

Stormwater Quality Monitoring Report

Pervious Concrete at Lakewood Maintenance  
Facility  
Lakewood, Colorado  
2005-2010

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# **I. Introduction**

## **UDFCD & Stormwater Quality**

The Urban Drainage and Flood Control District (UDFCD) was established by the Colorado legislature in 1969 for the purpose of assisting local governments in the Denver metropolitan area with multi-jurisdictional drainage and flood control problems. UDFCD monitors a number of stormwater Best Management Practice (BMP) sites in the Denver metropolitan area and plays a large role in stormwater quality improvement by way of research and promulgation of criteria. UDFCD samples inflow and outflow and collects data on rainfall and runoff at several BMP sites.

UDFCD's primary objectives are to:

- Determine the Event Mean Concentration (EMC) of different constituents that affect stormwater runoff.
- Assess the longer term performance of each BMP with regard to stormwater quality and runoff volume reduction.

## **Pervious Concrete at Lakewood Maintenance Facility**

At the Lakewood City Shops maintenance buildings, UDFCD is monitoring pervious concrete. Pervious concrete is one of several different types of permeable pavement systems that are designed to infiltrate stormwater through the pavement surface. Permeable pavements are a common and important practice of Low Impact Development (LID). pervious concrete is a monolithically-poured pavement that has 15% to 21% of its volume as void. The voids within the concrete are achieved by eliminating the fine sand aggregate from the concrete mix. The voids provide the flow paths for rainwater from the surface of the pavement to the base course underlying it.

A view of the pervious concrete from the street is shown in Photograph 1.



**Photograph 1.** Pervious concrete at Lakewood Maintenance Facility

## **II. Site Description**

### **Study Area**

The pervious concrete and a reference site parking areas are located at 850 Parfet Street in a parking lot for City of Lakewood employees. UDFCD had previously monitored concrete grid pavement at this site. This was replaced with pervious concrete in 2005. An adjacent area of conventional asphalt pavement provides the reference site. The reference site is located in the same parking lot as the pervious concrete and is used to compare water quality and flow of the treated (pervious concrete) effluent to untreated (reference site) runoff. Both sites receive similar traffic loads, generally vehicles that arrive in the morning and leave at the end of the workday. The vicinity and location of the site are shown in Figures 1 and 2, respectively, with the reference site and the pervious concrete located in Figure 2. The area of pervious concrete is circled in red.

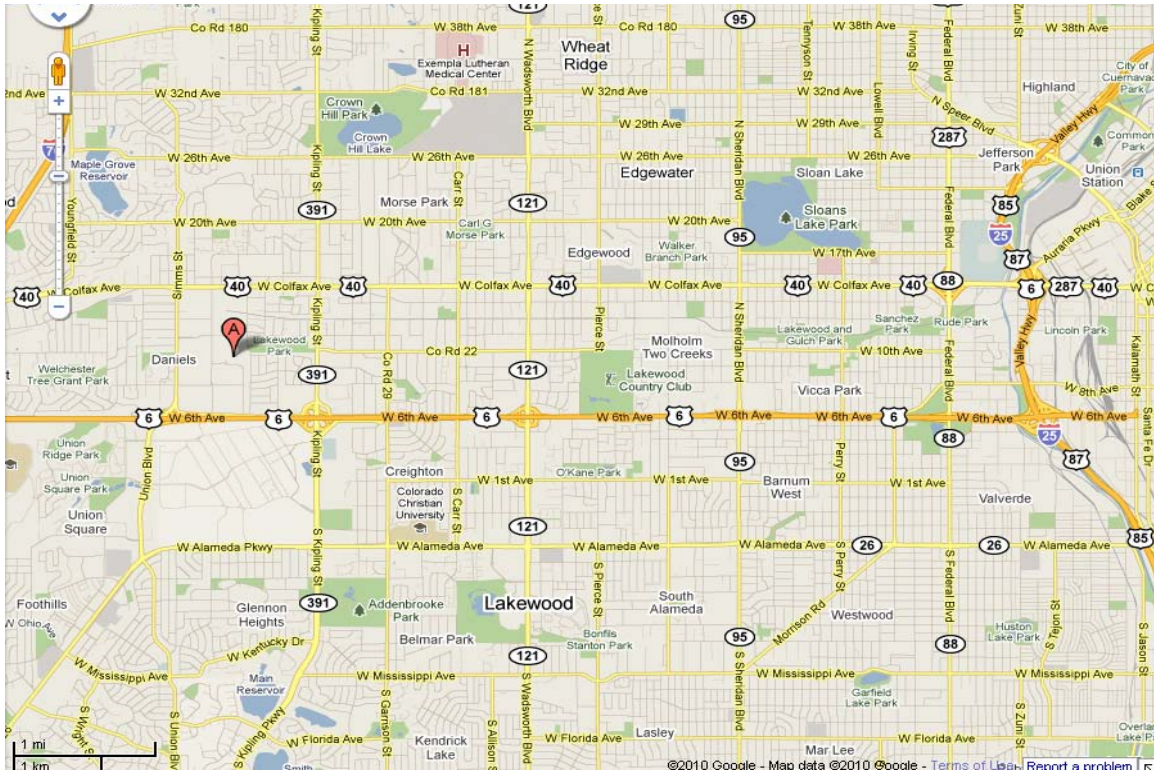


Figure 1. Vicinity Map

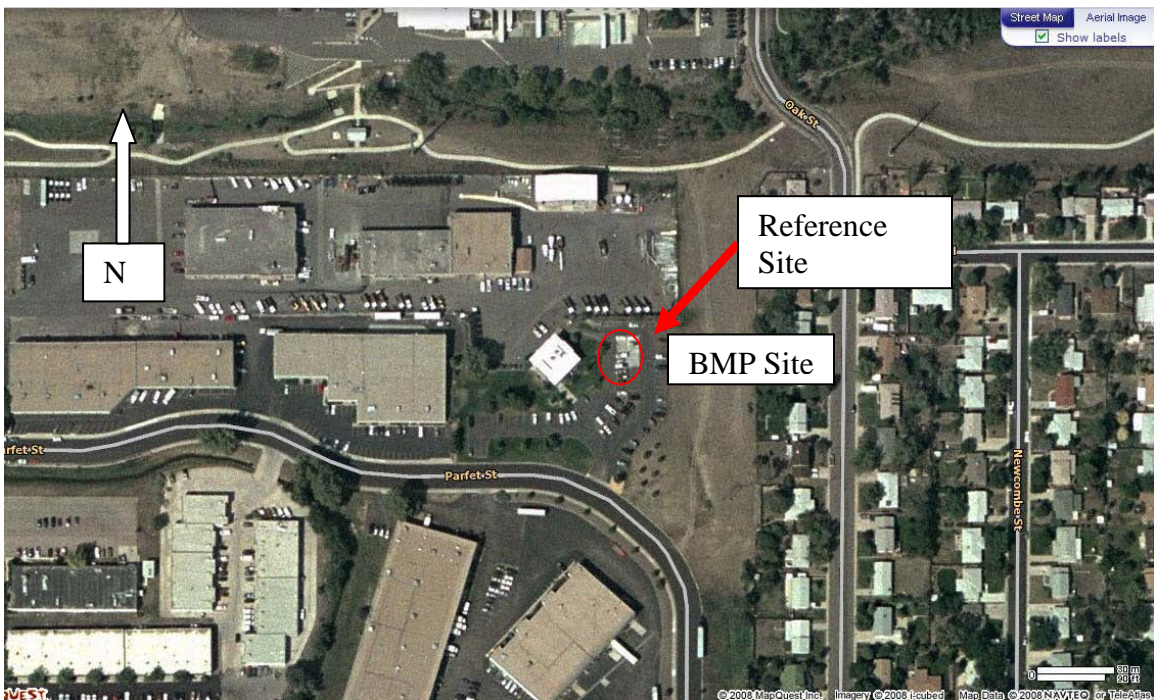


Figure 2. Location Map



## Watershed

Tributary area to the pervious concrete is 100% impervious and stable. It consists of traditional asphalt and concrete pavement and is 9,050 square feet, of which 7,077 square feet is impervious tributary to the pervious concrete. A plan view of the reference site tributary is provided in Figure 3. Note that asphalt berms have been constructed in areas where the tributary delineation lines are not perpendicular to the contours. The area of the watershed for the reference site is 8,900 square feet. Stormwater runoff from the control watershed is collected in a sump catch basin at the northeast corner of the site. The run-on ratio of the tributary impervious area to the pervious concrete is 3.5:1, which exceeds the recommended ratio of 2:1 provided in Volume 3 of the Urban Storm Drainage Criteria Manual (USDCM).

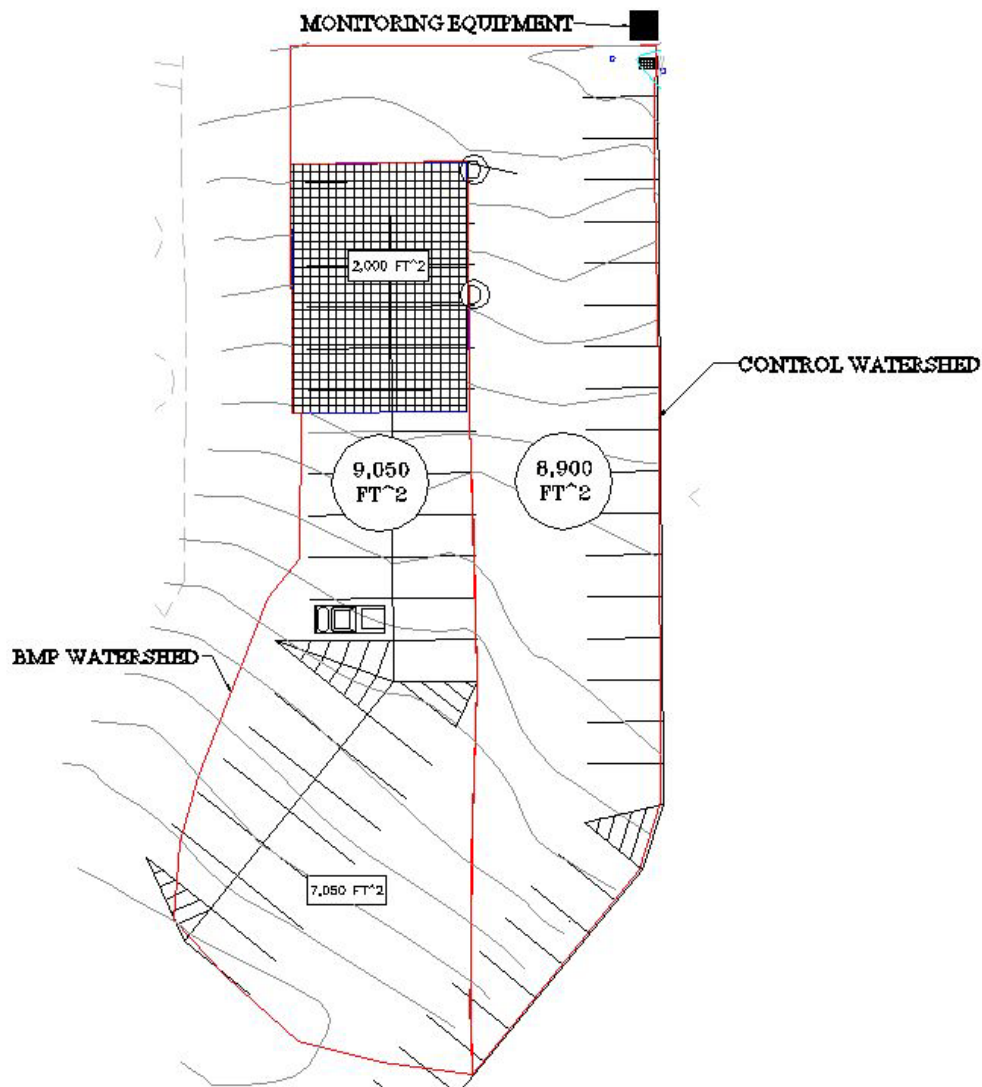


Figure 3. Plan of the Watersheds for the Pervious Concrete and Reference Site

### III. Methods and Materials

#### Pervious Concrete Components

The pervious concrete is divided into two cells, an upslope cell on the south side of the pervious concrete and a downslope cell on the north side. There is a wall in the middle that divides the cells to maximize water volume entrapment. Underneath the concrete there is an overflow weir in the middle wall that is designed to convey overflow from the upslope cell into the downslope cell when the volume in the upslope cell is completely utilized. This also serves to ensure that runoff doesn't resurface or freeze in the wearing course. The design utilizes a "no-infiltration" section with an impermeable liner at the bottom and edges of the section. Figure 4 provides an isometric view of the pervious concrete layout. Figure 5 provides details for the collection wells that drain each cell independently. The outlets for each contain orifices to release the WQCV over approximately 6 hours.

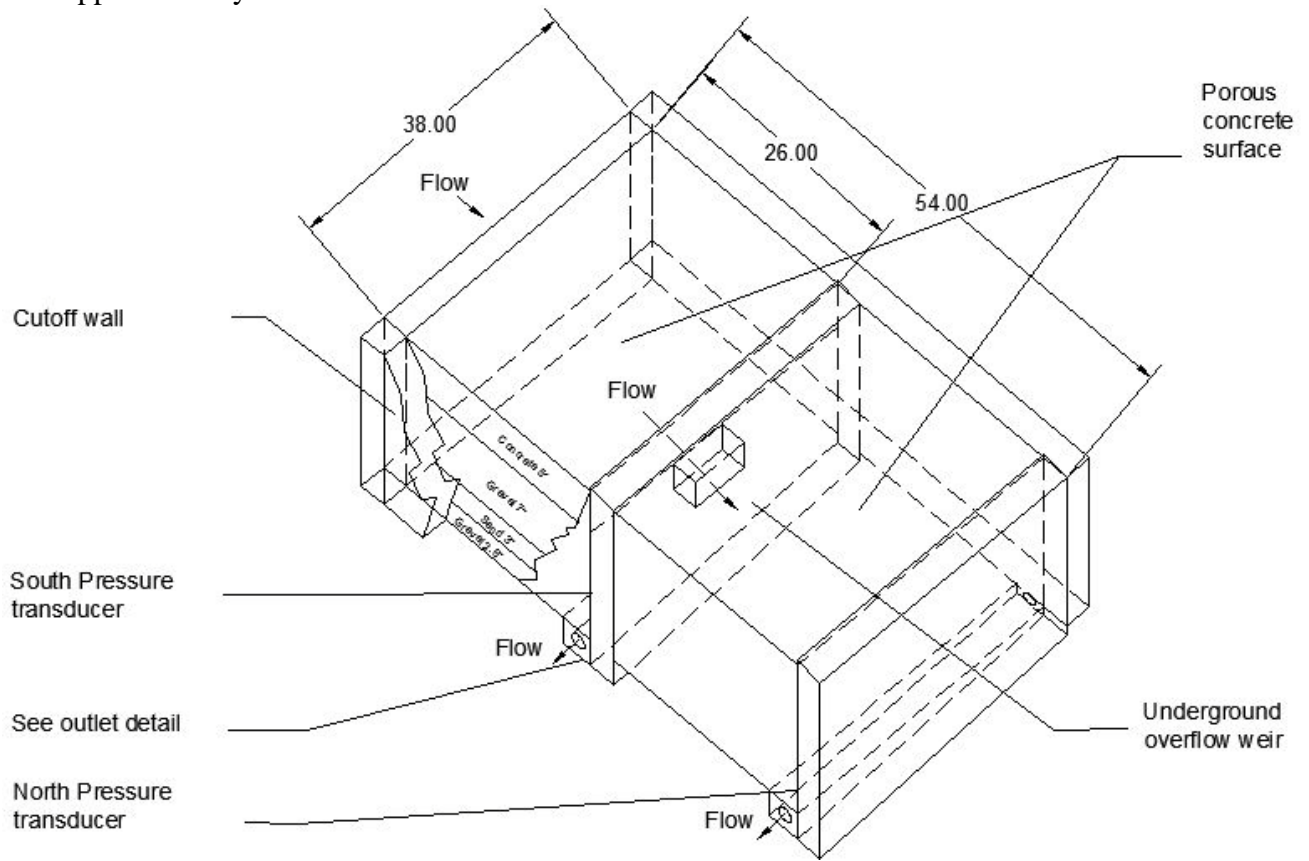
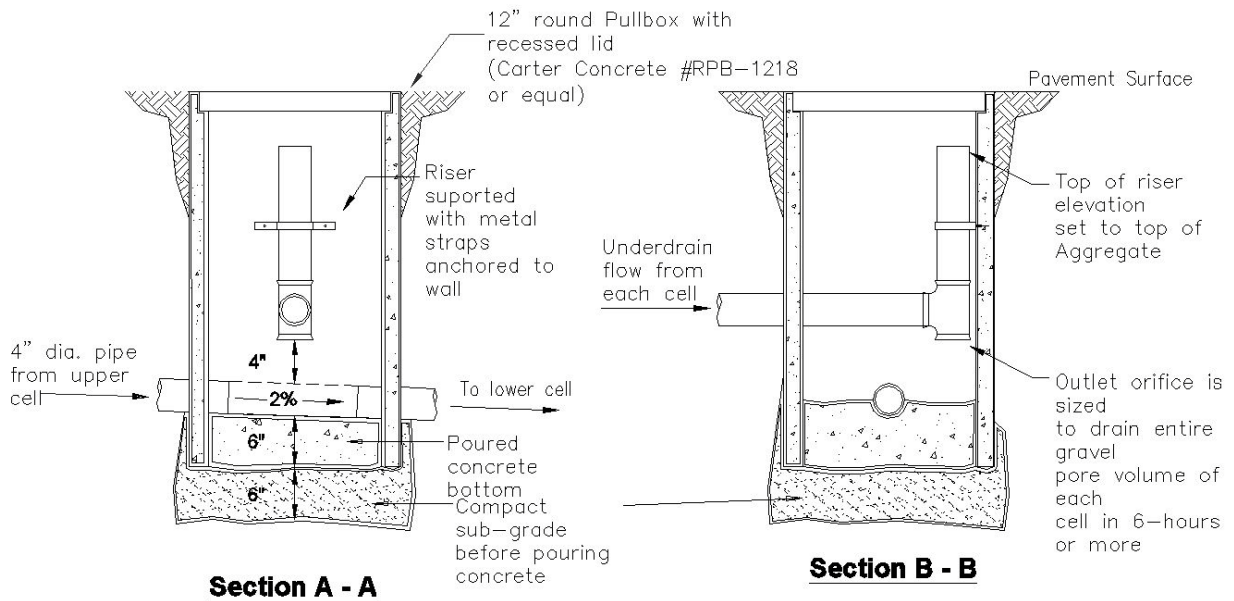
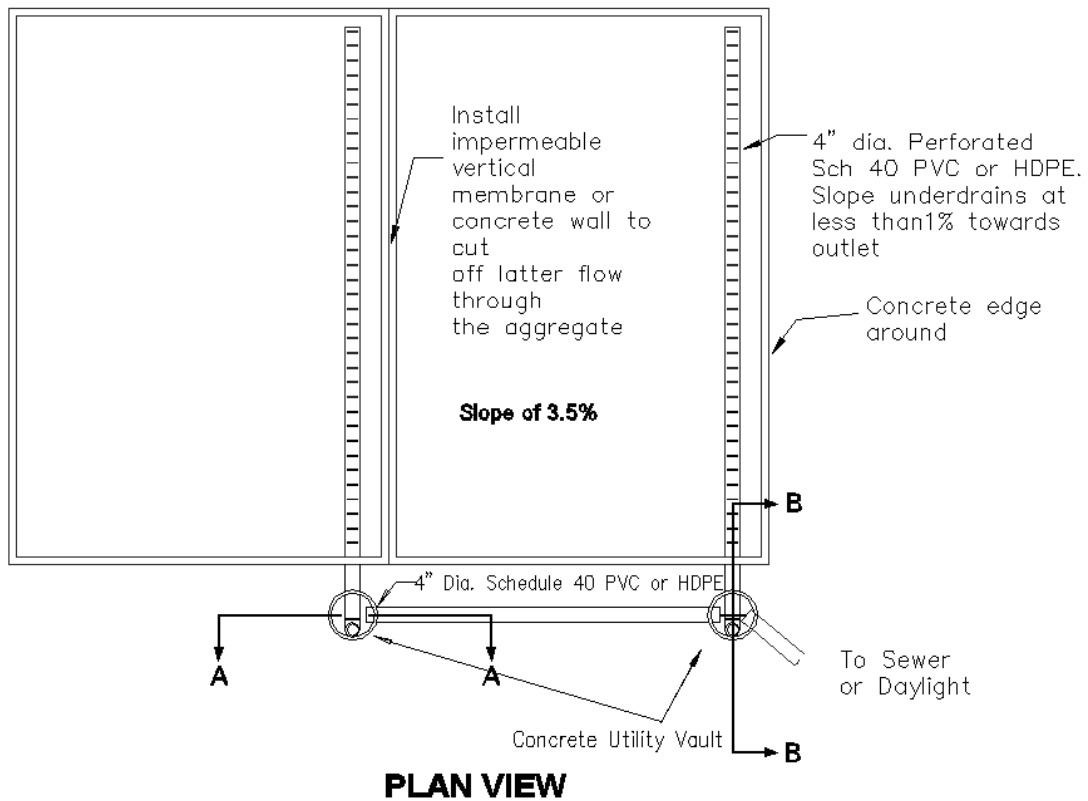


Figure 4. Isometric Plan of the pervious concrete

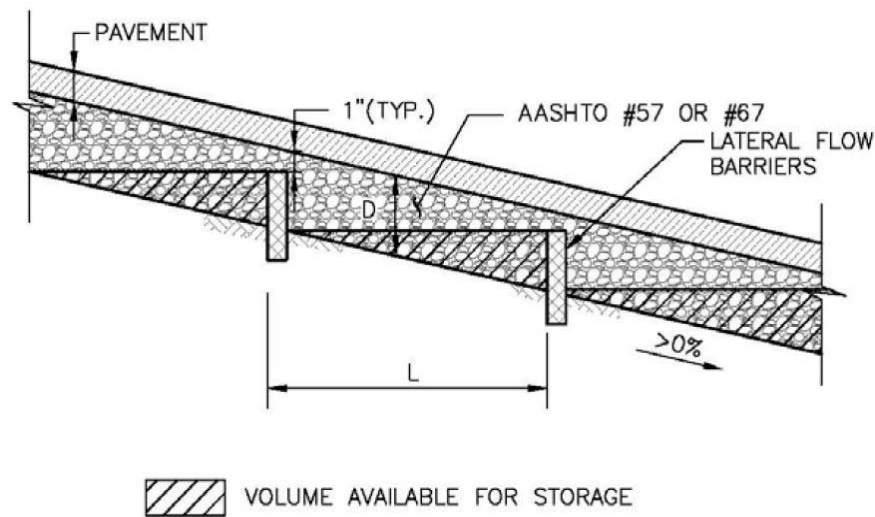


**Figure 5. Plan and Sections Detailing Outlet Control**



Both cells of the pervious concrete have two slightly different wearing courses. The east half of both cells utilizes AASHTO #67, a larger aggregate. The west side of each cell utilizes AASHTO #8, a smaller aggregate. The surfaces are shown in Photograph 2. In 2010 the AASHTO #8 aggregate course, which is the smaller of the two, began to ravel while the wearing course with larger aggregate remains undamaged. The section below the wearing course is consistent throughout the installation. It consists of a reservoir layer (large aggregate layer) and a sand filter layer. The reservoir layer beneath, immediately below the wearing course, provides structural support as well as stormwater storage volume. The filter layer provides improved water quality and fine particulate removal. At each lateral flow barrier, water is collected in a perforated pipe (underdrain) and is carried into a manhole. An impermeable membrane placed under the pavement section ensures that outflow samples can be collected and will not infiltrate into the subgrade. The outlet for each cell is designed to drain the gravel pore volume of each cell in approximately six hours. Figure 6 shows the volume available for storage in a sloping pavement. Finally the flows from each cell are combined and directed into a V-notch weir at the northeast corner of the site. The pervious concrete section is shown in Figure 7.

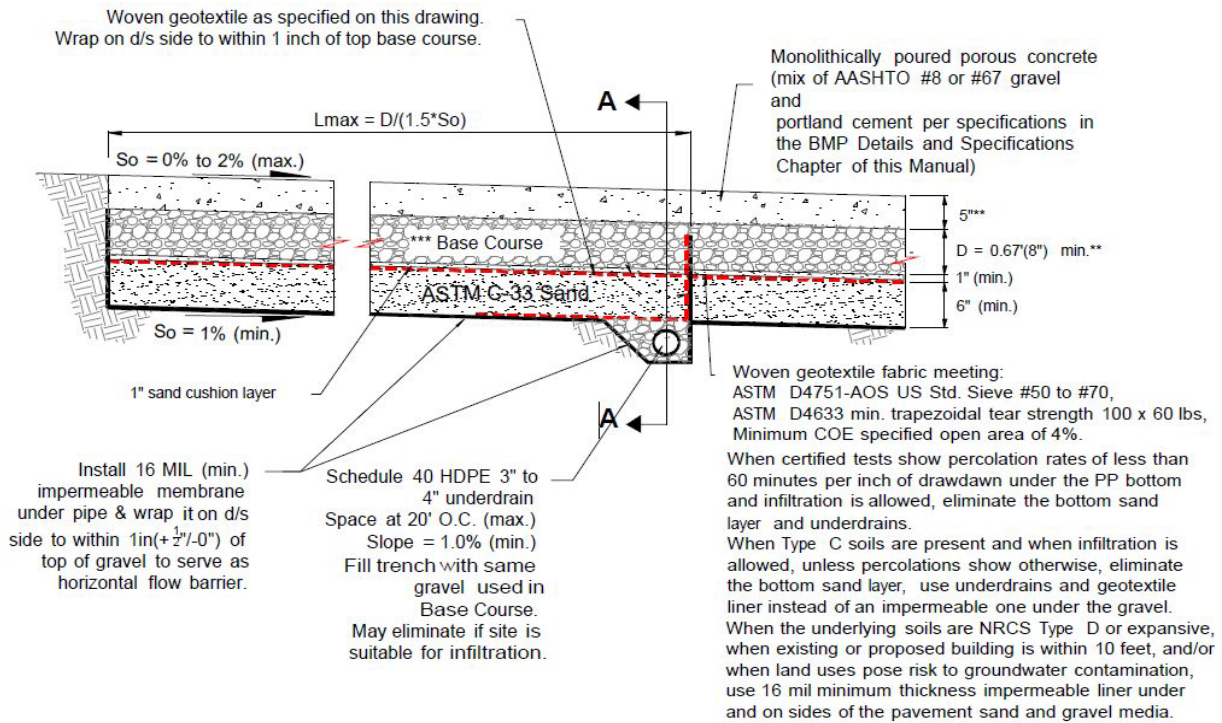
Level loggers have also been placed just upstream of the outlet for each cell. This provides the ability to monitor how quickly the section drains and if, over time, the sand filter layer becomes more limiting than the orifice.



**Figure 6. Profile of Lateral Flow Barriers in Permeable Pavement on a Sloped Surface**



**Photograph 2.** The installation included two mixes utilizing different aggregate. The AASHTO #67 mix is shown left, AASHTO #8 shown right.



**Figure 7. Pervious Concrete Section**

## Data Collection

All samples are tested for the following:

Category	Constituent	Units	Detection Limits	
Chemical:	Alkalinity	mg/L	20	
	Chloride	mg/L	1	
	Chemical Oxygen Demand	mg/L	20	
	Conductivity	umho/cm	0.1	
	Hardness	mg/L	10	
	pH			
	Total Organic Carbon	mg/L	1	
	Metal:	Dissolved Calcium	mg/L	1
		Dissolved Iron	mg/L	0.05
		Dissolved Magnesium	mg/L	1
Dissolved Sodium		mg/L	1	
Dissolved Chromium		µg/L	1	
Dissolved Manganese		µg/L	1	
Dissolved Nickel		µg/L	2	
Dissolved Copper		µg/L	5	
Dissolved Zinc		µg/L	1	
Dissolved Selenium		µg/L	0.2	
Dissolved Silver		µg/L	0.1	
Dissolved Cadmium		µg/L	1	
Dissolved Lead		µg/L	1	
Total Beryllium		µg/L	5	
Total Chromium		µg/L	1	
Total Manganese		µg/L	1	
Total Nickel		µg/L	2	
Total Copper		µg/L	20	
Total Zinc		µg/L	5	
Total Arsenic		µg/L	1	
Total Selenium		µg/L	5	
Total Molybdenum		µg/L	0.2	
Total Silver		µg/L	0.5	
Total Cadmium		µg/L	5	
Total Antimony		µg/L	5	
Total Lead		µg/L	5	
Nutrients:		Dissolved Phosphorus	mg/L	1
	Dissolved Potassium	mg/L	0.1	
	Nitrite+Nitrate	mg/L	0.01	
	Ortho-Phosphorus	mg/L	0.005	
	Total Kjeldahl Nitrogen	mg/L	0.3	
	Total Phosphorus	mg/L	0.01	
Physical	Total Suspended Solids	mg/L	1	

UDFCD has been collecting water quality and flow data from this site since 2005. Automatic samplers (ISCO model 6712) are used to record flow data and pull samples from both the pervious concrete and the reference site throughout the runoff event. The sampling equipment is stored in a shed near the outlet works. Rainfall is measured to 0.01 inches by a ISCO 674 tipping rain gauge on top of the shed, shown in Photograph 3. The rain gauge signals the ISCO samplers inside the shed to begin sampling when it detects over 0.08 inches of rainfall in two hours and a volume of ten cubic feet passes through the outlet.

The underdrain for the pervious concrete site drains into a 4-inch PVC pipe, which outlets to the 30 degree V-notch weir shown on the left side of Photograph 4. Just upstream of the weir an ISCO 720 pressure transducer is used to measure head over time for flow and volume calculations. Samples are also pulled at this location. A single sample of 500 mL is pulled each time ten cubic feet pass the weir. All samples are pulled into a single 10 L bottle located inside the sampler.

The reference site drains to an inlet that discharges through an H-flume at the reference site. The depth of the water going through the H-flume is measured by an ISCO 720 pressure transducer for flow and volume calculations. Similar to the pervious concrete site, a single sample of 500 mL is pulled each time 10 cubic feet pass the H-flume. All samples are pulled into a single 10 L bottle located inside the sampler.



**Photograph 3.** The sampling shed with rain gauge.





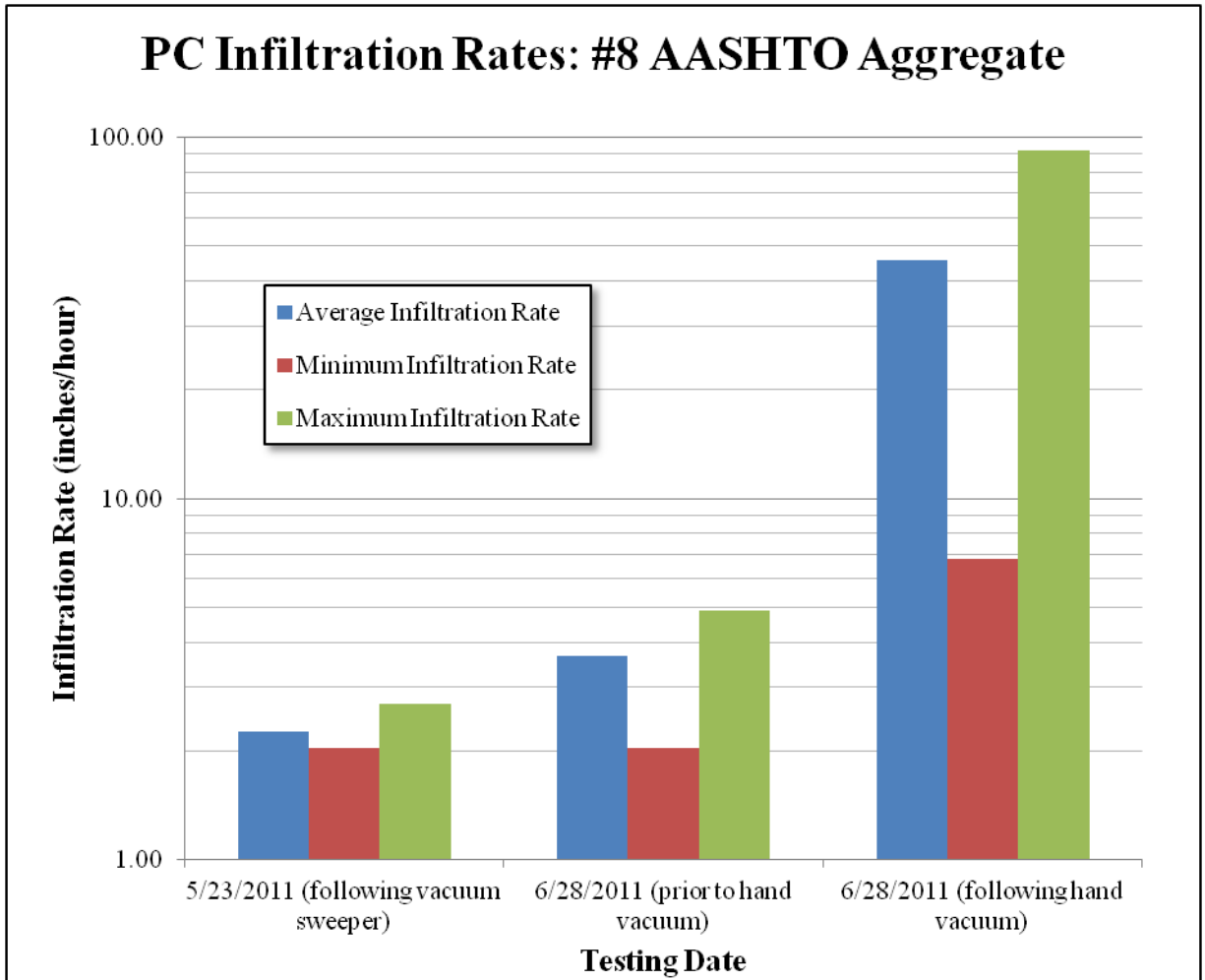
**Photograph 4.** The V-notch weir for the pervious concrete (left), and the H-flume weir for the reference site (right), with stilling wells in the background.

## **Maintenance Practices**

Left unmaintained this type of pavement will lose infiltration capacity resulting in a smaller volume of water being treated. According to USDCM Volume 3, a regenerative air or vacuum sweeper should be used approximately twice per year to maintain infiltration rates. This should be done on a warm dry day for best results. The frequency is site specific and inspections of the pavement may show that a different frequency of sweeping is more appropriate.

This site was not maintained to the above standards and was not vacuumed until 2011. Although the pavement consistently produced samples, it became relatively clogged over time. In 2011 the pavement was vacuumed with a vacuum sweeper truck; however, this was just following a rain event and conditions were wet. A second attempt to vacuum the pavement using small amounts of water and a hand vacuum were mildly successful in producing a noticeable increase in infiltration rates. In 2010, it was discovered that was a separation between the wearing course and the wall separating the cells allowing water to bypass the pervious concrete; however, it still passes through the sand filter and produces a sample.





**Figure 8. Infiltration Rates on Each Test Date for AASHTO #8 Aggregate Surface**

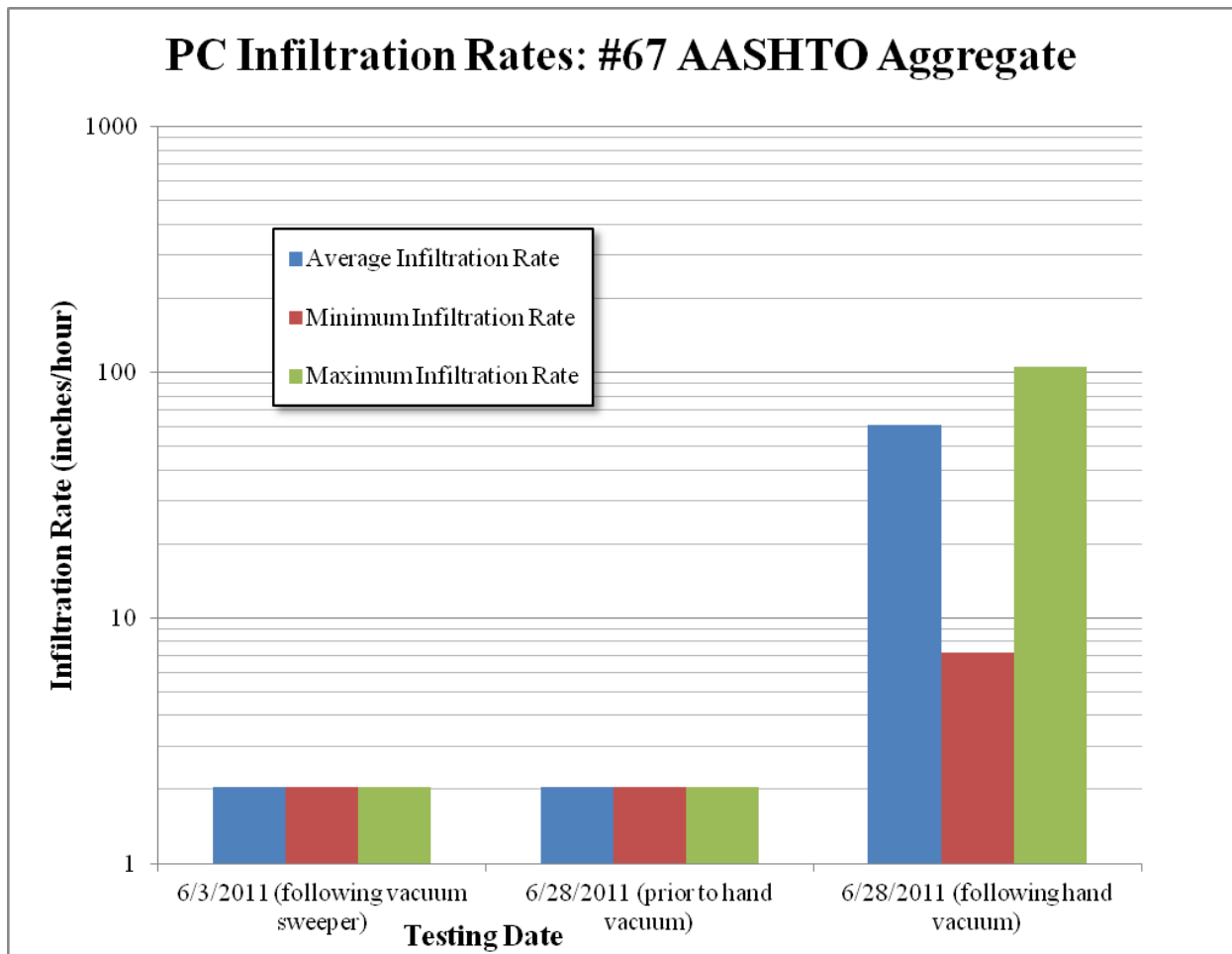


Figure 9. Infiltration on Each Test Date for #67 AASHTO Aggregate Surface

#### IV. Results and Discussion

##### Outflow Volume Reduction

Based on the inconsistencies observed with reference site and BMP flow and volume measurements as well as inconsistencies between reference site volume compared to calculated volume (based on rainfall), a low level of accuracy in these values is assumed.

The volume data includes 65 paired sets. Volume per unit tributary area was compared between the reference site and the BMP. A volume based on rainfall was also calculated for comparison with the reference site volume. Fifty of the 65 sets showed a reduction from the reference site to the BMP. Including all data sets and looking at total volume values, a reduction of 24% was

calculated between calculated volume and measured volume at the BMP and a reduction of 38% was calculated between measured flow at the reference site and measured flow at the BMP.

Flow data is provided in Tables 1 through 7. Figure 10 provides a comparison for each paired set of data.

