gates are inspected to make sure that they are working properly and are not damaged in any way.

3.2.2.2 Site 74203: Sand Filter, Foothill Maintenance Station

Removal of Standing Water

Standing water continues to be a maintenance management issue at this site. Currently non-stormwater discharges are contributing to increased maintenance needs at this BMP in terms of managing standing water. Non-stormwater accumulates in the sediment chamber and in the weir and sump area within the sand filter chamber. As the sand filter sump accumulates filtered water, it is removed by running the sump pump and discharging the water to the storm drain associated with the sand filter. Water within the sediment chamber and the weir is allowed to remain until it evaporates, and is treated with vector control chemicals if it persists.

To prevent the standing water from becoming a vector control issue with respect to mosquitoes, standing water will be treated by the San Gabriel Vector Control District (SGVCD) during their weekly site visits.

Sediment Control and Removal

Since this site only became operational in February of 1999, sediment accumulation within the sediment chamber from stormwater inflow has not been that significant. Currently there is approximately 0.5 inches of sediment that has accumulated along the sediment chamber floor. However, it is believed that most of this accumulation is attributed to non-storm flow. Non-stormwater flow at this site has been higher than anticipated and is contributing to sediment accumulation in the BMP. Sediment removal, characterization, and disposal are not anticipated until after the 1999/2000-storm season. However, if sediment begins to clog the orifices of the perforated riser or fills 25% of the storage volume of the sediment chamber, arrangements for the removal and disposal of the sediment will be made earlier.

The accumulation of sediment on the sand filter has not been significant this year. Sediment will be removed from the sand filter when sediment exceeds 1 to 2-inches or if sediment appears to be clogging or impairing the performance of the filter bed.

Structural Integrity

There have been no structural concerns at this BMP.

Landscape Management

No landscaping is present at this site, and landscape management is not required. However, if weeds are noted at this site they will be removed during maintenance visits to keep the site aesthetically pleasing.

Graffiti Removal

To date graffiti at this site has not been an issue. If graffiti is encountered at this site, the graffiti will be removed to improve the appearance of the facility.

Trash and Debris Removal

Minor amounts of trash in stormwater runoff have been noted within the sediment chamber of this BMP. Paper and styrofoam debris were removed during each maintenance visit.

Mosquito and Vector Control

The SGVVCD conducts vector control inspections at this site. Due to persistent inflow of non-stormwater at this maintenance station, standing water in the BMP sediment chamber has been identified as a vector concern. SGVVCD has observed mosquito activity in this BMP but will not treat the unit until safe and permanent access to allow sample collection is provided. Access by extension ladder is not suitable due to possible footing slippage on accumulated mud in the sediment chamber. Permanent ladder installations have been recommended by SGVVCD. Permanent ladders are being ordered and will be installed to provide access to the sediment chamber.

Although the automatic discharge pump of this BMP assists in reducing standing water within the sand filter area, standing water in the sediment chamber must be removed by other means. To reduce costs associated with the persistent, mechanical removal of standing water in the sediment chamber, chemical vector treatment will be the preferred method of control.

Apart from BMP activities, the SGVVCD has noted several other vector concerns at this site, which include but are not limited to bee nesting opportunities and waste pile management (rats/roaches). At the recommendation of SGVVCD, netting has been installed over the air vents of the BMP equipment enclosures to prevent bees from nesting inside. Tight-mesh netting has also been in place over the sump area to prevent mosquito entry and breeding opportunities.

General Facility Maintenance

Other general facility maintenance at this site has been minimal due to the security provided by the maintenance station, which limits public access. Planned maintenance at this site includes replacing cedar vault hatch covers with aluminum, reinforced covers that will provide additional weight-bearing capacity.

3.2.2.3 Site 74204: Sand Filter, Termination Park and Ride

This sand filter site became operational in April 1999, and no storm monitoring or maintenance visits were conducted at this site during the 1998/1999 storm season. This site will be incorporated into the June 1999 maintenance visits cycle.

Maintenance issues that are expected at this site are similar to issues that are present at the other sand filter sites. These issues include standing water, vector control, and sediment accumulation and removal. As applicable, these issues will be addressed in a similar manner as they are at the sand filters. In addition, this site is located in a large and busy public parking facility that will require additional attention to ensure that site does not become a target for vandalism or graffiti.

One maintenance issue that has already been noted at this site includes breeding of mosquitoes. This was noted by the GLACVCD on a site visit conducted during the week of May 21, 1999. Because of vector concerns to a neighboring elementary school, Golden Bear oil was applied to the accumulated water in the sediment chamber to inhibit hatching. Preventative measures are currently being taken to prevent further breeding of the mosquitoes by installing mosquito netting over the sump and removing any standing water present at the site.

3.2.3 Multi-Chambered Treatment Trains

3.2.3.1 Site 74206: Multi-Chambered Treatment Train, Via Verde Park and Ride

The multi-chambered treatment train (MCTT) located at the Via Verde Park and Ride became operational in May 1999. Since this MCTT only became operational a month ago, no storm or maintenance inspections have been conducted. This site will be incorporated into the June 1999 maintenance visits.

Maintenance issues that are expected at this site include standing water in the various chambers, vector control, vandalism and graffiti, and general site maintenance.

3.2.3.2 Site 74208: Multi-Chambered Treatment Train, Lakewood Park and Ride

The multi-chambered treatment train (MCTT) located at the Lakewood Park and Ride became operational in May 1999, and has not undergone storm monitoring or maintenance inspections. This site will be incorporated into the June 1999 maintenance visits.

Maintenance issues that are expected at this site include standing water in the various chambers, vector control, vandalism and graffiti, and general site maintenance.

Mosquito breeding has also been noted at this facility by GLACVCD during a site visit conducted during the week of May 21, 1999. GLACVCD treated the standing water with Vectolex. Mosquito netting over the sump area has been installed as a preventative measure to mitigate mosquito entry and breeding in the sump. As it is encountered during site inspections and maintenance visits, standing water is removed to limit breeding opportunities.

3.2.4 Oil/Water Separator

3.2.4.1 Site 74201: Oil/Water Separator, Alameda Maintenance Station

The oil/water separator located at the Alameda Maintenance Station became operational in May 1999, and has not been subject to stormwater monitoring nor has it required maintenance attention. This site will be incorporated into the June 1999 maintenance visits.

Maintenance issues that are expected at this site include sediment removal and disposal, trash removal and disposal, oil/grease removal, cleaning, and general maintenance.

4.0 DESIGN AND CONSTRUCTION EVALUATION

The following discussion paraphrases design and construction activities at each BMP that was constructed site during the 1998/1999 monitoring season.

4.1 Alameda Maintenance Station

Construction activities were substantially completed at the Alameda Maintenance Station site in early April. Brown and Caldwell staff and Caltrans representatives inspected the site on April 19, 1999. Following this inspection, a short punch list was created that listed additional tasks required to deem construction complete and to close the Caltrans construction encroachment permit. These final tasks were completed in early May 1999. Mr. Tyrone Taylor (Caltrans Permit Inspector) has verbally concurred that the site was complete and is in the process of submitting paperwork to that affect.

During the installation of the oil / water separator, minor changes were made in order to accommodate field conditions. The final location of the oil / water separator tank was shifted several feet from the originally planned location to avoid sub-surface utilities. Grades and elevations were slightly modified in the field to ensure that the system would drain properly. Additional fencing was installed along the west side of the BMP at the request of the Maintenance Station Superintendent to improve access to the east side of the building. With the exception of these few items, the oil / water separator system was installed in accordance with the design plans. Operational parameters such as capture volume and drainage area remain unchanged by these minor modifications.

4.2 Eastern Regional Maintenance Station

By late February 1999, Eastern Regional Maintenance Station construction activities were mostly complete. Following inspection of the site by Brown and Caldwell and Caltrans staff (March 9, 1999), additional tasks required to close the Caltrans construction encroachment permit were identified. These tasks were completed in early May. A Caltrans Permit Inspector (Andy Bott) later concurred that the site was complete on May 17, 1999, and submitted paperwork officially closing the construction encroachment permit for this site.

Minor installation changes to the media filter were made to accommodate field conditions, which included shifting the BMP location from its original planned location. At the request of the Maintenance Station Superintendent, the BMP location was shifted in order to allow access to the facility's southeast entrance. Grades and elevations also were slightly modified in the field to match the existing site grades. With the exception of these few items, the media filter was installed in accordance with the design plans. Operational parameters (capture volume and drainage area) were not changed by the BMP re-location.