**Table 1. Flow Data for 2005**

2005 Storm Event	Reference Flow Start Date	Reference Flow Start Time	Reference Flow End Date	Reference Flow End Time	Reference Flow Duration (hm)	BMP Outlet Flow Start Date	BMP Outlet Flow Start Time	BMP Outlet Flow End Date	BMP Outlet Flow End Time	BMP Outlet Flow Duration (hm)	Rainfall (in)	Total Reference Flow Volume (cf)	Total BMP Outlet Flow Volume (cf)	Peak Reference Flow Rate (cfs)	Peak BMP Outlet Flow Rate (cfs)	Reference Site Volume per Unit Tributary Area (cf/sf)	BMP Volume per Unit Tributary Area (cf/sf)
1	4-Jun	7:49	4-Jun	13:02	5:13	4-Jun	8:06	4-Jun	15:22	7:16	0.36	54.48	44.18	0.02	0.00	0.0061	0.0049
2	9-Jun	16:39	10-Jun	15:32	22:53	9-Jun	16:50	10-Jun	18:06	25:16	0.68	198.26	127.81	0.15	0.01	0.0223	0.0141
3	12-Jun	11:13	12-Jun	16:27	5:14	12-Jun	11:14	12-Jun	19:52	8:38	0.10	32.96	22.91	0.02	0.00	0.0037	0.0025
4	20-Jun	0:48	20-Jun	1:37	0:49	19-Jun	23:51	20-Jun	6:33	6:42	0.11	21.00	22.87	0.04	0.01	0.0024	0.0025
5	21-Jun	18:55	22-Jun	7:27	12:32	21-Jun	19:06	22-Jun	6:11	11:05	0.06	91.25	13.27	0.02	0.00	0.0103	0.0015
6	3-Aug	16:00	3-Aug	18:19	2:19	3-Aug	16:13	3-Aug	23:39	7:26	0.28	51.85	56.20	0.05	0.01	0.0058	0.0062
7	4-Aug	2:27	4-Aug	18:55	16:28	4-Aug	2:38	4-Aug	19:46	17:08	1.13	256.57	257.98	0.05	0.04	0.0288	0.0285
8	9-Aug	16:43	9-Aug	17:31	0:48	9-Aug	16:49	9-Aug	20:19	3:30	0.23	35.46	20.44	0.10	0.00	0.0040	0.0023
9	10-Aug	13:58	10-Aug	19:11	5:13	10-Aug	14:10	10-Aug	18:04	3:54	0.05	12.63	2.58	0.00	0.00	0.0014	0.0003
10	20-Aug	17:00	20-Aug	19:47	2:47	20-Aug	17:16	21-Aug	1:11	7:55	0.21	35.18	39.05	0.02	0.00	0.0040	0.0043

**Table 2. Flow Data for 2006**

2006 Storm Event	Reference Flow Start Date	Reference Flow Start Time	Reference Flow End Date	Reference Flow End Time	Reference Flow Duration (hm)	BMP Outlet Flow Start Date	BMP Outlet Flow Start Time	BMP Outlet Flow End Date	BMP Outlet Flow End Time	BMP Outlet Flow Duration (hm)	Rainfall (in)	Total Reference Flow Volume (cf)	Total BMP Outlet Flow Volume (cf)	Peak Reference Flow Rate (cfs)	Peak BMP Outlet Flow Rate (cfs)	Reference Site Volume per Unit Tributary Area (cf/sf)	BMP Volume per Unit Tributary Area (cf/sf)
2	**	**	**	**	**	30-Apr	22:57	1-May	0:28	1:31	0.08	**	19.57	**	0.005	**	0.0022
3	**	**	**	**	**	3-May	19:29	3-May	22:52	3:23	0.08	**	9.87	**	0.003	**	0.0011
4	9-May	22:30	10-May	2:52	4:22	9-May	22:42	10-May	9:14	10:32	0.34	9.196	790.50	0.0029	0.036	0.0010	0.0873
5	22-May	21:25	22-May	22:47	1:22	22-May	21:30	22-May	23:05	1:35	0.03	0.17	0.00	0.0001	0.000	0.0000	0.0000
8	3-Aug	14:58	3-Aug	15:22	0:24	3-Aug	15:03	3-Aug	17:28	2:25	0.18	0.078	1.19	0.0989	0.620	0.0000	0.0001
9	21-Sep	0:40	21-Sep	7:50	7:10	21-Sep	1:04	21-Sep	13:00	11:56	0.27	0.53	1.98	0.0320	0.409	0.0001	0.0002

\*\*No Data

**Table 3. Flow Data for 2007**

2007 Storm Event	Reference Flow Start Date	Reference Flow Start Time	Reference Flow End Date	Reference Flow End Time	Reference Flow Duration (hm)	BMP Outlet Flow Start Date	BMP Outlet Flow Start Time	BMP Outlet Flow End Date	BMP Outlet Flow End Time	BMP Outlet Flow Duration (hm)	Rainfall (in)	Total Reference Flow Volume (cf)	Total BMP Outlet Flow Volume (cf)	Peak Reference Flow Rate (cfs)	Peak BMP Outlet Flow Rate (cfs)	Reference Site Volume per Unit Tributary Area (cf/sf)	BMP Volume per Unit Tributary Area (cf/sf)
1	**	**	**	**	**	8-Apr	15:59	9-Apr	17:49	25:50	0.18	**	340.60	**	0.01	**	0.0376
2	**	**	**	**	**	16-Apr	1:31	16-Apr	8:14	6:43	0.42	**	192.2	**	0.01	**	0.0212
3	**	**	**	**	**	22-Apr	20:54	23-Apr	13:06	16:12	1.28	**	65.62	**	0.03	**	0.0073
4	30-Apr	15:44	30-Apr	16:43	:59	30-Apr	15:48	1-May	2:54	11:06	0.22	134.7	253.4	0.2245	0.02	0.0151	0.0280
5	13-May	18:58	14-May	4:37	9:39	13-May	19:05	14-May	4:58	9:53	0.46	296.3	375.8	0.7855	0.02	0.0333	0.0415
6	22-May	13:54	22-May	21:31	7:37	22-May	13:54	23-May	11:12	21:18	0.89	572.4	343.5	0.225	0.01	0.0643	0.0380
7	29-May	13:02	29-May	16:35	3:33	29-May	13:11	30-May	3:41	14:30	0.48	309.7	227.9	0.33667	0.01	0.0348	0.0252
8	11-Jun	15:08	11-Jun	21:30	6:22	11-Jun	15:24	12-Jun	7:40	16:16	0.28	181.83	137.8	0.11333	0.01	0.0204	0.0152
9	8-Jul	15:03	8-Jul	17:58	2:55	9-Jul	15:11	10-Jul	4:19	13:08	0.15	87.5	26.08	0.33667	0	0.0098	0.0029
10	4-Aug	22:41	5-Aug	0:37	1:56	4-Aug	22:59	5-Aug	4:26	5:27	0.29	181.8	33.02	0.11333	0	0.0204	0.0036

\*\*No Data

**Table 5. Flow Data for 2008**

2007 Storm Event	Reference Flow Start Date	Reference Flow Start Time	Reference Flow End Date	Reference Flow End Time	Reference Flow Duration (hm)	BMP Outlet Flow Start Date	BMP Outlet Flow Start Time	BMP Outlet Flow End Date	BMP Outlet Flow End Time	BMP Outlet Flow Duration (hm)	Rainfall (in)	Total Reference Flow Volume (cf)	Total BMP Outlet Flow Volume (cf)	Peak Reference Flow Rate (cfs)	Peak BMP Outlet Flow Rate (cfs)	Reference Site Volume per Unit Tributary Area (cf/sf)	BMP Volume per Unit Tributary Area (cf/sf)
1	**	**	**	**	**	1-May	8:16	**	**	**	0.27	**	**	**	**	**	**
2	10-May	14:5	10-May	11:10	9:25	10-May	1:47	10-May	11:10	9:23	0.13	23.998	16.658	6.70E-02	0.054	0.002696	0.00184
3	26-May	19:01	27-May	3:15	8:14	26-May	16:27	27-May	11:28	19:01	0.23	7.61	29.5	1.02E-02	0.0011	0.000855	0.00326
4	4-Jun	22:43	5-Jun	7:16	8:49	4-Jun	22:51	5-Jun	14:26	15:35	0.34	25.87	92.7	1.32E-01	0.055	0.002907	0.01024
5	15-Aug	3:08	17-Aug	19:40	64:32	15-Aug	3:33	17-Aug	21:05	65:32	1.37	1163	380.9	0.15667	0.01	0.130674	0.04209
6	11-Sep	19:47	12-Sep	17:21	21:34	11-Sep	19:51	12-Sep	17:21	21:30	0.96	102.998	69.382	0.00215	0.00172	0.011573	0.00767
**No Data																	

**Table 6. Flow Data for 2009**

2009 Storm Event	Reference Flow Start Date	Reference Flow Start Time	Reference Flow End Date	Reference Flow End Time	Reference Flow Duration (hm)	BMP Outlet Flow Start Date	BMP Outlet Flow Start Time	BMP Outlet Flow End Date	BMP Outlet Flow End Time	BMP Outlet Flow Duration (hm)	Rainfall (in)	Total Reference Flow Volume (cf)	Total BMP Outlet Flow Volume (cf)	Peak Reference Flow Rate (cfs)	Peak BMP Outlet Flow Rate (cfs)	Reference Site Volume per Unit Tributary Area	BMP Volume per Unit Tributary Area (cf/sf)
1	16-Apr	16:19	19-Apr	1:09	56:50	16-Apr	17:05	19-Apr	23:58	78:53	1.51	2272.48	996.91	0.09904	0.017	0.255335	0.11016
2	16-Apr	16:19	19-Apr	1:09	56:50	16-Apr	17:05	19-Apr	23:58	78:53	1.51	2272.48	996.91	0.09904	0.017	0.255335	0.11016
3	26-Apr	17:11	27-Apr	12:55	19:44	26-Apr	16:49	29-Apr	13:56	69:07	0.24	1085.33	1317.36	0.56989	0.109	0.121947	0.14556
4	27-Apr	14:14	28-Apr	7:35	17:21	26-Apr	16:49	29-Apr	13:56	69:07	0.4	536.12	1317.36	0.02422	0.109	0.060238	0.14556
5	11-May	9:31	11-May	22:44	13:13	9-May	23:38	12-May	14:16	62:38	0.19	334.59	143.80	0.01520	0.007	0.037594	0.01589
6	16-May	2:15	16-May	21:25	19:10	16-May	0:29	17-May	14:21	37:52	0.24	443.52	91.65	0.02707	0.163	0.049833	0.01013
7	23-May	17:24	24-May	5:05	11:41	23-May	17:24	24-May	12:45	19:21	0.77	1034.55	247.55	0.50482	0.013	0.116242	0.02735
8	24-May	12:48	25-May	0:21	11:33	24-May	13:17	25-May	18:16	28:59	0.68	1044.31	273.67	0.61882	0.014	0.117338	0.03024
9	25-May	18:40	26-May	6:02	11:22	25-May	18:39	28-May	16:51	70:12	1.04	806.63	786.10	0.15656	0.014	0.090632	0.08686
10	1-Jun	20:03	2-Jun	3:24	7:21	1-Jun	20:04	3-Jun	15:40	43:36	1.21	1402.99	568.05	0.21310	0.016	0.157639	0.06277
11	**	**	**	**	**	7-Jun	13:00	8-Jun	13:24	24:24	0.07	**	28.56	**	0.001	**	0.00316
12	11-Jun	12:42	11-Jun	22:09	9:27	11-Jun	12:40	12-Jun	22:05	33:25	0.09	657.09	9.43	0.12001	0.003	0.073831	0.00104
13	11-Jun	22:20	12-Jun	4:43	6:23	11-Jun	22:19	13-Jun	10:25	36:06	0.07	211.35	8.55	0.18192	0.002	0.023747	0.00095
14	13-Jun	17:33	13-Jun	22:07	4:34	13-Jun	17:34	14-Jun	14:28	20:54	0.49	589.51	143.35	0.57424	0.012	0.066237	0.01584
15	14-Jun	14:46	14-Jun	20:24	5:38	14-Jun	14:39	15-Jun	18:10	27:31	0.61	526.65	221.62	0.56989	0.015	0.059174	0.02449
16	16-Jun	17:55	16-Jun	23:34	5:39	16-Jun	17:55	17-Jun	14:58	21:07	0.04	195.04	78.51	0.02783	0.003	0.021915	0.00868
17	23-Jun	15:47	23-Jun	20:28	4:41	23-Jun	15:50	24-Jun	17:40	25:50	0.02	271.49	153.05	0.45751	0.006	0.030504	0.01691
18	26-Jun	14:48	26-Jun	21:37	6:49	26-Jun	9:52	27-Jun	10:12	24:20	0.31	474.00	168.86	0.57643	0.008	0.053259	0.01866
19	1-Jul	23:11	2-Jul	2:50	3:39	1-Jul	23:10	2-Jul	13:02	13:52	0.45	344.33	79.19	0.46715	0.007	0.038689	0.00875
20	3-Jul	16:41	3-Jul	21:15	4:34	3-Jul	16:43	4-Jul	0:14	7:31	0.61	464.62	78.40	0.52118	0.010	0.052205	0.00866
21	4-Jul	0:19	4-Jul	3:24	3:05	4-Jul	0:19	4-Jul	16:34	16:15	0.11	137.07	85.25	0.44420	0.005	0.015401	0.00942
22	4-Jul	16:46	4-Jul	20:48	4:02	4-Jul	16:45	5-Jul	18:03	25:18	0.28	355.62	163.55	0.39672	0.010	0.039957	0.01807
23	10-Jul	20:42	11-Jul	2:48	6:06	10-Jul	20:40	11-Jul	13:59	17:19	0.1	249.13	33.88	0.26077	0.004	0.027993	0.00374
24	20-Jul	22:27	21-Jul	0:06	1:39	20-Jul	22:24	21-Jul	14:13	15:49	0.4	392.01	319.36	0.49274	0.025	0.044047	0.03529
25	**	**	**	**	**	25-Jul	19:48	26-Jul	3:08	7:20	0.04	**	43.77	**	0.002	**	0.00484
26	27-Jul	19:46	28-Jul	0:29	4:43	27-Jul	19:47	28-Jul	15:28	19:41	0.35	426.46	129.73	0.41826	0.009	0.047917	0.01433
27	29-Jul	17:13	30-Jul	19:04	25:51	29-Jul	16:19	31-Jul	10:17	41:58	0.3	91.21	294.88	0.08622	0.009	0.010249	0.03258
28	**	**	**	**	**	31-Jul	21:46	1-Aug	12:06	14:20	0.02	**	52.11	**	0.002	**	0.00576
30	6-Aug	16:12	7-Aug	3:32	11:20	6-Aug	16:02	7-Aug	10:24	18:22	0.07	487.31	32.88	0.19958	0.003	0.054754	0.00363
31	9-Aug	20:18	10-Aug	3:29	7:11	9-Aug	20:15	10-Aug	11:45	15:30	0.23	342.32	26.90	0.51706	0.005	0.038463	0.00297
32	17-Aug	20:06	17-Aug	20:35	0:29	17-Aug	20:08	18-Aug	12:42	16:34	0.32	142.30	99.05	0.35557	0.008	0.015989	0.01095
33	18-Aug	12:55	18-Aug	13:42	0:47	18-Aug	12:49	18-Aug	13:02	0:13	0.07	18.56	97.37	0.02782	0.004	0.002085	0.01076
34	12-Sep	16:05	12-Sep	23:05	7:00	12-Sep	15:57	14-Sep	13:55	45:58	0.18	47.69	187.59	0.02259	0.006	0.005359	0.02073
35	**	**	**	**	**	21-Sep	5:21	22-Sep	21:50	32:29	0.2	**	185.53	**	0.008	**	0.0205
36	23-Sep	12:10	24-Sep	1:31	25:21	23-Sep	12:04	24-Sep	15:04	27:00	0.09	192.68	147.32	0.02130	0.004	0.02165	0.01628

**Table 7. Flow Data for 2010**

2010 Storm Event	Reference Flow Start Date	Reference Flow Start Time	Reference Flow End Date	Reference Flow End Time	Reference Flow Duration (hm)	BMP Outlet Flow Start Date	BMP Outlet Flow Start Time	BMP Outlet Flow End Date	BMP Outlet Flow End Time	BMP Outlet Flow Duration (hm)	Rainfall (in)	Total Reference Flow Volume (cf)	Total BMP Outlet Flow Volume (cf)	Peak Reference Flow Rate (cfs)	Peak BMP Outlet Flow Rate (cfs)	Reference Site Volume per Unit Tributary Area (cf/sf)	BMP Volume per Unit Tributary Area (cf/sf)
1	21-Apr	22:39	22-Apr	19:30	20:51	21-Apr	22:38	22-Apr	21:24	22:46	0.71	678.10	502.98	0.108	0.016	0.076191	0.05558
3	23-Apr	5:16	23-Apr	15:35	10:19	23-Apr	4:42	24-Apr	12:22	7:40	1.21	251.46	1319.34	0.028	0.029	0.028254	0.14578
4	**	**	**	**	**	25-Apr	20:19	26-Apr	4:07	7:48	0.07	**	167.82	**	0.009	**	0.01854
5	**	**	**	**	**	29-Apr	6:44	30-Apr	9:38	2:54	0.15	**	288.48	**	0.010	**	0.03188
6	11-May	17:45	12-May	3:03	9:18	11-May	17:36	12-May	14:16	20:40	0.41	217.67	760.68	0.114	0.014	0.024457	0.08405
7	12-May	10:12	12-May	21:10	10:58	12-May	16:49	13-May	0:55	8:06	0.24	80.06	138.84	0.008	0.010	0.008996	0.01534
8	13-May	20:07	13-May	23:36	0:29	13-May	20:23	14-May	4:04	7:41	0.19	50.69	183.72	0.010	0.011	0.005695	0.0203
9	14-May	15:47	14-May	23:44	7:57	14-May	15:50	15-May	1:54	10:04	0.45	482.69	196.80	0.323	0.011	0.054235	0.02175
10	11-Jun	15:06	12-Jun	14:20	23:14	11-Jun	15:09	12-Jun	22:03	6:54	1.35	981.21	661.50	0.532	0.021	0.110248	0.07309
12	12-Jun	23:23	13-Jun	13:35	10:12	12-Jun	23:14	14-Jun	2:25	3:11	0.54	362.06	361.50	0.171	0.010	0.040681	0.03994
13	26-Jun	18:08	26-Jun	19:40	1:32	26-Jun	18:13	27-Jun	3:49	9:36	0.05	35.56	14.22	0.028	0.002	0.003995	0.00157
14	4-Jul	18:15	5-Jul	6:35	12:20	4-Jul	18:25	5-Jul	19:17	0:52	0.59	1166.50	224.76	0.596	0.011	0.131067	0.02484
15	6-Jul	23:51	7-Jul	11:01	11:10	7-Jul	0:34	7-Jul	3:46	3:12	0.36	456.87	53.64	0.563	0.012	0.051334	0.00593
16	7-Jul	15:08	7-Jul	16:43	1:35	7-Jul	8:49	7-Jul	20:36	11:47	0.08	23.74	130.74	0.013	0.005	0.002667	0.01445
17	**	**	**	**	**	8-Jul	17:20	8-Jul	20:56	3:36	0.03	**	25.32	**	0.002	**	0.0028
18	19-Jul	16:25	20-Jul	10:30	18:05	**	**	**	**	**	0.07	741.40	**	0.185	**	0.083303	**
19	20-Jul	17:41	21-Jul	3:35	9:54	**	**	**	**	**	0.1	110.88	**	0.115	**	0.012459	**
20	22-Jul	18:23	22-Jul	22:18	3:55	**	**	**	**	**	0.11	133.77	**	0.166	**	0.01503	**
21	9-Aug	16:57	10-Aug	9:01	16:04	**	**	**	**	**	0.17	426.73	**	0.109	**	0.047947	**

\*\*No Data



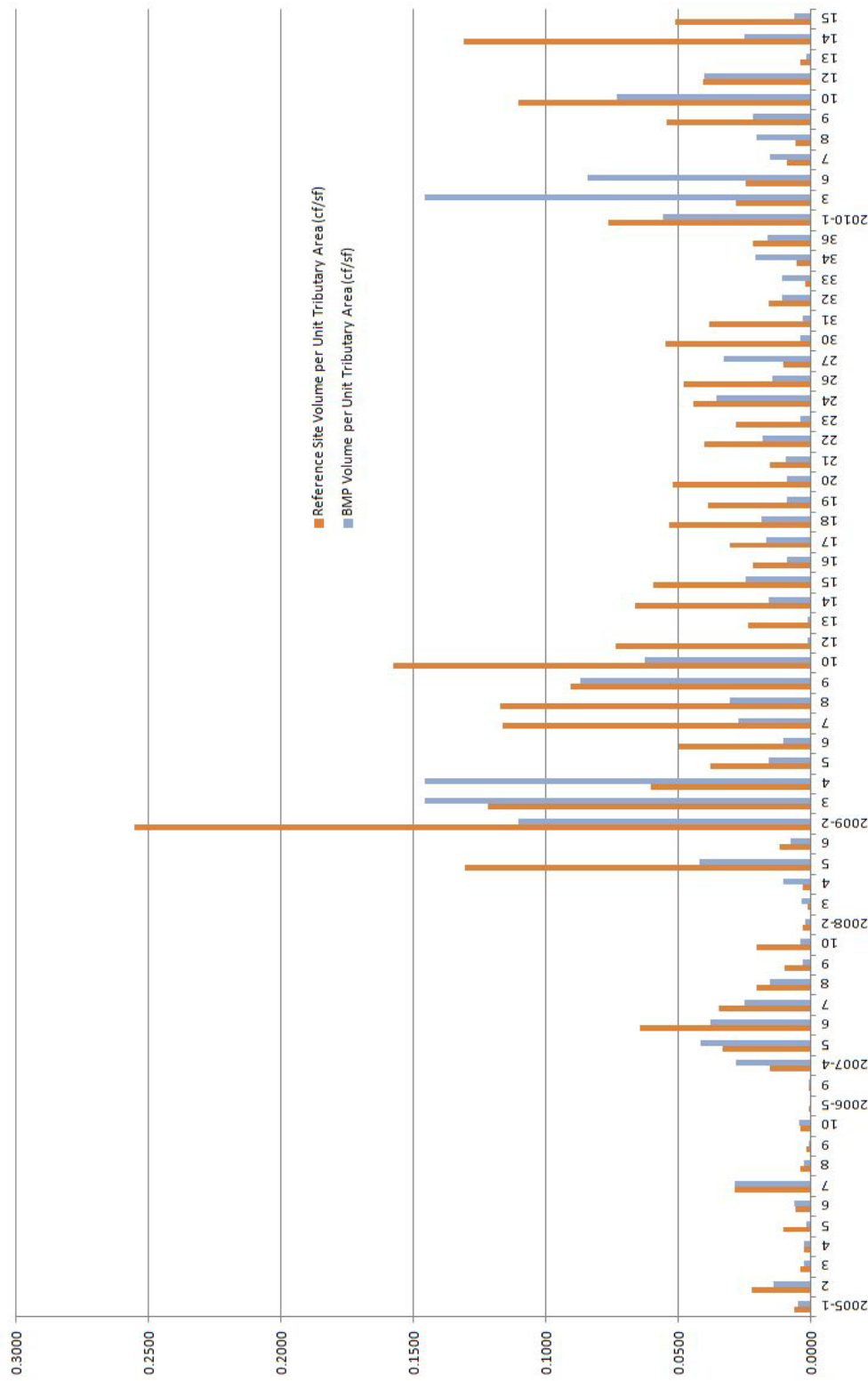


Figure 10. Measured Volume of Reference Site and BMP

## Impact on Water Quality

To conduct the water quality analysis, t-tests were performed to compare the means for the reference site and the BMP for each constituent. Data was analyzed year by year and then combined and analyzed for all years. A non-parametric Wilcoxon signed-rank tests were performed in addition to parametric paired t-tests and two sample t-tests since some of the data did not fit a normal distribution. The p-values generated for each of the constituents ( $\alpha=0.05$ ) are provided in Tables A-1 through A-7 of Appendix A. A summary table showing data sets with significant differences and also indicating whether constituent values were higher at the reference outlet or the BMP outlet is provided in Table 8. The values that were significant, below the alpha level of 0.05, are in bold. It is also important to note that in cases where certain constituents were not detected in a sample, we used zero as a number for our analysis.

The results of the statistical analysis show significant differences between the reference site and the BMP. About half of the constituents were in lower concentrations at the pervious concrete and half were in higher concentrations. Except for Total Copper and Total Manganese, none of the constituents that were in a significantly higher concentration in effluent from the reference site or BMP site in one year were significantly lower for another year. Total Copper data show a decrease in concentration in the BMP effluent of the 5 years of study. It is significantly high in BMP effluent in 2006 and 2007 and significantly lower in the BMP effluent in 2010. With the exception of 2005 data, Total Manganese also shows a decline in concentration over time. It is significantly higher at the BMP outlet in 2006 and significantly lower in 2010.

ANOVA and Tukey multi-comparison tests were also used to analyze the difference in variation between and within samples for each year, and to analyze pairwise differences in the mean for each year, respectively. The results of these tests are provided in Tables A-8 and A-9 of Appendix A. These tests were only performed for Total Suspended Solids, Total Phosphorus, and all total metals. The purpose of these tests was to investigate the relationship of these constituents, which have been known to adsorb to Total Suspended Solids, and can sometimes be removed through filtration of Total Suspended Solids. The values that were significant, below the alpha level of 0.05, are in bold. Generally speaking, the low number of significant values in the BMP effluent and high number at the reference site suggest that this BMP provides consistent effluent values of Total Suspended Solids and the constituents that adsorb to it. Total Selenium, Total Nickel, Total Cadmium, and Total Chromium were the exception; however, it should be noted that there was a lack of data for Total Selenium.

Tables with all the water quality data (by year) are provided in Tables 9 through 16 with descriptive statistics for each year provided in Tables 17 through 52. Box-and-whisker plots for each constituent for combined year data are provided in Figures 13-47.

**Table 8. Significant Constituent Concentrations**

Constituent	Data set with Higher Concentration at the Reference Site	Data Set with Higher Concentration at the BMP
Alkalinity		2005, 2006, 2007, CY
Chemical Oxygen Demand	2009, 2010, CY	
Chloride		2009, 2010, CY
Conductivity		2005, 2006, 2007, CY
Hardness		2007, CY
pH		2005, 2006, 2007, CY
Dissolved Calcium		2009, 2010, CY
Dissolved Iron		2009, CY
Dissolved Magnesium		2009, 2010, CY
Dissolved Sodium		2007, 2009, 2010, CY
Dissolved Chromium		2007, 2009, 2010, CY
Dissolved Manganese	2005, 2007, 2009, 2010, CY	
Dissolved Nickel	2007, 2009, 2010, CY	
Dissolved Copper		2006, 2007, 2009, CY
Dissolved Zinc	2005, 2006, 2007, 2009, 2010, CY	
Dissolved Selenium		CY
Total Chromium	2010	
Total Nickel	2009, 2010, CY	
Total Zinc	2005, 2007, 2009, 2010, CY	
Total Selenium		CY
Total Cadmium	CY	
Total Lead	2009, 2010, CY	
Total Manganese	2010	2006
Total Copper	2010	2006, 2007
Dissolved Potassium		2007, 2008, 2009, 2010, CY
Nitrite+Nitrate		2006, 2007, 2009, 2010, CY
Ortho-Phosphorus		CY
Total Kjeldahl Nitrogen	2007, 2009, 2010, CY	
Total Phosphorus	2009, 2010, CY	
Total Suspended Solids	2009, 2010, CY	
CY = Combined Years Data		

**Table 9. Water Quality Data for 2005**

Water Quality Constituent	Storm Event 1		Storm Event 2		Storm Event 3		Storm Event 4		Storm Event 5		Storm Event 6		Storm Event 7		Storm Event 8		Storm Event 10	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Alkalinity (mg/L)	**	34	0	88	12	89	69	84	71	84	36	71	**	99	51	82	21	71
Conductivity (umho/cm)	**	12.2	78.6	230	33.7	171	138	223	125	207	47	202	**	246	87	209	99.6	209
Hardness (mg/L)	**	38	88	110	50	85	75	55	50	112	62	75	**	75	60	55	36	65
pH	**	6.3	5.4	8.8	6.5	9.7	6.6	8.6	6.6	9	5.5	8.9	**	8.8	7	7.8	7.7	9
Total Organic Carbon (mg/L)	**	3	34	10	9	7	**	**	32	26	13	22	**	5	32	4	12	22
Dissolved Iron (mg/L)	0.06	0	0.08	0.1	0	0	0.13	0	0.13	0	0.05	0	**	0	0.1	0.08	0.15	0.22
Dissolved Chromium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Dissolved Manganese (µg/L)	0	0	70	0	0	60	100	0	50	0	30	0	**	0	50	0	30	0
Dissolved Nickel (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Dissolved Copper (µg/L)	4	0	9	5	2	2	10	11	5	10	8	11	**	6	9	4	7	11
Dissolved Zinc (µg/L)	4.2	8.2	43.3	3	16.9	8	48	1.4	22.4	2.7	34	2.6	**	0.9	56.5	13.2	24.8	5.3
Dissolved Lead (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Total Beryllium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Total Chromium (µg/L)	0	0	0	10	0	0	0	0	0	0	0	0	**	0	10	0	0	0
Total Manganese (µg/L)	**	0	100	140	0	60	100	30	60	20	40	30	**	60	60	60	30	0
Total Nickel (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Total Copper (µg/L)	0	2	18	14	4	7	14	12	7	17	9	12	**	22	13	7	9	11
Total Zinc (µg/L)	40	30	60	20	0	0	60	20	50	20	50	30	**	30	40	20	40	0
Total Cadmium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Total Antimony (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Total Lead (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0
Nitrite+Nitrate (mg/L)	0.43	0.12	1.61	1.62	0.4	0.91	1.72	2.42	2.98	3.65	0.85	3.16	**	0.92	1.76	0.91	1.26	3.44
Ortho-Phosphorus (mg/L)	**	0.03	0.07	0.22	0.01	0.09	**	**	0	0	0.06	0.06	**	0.14	0.02	0.27	0.03	0.04
Total Kjeldahl Nitrogen (mg/L)	1	0.7	3.7	1.1	1.5	1	**	**	4	2.5	1.7	2.1	**	0.8	4.5	1.3	1.4	1.7
Total Phosphorus (mg/L)	0.17	0.02	0.21	0.28	0.06	0.14	**	**	0.12	0.07	0.09	0.13	**	0.15	0.1	0.29	0.08	0.07
Total Suspended Solids (mg/L)	**	8	63	41	85	40	13	21	29	50	16	20	**	30	16	22	5	10

\*\*No Data

**Table 10. Water Quality Data for 2006**

Water Quality Constituent	Storm Event 1 (first flush)		Storm Event 1 (after first flush)		Storm Event 2		Storm Event 3		Storm Event 4		Storm Event 5		Storm Event 6		Storm Event 7		Storm Event 8		Storm Event 9	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Alkalinity (mg/L)	9.1	103	8	104	**	164	**	120	**	113	**	155	26	162	11	83	69	120	0	67
Conductivity (umho/cm)	72.3	443	71.4	423	**	546	**	431	**	364	**	681	56	382	62	223	200	38.5	30.6	180
Hardness (mg/L)	**	**	**	**	**	72	**	80	**	78	**	73	72	62	40	72	88	55	10	35
pH	6.3	9.8	6	9.6	**	10.2	**	9.5	**	10.1	**	7.8	6.1	10	5.8	9.2	6.1	9.4	5.7	9.4
Total Organic Carbon (mg/L)	13	16	14	16	**	18	**	17	**	12	**	26	32	14.8	32	31	21	22	14	9
Dissolved Iron (mg/L)	0.07	0.2	0.08	0.21	**	0.09	**	0.13	**	0.14	**	0.05	0.11	0.42	0.09	0.16	0.08	0.1	0.06	0.06
Dissolved Chromium (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Dissolved Manganese (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	40	0	50	0	40	0	0	0
Dissolved Nickel (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Dissolved Copper (µg/L)	5	11	4	11	**	16	**	11	**	9	**	15	6	11	9	13	8	10	5	5
Dissolved Zinc (µg/L)	23.5	28.3	18.3	16.4	**	2.4	**	31.7	**	13.4	**	10.4	22	0	41	0	40	0	0	**
Dissolved Lead (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Beryllium (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Chromium (µg/L)	0	0	0	0	**	20	**	0	**	0	**	0	0	20	0	0	0	0	0	0
Total Manganese (µg/L)	0	270	0	270	**	350	**	210	**	160	**	70	70	270	60	160	40	80	0	30
Total Nickel (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Copper (µg/L)	5	24	5	24	**	37	**	22	**	20	**	18	8	40	10	26	12	20	5	4
Total Zinc (µg/L)	40	80	50	100	**	70	**	70	**	30	**	40	60	40	50	40	60	40	20	30
Total Cadmium (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Antimony (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Lead (µg/L)	0	0	0	0	**	0	**	0	**	0	**	0	0	0	0	0	0	0	0	0
Nitrite+Nitrate (mg/L)	0.24	1.55	0.29	1.71	**	1.47	**	2.04	**	1	**	4.93	0.8	1.32	0.99	2.48	0.79	2.11	0.77	2.06
Ortho-Phosphorus (mg/L)	0.04	0.17	0.04	0.15	**	0.22	**	0.17	**	0.18	**	0.07	0.19	0.25	0.05	0.08	0.02	0.06	0.1	0.08
Total Kjeldahl Nitrogen (mg/L)	1.1	1.4	1.2	1.5	**	2	**	1.7	**	1.1	**	1.9	2.4	1.9	3.2	2.5	2.4	2	2.6	1.2
Total Phosphorus (mg/L)	0.1	0.77	0.08	0.29	**	0	**	0.22	**	0.18	**	0.13	0.3	0.31	0.22	0.21	0.14	0.1	0.13	0.07
Total Suspended Solids (mg/L)	9	65	10	71	**	129	**	87	**	56	**	36	111	84	24	56	17	25	16	14

\*\*No Data



**Table 11. Water Quality Data for 2007**

Water Quality Constituent	8-Apr		16-Apr		23-Apr		25-Apr		1-May		10-May		14-May		23-May		24-May		29-May		12-Jun		8-Jul		25-Jul		5-Aug		9-Aug			
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP		
Alkalinity (mg/L)	51	235	0	173	18	221	18	119	13	93	21	96	0	106	32	182	11	92	14	69	0	60	0	87	81	95	22	**	11.9	**		
Conductivity (umho/cm)	301	1210	67.2	702	48.3	1040	60.6	424	73.1	267	634	275	77.4	256	192	222	25.3	485	67	189	46.8	197	66	279	84	242	74	**	54	**		
Hardness (mg/L)	46	46	13	62	0	83	0	38	45	209	17	41	20	54	38	28	5.1	51	23	28	13	26	56	44	41	30	32	**	25	**		
pH	7	9.8	6.4	9.9	8.4	9.8	8.7	10.3	6.3	9.9	6.3	9.7	6.6	10.1	6.5	9.5	5.7	8.4	7.1	9.5	6	9.2	5.8	8.2	6.6	9.4	6.1	**	6.3	**		
Total Organic Carbon (mg/L)	16	10	22	19	9	8	5	3	12	11	8	8	27	14	25	8	7	25	11	8	**	20	**	**	14	15	19	**	33	**		
Dissolved Calcium (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	5	8	3	7	7	10	5	7	5	**	**	**		
Dissolved Iron (mg/L)	0.17	0	0.09	0.07	0.09	0	0	0.08	0.07	0.15	0.1	0.14	0.08	0.23	**	**	**	**	0	0.11	0	0.09	0.1	0.21	0.42	0.36	0.05	**	**	**		
Dissolved Magnesium (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0.7	0.3	0.4	0.6	0.9	1.3	0.8	0.5	0.8	**	**	**		
Dissolved Sodium (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	5	21	4	23	4	44	10	40	7	**	**	**		
Dissolved Chromium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**	**	**	**	0	1.5	0	2.8	0	3.3	1.2	3.2	0	**	0	**		
Dissolved Manganese (µg/L)	20	0	20	0	0	0	0	0	30	0	0	0	20	0	**	**	**	**	24.4	3.3	23.1	3.1	82.2	5	27.6	5.8	24.5	**	46.2	**		
Dissolved Nickel (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**	**	**	**	1.6	0	1.6	0	3.3	1.1	1.6	0	2	**	1.4	**		
Dissolved Copper (µg/L)	15	13	5	15	3	6	5	4	6	12	4	6	5	7	**	**	**	**	5.9	6.7	6.9	10.6	9.2	10.2	8.2	12.7	6.4	**	5.6	**		
Dissolved Zinc (µg/L)	0	0	20	0	0	0	0	0	30	0	0	0	10	0	**	**	**	**	15	0	24.7	5.4	80.7	0	12	0	15.1	**	21.3	**		
Dissolved Selenium (µg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	0	0	0	0	1.3	0	1.5	0	**	0	**		
Dissolved Silver (µg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	0	0	0	0	0	0	0	0	0	**	0	**	
Dissolved Cadmium (µg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0.1	0.4	0.2	0.1	0.2	0	0	0	0	0.1	**	0	**	
Dissolved Lead (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**	**	**	**	0	0	0	0	0	0	0	0	0	**	0	**		
Total Beryllium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**	0	**		
Total Chromium (µg/L)	0	10	0	0	0	0	0	0	10	10	0	10	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	**	0	**		
Total Manganese (µg/L)	40	40	60	90	**	0	**	**	**	**	**	**	80	400	**	**	**	**	**	**	**	**	**	**	**	**	**	**	45	**	182	**
Total Nickel (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	**	7	**	
Total Copper (µg/L)	17	30	10	24	8	22	7	17	25	40	7	20	15	49	0	0	0	0	0	0	0	0	0	30	20	0	30	10	**	22	**	
Total Zinc (µg/L)	0	0	40	0	20	0	0	0	140	60	0	30	50	60	30	0	30	0	70	60	40	20	170	0	20	0	0	**	141	**		
Total Arsenic (µg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	**	0	**
Total Selenium (µg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	**	0	**
Total Molybdenum (µg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	0	**	0	**
Total Cadmium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**	0	**		
Total Antimony (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**	0	**		
Total Lead (µg/L)	0	0	0	0	0	0	0	0	18	10	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	**	13	**		
Dissolved Potassium (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	1	11	1	13	2	18	6	17	4	**	**	**		
Nitrite+Nitrate (mg/L)	1.26	0.86	0.5	2.22	0.22	1.17	0.13	0.3	0.58	0.77	0.69	1.2	0.96	0.85	2.08	1.52	0.56	3.44	0.59	0.9	0.49	1.38	1.29	2.88	1	1.76	0.79	**	0.41	**		
Ortho-Phosphorus (mg/L)	0.09	0.03	0.05	0.09	0.06	0.01	0.21	0.42	0.05	0.17	0.05	0.08	0.15	0.21	0.06	0.04	0.02	0.01	0.05	0.09	0.04	0.05	0.04	0.02	0.1	0.07	0.03	**	0.06	**		
Total Kjeldahl Nitrogen (mg/L)	2.7	1.4	2.8	1.6	0.9	0.9	0	0	3.1	1.7	2.1	1.4	2.6	2.26	3.2	0.7	1.3	1.6	2.5	1.3	2.1	1.03	5.4	2.1	1.4	1.3	2.2	**	3.7	**		
Total Phosphorus (mg/L)	0.17	0.16	0.2	0.14	0.09	0.12	0.05	0.16	0.45	0.35	0.12	0.15	0.24	0.47	**	**	**	**	0.18	0.14	0.15	0.1	0.42	0.13	0.2	0.13	0.07	**	0.37	**		
Total Suspended Solids (mg/L)	40	121	115	57	49	135	70	44	455	143	46	54	303	278	**	35	81	54	165	54	37	26	297	62	35	33	130	**	518	**		

\*\*No Data

**Table 12. Water Quality Data for 2008**

Water Quality Constituent	2-May		14-May		15-May		27-May		6-Jun		18-Aug		15-Sep	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Alkalinity (mg/L)	92	33	119	0	101	**	0	129	0	133	**	**	**	**
Chemical Oxygen Demand (mg/L)	**	**	**	**	**	**	**	**	**	**	20	23	37	40
Conductivity (umho/cm)	327	150	336	68	323	**	50.6	446	56	373	**	**	**	**
Hardness (mg/L)	29	37	52	25	35	**	48	56	14	35	**	**	**	**
pH	9.4	7.8	9.6	7.4	10	**	6.8	9.9	7.1	9.5	**	**	**	**
Total Organic Carbon	19	29	9	16	11	**	31	17	13	10	**	**	**	**
Dissolved Calcium (mg/L)	9	7	3	5	10	**	12	15	5	11	5	6	3	7
Dissolved Iron (mg/L)	0.45	0.09	0.1	0.13	0.18	**	0.59	0.21	0.07	0.19	0	0.2	0	0.24
Dissolved Magnesium (mg/L)	1	1	0.4	0.7	0.6	**	1.2	0.9	0.5	0.9	0.4	0.8	0.2	0.9
Dissolved Sodium (mg/L)	47	17	44	7	44	**	56	58	4	57	2	30	2	28
Dissolved Chromium (µg/L)	2.3	2.4	1.6	0	1.6	**	0	2.5	0	2.1	0	1.3	0	1.4
Dissolved Manganese (µg/L)	14.2	11.4	3.9	19.9	7.3	**	83.5	4.3	19.2	4.3	5.8	3.6	6.8	4.3
Dissolved Nickel (µg/L)	1.2	2	0	1.2	0	**	2.8	0	1.1	0	0	0	0	0
Dissolved Copper (µg/L)	9.7	9.8	9.8	5.3	9.9	**	2.8	9.9	9.9	9.3	8	8	9.1	4.3
Dissolved Zinc (µg/L)	6.4	8.1	0	14.4	0	**	25.6	0	17.3	6.1	7.5	5.1	17.4	6.1
Dissolved Selenium (µg/L)	0	0	1.2	1.4	1.1	**	0	0	0	0	0	0	0	0
Dissolved Silver (µg/L)	0	0	0	0.7	0	**	0	0	0	0	0	0	0	0
Dissolved Cadmium (µg/L)	0.5	0.1	0	0.1	0	**	0.2	0	0.1	0	0.3	0	0.1	0.1
Dissolved Lead (µg/L)	0	0	0	0	0	**	1.7	0	0	0	0	0	0	0
Total Beryllium (µg/L)	0	0	0	0	0	**	0	0	0	0	0	0	0	0
Total Chromium (µg/L)	0	0	0	0	6.4	**	0	0	0	0	0	0	0	0
Total Manganese (µg/L)	40.6	59.3	48.6	31.9	114	**	77.8	59.4	28	64.9	13.2	60.7	17.5	42.3
Total Nickel (µg/L)	1.7	3.5	1.9	1.6	3.4	**	3.5	2.2	1.4	2.1	0	1.7	0	1.4
Total Copper (µg/L)	13.2	14.9	14.3	9.6	20.8	**	14	15	11.4	18	4.8	10.8	14.5	8.3
Total Zinc (µg/L)	0	33.7	0	26.1	24	**	74.4	0	0	0	0	0	0	0
Total Arsenic (µg/L)	0	0	0	0	0	**	0	0	0	0	0	0	0	0
Total Selenium (µg/L)	0	0	0	0	0	**	0	0	0	1	0	0	0	0
Total Molybdenum (µg/L)	0	0	0	0	0	**	0	0	0	0	0	0	0	0
Total Silver (µg/L)	0	0	0	0	0	**	0	0	0	0	0	0	0	0
Total Cadmium (µg/L)	0.8	0	0	0	0	**	0	0	0	0	0.9	0	0	0
Total Antimony (µg/L)	0	0	0	0	0	**	0	0	0	0	0	0	0	0
Total Lead (µg/L)	0	0	0	0	0	**	0	0	0	0	0	0	0	0
Dissolved Phosphorus (mg/L)	**	**	**	**	**	**	**	**	**	**	0.04	0.06	0.02	0.04
Dissolved Potassium (mg/L)	6	4	10	2	11	**	2	15	1	17	1	14	1	14
Nitrite+Nitrate (mg/L)	0.68	0.5	0.76	0.27	0.87	**	0.5	1.83	0.56	1.62	0.3	0.74	0.15	1.01
Ortho-Phosphorus	0.09	0.1	0.07	0.07	0.1	**	0.07	0.06	0.04	0.09	**	**	**	**
Total Kjeldahl Nitrogen (mg/L)	1.3	2.3	0.8	1.2	1	**	3	1.7	1.7	0.9	0.8	0.9	1	0.8
Total Phosphorus (mg/L)	0.93	0.28	0.05	0.13	0.15	**	0.3	0.1	0.08	0.1	0.06	0.08	0.07	0.09
Total Suspended Solids (mg/L)	27	82	26	23	55	**	156	48	19	23	16	23	21	15

\*\*No Data

**Table 13. Water Quality Data for 2009**

Water Quality Constituent	Storm Event 1		Storm Event 2		Storm Event 3		Storm Event 7		Storm Event 8		Storm Event 9		Storm Event 10		Storm Event 11		Storm Event 12		Storm Event 14		Storm Event 15		Storm Event 17		Storm Event 18		Storm Event 19		Storm Event 21	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Alkalinity (mg/L)	**	**	**	**	**	**	**	38	112	**	117	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Chemical Oxygen Demand (mg/L)	77	106	35	27	85	46	520	71	**	**	19	53	58	22	136	**	55	**	198	33	83	48	77	22	79	30	33	16	113	22
Chloride (mg/L)	12	127	15	89	12	54	9	44	**	**	2	19	4	31	26	**	13	**	2	61	2	56	73	7	3	57	1	59	1	41
Conductivity (umho/cm)	**	**	**	**	**	**	138	396	**	404	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Hardness (mg/L)	**	**	**	**	**	**	76	26	**	34	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
pH	**	**	**	**	**	**	7.1	9.1	**	9	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Organic Carbon (mg/L)	**	**	**	**	**	**	34	15	**	8	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Dissolved Calcium (mg/L)	3	9	3	17	4	8	10	5	**	9	2	4	3	6	10	**	7	**	4	8	3	12	6	8	4	11	2	8	3	7
Dissolved Iron (mg/L)	0.12	0.11	0.08	0	0.11	0.18	0.06	0.28	**	0.21	0	0.25	0	0.11	0.11	**	0.09	**	0	0.07	0	0.09	0.05	0.1	0	0.06	0	0.07	0	0.11
Dissolved Magnesium (mg/L)	0.7	1.4	0.7	0.1	0.6	0.5	1.1	0.6	**	1.7	0.2	0.4	0.3	0.8	1.2	**	0.8	**	0.3	0.9	0.2	1	0.7	1.1	0.3	1.2	0.2	1.2	0.2	0.8
Dissolved Sodium (mg/L)	14	110	11	77	12	53	12	71	**	68	3	35	5	44	26	**	17	**	3	74	2	68	10	94	5	74	2	73	2	59
Dissolved Chromium (µg/L)	0	2.2	0	2.4	0	1.2	0	2	**	1.5	0	1	0	1.7	0	**	0	**	0	2.5	0	2.7	1.5	4	0	4.1	0	3.3	0	2.7
Dissolved Manganese (µg/L)	11.2	5.7	11.9	0	12.1	2.7	15.4	6.7	**	4	2.8	6	5.7	4.9	8.2	**	2.1	**	1.7	3.5	4.6	4.5	14.7	4.1	2.6	4.9	8.8	4.1	3.2	3.3
Dissolved Nickel (µg/L)	0	0	0	0	0	0	1.4	0	**	0	0	0	0	0	1.8	**	1.8	**	0	1.2	0	0	3	1.2	0	0	0	0	0	0
Dissolved Copper (µg/L)	7.8	8.7	5.5	4.1	4.8	4.5	4.1	6.1	**	5.3	0	3.8	2.7	7.2	9.5	**	5.6	**	0	5.1	0	5.7	6.5	8.9	2.4	9.5	2.9	5.7	2.5	5.6
Dissolved Zinc (µg/L)	9.4	0	10	0	11	0	33.6	5.9	**	8.5	0	5.8	8.2	0	8.4	**	8.1	**	0	0	0	0	20.3	0	11.2	0	6.3	0	0	0
Dissolved Selenium (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved Silver (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved Cadmium (µg/L)	0	0	0.1	0	0	0	0.5	0.6	**	0.8	0	0.3	0.2	0	0	**	0	**	0	0.1	0	0	0.3	0.2	0.2	0	0.2	0	0.1	0.4
Dissolved Lead (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Total Beryllium (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Total Chromium (µg/L)	0	10.6	0	0	0	0	18.1	0	**	0	0	0	0	0	0	**	0	**	12.4	0	0	0	0	5.5	0	5.2	0	0	0	0
Total Manganese (µg/L)	44.4	44.5	41.9	27	35.7	56.9	363	81.1	**	77.9	12.6	41.6	52	45.3	30.8	**	26.5	**	240	50.8	91.5	47	30.3	58.2	81.5	47	49	45.1	95.5	46.4
Total Nickel (µg/L)	2.5	5.1	2.4	1.2	1.7	1.8	16.4	2.3	**	2.2	0	1.2	2.7	1.4	2.5	**	2.7	**	10.5	1.8	3.9	1.8	3.2	1.9	4.1	1.8	2.1	1.6	3.3	1.6
Total Copper (µg/L)	19	15	13.1	7.2	7.8	10.3	45.5	14.7	**	13.8	2.1	7.7	9.4	8.7	8.6	**	7.8	**	27.9	10.1	10.5	10.5	8.3	9.9	13	10	6.2	8.7	10.8	9.1
Total Zinc (µg/L)	45.7	0	39.2	0	27.2	0	311	26.1	**	20.3	0	0	57.6	0	23.4	**	31.2	**	174	0	57.2	0	35.7	0	75.7	0	45.2	0	62.5	0
Total Arsenic (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Total Selenium (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	1.1	0	0	0	0	0	0	0	0	0
Total Molybdenum (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Total Silver (µg/L)	0	0	0	0	0	0	0.2	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Total Cadmium (µg/L)	0	0	0	0	0	0	1.2	0.8	**	0.8	0	0	0	0	0	**	0	**	0.8	0	0	0	0	0	0	0	0	0	0.5	0.6
Total Antimony (µg/L)	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0
Total Lead (µg/L)	0	0	0	0	0	0	38.9	0	**	0	0	0	5.1	0	0	**	0	**	21.6	0	8	0	0	0	7.2	0	0	0	11.1	0
Dissolved Phosphorus (mg/L)	0.05	0.09	0.04	0.05	0.04	0.07	0.06	0.05	**	**	0.02	0.05	0.03	0.06	0.03	**	0.02	**	0.02	0.04	0.03	0.05	0.05	0.06	0.02	0.05	0.04	0.05	0.02	0.05
Dissolved Potassium (mg/L)	1	9	0	10	1	7	3	13	**	11	0	7	0	9	4	**	3	**	0	13	0	11	2	16	1	15	0	15	0	13
Nitrite+Nitrate (mg/L)	0.28	0.64	0.13	0.27	0.31	0.87	0.73	1.34	**	1.12	0.12	0.62	0.48	0.76	1.15	**	0.82	**	0.33	1.36	0.56	1.31	1.14	3.24	0.73	2.04	0.38	2.28	0.69	1.97
Total Kjeldahl Nitrogen (mg/L)	1.4	1.8	1.2	0.8	1.4	1.9	4.8	1.2	**	0.8	0.6	0.7	1.8	0.4	2.5	**	1.4	**	1.7	0.8	1.2	0.7	2.6	1	1.3	0.6	1.4	0.5	2.1	1.2
Total Phosphorus (mg/L)	0.16	0.14	0.15	0.11	0.12	0.13	0.97	0.14	**	0.14	0.05	0.08	0.15	0.09	0.12	**	0.09	**	0.34	0.06	0.22	0.08	0.15	0.12	0.14	0.08	0.14	0.1	0.26	0.1
Total Suspended Solids (mg/L)	65	79	53	27	47	27	1020	58	**	34	29	12	137	24	38	**	41	**	1180	40	539	26	39	27	190	17	156	18	347	23

\*\*No Data

**Table 14. Water Quality Data for 2009 (Cont.)**

Water Quality Constituent	Storm Event 22		Storm Event 23		Storm Event 24		Storm Event 25		Storm Event 26		Storm Event 27		Storm Event 29		Storm Event 30		Storm Event 31		Storm Event 32		Storm Event 33		Storm Event 34		Storm Event 35		Storm Event 36		Storm Event 37	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Alkalinity (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Chemical Oxygen Demand (mg/L)	37	0	85	41	302	85	52	80	64	40	59	40	**	39	155	65	177	47	100	48	74	38	162	83	**	66	56	33	**	41
Chloride (mg/L)	1	45	4	64	2	37	2	85	2	50	2	35	**	98	5	0	0	47	3	51	4	38	6	38	**	64	4	31	**	27
Conductivity (umho/cm)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Hardness (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
pH	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Organic Carbon (mg/L)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Dissolved Calcium (mg/L)	2	11	7	8	4	8	6	15	3	9	3	13	**	12	9	9	4	9	3	10	4	11	11	10	**	8	6	13	**	10
Dissolved Iron (mg/L)	0	0.1	0	0.17	0.08	0.09	0	0.06	0	0.23	0	0.21	**	0.07	0.06	0.18	0	0.16	0	0.07	0	0.08	0.15	0	**	0.08	0.06	0.1	**	0.09
Dissolved Magnesium (mg/L)	0.1	1.1	0.6	1	0.4	0.6	0.6	3	0.3	0.7	0.3	0.8	**	1	0.8	1.1	0.3	1.2	0.3	1.2	0.4	0.9	1	1.2	**	0.9	0.8	1.6	**	1.3
Dissolved Sodium (mg/L)	3	62	7	66	2	46	4	96	3	75	4	58	**	67	8	74	3	65	2	63	7	62	7	54	**	50	7	49	**	47
Dissolved Chromium (µg/L)	0	3	0	4.4	0	3.1	0	3.8	0	5.1	0	3.7	**	4.3	0	4.9	0	4.1	0	5.2	0	4.3	0	4.6	**	4	0	3.4	**	2.8
Dissolved Manganese (µg/L)	2.4	2.8	22.9	3.1	20.6	5.2	0	2.5	10.7	5.1	7.1	3.7	**	1.7	42.3	2.6	7.7	3.3	7.2	2	8.7	3.6	64	2	**	2.5	12.5	7.1	**	5.2
Dissolved Nickel (µg/L)	0	0	1.6	0	0	0	0	1.2	0	0	0	0	**	0	5	0	0	0	0	0	1.7	0	3.5	0	**	0	1.1	0	**	0
Dissolved Copper (µg/L)	2	5.6	6.8	6.5	3.8	8	3.3	10.1	3.1	6	2.9	7.1	**	6	6.9	4.8	0	4.9	3.9	5.2	7.6	14.4	9.9	7	**	5.7	4.2	5.9	**	8.5
Dissolved Zinc (µg/L)	0	0	24.9	0	14.6	10.9	6.7	0	6.2	0	7.3	0	**	0	31.1	0	8.7	11.2	7.6	0	16.3	0	77.5	7.4	**	0	12.5	0	**	0
Dissolved Selenium (µg/L)	0	0	0	0	0	0	0	0	0	1	0	0	**	1	0	0	0	0	0	1	0	0	0	0	**	0	0	0	**	0
Dissolved Silver (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0.5	0	0	**	0
Dissolved Cadmium (µg/L)	0	0.1	0.1	0	0	0.2	0	0.3	0	0	0	0.1	**	0.2	0	0	0	0	0	0	0	0	0.2	0	**	0.1	0.1	0	**	0.1
Dissolved Lead (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	**	0
Total Beryllium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	**	0
Total Chromium (µg/L)	0	0	0	6.1	5.5	5.2	0	5.3	0	6	0	0	**	0	0	6.3	0	0	0	6.3	0	0	0	5.6	**	0	0	0	**	0
Total Manganese (µg/L)	10	42.6	40	64.3	161	81.9	8.2	58.6	75.6	31.6	12.6	22.2	**	34.3	61.5	34.2	30.2	68.2	53	17.7	20.7	15.6	70.2	23.6	**	21	20.3	21.6	**	18.6
Total Nickel (µg/L)	0	1.7	2.4	1.7	4.9	2.6	2.7	2.3	3.3	1.3	1.1	1.2	**	1.3	4.2	1.4	1.4	1.1	2.6	1.1	2.4	1	3.7	1.1	**	1.1	1.3	0	**	0
Total Copper (µg/L)	3	9.4	8.4	10.9	15	14	3.4	14.5	10.4	8.2	4.3	10.7	**	8.1	11.5	7.6	4.4	5.7	7.6	7	7.8	7.2	10.8	9.2	**	7.7	5.5	8.6	**	6.3
Total Zinc (µg/L)	0	0	48.7	0	80.8	34.1	0	0	59.8	0	0	0	**	0	64.1	0	26.8	0	52.7	0	34	0	85.8	0	**	0	21.8	0	**	0
Total Arsenic (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	**	0
Total Selenium (µg/L)	0	0	0	1.3	0	1.5	0	1	0	0	0	0	**	0	0	0	0	0	1	0	0	0	1	**	0	0	0	**	0	
Total Molybdenum (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	**	0
Total Silver (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0.4	**	0	0	0	**	0	
Total Cadmium (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	**	0
Total Antimony (µg/L)	0	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	0	0	0	0	0	0	0	0	**	0	0	0	**	0
Total Lead (µg/L)	0	0	0	0	10.2	0	0	0	6.8	0	0	0	**	0	0	0	0	0	5.7	0	0	0	0	0	**	0	0	0	**	0
Dissolved Phosphorus (mg/L)	0.02	0.07	0.02	0.03	0.14	0.11	0.08	0.05	0.05	0.07	0.05	0.06	**	0.05	**	**	0.07	0.04	0.08	0.05	**	0.05	0.19	0.04	**	0.05	0.18	0.04	**	0.04
Dissolved Potassium (mg/L)	0	13	2	17	2	11	5	16	2	17	2	14	**	16	3	20	2	17	1	15	2	16	3	15	**	13	2	12	**	12
Nitrite+Nitrate (mg/L)	0.32	1.68	1.31	2.63	0.3	1.68	0.03	2.85	0.45	2.6	0.34	1.82	**	1.8	1.27	2.38	0.42	2.37	0.64	3.54	0.69	3.2	1.64	4.31	**	2.87	0.78	2.19	**	2.02
Total Kjeldahl Nitrogen (mg/L)	1.4	0.8	2.3	1	2.8	1.6	0.7	1.7	1.5	0.6	1.4	1	**	1.1	2.4	1.6	1.2	1.4	2.4	0.9	1.6	0.7	4.4	1.5	**	0.7	1.6	0.7	**	0.7
Total Phosphorus (mg/L)	0.05	0.1	0.12	0.1	0.58	0.25	0.16	0.17	0.24	0.11	0.12	0.08	**	0.08	0.14	0.1	0.19	0.09	0.16	0.08	**	0.07	0.31	0.09	**	0.07	0.23	0.05	**	0.05
Total Suspended Solids (mg/L)	50	19	59	24	465	136	7	57	293	15	20	16	**	22	94	37	326	27	164	19	31	7	32	27	**	16	15	5	**	6

\*\*No Data

**Table 15. Water Quality Data for 2010**

Water Quality Constituent	Storm Event 1		Storm Event 2		Storm Event 3		Storm Event 4		Storm Event 5		Storm Event 6		Storm Event 7		Storm Event 8		Storm Event 9		Storm Event 10		Storm Event 11	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Chemical Oxygen Demand (mg/L)	321	77	85	45	51	23	**	0	**	90	219	63	85	0	55	31	290	21	308	92	41	45
Chloride (mg/L)	8	82	3	93	0	19	**	42	**	57	3	50	13	61	6	55	5	33	6	47	2	59
Dissolved Calcium (mg/L)	4	9	2	18	2	6	**	14	**	13	5	11	7	10	5	14	9	14	12	12	3	15
Dissolved Iron (mg/L)	0.05	0.08	0	0	0	0.1	**	0.07	**	0.05	0	0.1	0.12	0.08	0.07	0.12	0	0.07	0.06	0.09	0	0.08
Dissolved Magnesium (mg/L)	0.6	0.8	0.2	1.4	0.2	0.2	**	0.4	**	0.7	0.5	0.8	1	1.8	0.6	1.1	0.7	0.8	0.8	1.1	0.2	1.8
Dissolved Sodium (mg/L)	10	84	4	90	2	28	**	40	**	51	5	53	18	52	9	56	6	36	6	50	3	64
Dissolved Chromium (µg/L)	1	2.5	0	2.8	0	0	**	1.5	**	2.1	0	2.2	0	2.2	0	2.1	0	1.6	0	2.7	0	3.4
Dissolved Manganese (µg/L)	10.2	3.7	6.8	2.3	3.2	4.8	**	2	**	1.7	25.6	4.8	19	2.6	14.4	2	7.6	4.5	62.5	3	5.1	2.3
Dissolved Nickel (µg/L)	1.3	0	0	0	0	0	**	2.2	**	0	0	0	1.2	0	0	0	0	0	2.2	0	0	0
Dissolved Copper (µg/L)	3.4	6.3	0	5.5	0	6.3	**	3	**	3.3	0	3.8	4.2	4.1	0	3.5	2.2	3.2	7.1	4.8	0	6.5
Dissolved Zinc (µg/L)	11.8	0	5.4	0	0	6.2	**	0	**	0	0	0	6.2	0	6	0	7.1	5.5	21.1	0	0	0
Dissolved Selenium (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved Silver (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Dissolved Cadmium (µg/L)	0	0.2	0	0	0	0	**	0	**	0	0	0	0.2	0	0.1	0	0	0	0	0	0	0
Dissolved Lead (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Beryllium (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Chromium (µg/L)	12.4	0	0	0	0	0	**	0	**	0	5.7	0	0	0	0	0	7.9	0	12	5.5	0	0
Total Manganese (µg/L)	211	66.5	50.7	40.6	61.7	35.5	**	32.2	**	36.3	190	42.6	66.3	20.1	37.8	20.8	208	25.7	260	56.9	24	22.5
Total Nickel (µg/L)	12	2.7	2.9	1.6	2.8	1.3	**	1.1	**	1.5	5.7	1.6	3.3	0	1.5	0	7.5	1.1	11.9	2.8	1.2	1.2
Total Copper (µg/L)	27.7	13.1	7.4	10.3	6.7	6.7	**	6.4	**	7.7	16.2	8	9.5	5.8	4.8	6.2	18.7	4.7	31.8	11.7	4.2	8.5
Total Zinc (µg/L)	212	30	50.8	0	49.6	0	**	0	**	0	93.7	0	34.5	0	27.3	0	121	0	204	33.2	20.5	0
Total Arsenic (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Selenium (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Molybdenum (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Silver (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0.3	83.7	0	0	0	0	0	0	0
Total Cadmium (µg/L)	0.7	0	0	0	0	0	**	0	**	0	0	0	0.6	0	0	0	0	0	0.6	0	0	0
Total Antimony (µg/L)	0	0	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Lead (µg/L)	19.2	0	0	0	0	0	**	0	**	0	8.6	0	0	0	0	0	11.9	0	18.2	0	0	0
Dissolved Phosphorus (mg/L)	0.04	0.08	0.04	0.07	0	0.07	**	0.04	**	0.03	0.08	0.06	0.05	0.01	0.06	0.02	0.04	0.02	0.03	0.03	0.02	0.04
Dissolved Potassium (mg/L)	1	8	0	11	0	4	**	7	**	8	0	8	2	8	1	10	1	7	2	8	0	12
Nitrite+Nitrate (mg/L)	0.45	1.26	0.15	0.93	0.04	0.29	**	0.56	**	0.75	0.48	1.09	0.46	1.06	0.49	0.84	1.45	0.82	0.62	2.06	0.14	1.36
Total Kjeldahl Nitrogen (mg/L)	3.1	0.9	0.7	0.6	0.5	0	**	0.4	**	0.6	2.4	1	1.7	0.6	0.8	0.4	3.7	0.9	4.1	1.5	0.5	0.8
Total Phosphorus (mg/L)	0.49	0.16	0.14	0.1	0.11	0.1	**	0.07	**	0.08	0.36	0.11	0.16	0.04	0.12	0.04	0.41	0.1	0.65	0.16	0.07	0.06
Total Suspended Solids (mg/L)	620	62	135	32	163	32	**	24	**	55	264	34	80	30	39	14	1940	37	1510	148	52	17

\*\*No Data



**Table 16. Water Quality Data for 2010 (Cont.)**

Water Quality Constituent	Storm Event 12		Storm Event 13		Storm Event 14		Storm Event 15		Storm Event 16		Storm Event 17		Storm Event 18		Storm Event 19		Storm Event 20		Storm Event 21	
	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP	Ref	BMP
Chemical Oxygen Demand (mg/L)	**	52	440	**	363	97	135	63	**	43	**	48	321	124	139	54	118	53	186	75
Chloride (mg/L)	**	76	24	**	8	44	3	43	**	50	**	52	15.3	59.1	12.9	59.1	5.3	26.6	0	31.2
Dissolved Calcium (mg/L)	**	10	18	**	11	14	4	13	**	14	**	13	17	23	10	15	7	11	6	17
Dissolved Iron (mg/L)	**	0.11	0.16	**	0.18	0.07	0	0.1	**	0.09	**	0.15	0.15	0.07	0.07	0.13	0	0.07	0	0
Dissolved Magnesium (mg/L)	**	3	1.7	**	0.8	1.3	0.3	1.4	**	2	**	1.9	1.2	2.6	0.8	2.1	0.5	1	0.5	1.9
Dissolved Sodium (mg/L)	**	74	17	**	8	54	4	62	**	68	**	66	14	56	11	60	7	35	6	50
Dissolved Chromium (µg/L)	**	3.7	1.3	**	0	3.8	0	3.8	**	4.3	**	4.9	1.4	3.1	0	3.7	0	2.5	0	3.1
Dissolved Manganese (µg/L)	**	2.9	120	**	69.9	2.3	10.5	7.2	**	15.6	**	17.2	97.4	25.3	21.8	4.4	16.4	3.4	22.1	1.5
Dissolved Nickel (µg/L)	**	0	5.4	**	2.4	0	0	0	**	0	**	0	6.7	2	2.5	1.1	1.5	0	7.3	0
Dissolved Copper (µg/L)	**	5.6	13.9	**	6.5	5.4	0	5.2	**	5.1	**	7.2	14	7.3	7.1	6.5	4.8	4.4	5.5	4.4
Dissolved Zinc (µg/L)	**	0	66.7	**	26.2	0	0	0	**	0	**	0	76.4	12.7	22	0	12.8	0	21.2	0
Dissolved Selenium (µg/L)	**	0	0	**	0	0	0	0	**	0	**	1.1	0	1.1	0	1.1	0	0	0	0
Dissolved Silver (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Dissolved Cadmium (µg/L)	**	0	0.2	**	0	0	0	0	**	0	**	0	0.2	0	0	0.1	0.1	0	0	0
Dissolved Lead (µg/L)	**	0	0	**	1.7	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Beryllium (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Chromium (µg/L)	**	0	0	**	13.6	5.3	8.6	0	**	5.3	**	5.1	6.6	0	0	0	0	0	0	0
Total Manganese (µg/L)	**	24.5	140	**	269	28.5	131	20.5	**	32.7	**	33.8	163	43	55.1	20.7	69.8	15.1	80.7	21.8
Total Nickel (µg/L)	**	1.4	6.2	**	12.2	1.6	5.7	1.1	**	1.1	**	1.1	10.8	2.5	3.7	1.4	4	1	5.2	1.2
Total Copper (µg/L)	**	10.1	17.3	**	34.2	9	16.3	7.3	**	6.9	**	6.9	28.7	9.8	11.5	7.7	12.2	5.3	13.6	6.7
Total Zinc (µg/L)	**	0	95.2	**	222	0	87.7	0	**	0	**	0	169	0	52.9	0	78.1	0	87.9	0
Total Arsenic (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Selenium (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	1	0	0	0	0	0	0
Total Molybdenum (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Silver (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Cadmium (µg/L)	**	0	0	**	0.6	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Antimony (µg/L)	**	0	0	**	0	0	0	0	**	0	**	0	0	0	0	0	0	0	0	0
Total Lead (µg/L)	**	0	0	**	19.6	0	10	0	**	0	**	0	8.1	0	0	0	0	0	6.3	0
Dissolved Phosphorus (mg/L)	**	0.03	0.04	**	0.03	0.03	0.03	0.04	**	0.04	**	0.03	0.04	0.02	0.02	0.03	0.03	0.09	0.07	0.04
Dissolved Potassium (mg/L)	**	13	3	**	2	10	0	12	**	13	**	13	3	10	2	10	2	8	2	10
Nitrite+Nitrate (mg/L)	**	1.09	1.92	**	0.68	2.1	0.36	2.09	**	2.17	**	1.97	0.9	2.19	1.27	2.66	0.94	2.31	0.88	2.08
Total Kjeldahl Nitrogen (mg/L)	**	0.9	8.9	**	5.2	1.6	2.2	1.3	**	0.8	**	0.7	5.7	2.5	2.3	1	1.8	1.1	2.5	1.5
Total Phosphorus (mg/L)	**	0.06	0.33	**	0.5	0.1	0.26	0.06	**	0.05	**	0.05	0.4	0.14	0.14	0.08	0.17	0.08	0.23	0.11
Total Suspended Solids (mg/L)	**	59	149	**	571	43	303	12	**	11	**	11	203	22	61	22	127	14	134	21

\*\*No Data

**Table 17. Descriptive Statistics for Alkalinity**

Test Statistic	Reference Site, 2008-2010	BMP, 2008-2010	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	44	49	26	27	16	20
Minimum	19	0	19	0	41	0
Maximum	520	124	520	106	440	124
1st Quartile	55.75	31	56.5	31.5	85	40
Median	<b>85</b>	<b>45</b>	<b>78</b>	<b>41</b>	<b>162.5</b>	<b>52.5</b>
3rd Quartile	179.25	65	130.25	59	311.25	75.5
Mean	<b>138.8</b>	<b>49.0</b>	<b>111.2</b>	<b>46.0</b>	<b>197.3</b>	<b>54.8</b>
Variance (n-1)	14263.587	750.833	10839.122	577.846	16218.896	1018.063
Standard deviation (n-1)	119.430	27.401	104.111	24.038	127.353	31.907

Note: There was not enough data for individual descriptive statistics in 2008.

**Table 18. Descriptive Statistics for Chemical Oxygen Demand**

Test Statistic	Reference Site, 2005-	BMP, 2005-2009	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008
Number of Observations	34	38	7	9	6	10	15	13	5	4
Minimum	0	0	0	34	0	67	0	60	0	0
Maximum	119	235	71	99	69	164	81	235	119	133
1st Quartile	8.275	83.25	16.5	71	8.275	103.25	5.5	92	0	24.75
Median	<b>18</b>	<b>97.5</b>	<b>36</b>	<b>84</b>	<b>10.05</b>	<b>116.5</b>	<b>14</b>	<b>96</b>	<b>92</b>	<b>81</b>
3rd Quartile	47.75	120	60	88	22.25	146.25	21.5	173	101	130
Mean	<b>30.2</b>	<b>106.4</b>	<b>37.1</b>	<b>78.0</b>	<b>20.5</b>	<b>119.1</b>	<b>19.5</b>	<b>125.2</b>	<b>62.4</b>	<b>73.8</b>
Variance (n-1)	1081.34	2268.90	771.14	348.00	635.84	1076.54	476.23	3327.03	3339.3	4554.25
Standard deviation (n-1)	32.884	47.633	27.769	18.654	25.216	32.811	21.823	57.68	57.787	67.485

Note: There was not enough data for individual descriptive statistics for 2009 and no data for 2010.

**Table 19. Descriptive Statistics for Chloride**

Test Statistic	Reference Site, 2009-2010	BMP, 2009-2010	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	42	47	26	27	16	20
Minimum	0	0	0	0	0	19
Maximum	73	127	73	127	24	93
1st Quartile	2	37.5	2	36	3	42.75
Median	<b>4</b>	<b>50</b>	<b>3.5</b>	<b>47</b>	<b>5.65</b>	<b>51</b>
3rd Quartile	8.75	59.1	8.25	60	9.23	59.1
Mean	<b>7.73</b>	<b>50.94</b>	<b>8.08</b>	<b>50.19</b>	<b>7.16</b>	<b>51.95</b>
Variance (n-1)	143.04	550.68	209.83	733.39	40.68	327.77
Standard deviation (n-1)	11.96	23.47	14.49	27.08	6.38	18.10

**Table 20. Descriptive Statistics for Conductivity**

Test Statistic	Reference Site, 2005-2009	BMP, 2005-2009	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008
Number of Observations	34	38	7	9	6	10	14	13	5	4
Minimum	25.3	12.2	33.7	12.2	30.6	38.5	25.3	189	50.6	68
Maximum	634	1210	138	246	200	681	634	1210	336	446
1st Quartile	56	207.5	62.8	202	57.5	258.25	61.95	242	56	129.5
Median	<b>72.7</b>	261.5	<b>87</b>	<b>209</b>	<b>66.7</b>	<b>402.5</b>	<b>70.15</b>	<b>275</b>	<b>323</b>	<b>261.5</b>
3rd Quartile	134.75	423.75	112.3	223	72.075	440	82.35	485	327	391.25
Mean	<b>123.6</b>	343.3	<b>87.0</b>	<b>189.9</b>	<b>82.1</b>	<b>371.2</b>	<b>129.8</b>	<b>445.2</b>	<b>218.5</b>	<b>259.3</b>
Variance (n-1)	15993.19	58948.12	1452.53	4869.22	3569.68	34147.11	26133.92	112431.53	22773.85	32108.92
Standard deviation (n-1)	126.46	242.79	38.11	69.78	59.75	184.79	161.66	335.31	150.91	179.19

Note: There was not enough data for individual descriptive statistics in 2009.

**Table 21. Descriptive Statistics for Hardness**

Test Statistic	Reference Site, 2005-2009	BMP, 2005-2009	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008
Number of Observations	32	36	7	9	4	8	15	13	5	4
Minimum	0	25	36	38	10	35	0	26	14	25
Maximum	88	209	88	112	88	80	56	209	52	56
1st Quartile	19.25	36.5	50	55	32.5	60.25	13	30	29	32.5
Median	<b>39</b>	<b>55</b>	<b>60</b>	<b>75</b>	<b>56</b>	<b>72</b>	<b>23</b>	<b>44</b>	<b>35</b>	<b>36</b>
3rd Quartile	53	73.5	68.5	85	76	74.25	39.5	54	48	41.75
Mean	<b>39</b>	<b>60</b>	<b>60</b>	<b>74</b>	<b>53</b>	<b>66</b>	<b>25</b>	<b>57</b>	<b>36</b>	<b>38</b>
Variance (n-1)	608.85	1175.69	298.14	620.03	1201.00	222.70	307.35	2344.08	233.30	167.58
Standard deviation (n-1)	24.67	34.29	17.27	24.90	34.66	14.92	17.53	48.42	15.27	12.95

Note: There was not enough data for individual descriptive statistics for 2009.

**Table 22. Descriptive Statistics for pH**

Test Statistic	Reference Site, 2005-2009	BMP, 2005-2009	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008
Number of Observations	34	38	7	9	6	10	15	13	5	4
Minimum	5.4	6.3	5.4	6.3	5.7	7.8	5.7	8.2	6.8	7.4
Maximum	10	10.3	7.7	9.7	6.3	10.2	8.7	10.3	10	9.9
1st Quartile	6.1	8.825	6	8.6	5.85	9.4	6.2	9.4	7.1	7.7
Median	<b>6.5</b>	<b>9.4</b>	<b>6.6</b>	<b>8.8</b>	<b>6.05</b>	<b>9.55</b>	<b>6.4</b>	<b>9.7</b>	<b>9.4</b>	<b>8.65</b>
3rd Quartile	7.075	9.8	6.8	9	6.1	9.95	6.8	9.9	9.6	9.6
Mean	<b>6.80</b>	<b>9.17</b>	<b>6.47</b>	<b>8.54</b>	<b>6.00</b>	<b>9.50</b>	<b>6.65</b>	<b>9.52</b>	<b>8.58</b>	<b>8.65</b>
Variance (n-1)	1.348	0.762	0.652	0.950	0.048	0.467	0.743	0.378	2.272	1.523
Standard deviation (n-1)	1.161	0.873	0.808	0.975	0.219	0.683	0.862	0.615	1.507	1.234

Note: There was not enough data for individual descriptive statistics for 2009.

**Table 23. Descriptive Statistics for Total Organic Carbon**

Test Statistic	Reference Site, 2005-2009	BMP, 2005-2009	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008
Number of Observations	31	36	6	8	6	10	13	12	5	4
Minimum	5	3	9	3	13	9	5	3	9	10
Maximum	34	31	34	26	32	31	33	25	31	29
1st Quartile	11.5	8	12.25	4.75	14	15.1	9	8	11	14.5
Median	<b>14</b>	<b>14.9</b>	<b>22.5</b>	<b>8.5</b>	<b>17.5</b>	<b>16.5</b>	<b>14</b>	<b>10.5</b>	<b>13</b>	<b>16.5</b>
3rd Quartile	29	19.25	32	22	29.25	21	22	16	19	20
Mean	<b>18.8</b>	<b>14.6</b>	<b>22.0</b>	<b>12.4</b>	<b>21.0</b>	<b>18.2</b>	<b>16.0</b>	<b>12.4</b>	<b>16.6</b>	<b>18.0</b>
Variance (n-1)	91.895	55.732	138.8	88.268	80.8	42.768	74.667	40.265	78.8	63.333
Standard deviation (n-1)	9.586	7.465	11.781	9.395	8.989	6.540	8.641	6.345	8.877	7.958

Note: There was not enough data for individual descriptive statistics for 2009.