During the March 25th storm event concerns were raised over the integrity of the sump at the Eastern Regional Site. Effluent failed to accumulate in the sand filter sump, and no samples could be collected. Significant leaking of the sand filter sump was found to be the problem, which allowed treated water to be released to the substrate underneath. The construction contractor was notified and a silicone-based sealant was applied to the seams of the sump. However, during the April 6th sampling event, field personnel observed that the water level in the

effluent sump was dropping at the Eastern Regional BMP. On April 9th field testing confirmed the effluent sump at this site was leaking. Additional tests performed after the sealant had dried revealed that although the sealant had slowed the leak, the sump was not sealed completely. The construction contractor has planned to remobilize during early June to pressure-grout the effluent sump at the Eastern Regional BMP.

4.3 Foothill Regional Maintenance Station

The Foothill Regional Maintenance Station sand filter was mostly constructed by late February 1999. On March 9, 1999, the BMP was inspected by Brown and Caldwell and Caltrans staff during which Caltrans maintenance station personnel requested minor changes to the BMP. Requested BMP changes were included with standard punch list items, which were submitted as a contractor change order. Following inspection by a Caltrans Permit Inspector (Andy Bott), the requested changes were deemed complete in early May and BMP construction paperwork was filed which officially closed the construction encroachment permit for this site.

As with other BMP sites, minor installation modifications for the media filter were necessary to accommodate field conditions, which included:

- slightly modifying design grades and elevations to match the existing features,
- installing a sliding gate in the BMP fence to provide additional storage space for maintenance station operations, and
- changing the pre-cast flow interceptor box to include a traffic-rated cover and sloping the sides to accommodate truck traffic.

With the exception of these items, the media filter was installed in accordance with the design plans. Operational parameters were not affected by these modifications.

4.4 Termination Park and Ride

Construction of the Termination Park and Ride sand filter was substantially complete by early April 1999. On April 19, 1999, Brown and Caldwell and Caltrans representatives inspected the site and developed construction-completion tasks that were required to close the Caltrans construction encroachment permit. These tasks were completed in early May. On May 17, 1999, Mr. Andy Bott (Caltrans Permit Inspector) concurred that the site was complete and submitted paperwork officially closing the construction encroachment permit for this site.

Minor design changes of the media filter during installation included shifting the locations of the pre-cast concrete vaults to avoid a stormwater pipe that was closer to the BMP than shown on as-built plans, and modifying design grades and elevations to match actual conditions. With the exception of these few items, the media filter was installed in accordance with the design plans. Operational parameters were unchanged by these minor modifications.

4.5 Via Verde Park and Ride

Construction activities were substantially completed at the Via Verde Park and Ride site in early April. The BMP was inspected on April 19, 1999 by Brown and Caldwell and Caltrans staff. Punch list items required to close the Caltrans construction encroachment permit were

completed, with the exception of replanting a planter area. The planter in question will be re-planted shortly, officially closing the construction encroachment permit for this site.

Prior to the construction of the MCTT, the structure was relocated about 10 feet east to allow the continued use of electric vehicle charging stations that had recently been installed at the site. This change did not affect the drainage area received by the MCTT. However, the relocation required slight changes to the outside dimensions of the structure, as well as relocations of the associated pre-cast concrete vaults. These changes did not affect the storage capacity or operation of the MCTT. Significant boulders (up to 5 feet across) were encountered during the excavation. These were not identified in the soils investigation, and added to the time expended at the site. With the exception of these changes, the media filter was installed in accordance with the design plans. Operational parameters such as capture volume and drainage area remain unchanged by these modifications.

4.6 Lakewood Park and Ride

Construction activities were substantially completed at the Lakewood Park and Ride site in early May. On May 11, 1999 Brown and Caldwell personnel met with Caltrans representatives to inspect the site. At this time the Caltrans Permit Inspector, Mr. Andy Bott, requested that a change be made in the BMP fence to accommodate traffic flow. This change was included on the punch list and is currently being negotiated as a change order. Following the resolution of this change, paperwork officially closing the construction encroachment permit for this site can be filed.

During the installation of the MCTT, minor changes were made in order to accommodate field conditions. The locations of the pre-cast concrete vaults were shifted slightly from the originally planned location. This was necessary in order to avoid a stormwater pipe that was closer to the pre-cast vaults than was shown on as-built plans. Grades and elevations also were slightly modified in the field to match the existing site grades. With the exception of these few items, the media filter was installed in accordance with the design plans. Operational parameters such as capture volume and drainage area remain unchanged by these minor modifications.

5.0 COST ACCOUNTING

Cost accounting summaries for operation and maintenance efforts are currently in preparation and will be available for a later comprehensive report.