**Table 24. Descriptive Statistics for Dissolved Calcium**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	54	58	5	4	7	6	26	28	16	20
Minimum	2	4	3	7	3	5	2	4	2	6
Maximum	18	23	7	10	12	15	11	17	18	23
1st Quartile	3	8	5	7	4	6.25	3	8	4	11
Median	<b>5</b>	<b>10</b>	<b>5</b>	<b>7.5</b>	<b>5</b>	<b>7</b>	<b>4</b>	<b>9</b>	<b>6.5</b>	<b>13.5</b>
3rd Quartile	7	13	5	8.5	9.5	10	6	11	10.25	14.25
Mean	<b>5.9</b>	<b>10.6</b>	<b>5.0</b>	<b>8.0</b>	<b>6.7</b>	<b>8.5</b>	<b>4.8</b>	<b>9.6</b>	<b>7.6</b>	<b>13.3</b>
Variance (n-1)	13.391	13.463	2	2	12.905	14.3	7.095	8.032	24.117	12.853
Standard deviation (n-1)	3.659	3.669	1.414	1.414	3.592	3.782	2.664	2.834	4.911	3.585

**Table 25. Descriptive Statistics for Dissolved Iron**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	75	84	8	9	6	10	12	11	7	6	26	28	16	20
Minimum	0	0	0	0	0.06	0.05	0	0	0	0.09	0	0	0	0
Maximum	0.59	0.42	0.15	0.22	0.11	0.42	0.42	0.36	0.59	0.24	0.15	0.28	0.18	0.15
1st Quartile	0	0.07	0.058	0	0.073	0.093	0.038	0.075	0.035	0.145	0	0.07	0	0.07
Median	<b>0.06</b>	<b>0.095</b>	<b>0.09</b>	<b>0</b>	<b>0.08</b>	<b>0.14</b>	<b>0.085</b>	<b>0.11</b>	<b>0.1</b>	<b>0.195</b>	<b>0</b>	<b>0.1</b>	<b>0.025</b>	<b>0.08</b>
3rd Quartile	0.1	0.153	0.13	0.08	0.088	0.19	0.1	0.18	0.315	0.208	0.075	0.173	0.083	0.1
Mean	<b>0.074</b>	<b>0.112</b>	<b>0.088</b>	<b>0.044</b>	<b>0.082</b>	<b>0.156</b>	<b>0.098</b>	<b>0.131</b>	<b>0.199</b>	<b>0.177</b>	<b>0.037</b>	<b>0.119</b>	0.054	0.082
Variance (n-1)	0.010	0.007	0.003	0.006	0.000	0.011	0.013	0.011	0.054	0.003	0.002	0.005	0.004	0.001
Standard deviation (n-1)	0.102	0.081	0.050	0.077	0.017	0.107	0.113	0.106	0.232	0.056	0.049	0.071	0.066	0.037

**Table 26. Descriptive Statistics for Dissolved Magnesium**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	54	58	5	4	7	6	26	28	16	20
Minimum	0.1	0.1	0.4	0.3	0.2	0.7	0.1	0.1	0.2	0.2
Maximum	1.7	3	0.9	1.3	1.2	1	1.2	3	1.7	3
1st Quartile	0.3	0.8	0.7	0.45	0.4	0.825	0.3	0.8	0.45	0.8
Median	<b>0.6</b>	<b>1</b>	<b>0.8</b>	<b>0.55</b>	<b>0.5</b>	<b>0.9</b>	<b>0.4</b>	<b>1</b>	<b>0.6</b>	<b>1.35</b>
3rd Quartile	0.8	1.3	0.8	0.775	0.8	0.9	0.7	1.2	0.8	1.9
Mean	<b>0.591</b>	<b>1.126</b>	<b>0.72</b>	<b>0.675</b>	<b>0.614</b>	<b>0.867</b>	<b>0.515</b>	<b>1.046</b>	<b>0.663</b>	<b>1.405</b>
Variance (n-1)	0.113	0.366	0.037	0.189	0.128	0.011	0.093	0.269	0.160	0.528
Standard deviation (n-1)	0.335	0.605	0.192	0.435	0.358	0.103	0.306	0.518	0.400	0.727

**Table 27. Descriptive Statistics for Dissolved Sodium**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	54	58	5	4	7	6	26	28	16	20
Minimum	2	7	4	21	2	7	2	35	2	28
Maximum	56	110	10	44	56	58	26	110	18	90
1st Quartile	3.25	46.25	4	22.5	3	19.75	3	53.75	4.75	50
Median	<b>6</b>	<b>57.5</b>	<b>5</b>	<b>31.5</b>	<b>44</b>	<b>29</b>	<b>5</b>	<b>65.5</b>	<b>6.5</b>	<b>55</b>
3rd Quartile	10.75	68	7	41	45.5	50.25	9.5	74	10.25	64.5
Mean	<b>10</b>	<b>56.690</b>	<b>6</b>	<b>32</b>	<b>28.429</b>	<b>32.833</b>	<b>6.962</b>	<b>65.5</b>	<b>8.125</b>	<b>56.45</b>
Variance (n-1)	142	395.446	6.5	136.667	597.286	433.367	32.678	270.704	23.05	243.524
Standard deviation (n-1)	11.916	19.886	2.550	11.690	24.439	20.817	5.717	16.453	4.801	15.605

**Table 28. Descriptive Statistics for Dissolved Chromium**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	76	84	13	10	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	1	0	0
Maximum	2.3	5.2	1.2	3.3	2.3	2.5	1.5	5.2	1.4	4.9
1st Quartile	0	0	0	0	0	1.325	0	2.475	0	2.175
Median	<b>0</b>	<b>2.2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1.75</b>	<b>0</b>	<b>3.35</b>	<b>0</b>	<b>2.75</b>
3rd Quartile	0	3.325	0	1.125	1.6	2.325	0	4.15	0	3.7
Mean	<b>0.16</b>	<b>2.01</b>	<b>0.09</b>	<b>0.76</b>	<b>0.79</b>	<b>1.62</b>	<b>0.06</b>	<b>3.29</b>	<b>0.23</b>	<b>2.80</b>
Variance (n-1)	0.225	2.819	0.111	1.689	1.015	0.878	0.087	1.405	0.253	1.246
Standard deviation (n-1)	0.475	1.679	0.333	1.300	1.007	0.937	0.294	1.185	0.503	1.116

Note: All the data for 2005 and 2006 were non-detects (0).



**Table 29. Descriptive Statistics for Dissolved Manganese**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	76	84	8	9	6	10	13	11	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0	3.9	3.6	0	0	3.2	1.5
Maximum	120	60	100	60	50	0	82.2	5.8	83.5	19.9	64	7.1	120	25.3
1st Quartile	5.55	0	22.5	0	0	0	20	0	6.3	4.3	3.55	2.68	9.55	2.3
Median	<b>13.35</b>	<b>2.85</b>	<b>40</b>	<b>0</b>	<b>20</b>	<b>0</b>	<b>23.1</b>	<b>0</b>	<b>7.3</b>	<b>4.3</b>	<b>8.45</b>	<b>3.65</b>	<b>17.7</b>	<b>3.2</b>
3rd Quartile	28.2	4.5	55	0	40	0	27.6	3.2	16.7	9.625	12.4	4.95	34.825	4.8
Mean	<b>22.93</b>	<b>4.11</b>	<b>41.25</b>	<b>6.67</b>	<b>21.67</b>	<b>0.00</b>	<b>24.46</b>	<b>1.56</b>	<b>20.10</b>	<b>7.97</b>	<b>11.97</b>	<b>3.81</b>	<b>32.03</b>	<b>5.68</b>
Variance (n-1)	700.877	56.948	1155.357	400	576.667	0	475.291	5.225	810.473	42.719	188.902	2.592	1271.592	39.534
Standard deviation (n-1)	26.474	7.546	33.991	20	24.014	0	21.801	2.286	28.469	6.536	13.744	1.610	35.659	6.288

**Table 30. Descriptive Statistics for Dissolved Nickel**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	76	84	13	11	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	7.3	2.2	3.3	1.1	2.8	2	5	1.2	7.3	2.2
1st Quartile	0	0	0	0	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1.25</b>	<b>0</b>
3rd Quartile	1.525	0	1.6	0	1.15	0.9	1.55	0	2.425	0
Mean	<b>0.89</b>	<b>0.16</b>	<b>0.88</b>	<b>0.10</b>	<b>0.73</b>	<b>0.53</b>	<b>0.80</b>	<b>0.13</b>	<b>1.91</b>	<b>0.27</b>
Variance (n-1)	2.468	0.228	1.196	0.11	1.129	0.747	1.782	0.143	6.095	0.455
Standard deviation (n-1)	1.571	0.478	1.094	0.332	1.063	0.864	1.335	0.378	2.469	0.675

Note: All the data for 2005 and 2006 were non-detects (0).

**Table 31. Descriptive Statistics for Dissolved Copper**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	76	84	8	9	6	10	13	11	7	6	26	28	16	20
Minimum	0	0	2	0	4	5	3	4	2.8	4.3	0	3.8	0	3
Maximum	15	16	10	11	9	16	15	15	9.9	9.9	9.9	14.4	14	7.3
1st Quartile	2.975	5.075	4.75	4	5	10.3	5	6.35	8.55	5.98	2.55	5.28	0	4.03
Median	<b>5</b>	<b>6.2</b>	<b>7.5</b>	<b>6</b>	<b>5.5</b>	<b>11</b>	<b>5.9</b>	<b>10.2</b>	<b>9.7</b>	<b>8.65</b>	<b>3.85</b>	<b>5.95</b>	<b>3.8</b>	<b>5.15</b>
3rd Quartile	7.85	9.825	9	11	7.5	12.5	6.9	12.35	9.85	9.68	6.275	7.4	6.65	6.3
Mean	<b>5.4</b>	<b>7.3</b>	<b>6.8</b>	<b>6.7</b>	<b>6.2</b>	<b>11.2</b>	<b>6.6</b>	<b>9.4</b>	<b>8.457</b>	<b>7.767</b>	<b>4.181</b>	<b>6.639</b>	<b>4.294</b>	<b>5.07</b>
Variance (n-1)	12.069	10.511	7.929	18	3.767	9.511	9.103	12.938	6.690	5.839	7.915	4.960	21.642	1.796
Standard deviation (n-1)	3.474	3.242	2.816	4.243	1.941	3.084	3.017	3.597	2.586	2.416	2.813	2.227	4.652	1.340

**Table 32. Descriptive Statistics for Dissolved Zinc**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	76	83	8	9	6	9	13	11	7	6	26	28	16	20
Minimum	0	0	4.2	0.9	0	0	0	0	0	0	0	0	0	0
Maximum	80.7	31.7	56.5	13.2	41	31.7	80.7	5.4	25.6	14.4	77.5	11.2	76.4	12.7
1st Quartile	6.15	0	21.025	2.6	19.225	0	0	0	3.2	5.35	6.4	0	4.05	0
Median	<b>11.9</b>	<b>0</b>	<b>29.4</b>	<b>3</b>	<b>22.75</b>	<b>10.4</b>	<b>15</b>	<b>0</b>	<b>7.5</b>	<b>6.1</b>	<b>8.55</b>	<b>0</b>	<b>9.45</b>	<b>0</b>
3rd Quartile	22.675	5.45	44.475	8	35.875	16.4	21.3	0	17.35	7.6	14.075	0	21.4	0
Mean	<b>17.38</b>	<b>3.22</b>	<b>31.26</b>	<b>5.03</b>	<b>24.13</b>	<b>11.40</b>	<b>17.60</b>	<b>0.49</b>	<b>10.60</b>	<b>6.63</b>	<b>13.07</b>	<b>1.78</b>	<b>17.68</b>	<b>1.22</b>
Variance (n-1)	348.029	35.850	304.063	16.423	231.527	149.823	462.2	2.651	94.683	21.879	250.962	13.018	520.400	10.537
Standard deviation (n-1)	18.656	5.987	17.437	4.052	15.216	12.240	21.499	1.628	9.731	4.677	15.842	3.608	22.812	3.246

**Table 33. Descriptive Statistics for Dissolved Selenium**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	55	58	6	4	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	1.2	1.5	0	1.5	1.2	1.4	0	1	0	1.1
1st Quartile	0	0	0	0	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.65</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0	1.35	0.55	0	0	0	0	0
Mean	<b>0.042</b>	<b>0.181</b>	<b>0</b>	<b>0.7</b>	<b>0.329</b>	<b>0.233</b>	<b>0</b>	<b>0.107</b>	<b>0</b>	<b>0.165</b>
Variance (n-1)	0.047	0.186	0	0.66	0.316	0.327	0	0.099	0	0.162
Standard deviation (n-1)	0.217	0.432	0	0.812	0.562	0.572	0	0.315	0	0.403

**Table 34. Descriptive Statistics for Dissolved Silver**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009
Number of Observations	55	58	7	6	26	28
Minimum	0	0	0	0	0	0
Maximum	0	0.7	0	0.7	0	0.5
1st Quartile	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0	0	0	0
Mean	<b>0</b>	<b>0.021</b>	<b>0</b>	<b>0.117</b>	<b>0</b>	<b>0.018</b>
Variance (n-1)	0	0.013	0	0.082	0	0.009
Standard deviation (n-1)	0	0.112	0	0.286	0	0.094

Note: All the data for 2007 and 2010 were non-detects (0).

**Table 35. Descriptive Statistics for Dissolved Cadmium**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	55	58	6	4	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0	0	0
Maximum	0.5	0.8	0.2	0.4	0.5	0.1	0.5	0.8	0.2	0.2
1st Quartile	0	0	0.025	0	0.05	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0.1</b>	<b>0.05</b>	<b>0.1</b>	<b>0.05</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0.15	0.1	0.175	0.175	0.25	0.1	0.1	0.2	0.1	0
Mean	<b>0.084</b>	<b>0.079</b>	<b>0.1</b>	<b>0.125</b>	<b>0.171</b>	<b>0.05</b>	<b>0.077</b>	<b>0.13</b>	<b>0.05</b>	<b>0.015</b>
Variance (n-1)	0.015	0.024	0.008	0.036	0.032	0.003	0.015	0.040	0.007	0.002
Standard deviation (n-1)	0.121	0.156	0.089	0.189	0.180	0.055	0.124	0.199	0.082	0.049

**Table 36. Descriptive Statistics for Dissolved Lead**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2008	BMP, 2008	Reference Site, 2010	BMP, 2010
Number of Observations	76	84	7	6	16	20
Minimum	0	0	0	0	0	0
Maximum	1.7	0	1.7	0	1.7	0
1st Quartile	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0	0	0	0
Mean	<b>0.045</b>	<b>0</b>	<b>0.243</b>	<b>0</b>	<b>0.106</b>	<b>0</b>
Variance (n-1)	0.075	0	0.413	0	0.181	0
Standard deviation (n-1)	0.274	0	0.643	0	0.425	0

Note: All the data for 2005, 2006, 2007, and 2009 were non-detects (0).

**Table 37. Descriptive Statistics for Total Chromium**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	8	9	6	10	15	13	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	18.1	20	10	10	0	20	10	20	6.4	0	18.1	10.6	13.6	5.5
1st Quartile	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0	0	0	0	0	10	0	0	0	5.35	8.075	0
Mean	<b>1.66</b>	<b>2.13</b>	<b>1.25</b>	<b>1.11</b>	<b>0.00</b>	<b>4.00</b>	<b>0.67</b>	<b>3.85</b>	<b>0.91</b>	<b>0.00</b>	<b>1.38</b>	<b>2.22</b>	<b>4.18</b>	<b>1.06</b>
Variance (n-1)	16.022	20.359	12.5	11.111	0	71.111	6.667	42.308	5.851	0	18.471	10.037	27.75	4.735
Standard deviation (n-1)	4.003	4.512	3.536	3.333	0	8.433	2.582	6.504	2.419	0	4.298	3.168	5.268	2.176

**Table 38. Descriptive Statistics for Total Manganese**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	67	77	7	9	6	10	5	4	7	6	26	28	16	20
Minimum	0	0	0	0	0	30	40	0	13.2	31.9	8.2	15.6	24	15.1
Maximum	363	400	100	140	70	350	182	400	114	64.9	363	81.9	269	66.5
1st Quartile	30.25	25.7	35	20	0	100	45	30	22.75	46.55	27.425	26.15	60.05	21.55
Median	<b>53</b>	<b>42.6</b>	<b>60</b>	<b>30</b>	<b>20</b>	<b>185</b>	<b>60</b>	<b>65</b>	<b>40.6</b>	<b>59.35</b>	<b>43.15</b>	<b>44.8</b>	<b>105.85</b>	<b>30.35</b>
3rd Quartile	86.5	60.7	80	60	55	270	80	167.5	63.2	60.375	74.25	57.225	194.5	37.375
Mean	<b>75.863</b>	<b>64.722</b>	<b>55.714</b>	<b>44.444</b>	<b>28.333</b>	<b>187</b>	<b>81.4</b>	<b>132.5</b>	<b>48.53</b>	<b>53.08</b>	<b>67.62</b>	<b>43.74</b>	<b>126.13</b>	<b>32.02</b>
Variance (n-1)	5345.83	5708.69	1328.57	1852.78	1056.67	11001.11	3404.80	33158.33	1306.42	168.24	6172.17	382.16	6655.26	171.96
Standard deviation (n-1)	73.115	75.556	36.450	43.044	32.506	104.886	58.351	182.094	36.144	12.971	78.563	19.549	81.580	13.113

**Table 39. Descriptive Statistics for Total Nickel**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	15	13	7	6	26	28	16	20
Minimum	0	0	0	0	0	1.4	0	0	1.2	0
Maximum	16.4	5.1	7	0	3.5	3.5	16.4	5.1	12.2	2.8
1st Quartile	0	0	0	0	0.7	1.625	2.175	1.175	3.2	1.1
Median	<b>1.8</b>	<b>1.1</b>	<b>0</b>	<b>0</b>	<b>1.7</b>	<b>1.9</b>	<b>2.65</b>	<b>1.5</b>	<b>5.45</b>	<b>1.25</b>
3rd Quartile	3.475	1.6	0	0	2.65	2.175	3.6	1.8	8.325	1.6
Mean	<b>2.647</b>	<b>0.981</b>	<b>0.667</b>	<b>0</b>	<b>1.7</b>	<b>2.083</b>	<b>3.385</b>	<b>1.593</b>	<b>6.038</b>	<b>1.365</b>
Variance (n-1)	11.832	1.012	3.667	0	2.007	0.574	10.853	0.818	14.340	0.505
Standard deviation (n-1)	3.440	1.006	1.915	0	1.417	0.757	3.294	0.904	3.787	0.710

Note: All the data for 2005 and 2006 were non-detects (0).

**Table 40. Descriptive Statistics for Total Copper**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	8	9	6	10	15	13	7	6	26	28	16	20
Minimum	0	0	0	2	5	4	0	0	4.8	8.3	2.1	5.7	4.2	4.7
Maximum	45.5	49	18	22	12	40	30	49	20.8	18	45.5	15	34.2	13.1
1st Quartile	6.325	7.225	6.25	7	5	20	0	0	12.3	9.9	6.55	7.7	8.975	6.625
Median	<b>10</b>	<b>9.95</b>	<b>9</b>	<b>12</b>	<b>6.5</b>	<b>23</b>	<b>8</b>	<b>20</b>	<b>14</b>	<b>12.85</b>	<b>8.5</b>	<b>9.15</b>	<b>14.9</b>	<b>7.5</b>
3rd Quartile	14.45	15	13.25	14	9.5	25.5	16	30	14.4	14.98	11.325	10.6	20.95	9.2
Mean	<b>11.614</b>	<b>12.758</b>	<b>9.25</b>	<b>11.556</b>	<b>7.5</b>	<b>23.5</b>	<b>10.067</b>	<b>19.385</b>	<b>13.286</b>	<b>12.767</b>	<b>10.85</b>	<b>9.671</b>	<b>16.3</b>	<b>7.94</b>
Variance (n-1)	74.179	82.989	33.071	34.778	9.1	99.833	97.495	255.423	22.508	14.155	78.879	6.801	92.971	4.690
Standard deviation (n-1)	8.613	9.110	5.751	5.897	3.017	9.992	9.874	15.982	4.744	3.762	8.881	2.608	9.642	2.166

**Table 41. Descriptive Statistics for Total Zinc**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	8	9	6	10	15	13	7	6	26	28	16	20
Minimum	0	0	0	0	20	30	0	0	0	0	0	0	20.5	0
Maximum	311	100	60	30	60	100	170	60	74.4	33.7	311	34.1	222	33.2
1st Quartile	23.55	0	40	20	42.5	40	10	0	0	0	26.9	0	50.5	0
Median	<b>47.2</b>	<b>0</b>	<b>45</b>	<b>20</b>	<b>50</b>	<b>40</b>	<b>30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>45.45</b>	<b>0</b>	<b>87.8</b>	<b>0</b>
3rd Quartile	68.525	26.1	52.5	30	57.5	70	60	30	12	19.575	61.825	0	133	0
Mean	<b>58.15</b>	<b>13.297</b>	<b>42.5</b>	<b>18.889</b>	<b>46.667</b>	<b>54</b>	<b>50.067</b>	<b>17.692</b>	<b>14.06</b>	<b>9.97</b>	<b>56.16</b>	<b>2.88</b>	<b>100.39</b>	<b>3.16</b>
Variance (n-1)	3444.713	490.243	364.286	136.111	226.667	582.222	3141.495	669.231	788.023	244.179	3980.183	74.988	4490.576	94.870
Standard deviation (n-1)	58.692	22.141	19.086	11.667	15.055	24.129	56.049	25.869	28.072	15.626	63.089	8.660	67.012	9.740

**Table 42. Descriptive Statistics for Total Selenium**

Test Statistic	Reference Site, 2008-2010	BMP, 2008-2010	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	49	54	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0
Maximum	1.1	1.5	0	1	1.1	1.5	0	1
1st Quartile	0	0	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0	0	0	0	0	0
Mean	<b>0.02</b>	<b>0.14</b>	<b>0.00</b>	<b>0.17</b>	<b>0.04</b>	<b>0.21</b>	<b>0.00</b>	<b>0.05</b>
Variance (n-1)	0.025	0.147	0	0.167	0.047	0.213	0	0.05
Standard deviation (n-1)	0.157	0.384	0	0.408	0.216	0.461	0	0.224

**Table 43. Descriptive Statistics for Total Silver**

Test Statistic	Reference Site, 2008-2010	BMP, 2008-2010	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	49	54	26	28	16	20
Minimum	0	0	0	0	0	0
Maximum	83.7	0.4	0.2	0.4	83.7	0.3
1st Quartile	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0	0	0	0
Mean	<b>1.71</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	<b>5.23</b>	<b>0.02</b>
Variance (n-1)	142.960	0.005	0.002	0.006	437.856	0.005
Standard deviation (n-1)	11.957	0.067	0.039	0.076	20.925	0.067

Note: All data for 2008 were non-detects (0).



**Table 44. Descriptive Statistics for Total Cadmium**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	7	6	26	28	16	20
Minimum	0	0	0	0	0	0	0	0
Maximum	1.2	0.8	0.9	0	1.2	0.8	0.7	0
1st Quartile	0	0	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
3rd Quartile	0	0	0.4	0	0	0	0.15	0
Mean	<b>0.086</b>	<b>0.026</b>	<b>0.243</b>	<b>0</b>	<b>0.096</b>	<b>0.079</b>	<b>0.156</b>	<b>0</b>
Variance (n-1)	0.062	0.019	0.173	0	0.084	0.054	0.079	0
Standard deviation (n-1)	0.249	0.136	0.416	0	0.289	0.233	0.280	0

Note: All data for 2005, 2006, and 2007 were non-detects (0).

**Table 45. Descriptive Statistics for Total Lead**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	15	13	26	28	16	20
Minimum	0	0	0	0	0	0	0	0
Maximum	38.9	11	18	11	38.9	0	19.6	0
1st Quartile	0	0	0	0	0	0	0	0
Median	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3.15</b>	<b>0</b>
3rd Quartile	0	0	0	0	6.525	0	10.475	0
Mean	<b>3.173</b>	<b>0.244</b>	<b>2.067</b>	<b>1.615</b>	<b>4.408</b>	<b>0</b>	<b>6.369</b>	<b>0</b>
Variance (n-1)	47.275	2.540	30.638	15.590	76.899	0	57.062	0
Standard deviation (n-1)	6.876	1.594	5.535	3.948	8.769	0	7.554	0

Note: All data for 2005, 2006, and 2008 were non-detects (0).

**Table 46. Descriptive Statistics for Dissolved Phosphorus**

Test Statistic	Reference Site, 2008-2010	BMP, 2008-2010	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	42	48	24	25	16	20
Minimum	0	0.01	0.02	0.03	0	0.01
Maximum	0.19	0.11	0.19	0.11	0.08	0.09
1st Quartile	0.023	0.04	0.02	0.05	0.03	0.03
Median	<b>0.04</b>	<b>0.05</b>	<b>0.04</b>	<b>0.05</b>	<b>0.04</b>	<b>0.035</b>
3rd Quartile	0.05	0.06	0.063	0.06	0.043	0.045
Mean	<b>0.048</b>	<b>0.049</b>	<b>0.056</b>	<b>0.055</b>	<b>0.039</b>	<b>0.041</b>
Variance (n-1)	0.002	0.000	0.002	0.000	0.000	0.000
Standard deviation (n-1)	0.039	0.020	0.048	0.017	0.020	0.022

Note: There was not enough data for individual descriptive statistics for 2008.

**Table 47. Descriptive Statistics for Dissolved Potassium**

Test Statistic	Reference Site, 2007-2010	BMP, 2007-2010	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	54	58	5	4	7	6	26	28	16	20
Minimum	0	2	1	11	1	2	0	7	0	4
Maximum	11	20	6	18	11	17	5	20	3	13
1st Quartile	1	9.25	1	12.5	1	6.5	0	11	0	8
Median	<b>2</b>	<b>12</b>	<b>2</b>	<b>15</b>	<b>2</b>	<b>14</b>	<b>2</b>	<b>13</b>	<b>1.5</b>	<b>10</b>
3rd Quartile	2	15	4	17.25	8	14.75	2	16	2	11.25
Mean	<b>2</b>	<b>11.862</b>	<b>2.8</b>	<b>14.75</b>	<b>4.571</b>	<b>11</b>	<b>1.577</b>	<b>13.321</b>	<b>1.313</b>	<b>9.5</b>
Variance (n-1)	4.981	14.472	4.7	10.917	19.619	40	1.934	10.152	1.163	5.737
Standard deviation (n-1)	2.232	3.804	2.168	3.304	4.429	6.325	1.391	3.186	1.078	2.395

**Table 48. Descriptive Statistics for Nitrite+Nitrate**

Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	78	86	8	9	6	10	15	13	7	6	26	28	16	20
Minimum	0.03	0.12	0.4	0.12	0.24	1	0.13	0.3	0.15	0.27	0.03	0.27	0.04	0.29
Maximum	2.98	4.93	2.98	3.65	0.99	4.93	2.08	3.44	0.87	1.83	1.64	4.31	1.92	2.66
1st Quartile	0.385	0.923	0.745	0.91	0.41	1.49	0.495	0.86	0.4	0.56	0.3225	1.333	0.4275	0.908
Median	<b>0.63</b>	<b>1.65</b>	<b>1.435</b>	<b>1.62</b>	<b>0.78</b>	<b>1.875</b>	<b>0.59</b>	<b>1.2</b>	<b>0.56</b>	<b>0.875</b>	<b>0.52</b>	<b>1.995</b>	<b>0.555</b>	<b>1.31</b>
3rd Quartile	0.93	2.213	1.73	3.16	0.798	2.098	0.98	1.76	0.72	1.468	0.768	2.608	0.91	2.093
Mean	<b>0.738</b>	<b>1.727</b>	<b>1.376</b>	<b>1.906</b>	<b>0.647</b>	<b>2.067</b>	<b>0.77</b>	<b>1.481</b>	<b>0.546</b>	<b>0.995</b>	<b>0.617</b>	<b>1.991</b>	<b>0.702</b>	<b>1.484</b>
Variance (n-1)	0.277	0.928	0.719	1.682	0.094	1.202	0.245	0.802	0.065	0.385	0.166	0.935	0.259	0.486
Standard deviation (n-1)	0.526	0.963	0.848	1.297	0.307	1.096	0.495	0.896	0.254	0.620	0.407	0.967	0.509	0.697

**Table 49. Descriptive Statistics for Ortho-Phosphorus**

Test Statistic	Reference Site, 2005-2008	BMP, 2005-2008	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008
Number of Observations	33	35	6	8	6	10	15	13	6	4
Minimum	0	0	0	0	0.016	0.059	0.022	0.009	0.042	0.063
Maximum	0.21	0.416	0.065	0.267	0.188	0.246	0.21	0.416	0.097	0.103
1st Quartile	0.042	0.055	0.010	0.034	0.043	0.080	0.045	0.030	0.049	0.069
Median	<b>0.046</b>	<b>0.081</b>	<b>0.027</b>	<b>0.073</b>	<b>0.045</b>	<b>0.158</b>	<b>0.051</b>	<b>0.069</b>	<b>0.070</b>	<b>0.079</b>
3rd Quartile	0.071	0.166	0.051	0.160	0.088	0.173	0.073	0.085	0.085	0.090
Mean	<b>0.063</b>	<b>0.110</b>	<b>0.030</b>	<b>0.104</b>	<b>0.073</b>	<b>0.142</b>	<b>0.070</b>	<b>0.099</b>	<b>0.068</b>	<b>0.081</b>
Variance (n-1)	0.002	0.008	0.001	0.009	0.004	0.004	0.003	0.013	0.001	0.000
Standard deviation (n-1)	0.046	0.090	0.027	0.097	0.063	0.066	0.050	0.113	0.023	0.018

**Table 50. Descriptive Statistics for Total Kjeldahl Nitrogen**

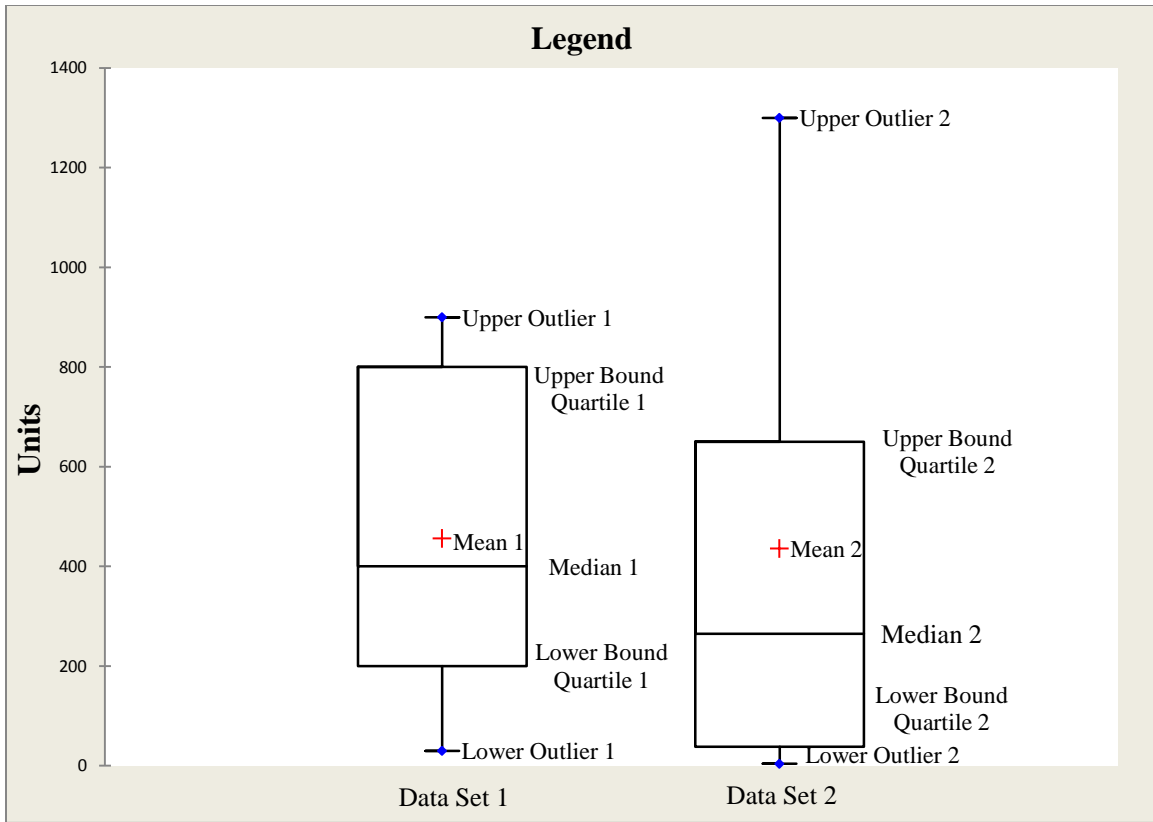
Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	77	85	7	8	6	10	15	13	7	6	26	28	16	20
Minimum	0	0	1	0.7	1.1	1.1	0	0	0.8	0.8	0.6	0.4	0.5	0
Maximum	8.9	2.5	4.5	2.5	3.2	2.5	5.4	2.26	3	2.3	4.8	1.9	8.9	2.5
1st Quartile	1.3	0.8	1.45	0.95	1.5	1.425	1.75	1.03	0.9	0.9	1.4	0.7	1.475	0.6
Median	<b>1.8</b>	<b>1.1</b>	<b>1.7</b>	<b>1.2</b>	<b>2.4</b>	<b>1.8</b>	<b>2.5</b>	<b>1.4</b>	<b>1</b>	<b>1.05</b>	<b>1.55</b>	<b>0.85</b>	<b>2.35</b>	<b>0.9</b>
3rd Quartile	2.7	1.6	3.85	1.8	2.55	1.975	2.95	1.6	1.5	1.575	2.375	1.25	3.8	1.15
Mean	<b>2.23</b>	<b>1.19</b>	<b>2.54</b>	<b>1.40</b>	<b>2.15</b>	<b>1.72</b>	<b>2.40</b>	<b>1.33</b>	<b>1.37</b>	<b>1.30</b>	<b>1.89</b>	<b>1.01</b>	<b>2.88</b>	<b>0.96</b>
Variance (n-1)	2.084	0.313	2.130	0.414	0.687	0.182	1.611	0.349	0.616	0.348	0.955	0.178	5.062	0.293
Standard deviation (n-1)	1.444	0.559	1.459	0.644	0.829	0.426	1.269	0.591	0.785	0.590	0.977	0.421	2.250	0.541

**Table 51. Descriptive Statistics for Total Phosphorus**

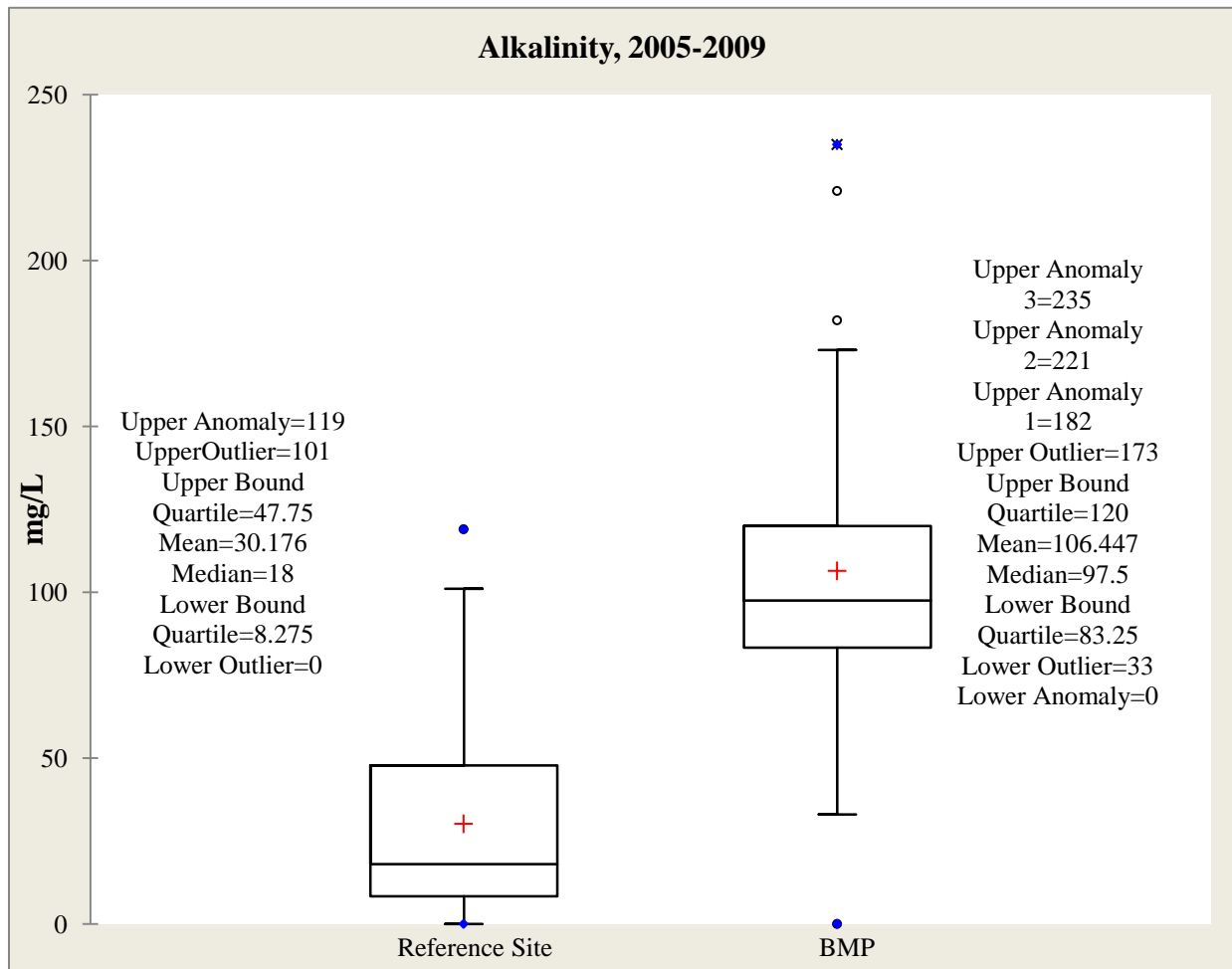
Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	74	83	7	8	6	10	13	11	7	6	25	28	16	20
Minimum	0.05	0	0.061	0.023	0.081	0	0.053	0.104	0.05	0.08	0.05	0.05	0.07	0.04
Maximum	0.97	0.774	0.206	0.29	0.297	0.774	0.445	0.471	0.93	0.28	0.97	0.25	0.65	0.16
1st Quartile	0.12	0.08	0.0855	0.0725	0.1065	0.106	0.123	0.128	0.065	0.093	0.12	0.08	0.14	0.06
Median	<b>0.155</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1325</b>	<b>0.1325</b>	<b>0.196</b>	<b>0.184</b>	<b>0.141</b>	<b>0.08</b>	<b>0.1</b>	<b>0.15</b>	<b>0.095</b>	<b>0.245</b>	<b>0.08</b>
3rd Quartile	0.255	0.14	0.145	0.1793	0.20125	0.27	0.24	0.16	0.225	0.123	0.23	0.113	0.403	0.103
Mean	<b>0.217</b>	<b>0.131</b>	<b>0.118</b>	<b>0.143</b>	<b>0.161</b>	<b>0.229</b>	<b>0.208</b>	<b>0.186</b>	<b>0.234</b>	<b>0.13</b>	<b>0.214</b>	<b>0.102</b>	<b>0.284</b>	<b>0.088</b>
Variance (n-1)	0.032	0.011	0.003	0.009	0.007	0.046	0.016	0.013	0.102	0.006	0.037	0.002	0.029	0.001
Standard deviation (n-1)	0.179	0.105	0.052	0.097	0.083	0.214	0.128	0.115	0.319	0.075	0.191	0.041	0.171	0.036

**Table 52. Descriptive Statistics for Total Suspended Solids**

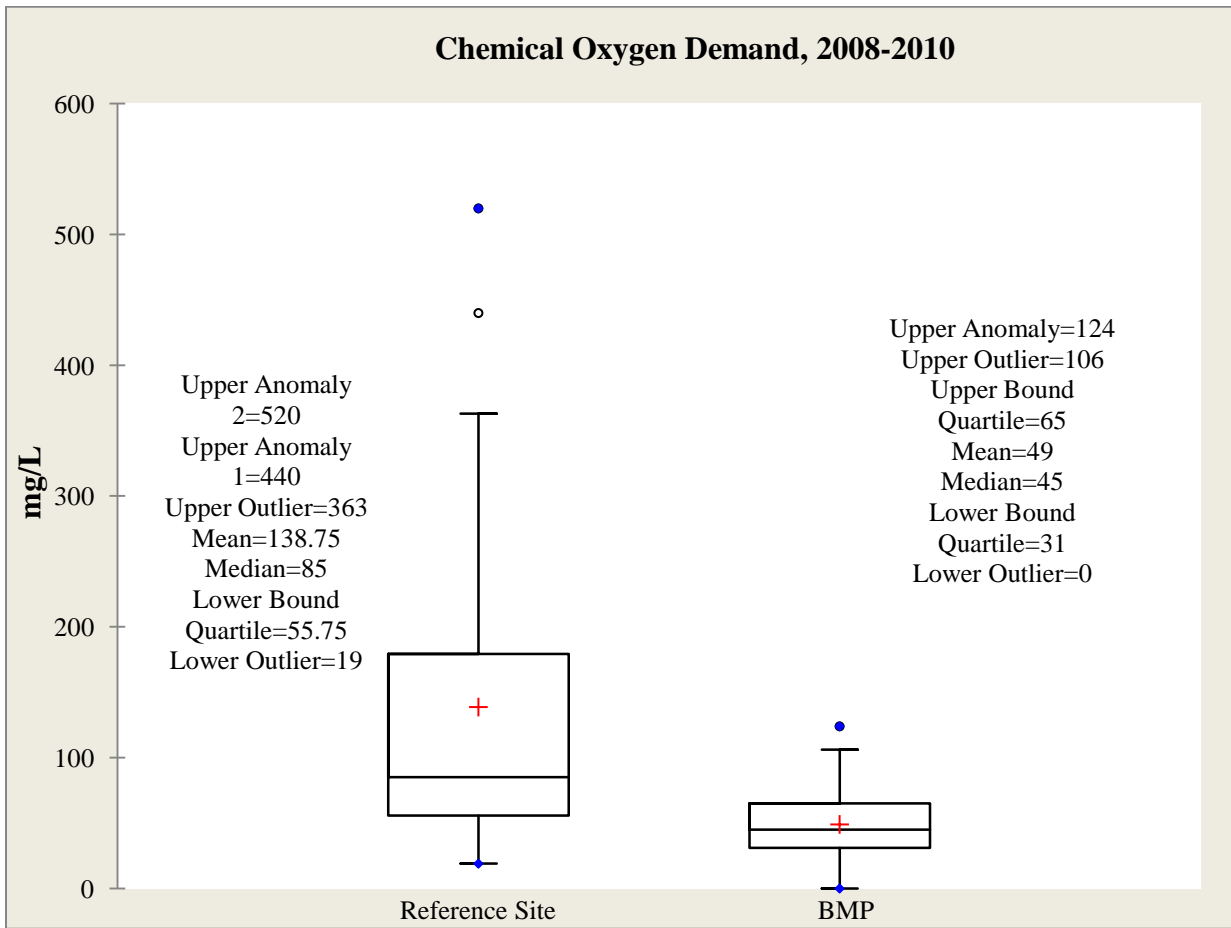
Test Statistic	Reference Site, 2005-2010	BMP, 2005-2010	Reference Site, 2005	BMP, 2005	Reference Site, 2006	BMP, 2006	Reference Site, 2007	BMP, 2007	Reference Site, 2008	BMP, 2008	Reference Site, 2009	BMP, 2009	Reference Site, 2010	BMP, 2010
Number of Observations	76	86	7	9	6	10	14	13	7	6	26	28	16	20
Minimum	5	5	5	8	9	14	35	26	16	15	7	5	39	11
Maximum	1940	278	85	50	111	129	518	278	156	82	1180	136	1940	148
1st Quartile	30.5	20.25	14.5	20	11.5	41	46.75	44	20	23	38.25	16.75	115.25	16.25
Median	<b>64</b>	<b>28.5</b>	<b>16</b>	<b>22</b>	<b>16.5</b>	<b>60.5</b>	<b>98</b>	<b>54</b>	<b>26</b>	<b>23</b>	<b>62</b>	<b>24</b>	<b>156</b>	<b>27</b>
3rd Quartile	171.25	54.75	46	40	22.25	80.75	264	121	41	41.75	267.25	28.75	370	38.5
Mean	<b>195.566</b>	<b>43.256</b>	<b>32.429</b>	<b>26.889</b>	<b>31.167</b>	<b>62.3</b>	<b>167.214</b>	<b>84.308</b>	<b>45.714</b>	<b>35.667</b>	<b>209.115</b>	<b>30.179</b>	<b>396.938</b>	<b>35</b>
Variance (n-1)	111267.3	1709.4	896.6	207.9	1559.0	1123.1	26264.6	4913.7	2532.6	641.5	90137.1	695.8	303422.1	954.1
Standard deviation (n-1)	333.568	41.345	29.944	14.417	39.484	33.513	162.064	70.098	50.325	25.327	300.228	26.378	550.838	30.889



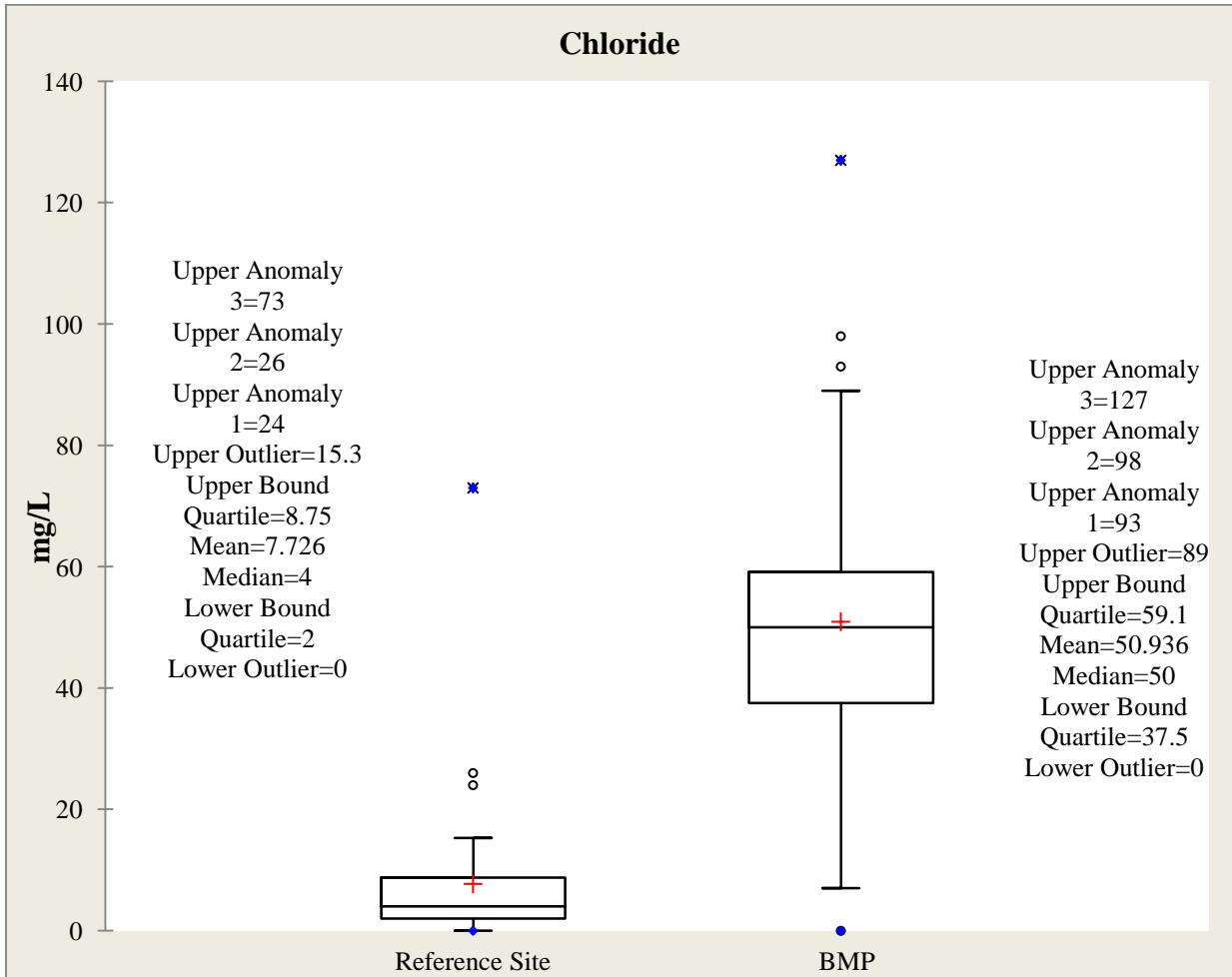
**Figure 11. Legend for Box-and-Whisker Plots**



**Figure 12. Alkalinity Concentrations at the BMP and Reference Site**

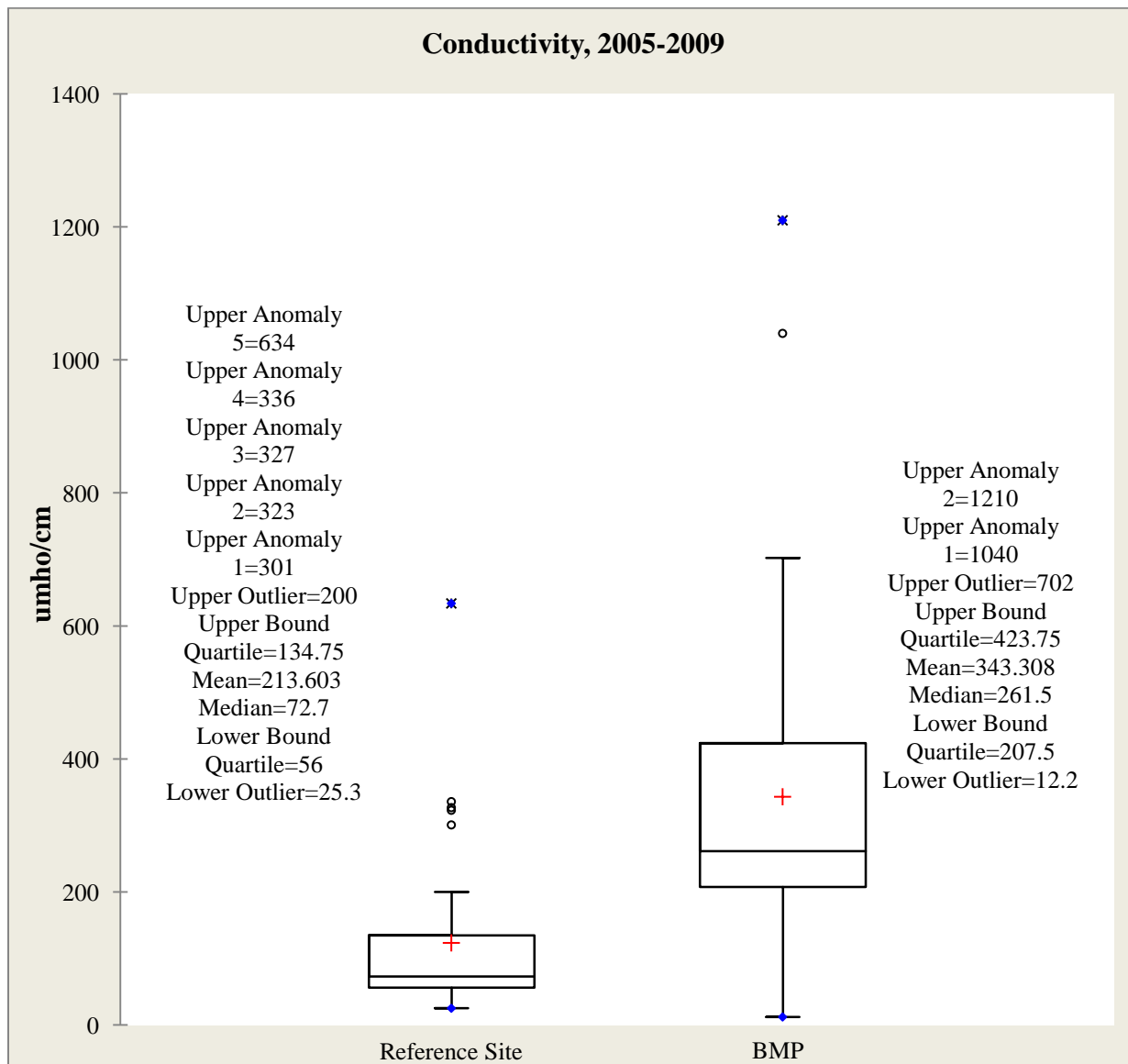


**Figure 13. Chemical Oxygen Demand Concentrations at the Reference Site and BMP**

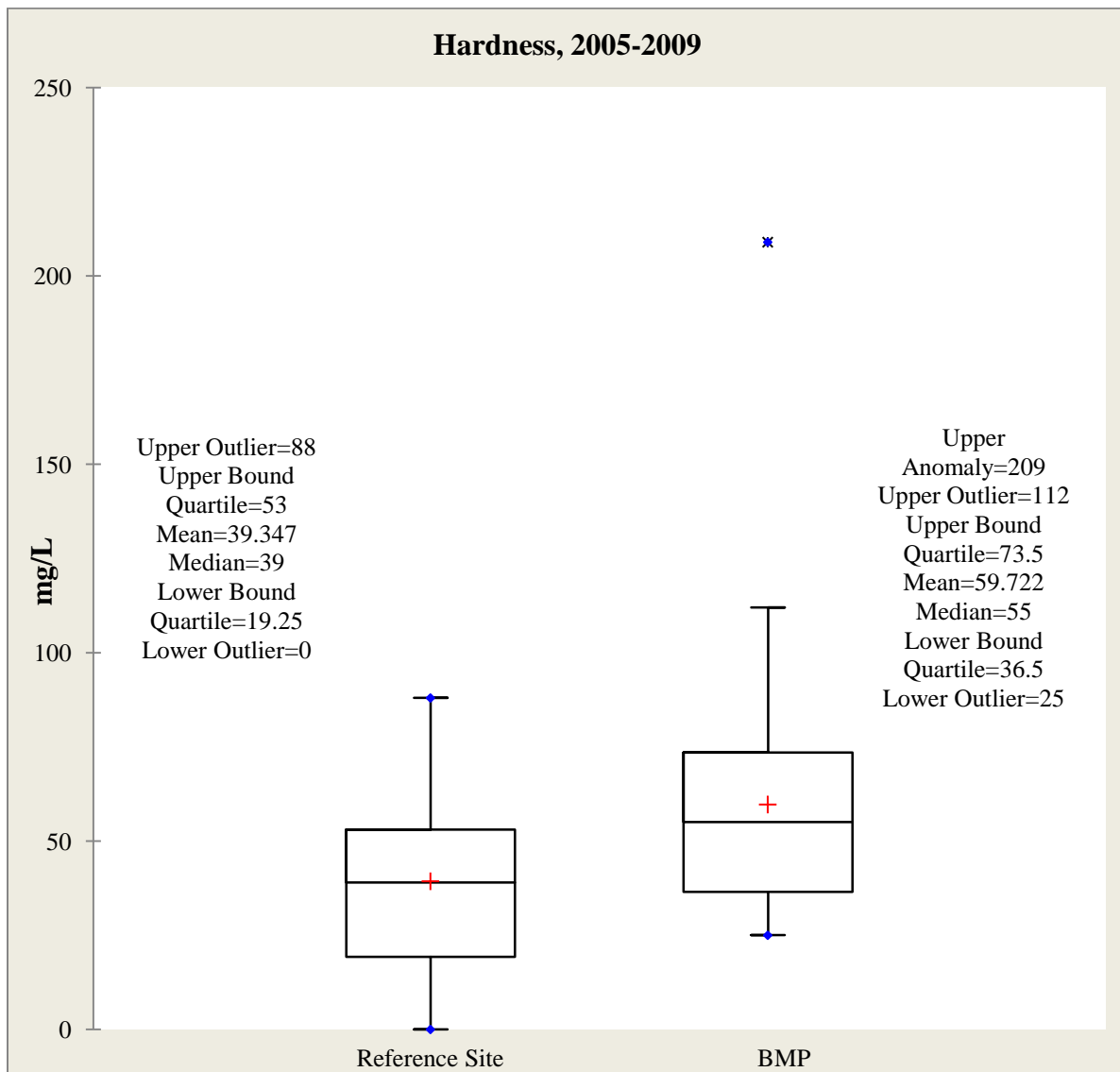


**Figure 14. Chloride Concentrations at the Reference Site and BMP**

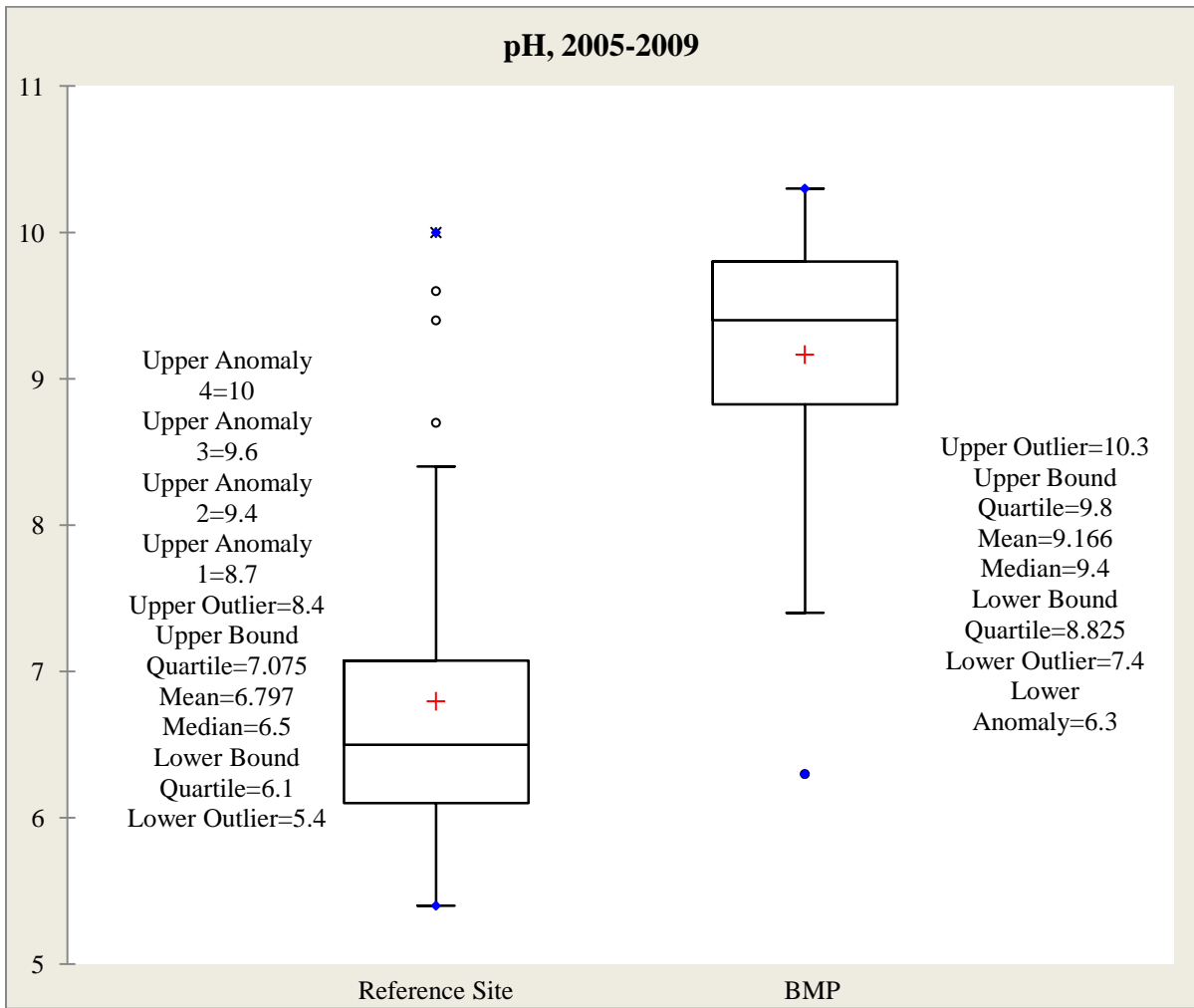




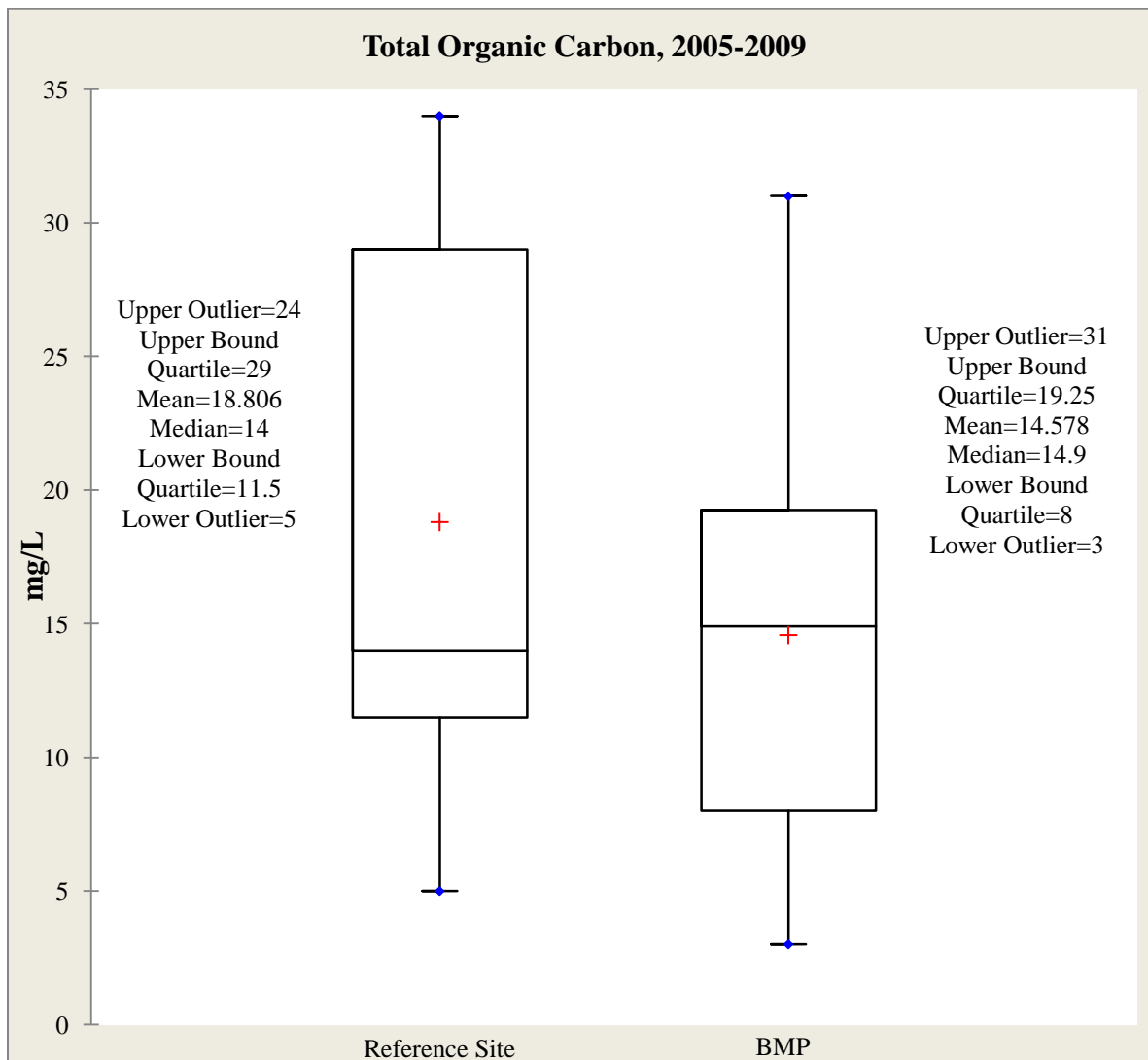
**Figure 15. Conductivity at the Reference Site and BMP**



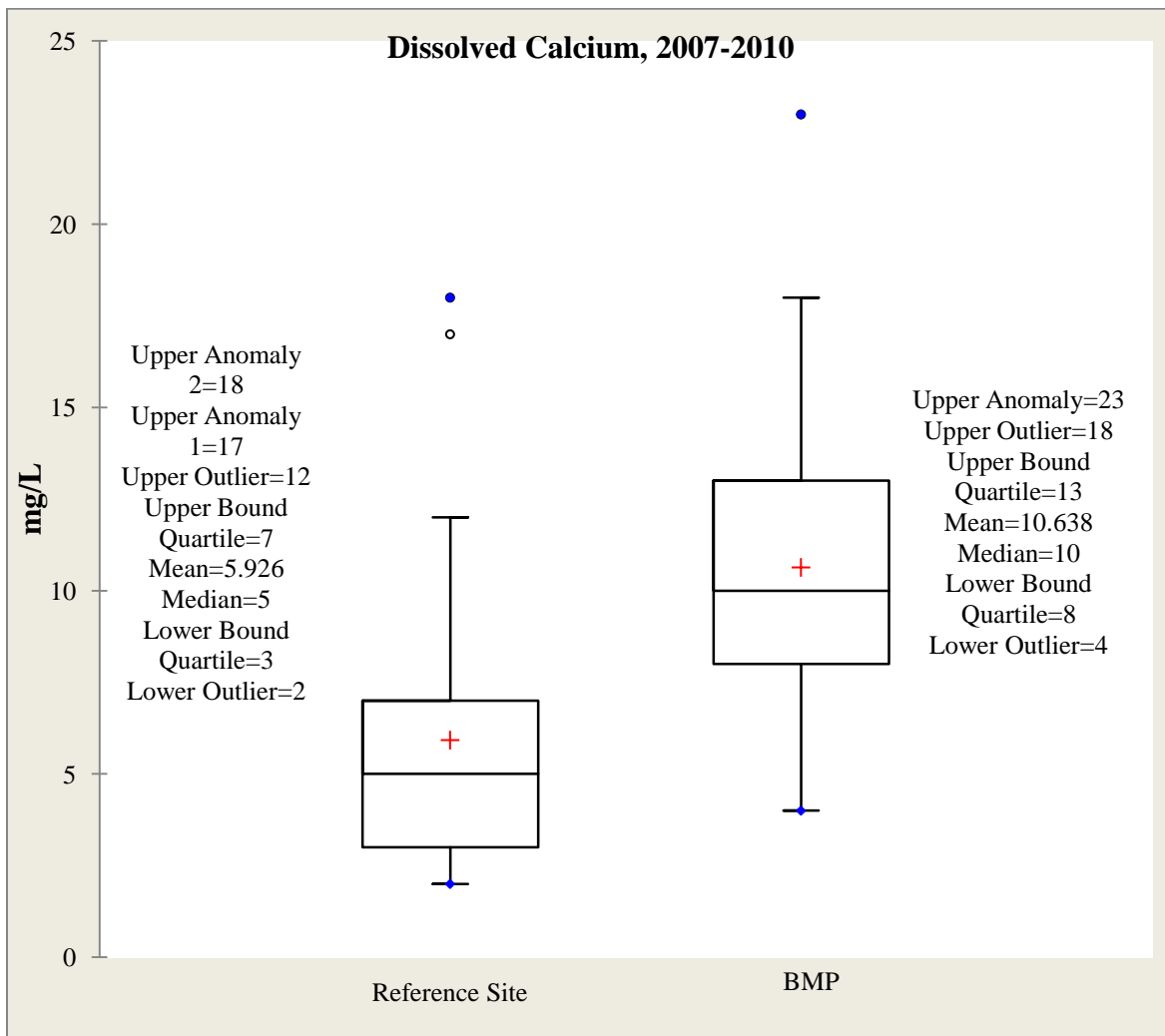
**Figure 16. Hardness Concentrations at the Reference Site and BMP**



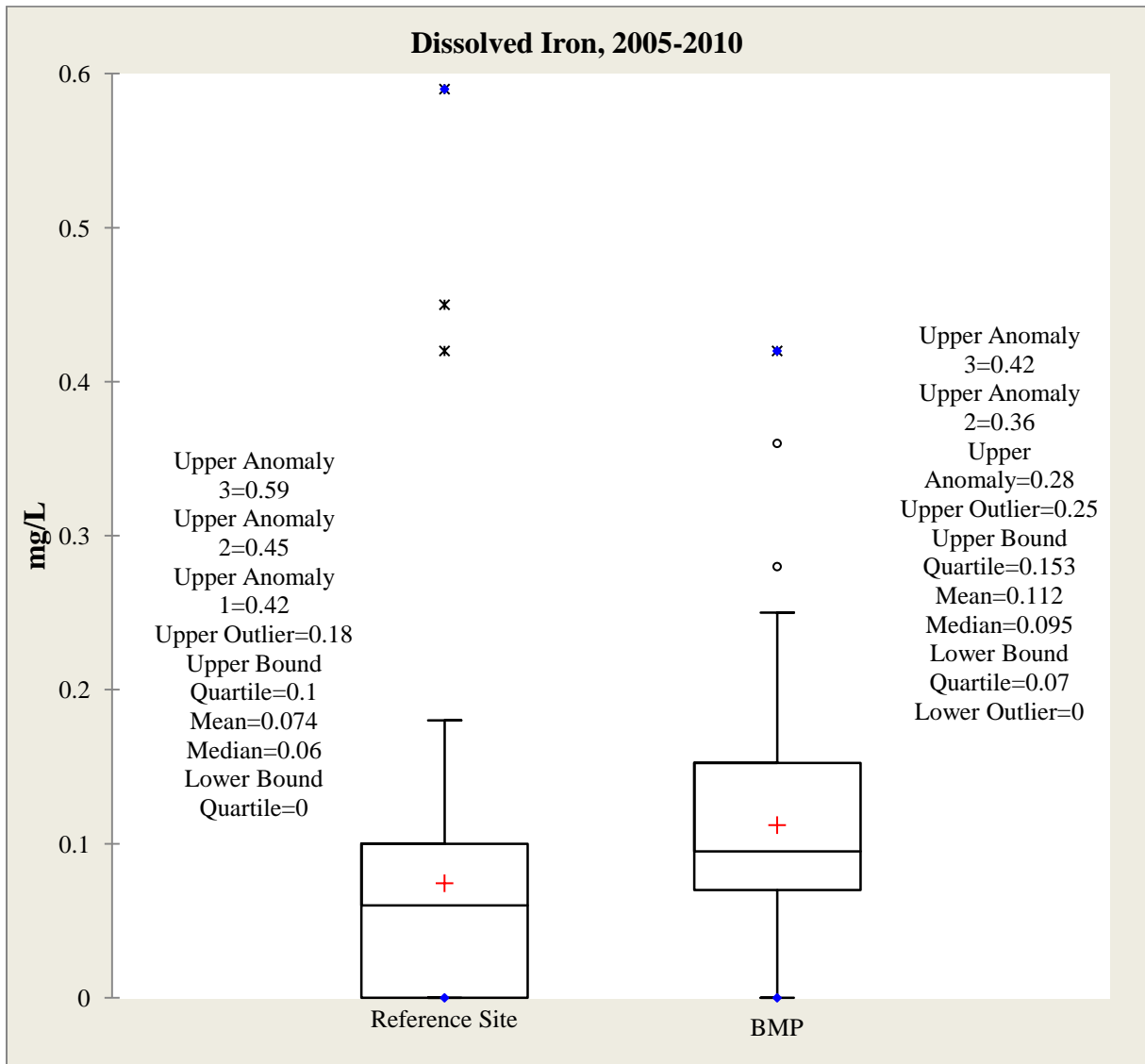
**Figure 17. pH at the Reference Site and BMP**



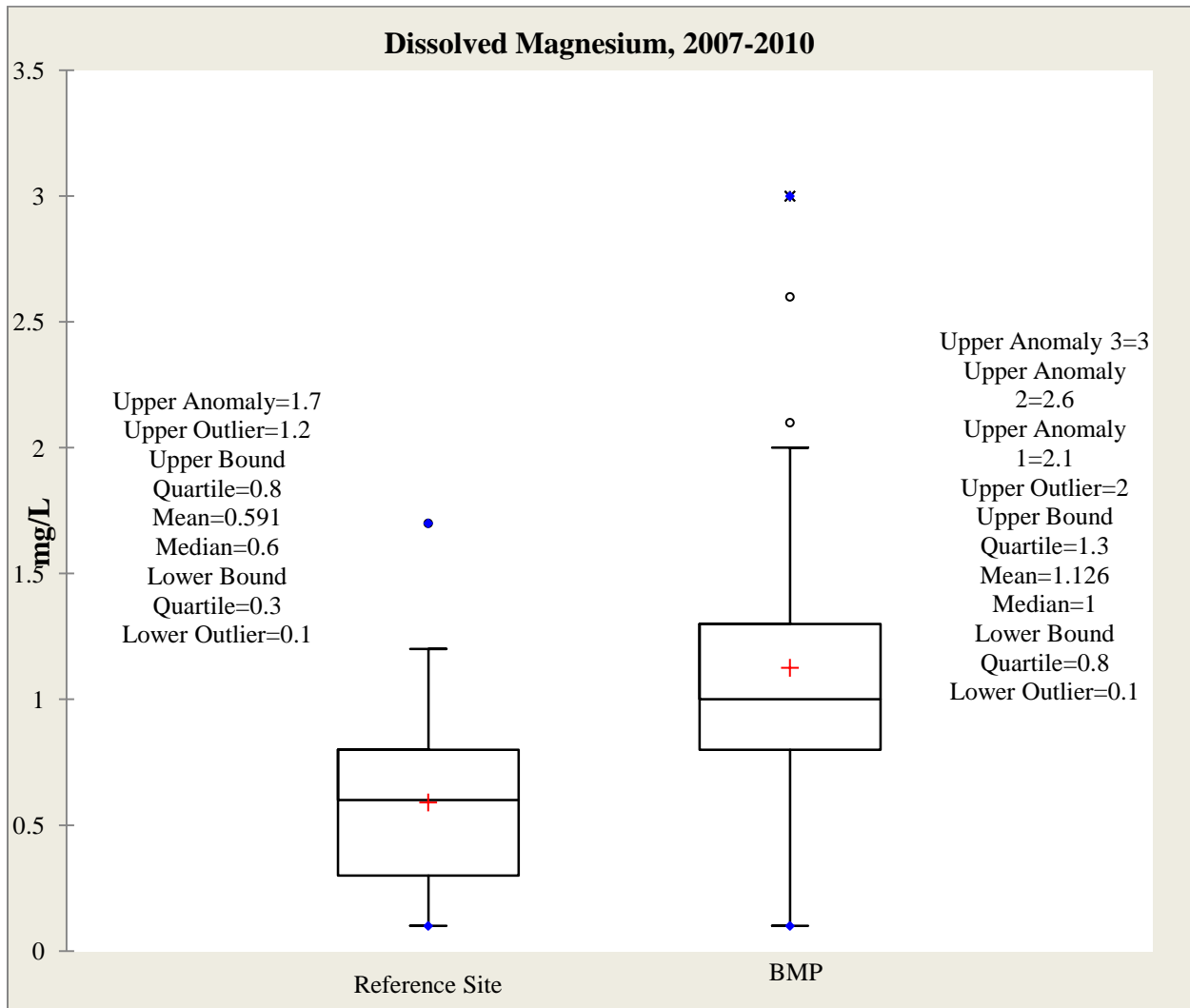
**Figure 18. Total Organic Carbon Concentrations at the Reference Site and BMP**



**Figure 19. Dissolved Calcium Concentrations at the Reference Site and BMP**

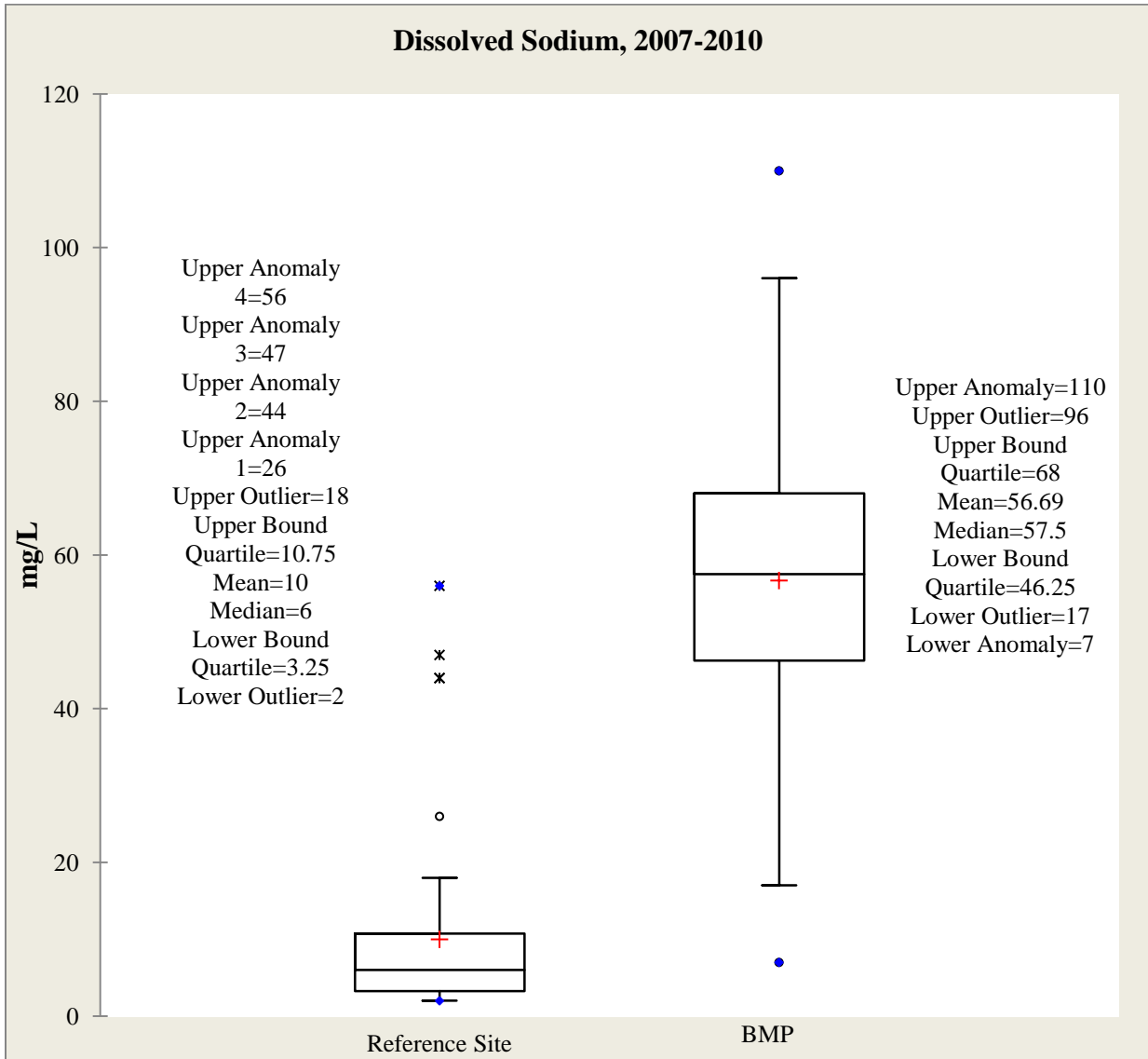


**Figure 20. Dissolved Iron Concentrations at the Reference Site and BMP**

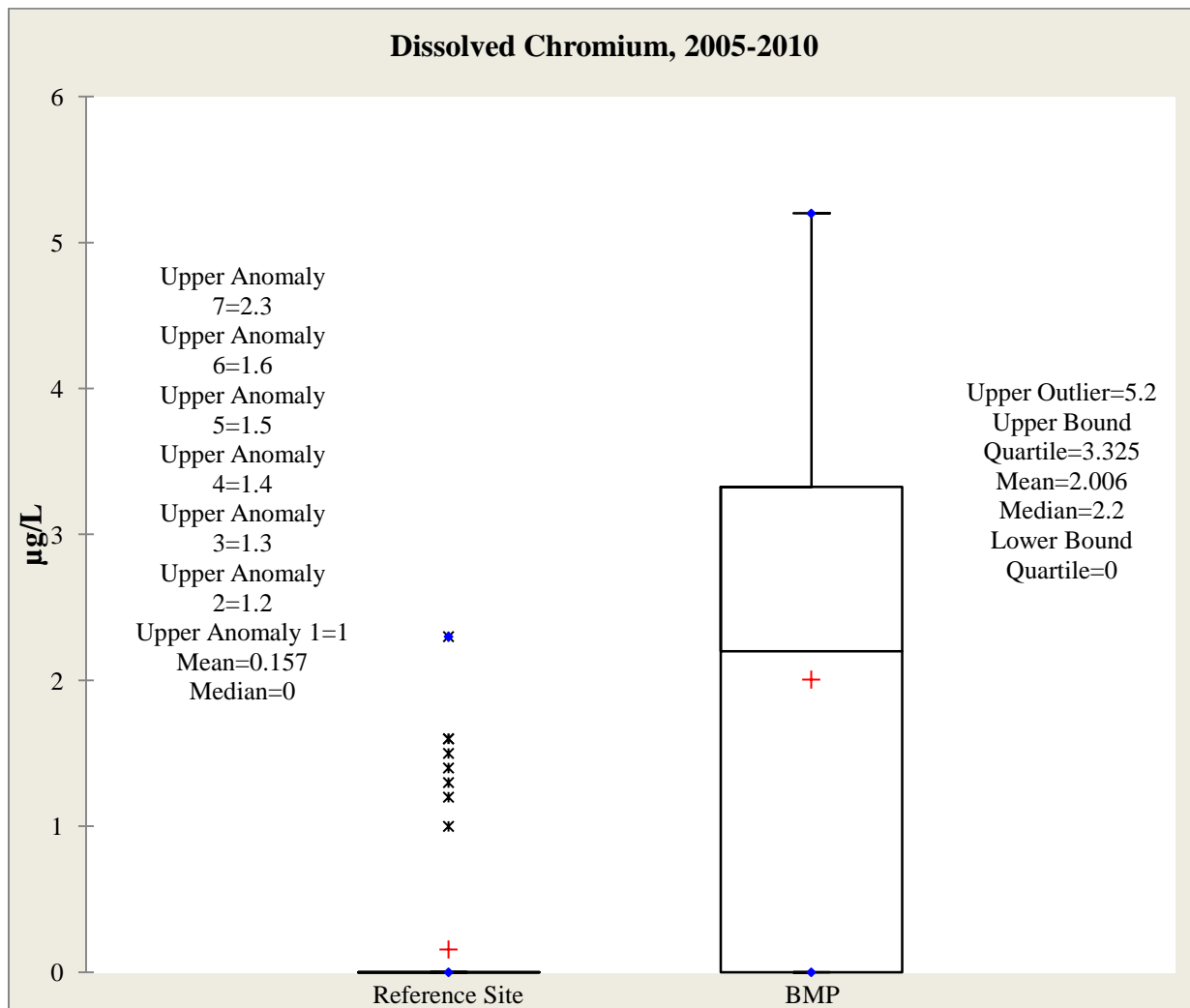


**Figure 21. Dissolved Magnesium Concentrations at the Reference Site and BMP**

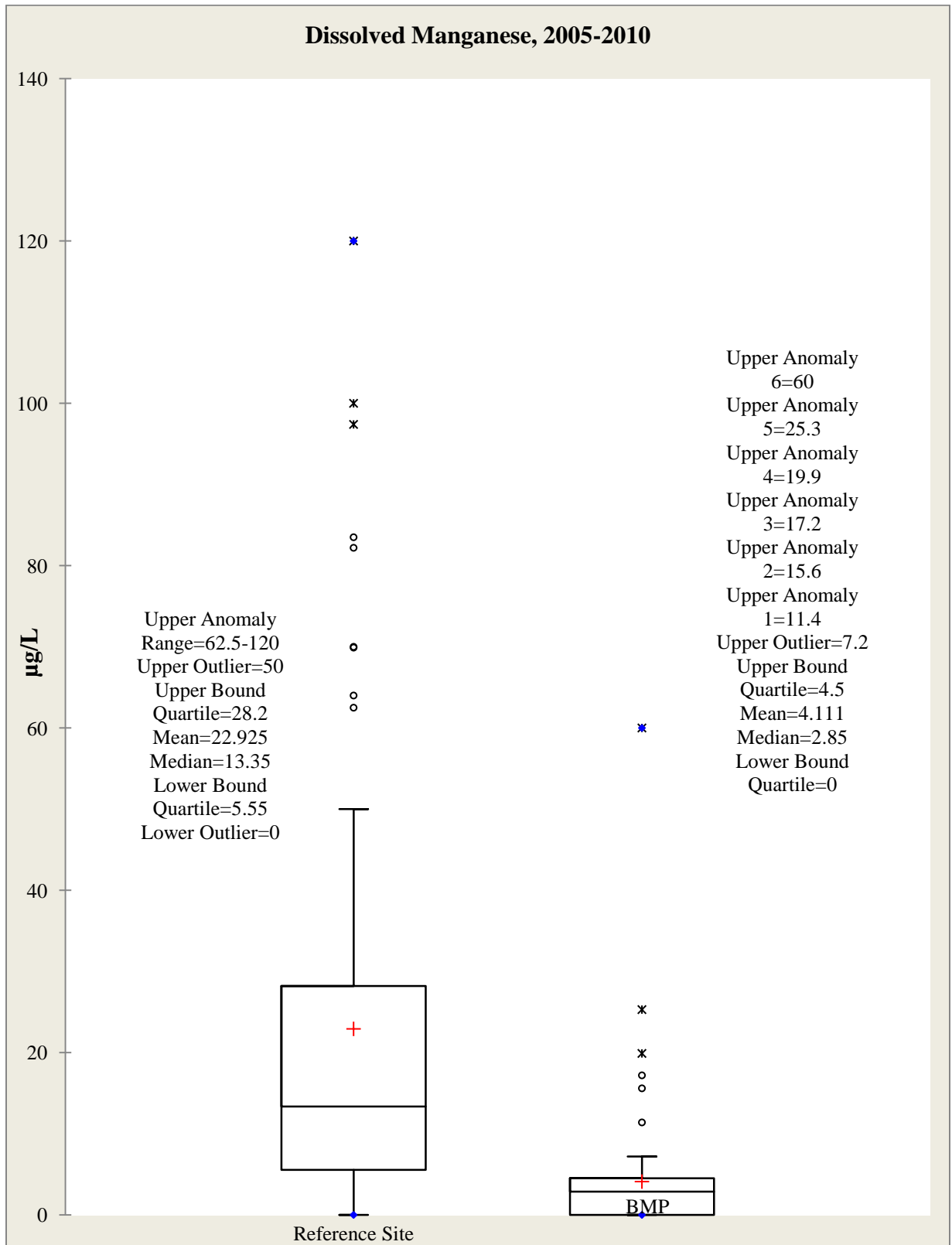




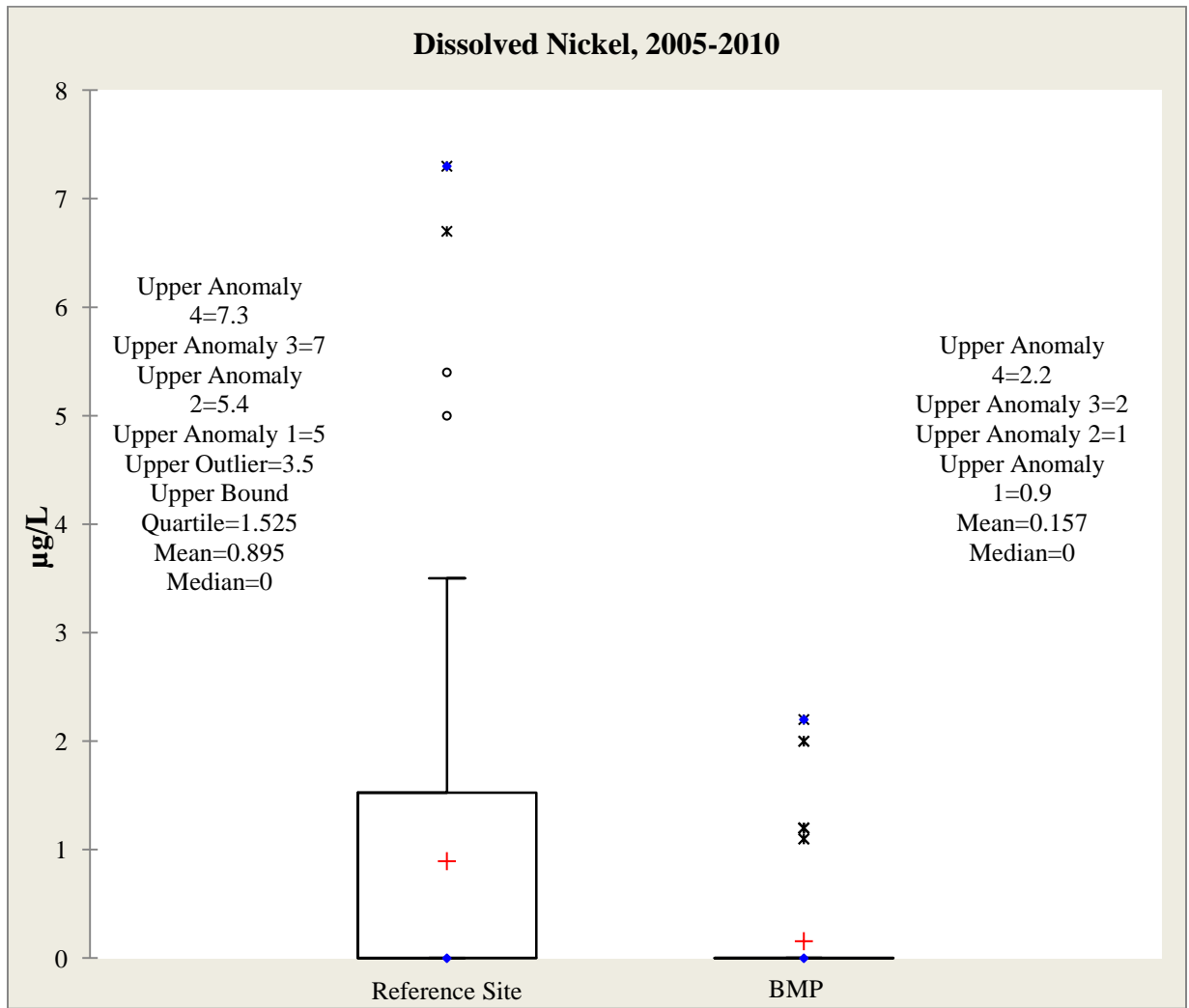
**Figure 22. Dissolved Sodium Concentrations at the Reference Site and BMP**



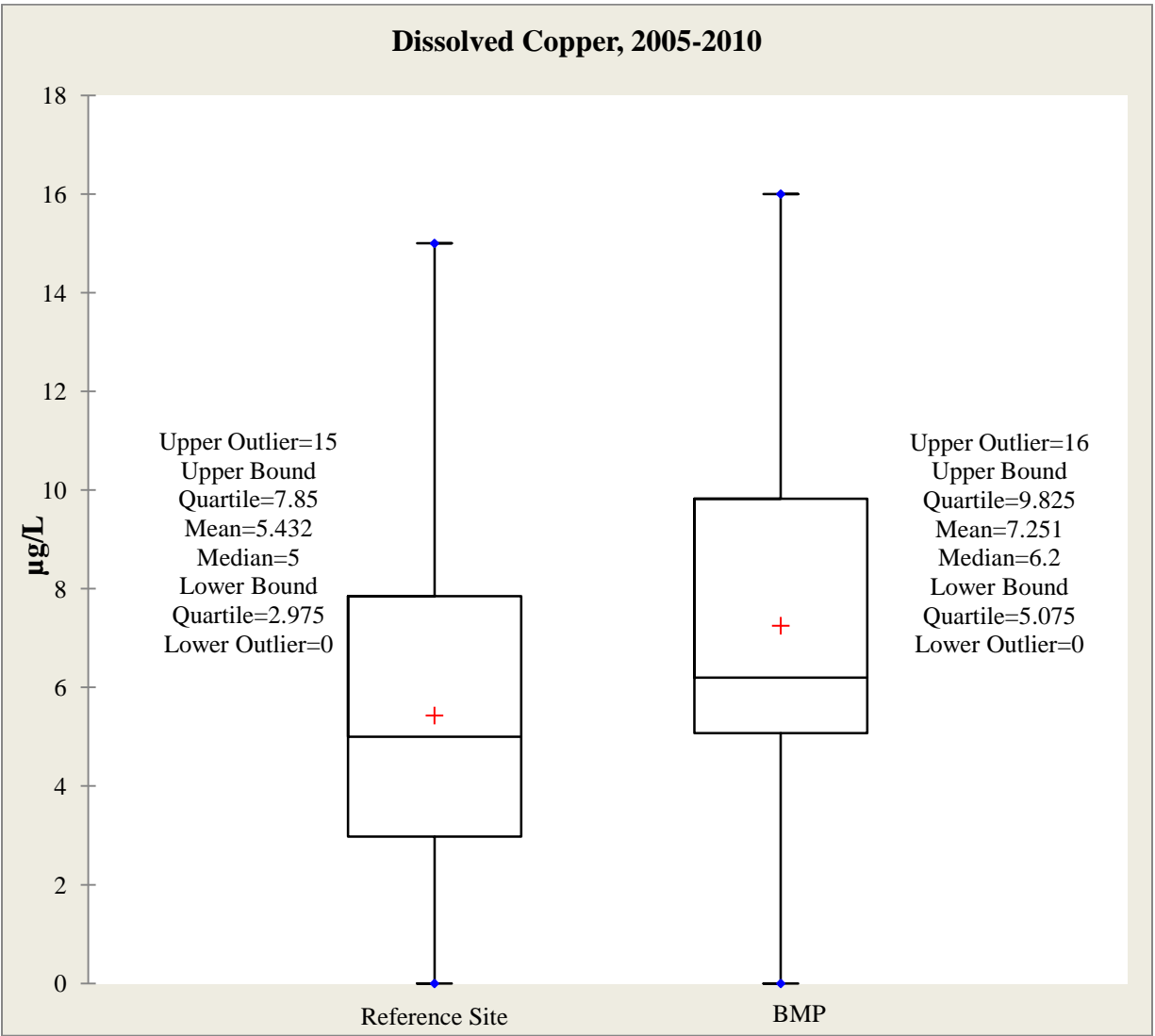
**Figure 23. Dissolved Chromium Concentrations at the Reference Site and BMP**



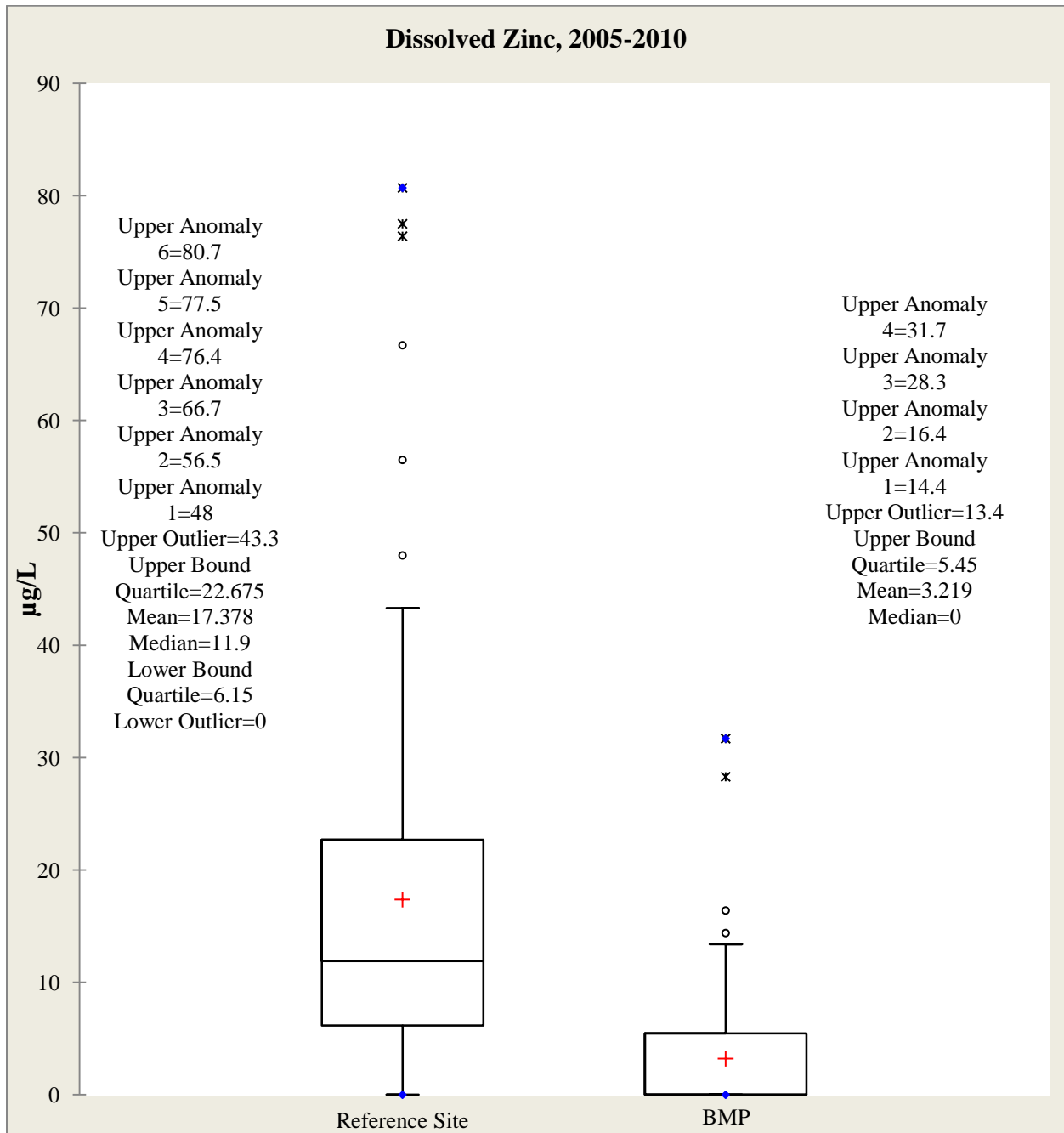
**Figure 24. Dissolved Manganese Concentrations at the Reference Site and BMP**



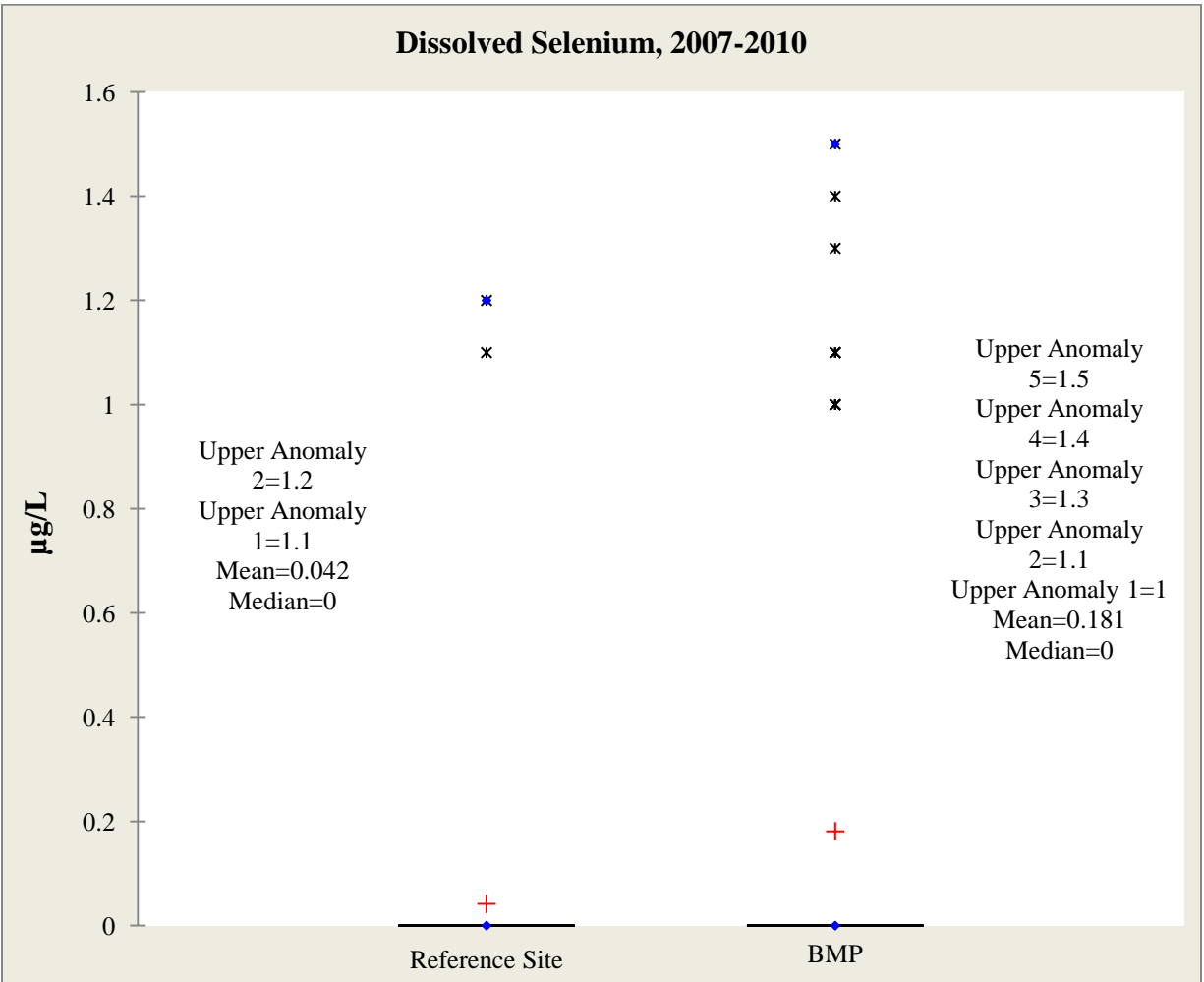
**Figure 25. Dissolved Nickel Concentrations at the Reference Site and BMP**



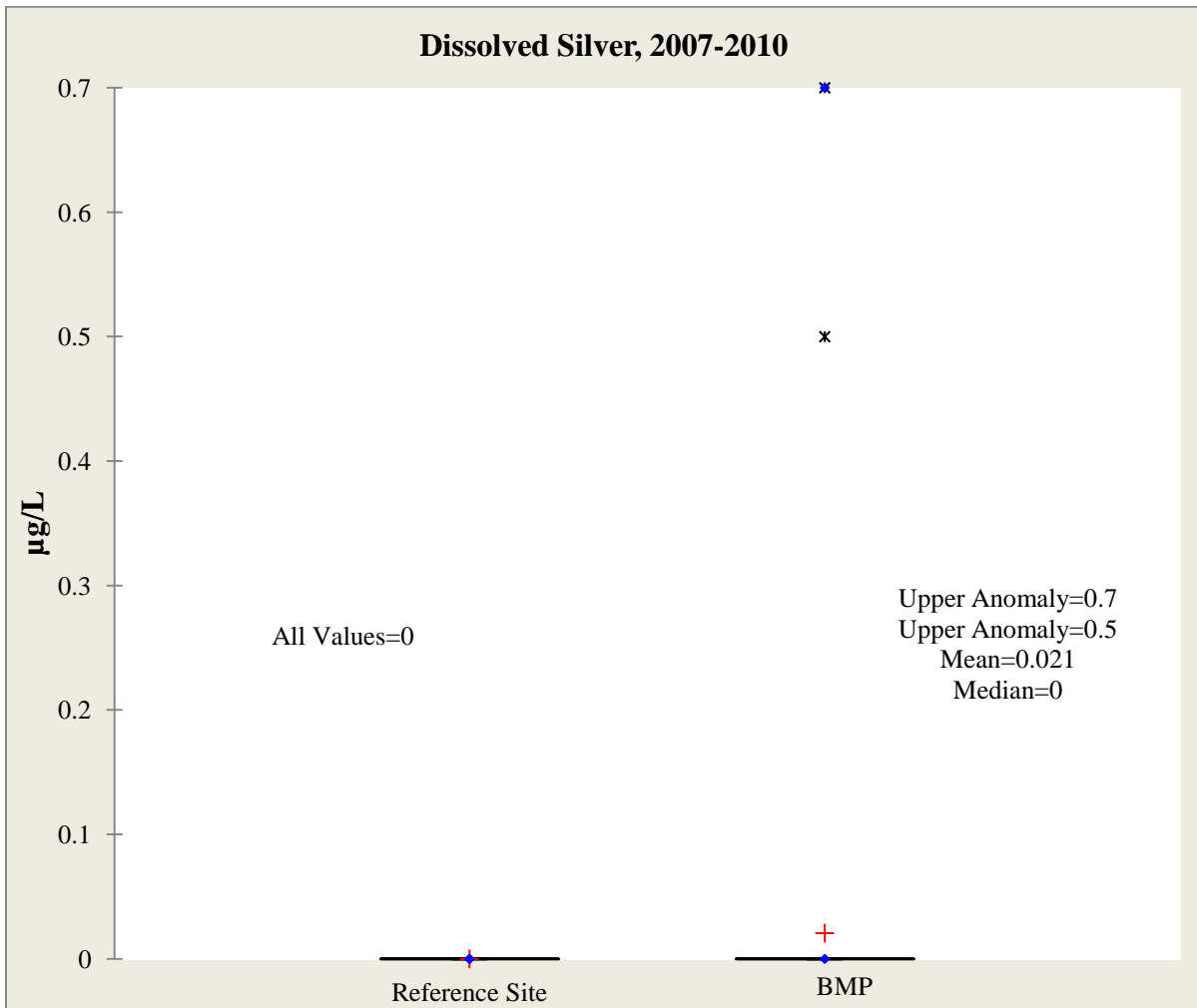
**Figure 26. Dissolved Copper Concentrations at the Reference Site and BMP**



**Figure 27. Dissolved Zinc Concentrations at the Reference Site and BMP**

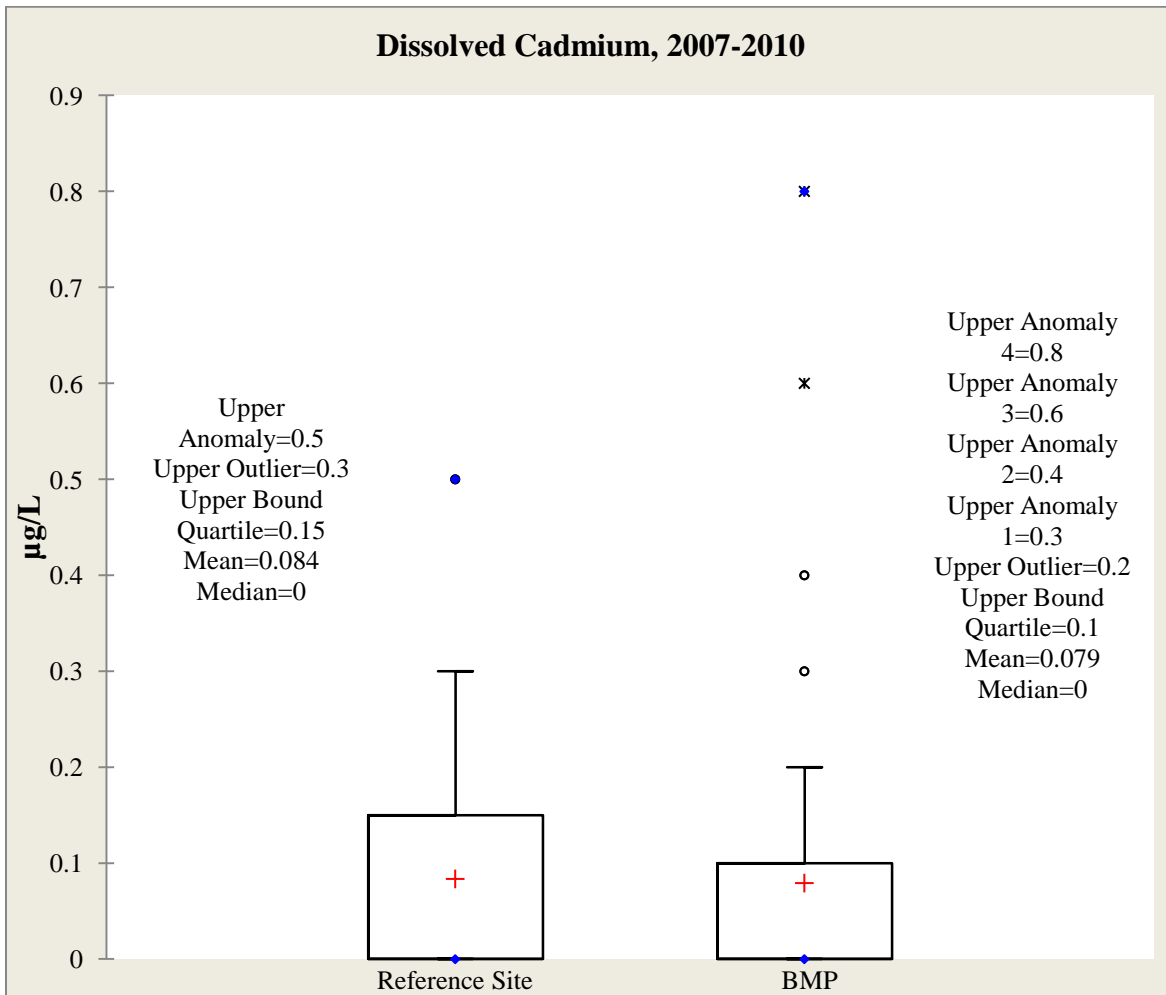


**Figure 28. Dissolved Selenium Concentrations at the Reference Site and BMP**

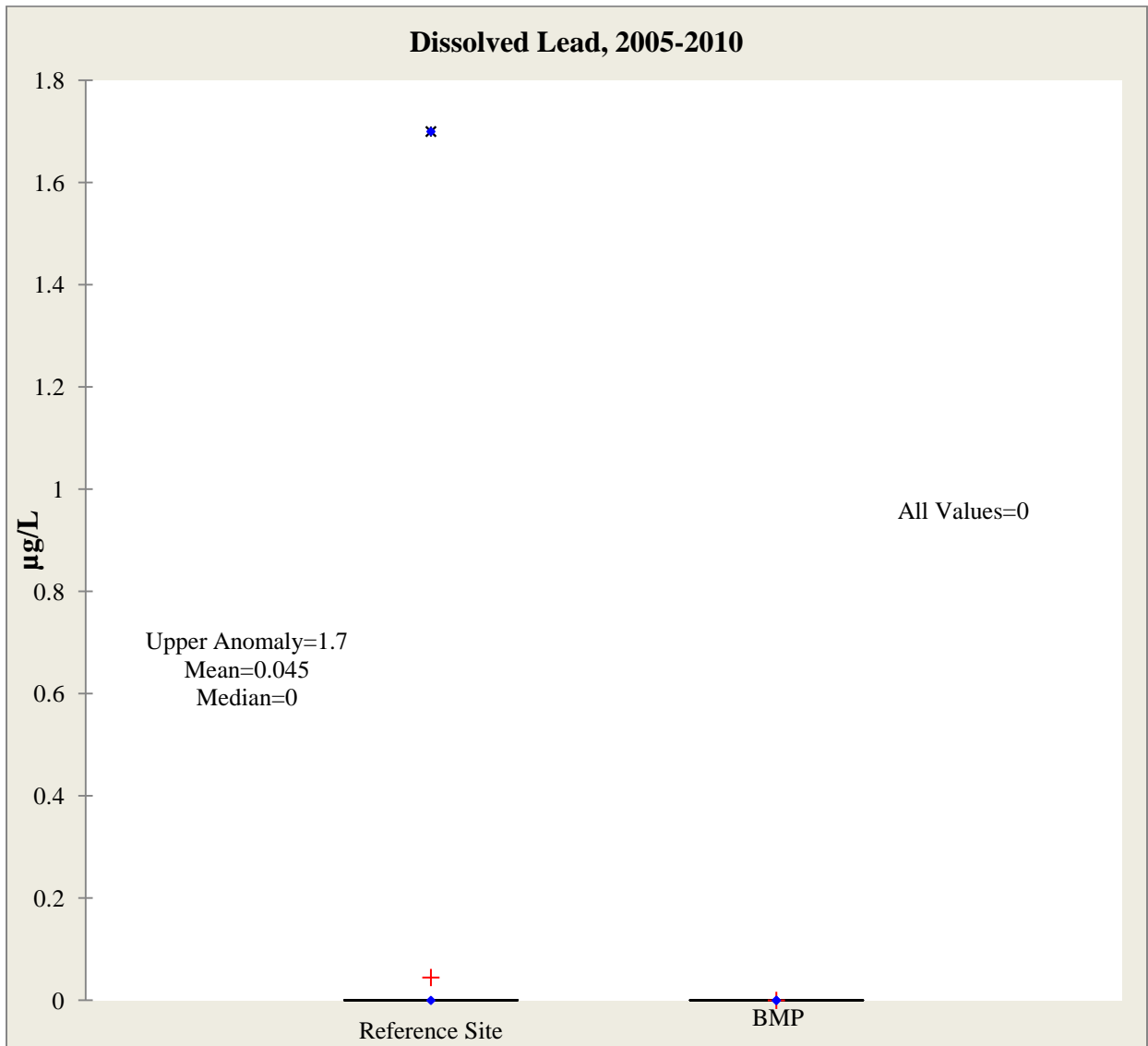


**Figure 29. Dissolved Silver Concentrations at the Reference Site and BMP**

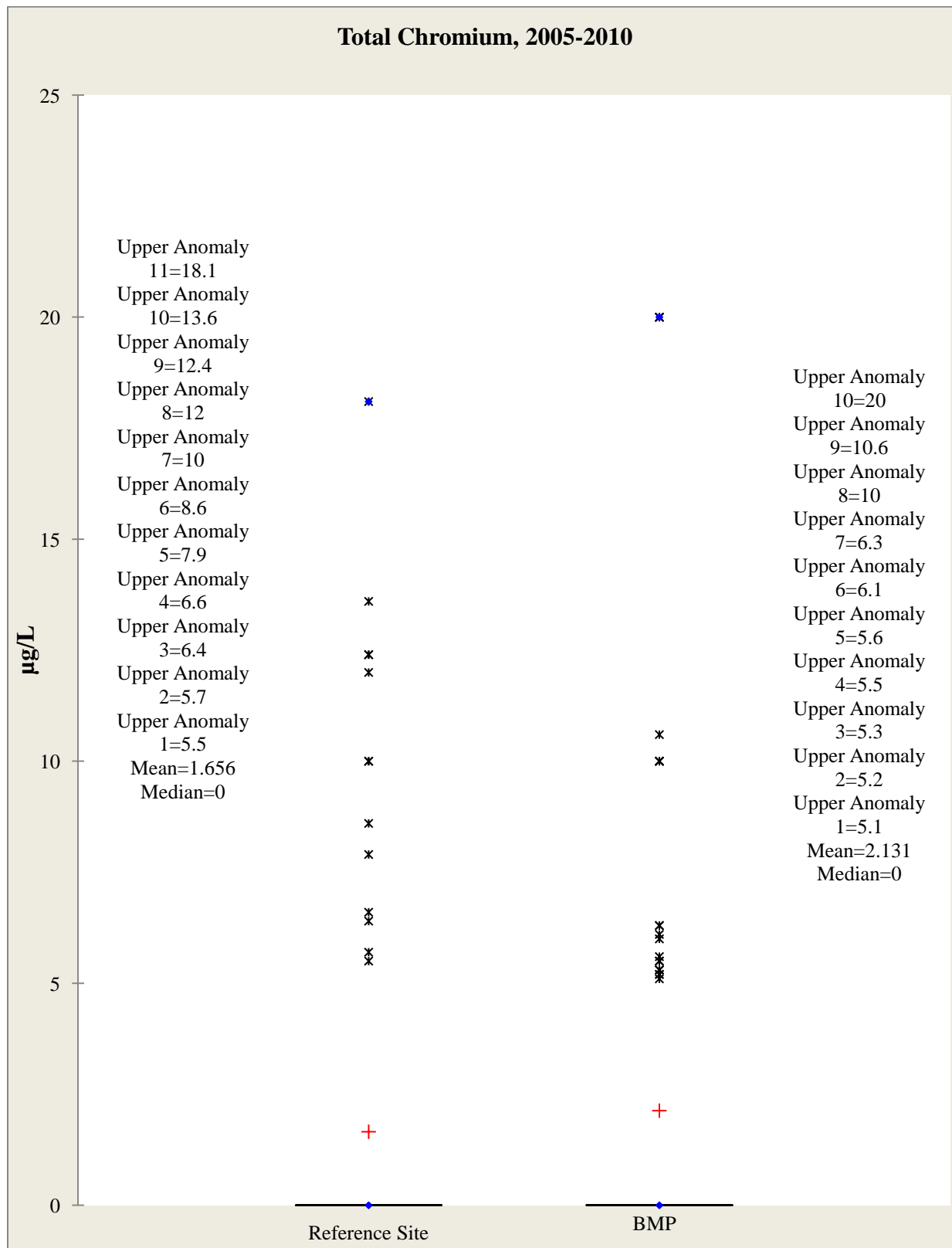




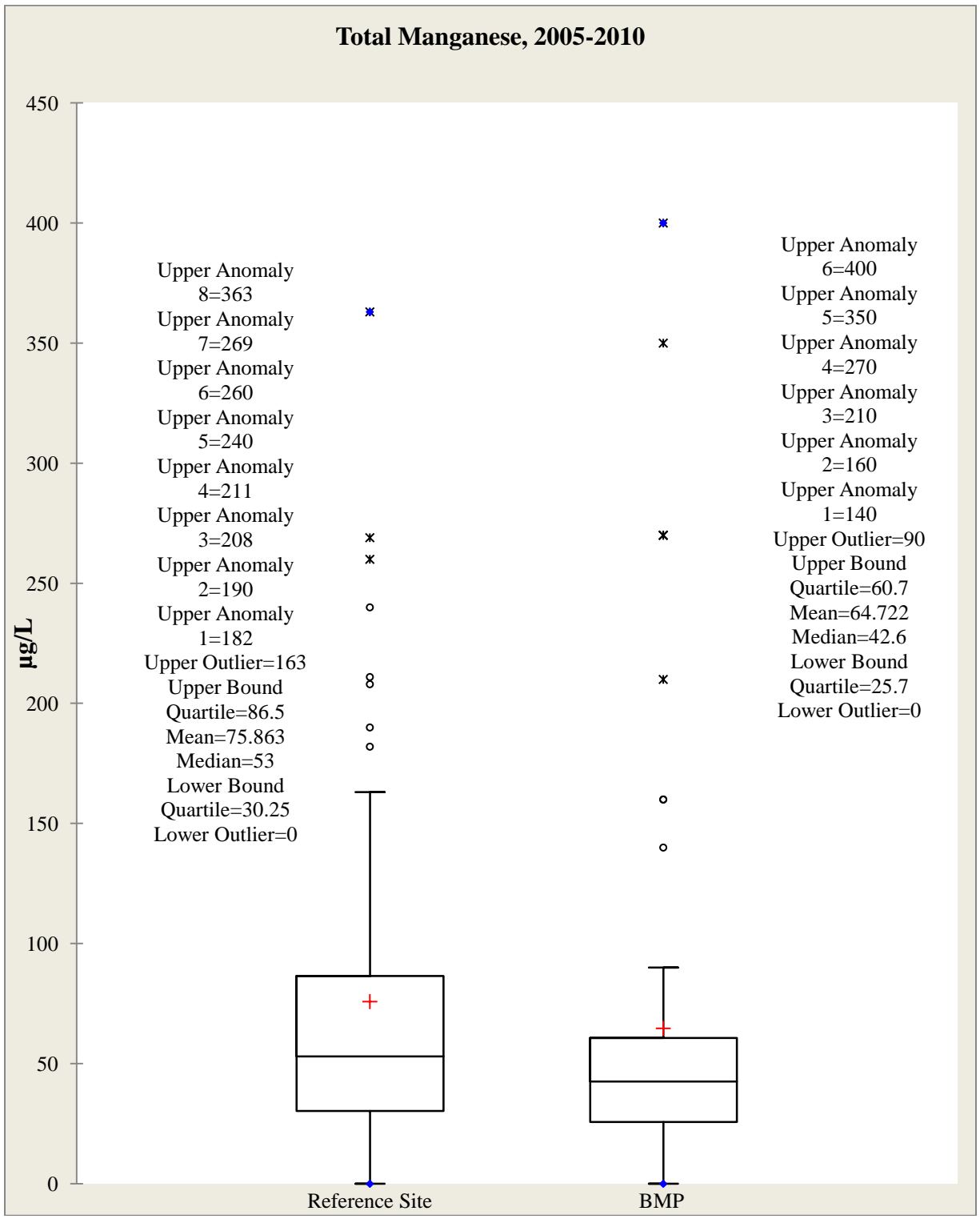
**Figure 30. Dissolved Cadmium Concentrations at the Reference Site and BMP**



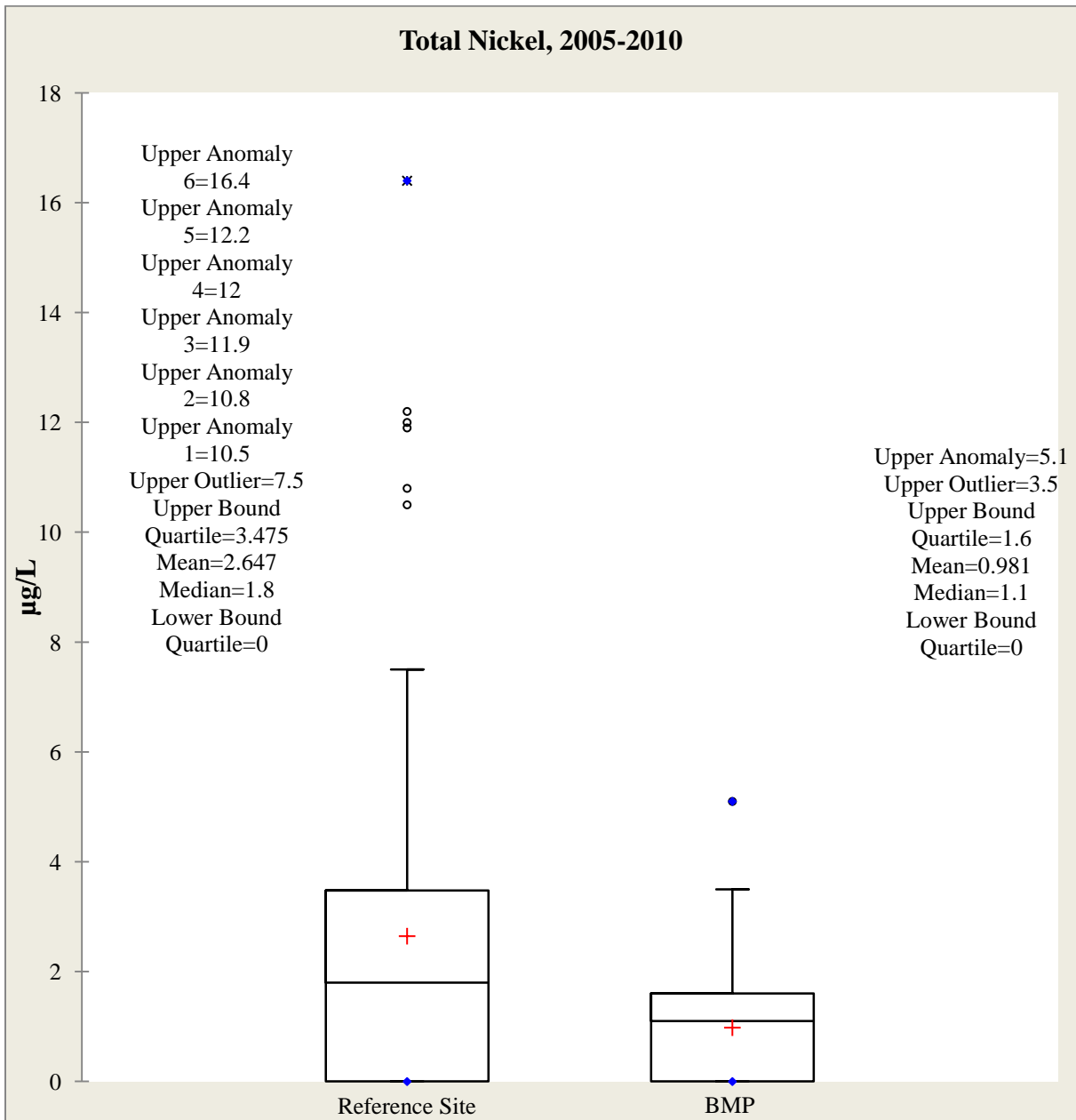
**Figure 31. Dissolved Lead Concentrations at the Reference Site and BMP**



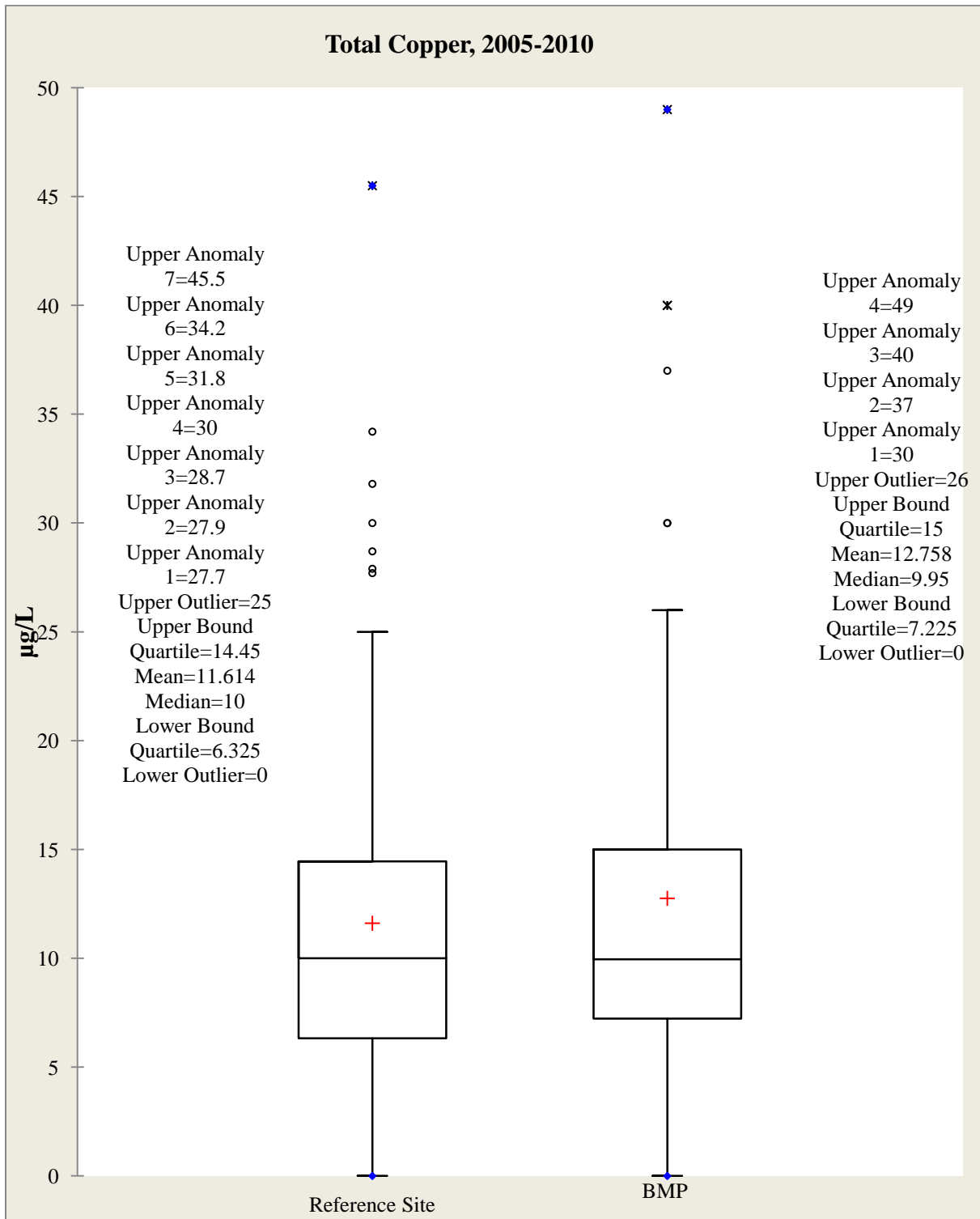
**Figure 32. Total Chromium Concentrations at the Reference Site and BMP**



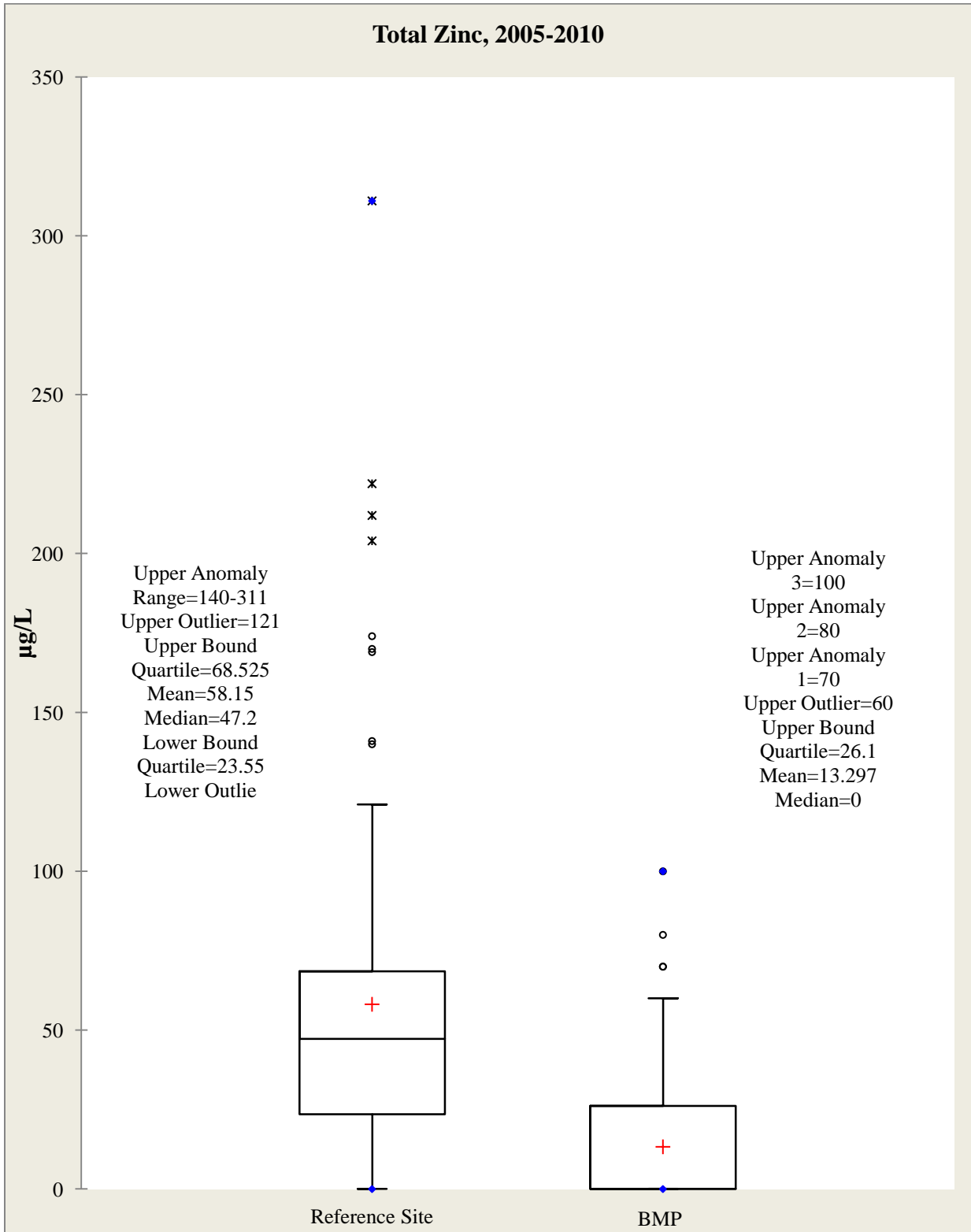
**Figure 33. Total Manganese Concentrations at the Reference Site and BMP**



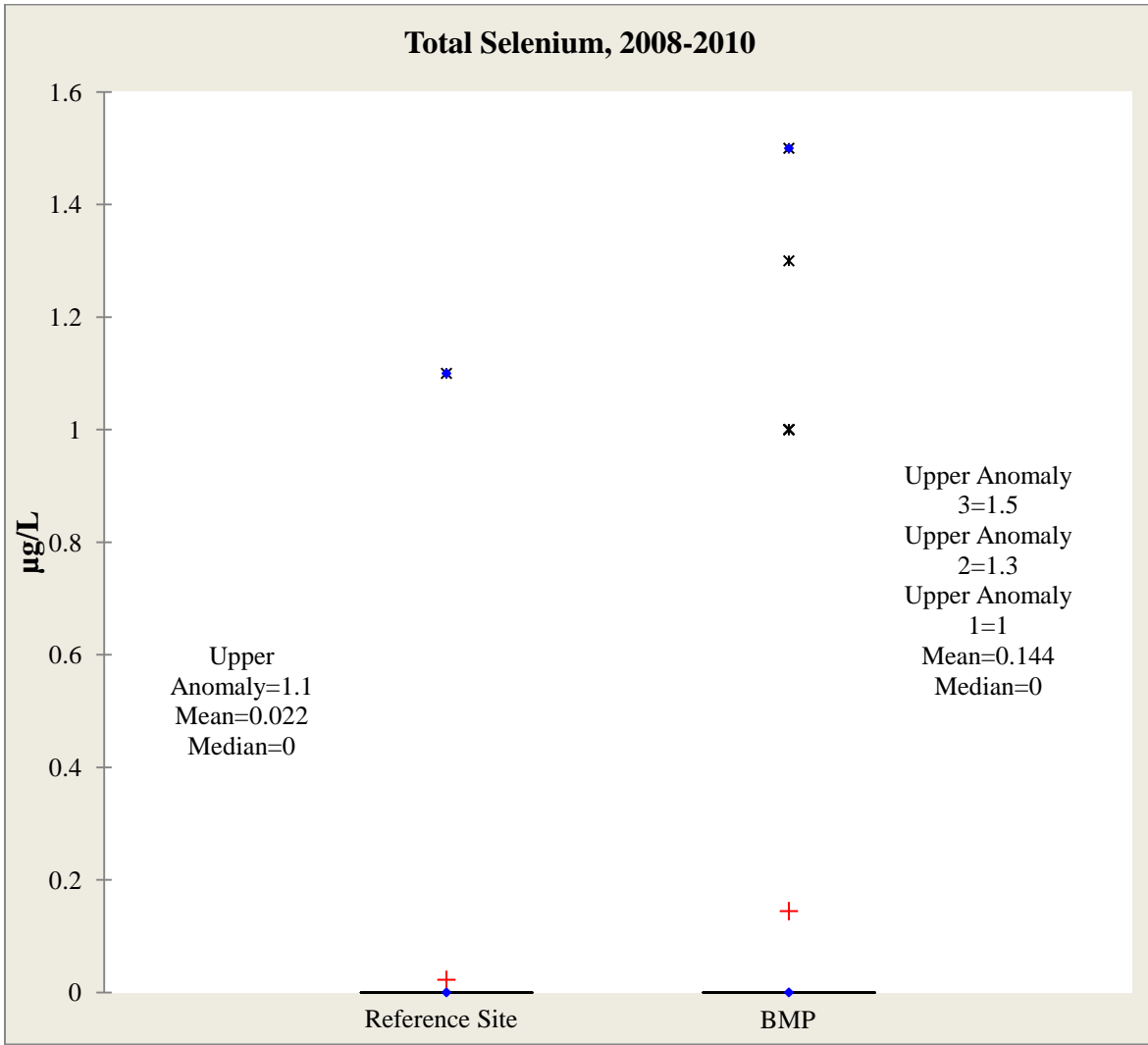
**Figure 34. Total Nickel Concentrations at the Reference Site and BMP**



**Figure 35. Total Copper Concentrations at the Reference Site and BMP**

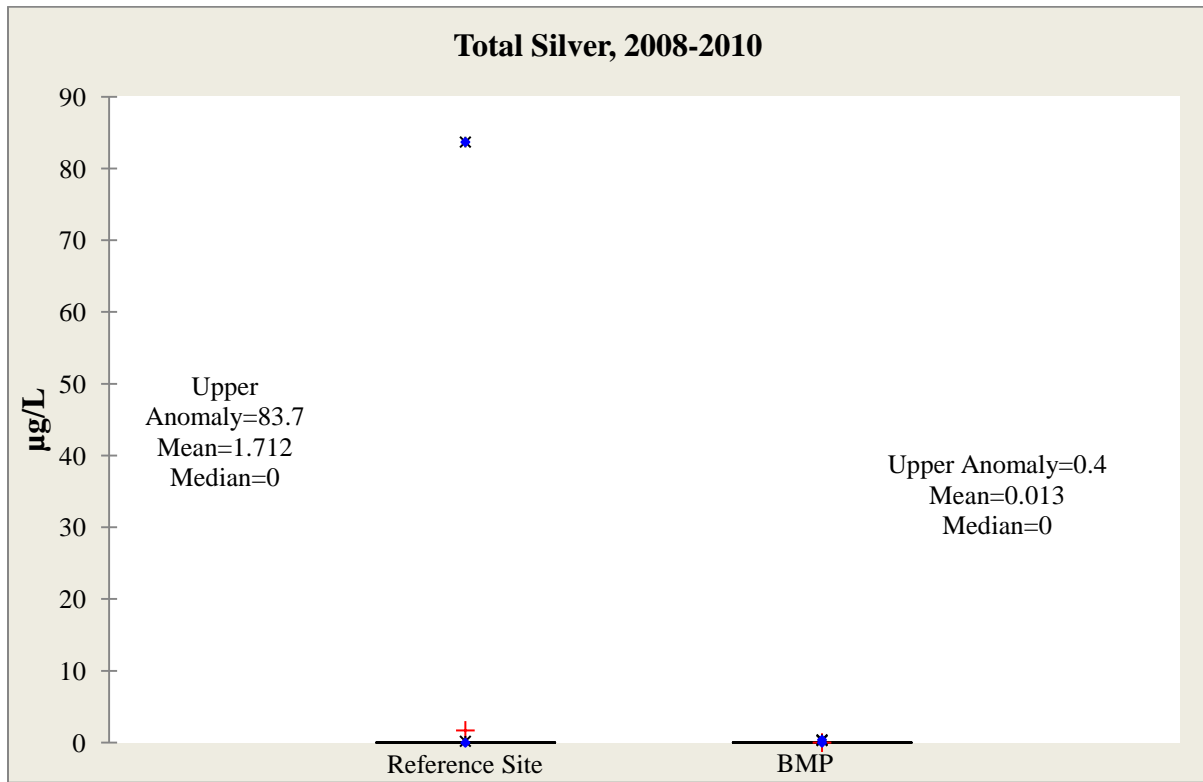


**Figure 36. Total Zinc Concentrations at the Reference Site and BMP**

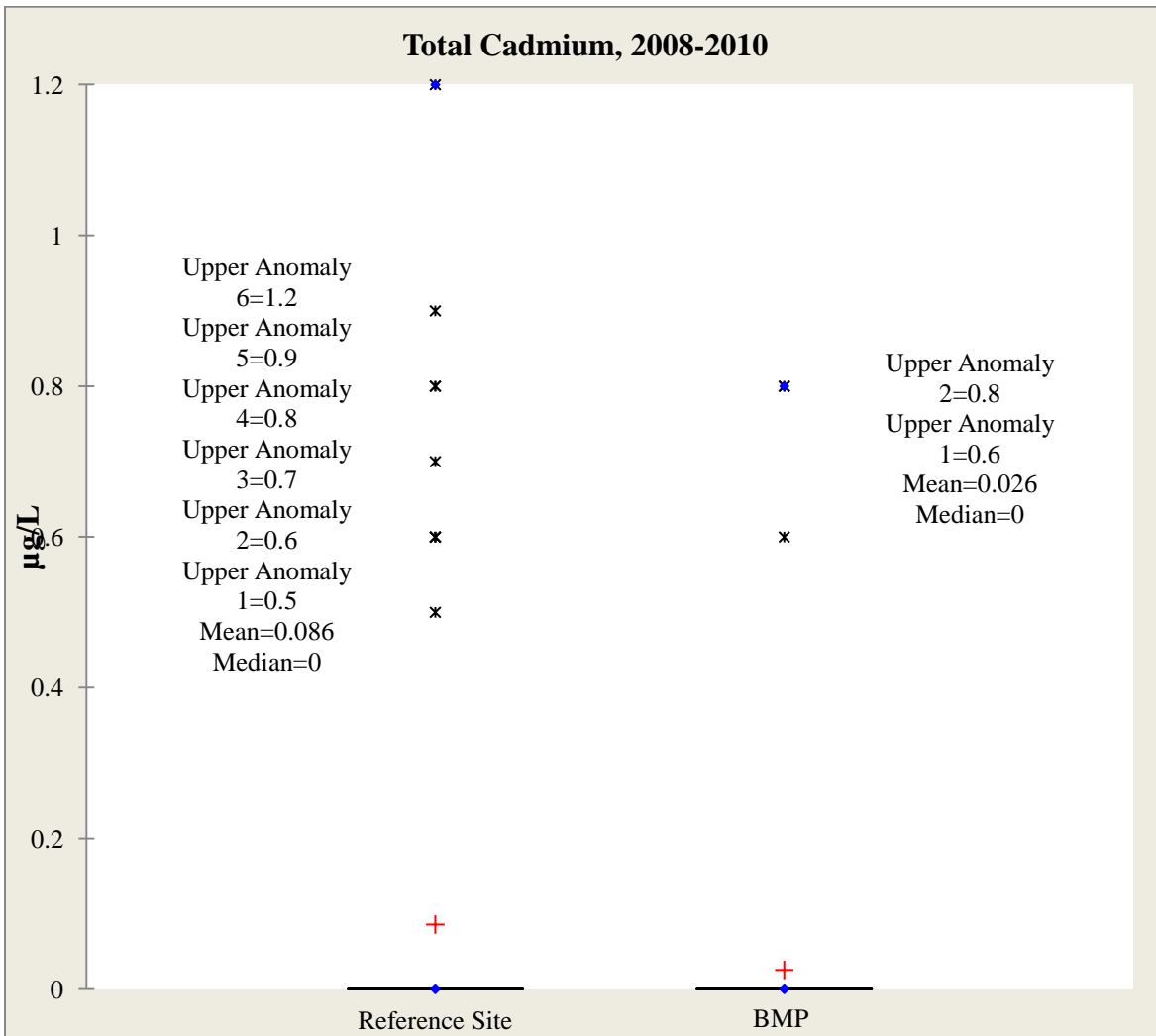


**Figure 37. Total Selenium Concentrations at the Reference Site and BMP**

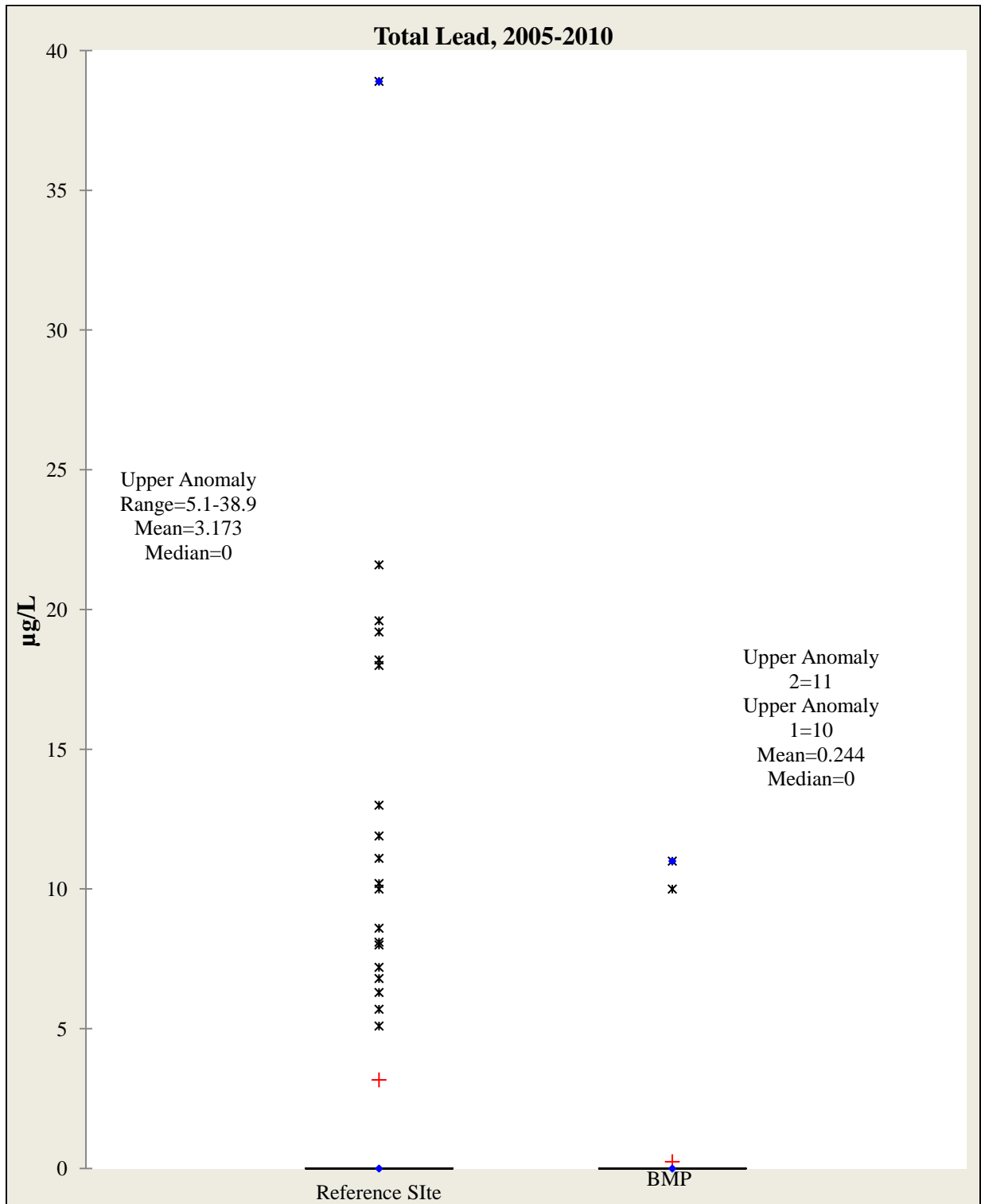




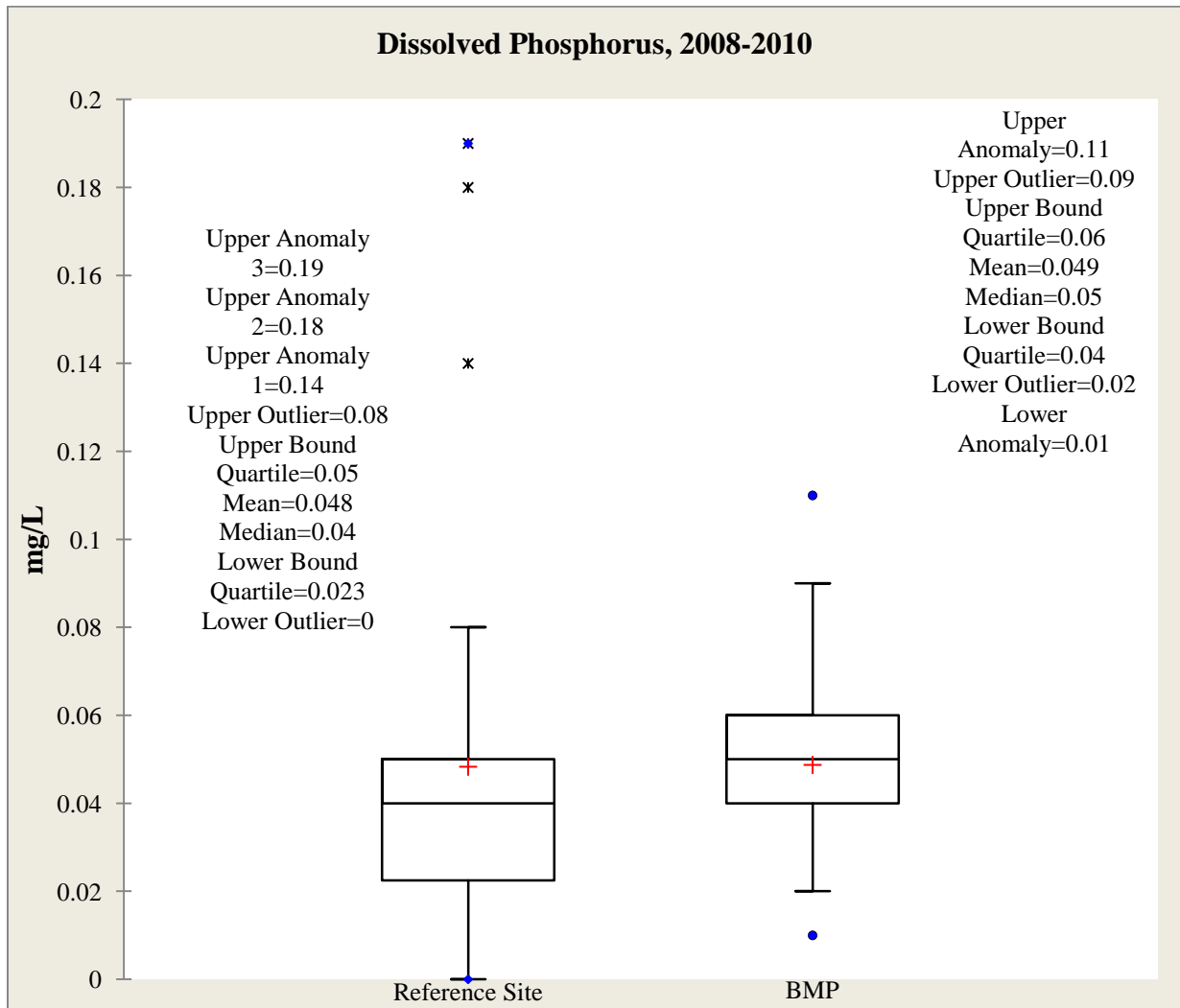
**Figure 38. Total Silver Concentrations at the Reference Site and BMP**



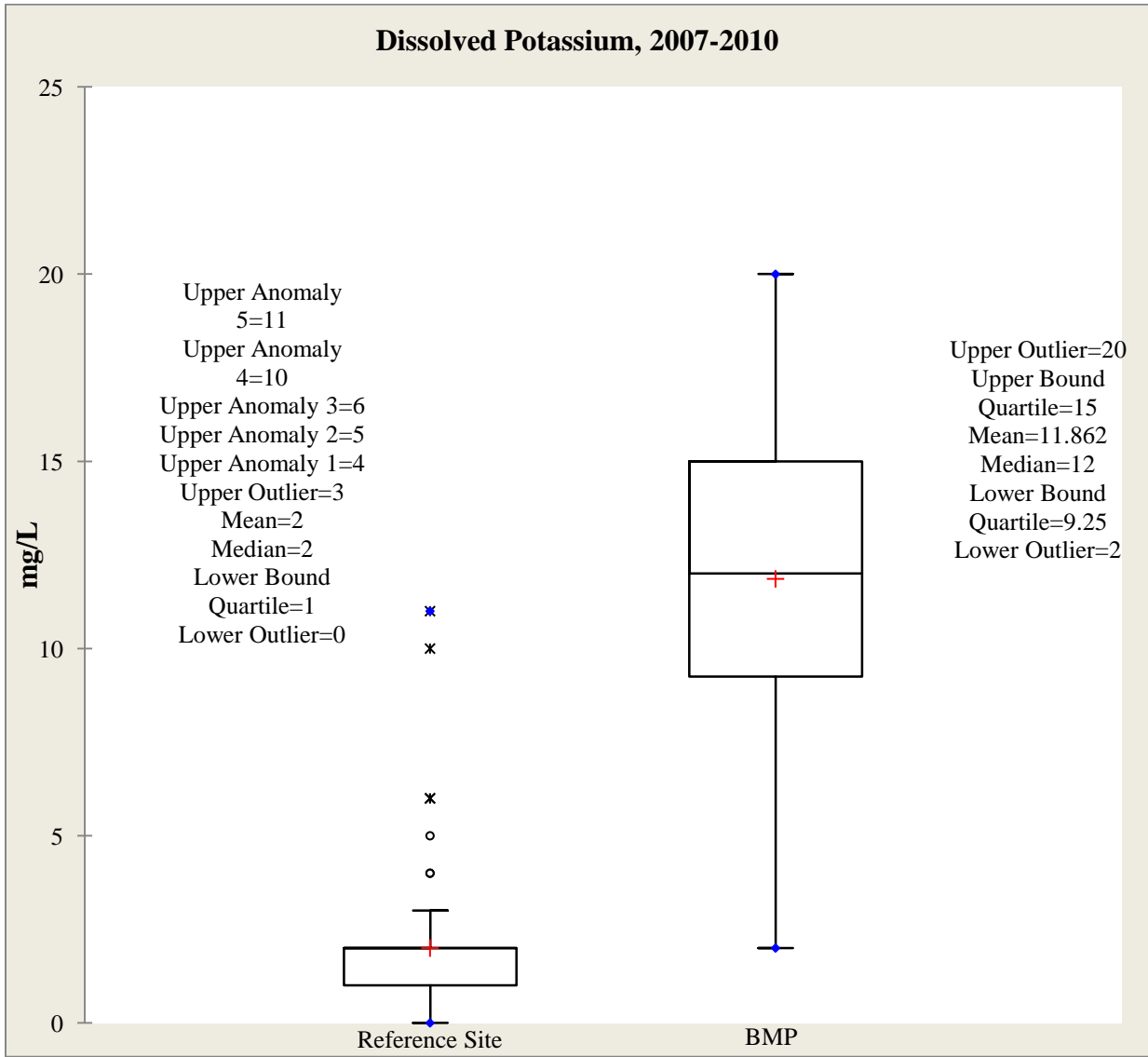
**Figure 39. Total Cadmium Concentrations at the Reference Site and BMP**



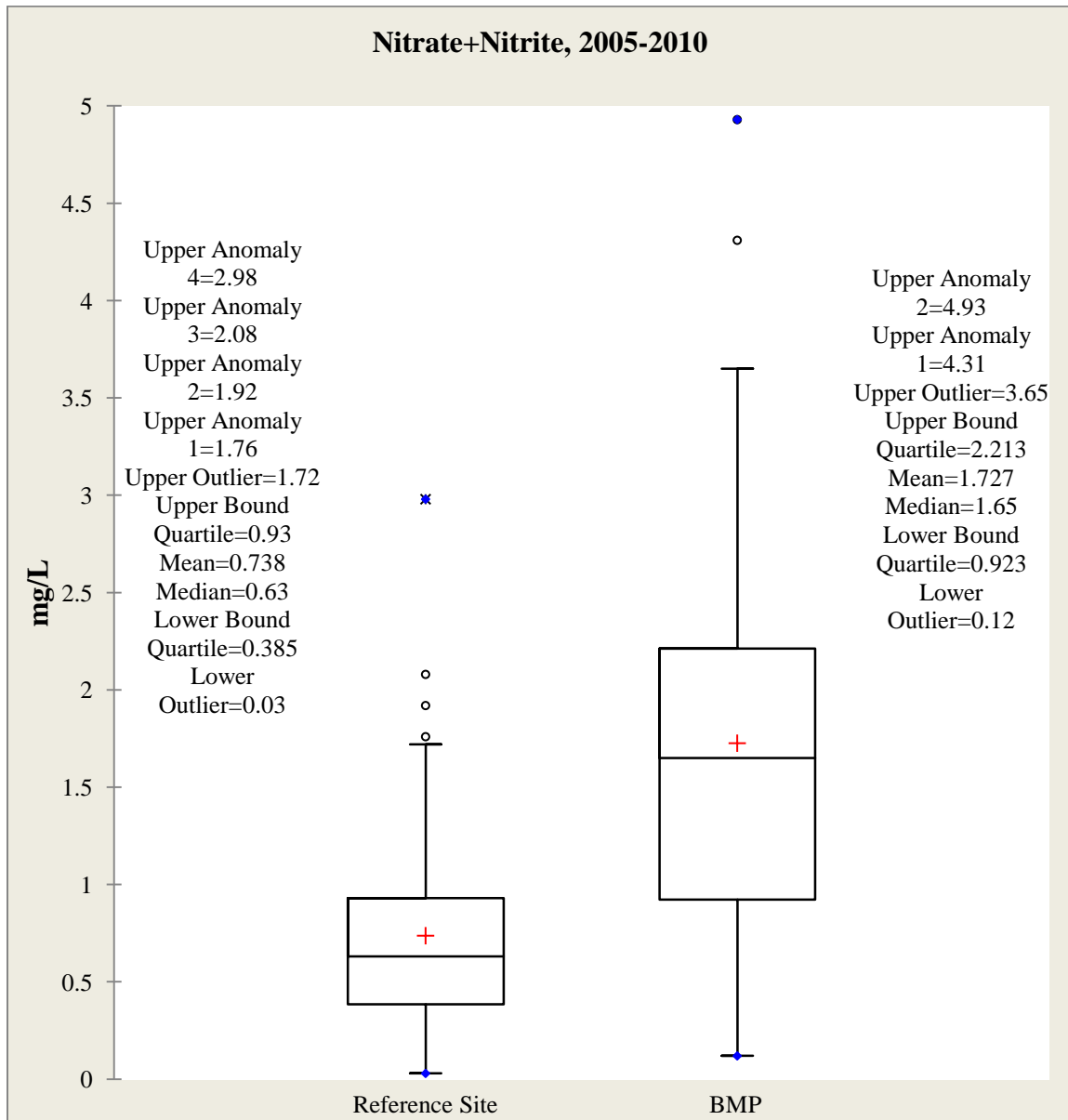
**Figure 40. Total Lead Concentrations at the Reference Site and BMP**



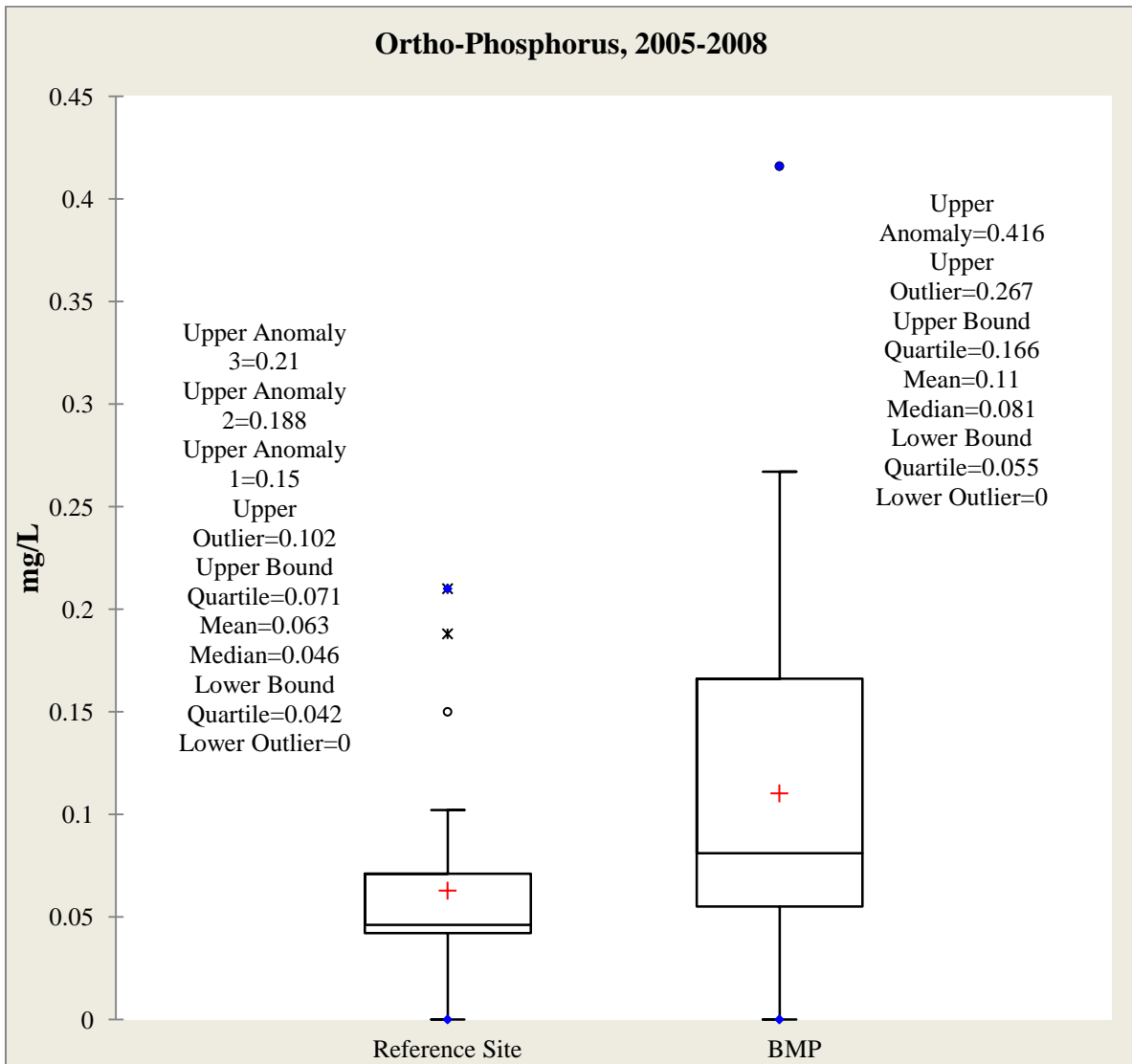
**Figure 41. Dissolved Phosphorus Concentrations at the Reference Site and BMP**



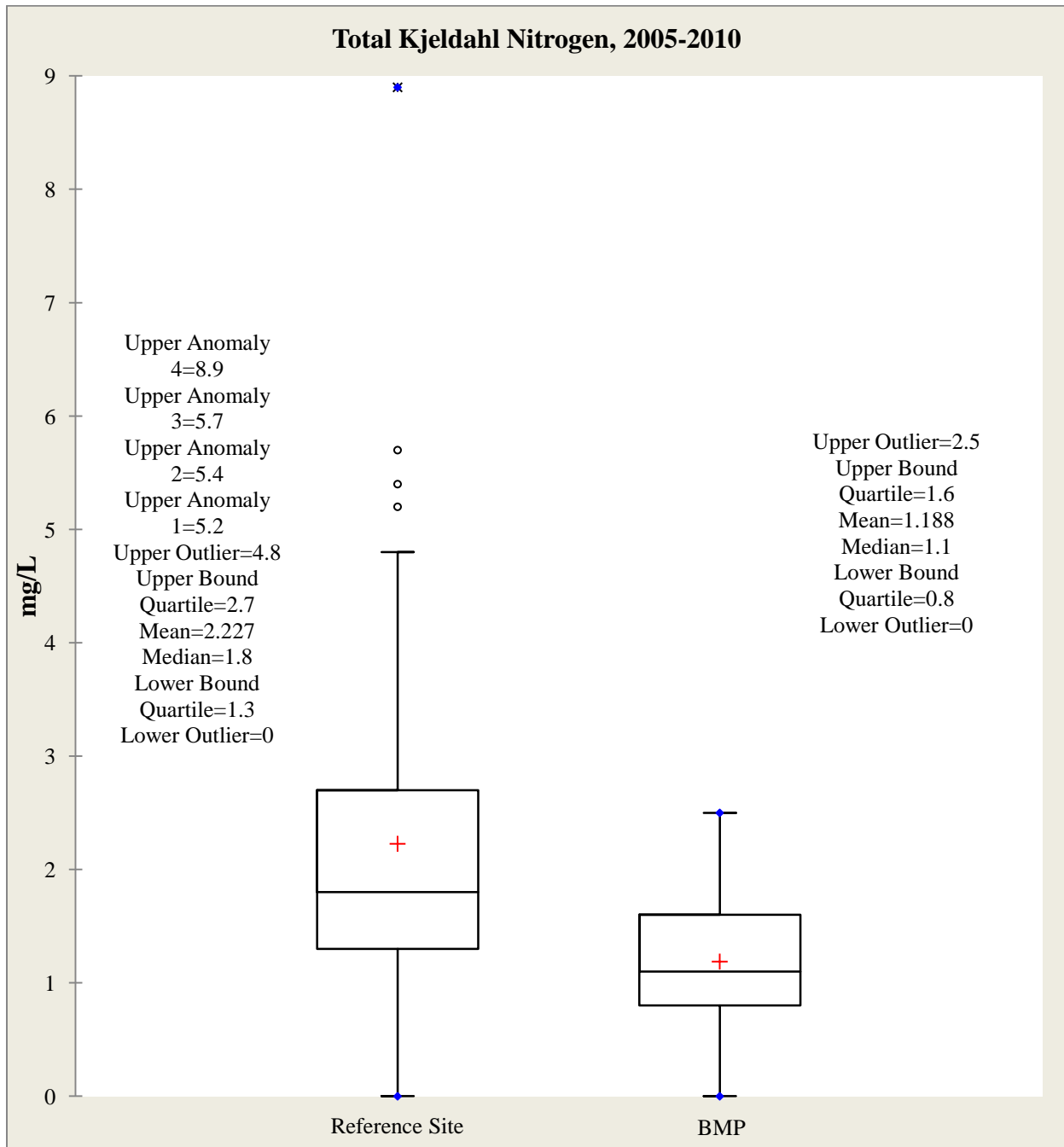
**Figure 42. Dissolved Potassium Concentrations at the Reference Site and BMP**



**Figure 43. Nitrite+Nitrate Concentrations at the Reference Site and BMP**

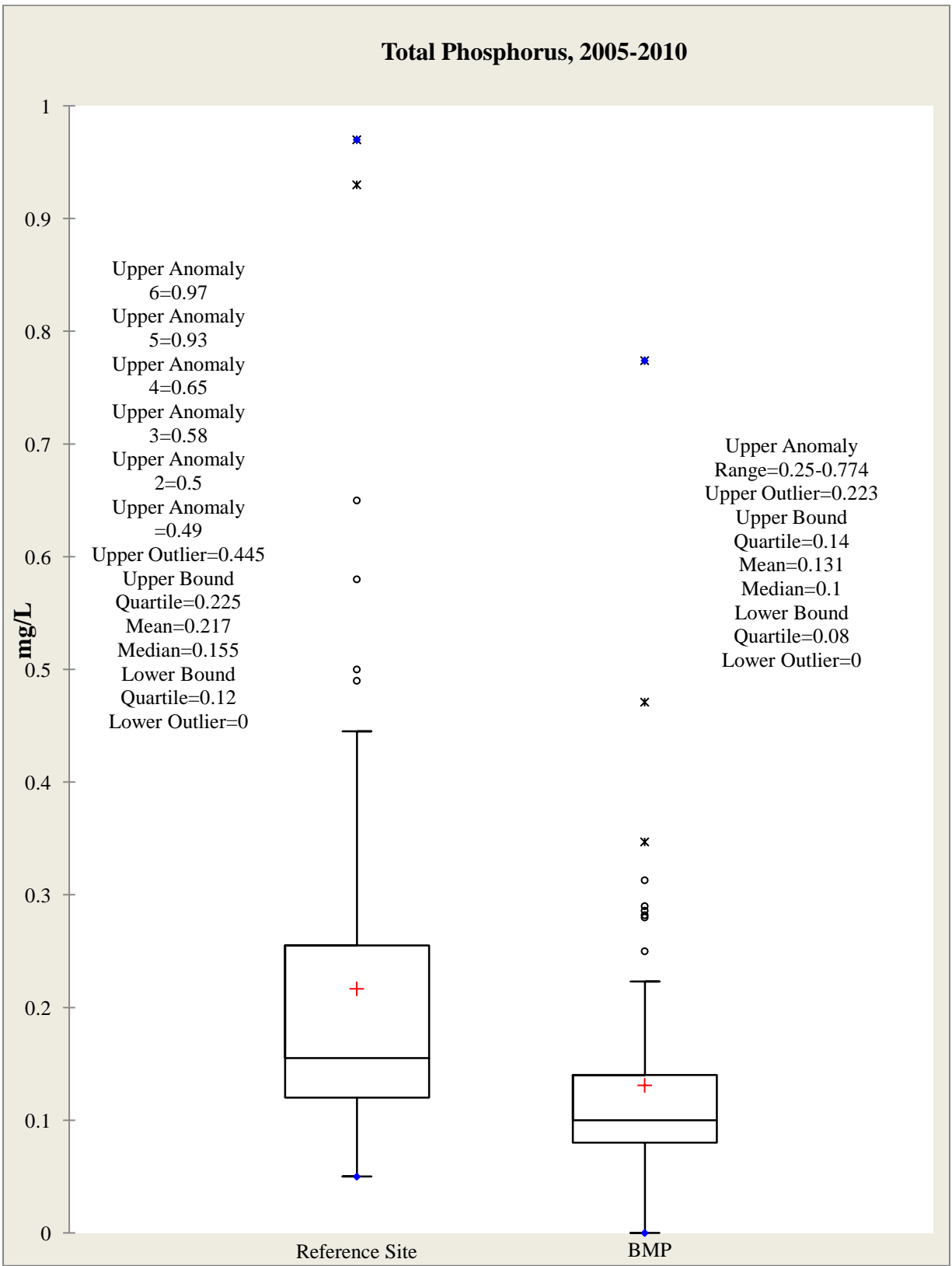


**Figure 44. Ortho-Phosphorus Concentrations at the Reference Site and BMP**

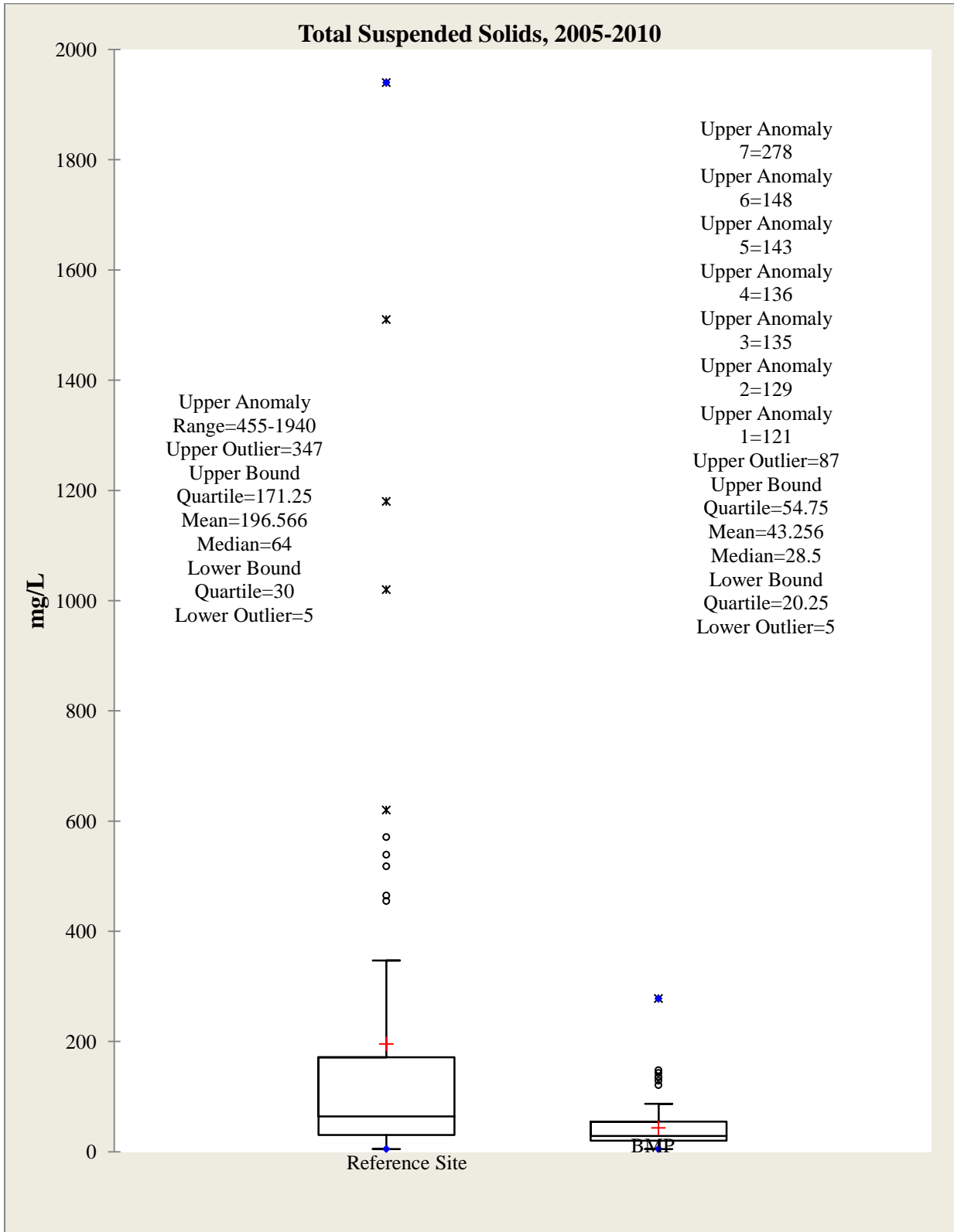


**Figure 45. Total Kjeldahl Nitrogen Concentrations at the Reference Site and BMP**





**Figure 46. Total Phosphorus Concentrations at the Reference Site and BMP**



**Figure 47. Total Suspended Solids at the Reference Site and BMP**

## V. Conclusion

Although the wearing course of the pavement has become relatively clogged due to lack of maintenance, runoff is also enters the pavement at the pavement interface with lateral barrier walls and flows through the sand filter layer into the underdrain. Efforts to increase infiltration should continue.

Calculations show that this BMP may provide volume reduction between 24 to 38%; however, due to inconsistencies observed in the data, a low level of accuracy in this value is assumed.

Water quality data shows a high number of statistically significant differences between reference and BMP sites. Most of the data was highly significant, about half of the constituents were in lower concentrations at the pervious concrete and half were in higher concentrations. Except for Total Copper and Total Manganese, none of the constituents that were in a significantly higher concentration in effluent from the reference site or BMP site in one year were significantly lower for another year. Total Copper data show a decrease in concentration in the BMP effluent of the 5 years of study. It is significantly high in BMP effluent in 2006 and 2007 and significantly lower in the BMP effluent in 2010. With the exception of 2005 data, Total Manganese also shows a decline in concentration over time. It is significantly higher at the BMP outlet in 2006 and significantly lower in 2010. Based on this study, this BMP provides significant reductions in several targeted constituents including Total Suspended Solids, Total Phosphorus, Total Kjeldahl Nitrogen, Chemical Oxygen Demand, and several dissolved and total metals. The most problematic water quality issue may be the increase in pH observed in the BMP effluent, with both mean and median values for combined years data above nine and no downward trend of this constituent.

Water quality constituent concentrations can be compared with other permeable pavement studies found in the International Stormwater BMP database, as summarized in Table 53, which is adapted from Table 2-2 in Volume 3 of the USDCM. The database values are fairly consistent with those produced by this study. Water quality data for the reference site can also be compared to commercial runoff data from the Denver Regional Urban Runoff Program (DRURP), as summarized in Table 54. The commercial DRURP data and the reference site data are also fairly consistent.

**Table 53. Comparison of Median Constituents for the Pervious Concrete at Lakewood Maintenance Shops and the International Stormwater BMP Database**

Water Quality Constituent	Lakewood Shops Pervious Concrete		International Stormwater BMP Database	
	Reference Median Value	BMP Median Value	Inlet Median Value	Outlet Median Value
Total Phosphorus (mg/L)	0.155	0.1	0.12	0.13
Total Suspended Solids (mg/L)	64	28.5	23.5	29.1
Total Kjeldahl Nitrogen (mg/L)	1.8	1.1	2.4	1.05
Nitrite+Nitrate (mg/L)	0.63	1.65	0.59	1.24
Total Cadmium (µg/L)	0	0	NA	0.3
Dissolved Copper (µg/L)	5	6.2	5	6.2
Total Copper (µg/L)	10	9.95	7	9
Dissolved Lead (µg/L)	0	0	0.1	0.3
Total Lead (µg/L)	0	0	2.5	2.5
Dissolved Zinc (µg/L)	11.9	0	25	14.6
Total Zinc (µg/L)	47.2	0	50	22

NA=Not Analyzed

**Table 54. Event Mean Concentration of Constituents for Commercial DRURP Data and the Reference Site and BMP at Lakewood Maintenance Shops**

Constituent	EMC Commercial DRURP Mean Concentration	EMC Reference Site Mean Concentration	EMC BMP Mean Concentration
Total Phosphorus (mg/L)	0.42	0.22	0.13
Ortho-Phosphorus, (mg/L)	0.15	0.06	0.11
Total Kjeldahl Nitrogen (mg/L)	2.3	2.23	1.19
Nitrate+Nitrite (mg/L)	0.96	0.74	1.73
Total Lead (µg/L)	0.06	3.17	0.24
Total Zinc (µg/L)	0.24	58.15	13.29
Total Copper (µg/L)	0.04	11.61	12.76
Total Cadmium (µg/L)	0.001	0.09	0.03
Chemical Oxygen Demand	173	138.75	49.00
Total Organic Carbon (mg/L)	40	18.81	14.58
Total Suspended Solids (mg/L)	225	195.57	43.26

## VI. References

Geosyntec Consultants, Inc., and Wright Water Engineers, Inc. 2010. *International Stormwater Best Management Practices (BMP) Database Pollutant Category Summary: Nutrients*. <http://bmpdatabase.org/Docs/BMP%20Database%20Nutrients%20Paper%20December%202010%20Final.pdf>. (June 14, 2011).

International Stormwater Best Management Practices (BMP) data base: [www.bmpdatabase.org](http://www.bmpdatabase.org). (June 14, 2011).

Urban Drainage and Flood Control District (UDFCD). 2001. *Urban Storm Drainage Criteria Manual – Volume 1 and 2*. Updated and maintained by UDFCD. Denver, Colorado

Urban Drainage and Flood Control District (UDFCD). 2010. *Urban Storm Drainage Criteria Manual – Volume 3*. Updated and maintained by UDFCD. Denver, Colorado

## Appendix A

**Table A-1. Significance of Differences in Constituent Concentrations at Reference Site and BMP (2005)**

Constituent	Two Sample T-Test	Wilcoxon Signed Rank Test	Paired T-Test
Alkalinity	<b>0.005009</b>	<b>0.01563</b>	<b>0.007112</b>
Conductivity	<b>4.341 E-5</b>	<b>0.01563</b>	<b>3.903 E-5</b>
Hardness	0.11	0.1094	0.1047
pH	<b>6.28 E-5</b>	<b>0.02225</b>	<b>0.0009941</b>
Total Organic Carbon	0.2915	0.5625	0.347
Dissolved Iron	0.2835	0.235	0.1738
Dissolved Chromium	NA	NA	NA
Dissolved Manganese	<b>0.03503</b>	0.1493	0.08752
Dissolved Nickel	NA	NA	NA
Dissolved Copper	1	1	1
Dissolved Zinc	<b>0.003872</b>	<b>0.01563</b>	<b>0.004727</b>
Dissolved Lead	NA	NA	NA
Total Beryllium	NA	NA	NA
Total Chromium	1	1	1
Total Manganese	0.752	0.7525	0.6914
Total Nickel	NA	NA	NA
Total Copper	0.7096	0.7247	0.5882
Total Zinc	<b>0.008523</b>	<b>0.0213</b>	<b>0.002269</b>
Total Cadmium	NA	NA	NA
Total Antimony	NA	NA	NA
Total Lead	NA	NA	NA
Nitrite+Nitrate	0.2647	0.1953	0.1418
Ortho-Phosphorus	0.1245	0.05906	0.1065
Total Kjeldahl Nitrogen	0.1165	0.1275	0.09551
Total Phosphorus	0.5877	0.5781	0.56
Total Suspended Solids	0.8	0.9375	0.7716

**Table A-2. Significance of Differences in Constituent Concentrations at Reference Site and BMP (2006)**

Constituent	Two Sample T-Test	Wilcoxon Signed Rank Test	Paired T-Test
Alkalinity	<b>0.0005788</b>	<b>0.03125</b>	<b>0.000879</b>
Conductivity	<b>0.0273</b>	0.1563	0.05959
Hardness	0.8625	1	0.8332
pH	<b>1.317 E-9</b>	<b>0.03125</b>	<b>1.74E-07</b>
Total Organic Carbon	0.5632	0.7525	0.3962
Dissolved Iron	0.08551	0.05791	0.06101
Dissolved Chromium	NA	NA	NA
Dissolved Manganese	0.0781	0.1736	0.0781
Dissolved Nickel	NA	NA	NA
Dissolved Copper	<b>0.01648</b>	0.05906	0.1319
Dissolved Zinc	<b>0.02948</b>	0.1875	0.1016
Dissolved Lead	NA	NA	NA
Total Beryllium	NA	NA	NA
Total Chromium	0.3632	1	0.3632
Total Manganese	<b>0.01628</b>	<b>0.03552</b>	<b>0.0196</b>
Total Nickel	NA	NA	NA
Total Copper	<b>0.02074</b>	0.05848	<b>0.01937</b>
Total Zinc	0.5407	0.7518	0.5343
Total Cadmium	NA	NA	NA
Total Antimony	NA	NA	NA
Total Lead	NA	NA	NA
Nitrite+Nitrate	<b>0.0002669</b>	<b>0.03125</b>	<b>0.0003743</b>
Ortho-Phosphorus	0.1721	0.0625	<b>0.04504</b>
Total Kjeldahl Nitrogen	0.3355	0.1563	0.1892
Total Phosphorus	0.2743	0.6875	0.3049
Total Suspended Solids	0.3052	0.2188	0.1902

**Table A-3. Significance of Differences in Constituent Concentrations at Reference Site and BMP (2007)**

Constituent	Two Sample T-Test	Wilcoxon Signed Rank Test	Paired T-Test
Alkalinity	<b>1.599 E-5</b>	<b>0.002441</b>	<b>1.985 E-5</b>
Conductivity	<b>0.007923</b>	<b>0.006104</b>	<b>0.009745</b>
Hardness	<b>0.03871</b>	<b>0.02066</b>	<b>0.03252</b>
pH	<b>8.203 E-9</b>	<b>0.001651</b>	<b>6.459 E-9</b>
Total Organic Carbon	0.4118	0.125	0.3774
Dissolved Calcium	0.2262	0.2665	0.2739
Dissolved Iron	0.549	0.3278	0.3594
Dissolved Magnesium	0.9225	1	0.9052
Dissolved Sodium	<b>0.01758</b>	0.125	<b>0.01733</b>
Dissolved Chromium	0.07587	0.1003	<b>0.04847</b>
Dissolved Manganese	<b>0.01239</b>	<b>0.0131</b>	<b>0.008774</b>
Dissolved Nickel	0.09714	0.08897	<b>0.04063</b>
Dissolved Copper	0.0784	<b>0.02586</b>	<b>0.0221</b>
Dissolved Zinc	<b>0.03756</b>	<b>0.02249</b>	<b>0.03671</b>
Dissolved Selenium	0.1833	0.3711	0.1833
Dissolved Silver	NA	NA	NA
Dissolved Cadmium	1	1	1
Dissolved Lead	NA	NA	NA
Total Beryllium	NA	NA	NA
Total Chromium	0.136	0.1736	0.1039
Total Nickel	NA	NA	NA
Total Copper	0.06469	<b>0.01489</b>	<b>0.01169</b>
Total Zinc	0.08901	<b>0.03208</b>	0.05637
Total Cadmium	NA	NA	NA
Total Antimony	NA	NA	NA
Total Lead	0.8971	1	0.8354
Dissolved Potassium	<b>0.001344</b>	0.125	<b>0.002619</b>
Nitrite+Nitrate	<b>0.02779</b>	<b>0.02148</b>	<b>0.02349</b>
Ortho-Phosphorus	0.4766	0.3757	0.2419
Total Kjeldahl Nitrogen	<b>0.02489</b>	<b>0.006692</b>	<b>0.005014</b>
Total Phosphorus	0.6941	0.4648	0.6131
Total Suspended Solids	0.2566	0.1294	0.1479



**Table A-4. Significance of Differences of Constituent Concentrations at Reference Site and BMP (2008)**

Constituent	Two Sample T-Test	Wilcoxon Signed Rank Test	Paired T-Test
Alkalinity	0.6627	0.625	0.7668
Conductivity	0.5989	0.625	0.7186
Hardness	0.8274	0.8539	0.8239
pH	0.675	0.625	0.7744
Total Organic Carbon	1	1	1
Dissolved Calcium	0.2994	0.1148	0.09071
Dissolved Iron	0.8221	1	0.8337
Dissolved Magnesium	0.1843	0.1344	0.1412
Dissolved Sodium	0.6159	0.8438	0.6481
Dissolved Chromium	0.1203	0.2188	0.1756
Dissolved Manganese	0.3104	0.3125	0.3422
Dissolved Nickel	0.5941	0.8551	0.6159
Dissolved Copper	0.7694	0.7874	0.8083
Dissolved Zinc	0.2191	0.4375	0.3497
Dissolved Selenium	0.9158	1	0.3623
Dissolved Silver	0.3632	1	0.3632
Dissolved Cadmium	0.09773	0.1362	0.1067
Dissolved Lead	0.3632	1	0.3632
Total Beryllium	NA	NA	NA
Total Chromium	NA	NA	NA
Total Manganese	0.2013	0.1563	0.2259
Total Nickel	0.3138	0.2188	0.2451
Total Copper	0.7412	0.6875	0.7487
Total Zinc	0.8661	1	0.8823
Total Arsenic	NA	NA	NA
Total Selenium	0.3632	1	0.3632
Total Molybdenum	NA	NA	NA
Total Silver	NA	NA	NA
Total Cadmium	0.1756	0.3711	0.1756
Total Antimony	NA	NA	NA
Total Lead	NA	NA	NA
Dissolved Potassium	<b>0.03646</b>	0.1378	0.1237
Nitrite+Nitrate	0.109	0.2188	0.1466
Ortho-Phosphorus	0.3643	0.4227	0.3227
Total Kjeldahl Nitrogen	0.7578	0.8438	0.7097
Total Phosphorus	0.4485	1	0.3447
Total Suspended Solids	0.7408	1	0.7137

**Table A-5. Significance of Differences of Constituent Concentrations at Reference Site and BMP (2009)**

Constituent	Two Sample T-Test	Wilcoxon Signed Rank Test	Paired T-Test
Chemical Oxygen	<b>0.006589</b>	<b>0.000241</b>	<b>0.003309</b>
Chloride	<b>7.32 E-8</b>	<b>0.0002689</b>	<b>2.442 E-6</b>
Dissolved Calcium	<b>1.32 E-7</b>	<b>0.0001313</b>	<b>3.529 E-6</b>
Dissolved Iron	<b>1.366 E-5</b>	<b>0.0007064</b>	<b>0.0001204</b>
Dissolved Magnesium	<b>0.0001079</b>	<b>0.0004144</b>	<b>0.0001304</b>
Dissolved Sodium	<b>2.154 E-15</b>	<b>1.925 E-5</b>	<b>2.03 E-15</b>
Dissolved Chromium	<b>8.778 E-13</b>	<b>1.937 E-5</b>	<b>2.907 E-12</b>
Dissolved Manganese	<b>0.006693</b>	<b>0.0006734</b>	<b>0.00805</b>
Dissolved Nickel	0.05872	<b>0.04383</b>	0.05541
Dissolved Copper	<b>0.0004042</b>	<b>0.0005174</b>	<b>6.033 E-3</b>
Dissolved Zinc	<b>0.002135</b>	<b>0.0001755</b>	<b>0.001181</b>
Dissolved Selenium	0.1617	0.3458	0.1617
Dissolved Silver	NA	NA	NA
Dissolved Cadmium	0.7661	0.774	0.6984
Dissolved Lead	NA	NA	NA
Total Beryllium	NA	NA	NA
Total Chromium	0.3416	0.2552	0.3857
Total Manganese	0.1356	0.1515	0.09545
Total Nickel	<b>0.02138</b>	<b>0.0031</b>	<b>0.01626</b>
Total Copper	0.5167	0.9394	0.4562
Total Zinc	<b>0.0003407</b>	<b>9.569 E-5</b>	<b>0.0001517</b>
Total Arsenic	NA	NA	NA
Total Selenium	0.08487	0.2034	0.1005
Total Molybdenum	NA	NA	NA
Total Silver	0.6576	1	0.6643
Total Cadmium	0.5368	0.4227	0.2291
Total Antimony	NA	NA	NA
Total Lead	<b>0.01648</b>	<b>0.009152</b>	<b>0.01648</b>
Dissolved Phosphorus	0.7792	0.4259	0.7752
Dissolved Potassium	<b>2.261 E-16</b>	<b>1.884 E-5</b>	<b>3.011 E-16</b>
Nitrite+Nitrate	<b>5.457 E-7</b>	<b>1.192 E-7</b>	<b>1.705 E-8</b>
Total Kjeldahl Nitrogen	<b>0.000745</b>	<b>0.0007445</b>	<b>0.0004181</b>
Total Phosphorus	<b>0.009865</b>	<b>0.0003307</b>	<b>0.005539</b>
Total Suspended Solids	<b>0.005972</b>	<b>2.468 E-5</b>	<b>0.004883</b>

**Table A-6. Significance of Differences of Constituent Concentrations at Reference Site and BMP (2010)**

Constituent	Two Sample T-Test	Wilcoxon Signed Rank Test	Paired T-Test
Chemical Oxygen Demand	<b>0.0008934</b>	<b>0.0008898</b>	<b>0.0001563</b>
Chloride	<b>3.28 E-7</b>	<b>6.104 E-5</b>	<b>2.318 E-7</b>
Dissolved Calcium	<b>0.000174</b>	<b>0.001072</b>	<b>2.674 E-5</b>
Dissolved Iron	0.1091	0.1415	0.09135
Dissolved Magnesium	<b>0.0004086</b>	<b>0.001091</b>	<b>0.0001009</b>
Dissolved Sodium	<b>8.525 E-9</b>	<b>0.0007247</b>	<b>2.415 E-8</b>
Dissolved Chromium	<b>3.115 E-8</b>	<b>0.001091</b>	<b>2.568 E-7</b>
Dissolved Manganese	<b>0.01099</b>	<b>0.0001221</b>	<b>0.004695</b>
Dissolved Nickel	<b>0.03335</b>	<b>0.01427</b>	<b>0.01659</b>
Dissolved Copper	0.1876	0.2442	0.1435
Dissolved Zinc	<b>0.02383</b>	<b>0.007626</b>	<b>0.01193</b>
Dissolved Selenium	0.1643	0.3458	0.1643
Dissolved Silver	NA	NA	NA
Dissolved Cadmium	0.4104	0.5201	0.4577
Dissolved Lead	0.3343	1	0.3343
Total Beryllium	NA	NA	NA
Total Chromium	<b>0.02017</b>	<b>0.02249</b>	<b>0.005229</b>
Total Manganese	<b>0.0007684</b>	<b>6.104 E-5</b>	<b>0.0003365</b>
Total Nickel	<b>0.0004355</b>	<b>0.001097</b>	<b>0.0001027</b>
Total Copper	<b>0.00722</b>	<b>0.00573</b>	<b>0.003073</b>
Total Zinc	<b>9.093 E-5</b>	<b>6.104 E-5</b>	<b>3.638 E-5</b>
Total Arsenic	NA	NA	NA
Total Selenium	0.3343	1	0.3343
Total Molybdenum	NA	NA	NA
Total Silver	0.336	1	0.3361
Total Cadmium	0.04113	0.8897	0.4113
Total Antimony	NA	NA	NA
Total Lead	<b>0.003879</b>	<b>0.01427</b>	<b>0.003879</b>
Dissolved Phosphorus	0.5765	0.7794	0.6076
Dissolved Potassium	<b>2.248 E-11</b>	<b>0.0006876</b>	<b>3.012 E-9</b>
Nitrite+Nitrate	<b>0.0002221</b>	<b>0.0006104</b>	<b>4.625 E-5</b>
Total Kjeldahl Nitrogen	<b>0.005092</b>	<b>0.0001831</b>	<b>0.0003383</b>
Total Phosphorus	<b>0.00119</b>	<b>6.104 E-5</b>	<b>0.000289</b>
Total Suspended Solids	<b>0.02179</b>	<b>0.0007247</b>	<b>0.01787</b>

**Table A-7. Significance of Differences of Constituent Concentrations at Reference Site and BMP  
(Combined Years Data)**

Constituent	Two Sample T-Test	Wilcoxon Signed	Paired T-Test
Alkalinity	<b>2.387 E-9</b>	<b>2.99 E-6</b>	<b>3.94 E-7</b>
Chemical Oxygen Demand	<b>3.292 E-5</b>	<b>4.789 E-7</b>	<b>3.222 E-6</b>
Chloride	<b>4.203 E-14</b>	<b>7.512 E-7</b>	<b>1.149 E-11</b>
Conductivity	<b>0.0001187</b>	<b>0.000627</b>	<b>0.0002371</b>
Hardness	<b>0.03335</b>	<b>0.01786</b>	<b>0.02103</b>
pH	<b>3.217 E-5</b>	<b>3.91 E-6</b>	<b>6.213 E-11</b>
Total Organic Carbon	0.1114	0.08764	0.07654
Dissolved Calcium	<b>7.462 E-10</b>	<b>1.879 E-8</b>	<b>1.288 E-11</b>
Dissolved Iron	<b>0.006773</b>	<b>0.0004097</b>	<b>0.002995</b>
Dissolved Magnesium	<b>1.368 E-7</b>	<b>5.368 E-7</b>	<b>4.467 E-8</b>
Dissolved Sodium	<b>2.2 E-16</b>	<b>4.366 E-9</b>	<b>2.1 E-16</b>
Dissolved Chromium	<b>5.11 E-14</b>	<b>2.854 E-9</b>	<b>6.923 E-14</b>
Dissolved Manganese	<b>1.434 E-7</b>	<b>2.524 E-9</b>	<b>2.865 E-7</b>
Dissolved Nickel	<b>0.001224</b>	<b>9.945 E-5</b>	<b>0.0003825</b>
Dissolved Copper	<b>0.00037671</b>	<b>3.086 E-5</b>	<b>8.132 E-6</b>
Dissolved Zinc	<b>1.443 E-8</b>	<b>1.7-5 E-9</b>	<b>4.96 E-9</b>
Dissolved Selenium	<b>0.02993</b>	<b>0.02201</b>	<b>0.011444</b>
Dissolved Silver	0.3223	1	0.3223
Dissolved Cadmium	0.4798	0.4049	0.4069
Dissolved Lead	NA	NA	NA
Total Beryllium	NA	NA	NA
Total Chromium	0.5541	0.8611	0.5541
Total Manganese	0.37	0.1615	0.3831
Total Nickel	<b>0.0008197</b>	<b>2.864 E-5</b>	<b>8.12 E-5</b>
Total Copper	0.4318	0.4264	0.3832
Total Zinc	<b>1.502 E-8</b>	<b>3.303 E-9</b>	<b>9.903 E-9</b>
Total Arsenic	NA	NA	NA
Total Selenium	<b>0.02919</b>	0.09868	<b>0.03388</b>
Total Molybdenum	NA	NA	NA
Total Silver	0.3256	1	0.3257
Total Cadmium	<b>0.0298</b>	<b>0.01246</b>	<b>0.005919</b>
Total Antimony	NA	NA	NA
Total Lead	<b>0.0008111</b>	<b>0.0008992</b>	<b>0.0006016</b>
Dissolved Phosphorus	0.8888	0.3812	0.8852
Dissolved Potassium	<b>&lt;2.2 E-16</b>	<b>2.692 E-9</b>	<b>&lt;2.2 E-16</b>
Nitrite+Nitrate	<b>1.184 E-12</b>	<b>2.243 E-11</b>	<b>7.668 E-15</b>
Ortho-Phosphorus	<b>0.03841</b>	<b>0.007389</b>	<b>0.004677</b>
Total Kjeldahl Nitrogen	<b>1.718 E-7</b>	<b>3.278 E-9</b>	<b>7.797 E-10</b>
Total Phosphorus	<b>0.0026</b>	<b>7.039 E-5</b>	<b>0.001493</b>
Total Suspended Solids	<b>0.0003767</b>	<b>6.063 E-7</b>	<b>0.0002591</b>

**Table A-8. Significant Constituents for ANOVA and Tukey Tests at the BMP**

Year	Total Suspended Solids	Total Phosphorus	Total Zinc	Total Nickel	Total Copper	Total Chromium	Total Manganese	Total Selenium	Total Cadmium	Total Lead
Anova P-Value	0.05548	0.4163	<b>0.01568</b>	<b>5.758 E-7</b>	0.1736	0.1159	<b>0.02858</b>	0.6519	0.1806	0.09766
Ref. 2006-2005	1	0.9980928	0.9999922	1	0.998881	0.991148	0.9793852	**	1	1
Ref. 2007-2005	0.9428305	0.8924485	0.9995809	0.9937315	0.999925	0.999358	0.9876799	**	1	0.980492
Ref. 2008-2005	0.9999996	0.8281539	0.9178	0.8408321	0.939442	0.999982	0.9999586	**	0.39939	1
Ref. 2009-2005	0.7861808	0.8062486	0.9898219	<b>0.0383272</b>	0.997085	0.999999	0.9985103	**	0.92517	0.579553
Ref. 2010-2005	0.1345069	0.3290196	0.1623202	<b>0.000047</b>	0.394932	0.515026	0.2272485	**	0.68074	0.248909
Ref. 2007-2006	0.9521907	0.994692	0.9999951	0.9960442	0.988509	0.999239	0.7980664	**	1	0.987447
Ref. 2008-2006	0.9999995	0.9762768	0.894602	0.8774407	0.820528	0.998232	0.9948499	**	0.48179	1
Ref. 2009-2006	0.8220595	0.9856887	0.9989312	0.0868079	0.951255	0.969346	0.8049522	**	0.95286	0.691548
Ref. 2010-2006	0.1751459	0.7043378	0.3340257	<b>0.0002834</b>	0.262226	0.233859	<b>0.0467322</b>	**	0.76485	0.356295
Ref. 2008-2007	0.9629132	0.9995505	0.7114914	0.9634961	0.960548	0.999993	0.9635272	**	0.26479	0.984004
Ref. 2009-2007	0.9987087	0.9999977	0.9993708	<b>0.0379163</b>	0.999732	0.992783	0.9984374	**	0.82932	0.887066
Ref. 2010-2007	0.3751021	0.8627449	0.1270666	<b>0.0000115</b>	0.324078	0.136515	0.8005936	**	0.48637	0.476383
Ref. 2009-2008	0.8360575	0.9998303	0.4775304	0.707775	0.983972	0.999743	0.9864168	0.80735	0.72163	0.632941
Ref. 2010-2008	0.1632644	0.9898851	<b>0.0115817</b>	<b>0.0111865</b>	0.968891	0.443545	0.1436506	1	0.96982	0.296107
Ref. 2010-2009	0.4434961	0.8292586	0.1312391	<b>0.0391597</b>	0.336327	0.227138	0.0950075	0.68204	0.97115	0.938872

\*\*No Data

**Table A-9. Significant Constituents for ANOVA and Tukey Tests at the Reference Site**

Year	Total Suspended Solids	Total Phosphorus	Total Zinc	Total Nickel	Total Copper	Total Chromium	Total Manganese	Total Selenium	Total Cadmium	Total Lead
Anova P-Value=	<b>0.0005148</b>	<b>0.002103</b>	<b>4.272 E-12</b>	<b>1.303 E-14</b>	<b>1.451 E-6</b>	0.2595	<b>6.633 E-9</b>	0.3793	0.2845	<b>0.03969</b>
BMP, 2006-2005	0.3132418	0.4202509	<b>0.0000689</b>	1	<b>0.011758</b>	0.722713	<b>0.000009</b>	**	1	1
BMP, 2007-2005	<b>0.0080495</b>	0.9302324	0.9999749	1	0.174047	0.720038	0.113878	**	1	0.156451
BMP, 2008-2005	0.9976619	0.9998384	0.8852319	<b>0.0000008</b>	0.999642	0.996991	0.999715	**	1	1
BMP, 2009-2005	0.9999073	0.8910843	0.0899823	<b>0.0000002</b>	0.986727	0.987015	1	**	0.65627	1
BMP, 2010-2005	0.994178	0.7317992	0.1317825	<b>0.0000239</b>	0.840467	1	0.9939524	**	1	1
BMP, 2007-2006	0.7235826	0.9071522	<b>0.0000054</b>	<b>1</b>	0.788351	1	0.5840336	**	1	0.133082
BMP, 2008-2006	0.7355236	0.3520753	<b>0.0000072</b>	<b>0.0000004</b>	0.077511	0.514248	<b>0.0002728</b>	**	1	1
BMP, 2009-2006	0.1896945	<b>0.0073638</b>	<b>0</b>	<b>0.0000001</b>	<b>5.63E-05</b>	0.886938	<b>0</b>	**	0.61724	1
BMP, 2010-2006	0.4136494	<b>0.0036595</b>	<b>0</b>	<b>0.0000112</b>	<b>1.42E-05</b>	0.536705	<b>0</b>	**	1	1
BMP, 2008-2007	0.0978514	0.8587764	0.9149816	<b>0.0000001</b>	0.489977	0.50748	0.2636035	**	1	0.277634
BMP, 2009-2007	<b>0.0005894</b>	0.1506112	0.0621866	<b>0</b>	<b>0.003431</b>	0.885698	<b>0.0496238</b>	**	0.51724	<b>0.027066</b>
BMP, 2010-2007	<b>0.0048309</b>	0.0800723	0.1045475	<b>0.0000016</b>	<b>0.000812</b>	0.5035	<b>0.0216305</b>	**	1	<b>0.044429</b>
BMP, 2009-2008	0.9994796	0.9870997	0.9126116	0.562258	0.94318	0.87866	0.999098	0.97021	0.78978	1
BMP, 2010-2008	1	0.9315315	0.9351438	0.1872109	0.744821	0.995669	0.9667519	0.79172	1	1
BMP, 2010-2009	0.9977841	0.9951818	0.9999999	0.8429226	0.96996	0.94906	0.98048	0.3497	0.36185	1

\*\*No Data