

DEPARTMENT OF ECOLOGY
ENVIRONMENTAL ASSESSMENT PROGRAM
Quarterly Report

May 30, 2013

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SUBJECT: Clover Creek Dissolved Oxygen, Fecal Coliform, and Temperature Total
Maximum Daily Load Study: 1st Quarterly Report

Project Code: 13-012

Introduction

The study area and sampling locations for this TMDL includes; Clover Creek, and its tributaries, the North Fork Clover Creek, Morey Creek, and Spanaway Creek (Figure 1 and Table 1). The headwaters are located 6 miles east of Spanaway. Clover Creek flows 13.8 miles through residential and commercial areas, and empties into Steilacoom Lake. Other lakes in its 74-square-mile watershed include Spanaway Lake and Tule Lake.

Ecology is conducting the Clover Creek TMDL study because water quality data show that portions of the watershed do not meet the State criteria for dissolved oxygen (DO), fecal coliform (FC), and temperature (Table 2). Water quality criteria and beneficial uses are described in Table 3.

This memorandum summarizes the data collection progress for the 1st Quarter (March - May) 2013. Data quality has not been assessed or checked for errors, therefore data presented are provisional.

Progress to Date

Bi-weekly Sampling

Fecal Coliform

Field sampling began on March 12th and reoccurred every other week for a total of six sampling events ending on May 21st. Field parameters collected at each sampling site included FC grab samples and stream discharge. Discharge was not measured at NFCB1.1LB and NFCB1.1RB. These sites are intermittent outfalls to the North Fork Clover Creek that drain along 121st Street.

Table 4 is a summary of the most recent FC results covering four sampling events. The highest in-stream geometric mean excluding outfalls to the creek was calculated at Clover Creek at Spanaway Loop Rd. (CLO4.6). The highest geometric mean calculated including outfalls occurred at the outfall to North Fork Clover Creek at 121st (NFCB1.1RB). The in-stream sampling point at North Fork Clover Creek at 121st (NFCB1.1) is a few feet upstream of the outfall and therefore does not capture its influence. This site (NFCB1.1) had the second highest geometric mean compared to other in-stream sampling locations. The lowest geometric means were found on Morey Creek at the Morey Pond outfall (MOR0.1) and at Spanaway Creek at the Spanaway Lake outfall (SPA1.8).

Samples collected on 5/7/13 were incubated at a temperature too high for accurate FC laboratory analysis (Table 4). As a result the FC bacteria were over-heated and therefore produced unusable results. No additional data collection is scheduled to replace these missing data.

An additional sampling location was established on Morey Creek at Spanaway Loop Rd. (MOR0.9). Sampling began at this site in April and will continue for the duration of field data collection, stream discharge permitting.

Stream Discharge

Table 5 is a summary of instantaneous discharge measurements taken at the time of bi-weekly FC sampling. Clover Creek at Joint Base Lewis-McChord (JBLM) (CLO3.5) had the highest maximum and average discharge. The lowest average discharge was observed at Morey Creek below the Morey Pond outlet (MOR0.1).

Clover Creek at Spanaway Loop Rd. (CLO4.6) was found dry on 5/7 and 5/21. This is the only sampling site that has a concrete channel bed. Less than half a mile downstream of this site is the confluence with Spanaway Creek that joins Clover Creek as a disperse wetland. Interestingly the next site downstream, Clover Creek at JBLM (CLO3.5) has the highest discharge. At this point inputs from Spanaway Creek seems to contribute as the majority of discharge to Clover Creek, but remain lower than those observed at CLO3.5. Therefore this reach may be receiving significant groundwater contributions.

North Fork Clover Creek at Brookdale Rd. (NFC1.0) was found dry on 5/7. Sufficient discharge was observed two weeks later on 5/21 due to recent precipitation inputs to the watershed.

Spanaway Creek at Spanaway Loop Rd. has no discharge measurements however remains as location for sampling FC. This site is not suitable for measuring discharge because it is a series of culverts that variably empty into a heavily vegetated wetland with losly define flow direction. An alternate sampling location was scoped and permission to gain access on privately owned lands was requested. However permission was not approved by the private land owner in order to establish a site for suitable discharge measurements.

There are two USGS gage stations in the watershed, providing continuous stream discharge data. One is located on Clover Creek on Pacific Highway SW (station ID 12090500). The other is located on North Fork Clover Creek at Golden Given Road E (station ID 12090400). Data for the Clover Creek station are available quarterly throughout the year and did not cover the duration of these TMDL sampling events. Data for the North Fork station are available in real-time at the USGS webpage. Figure 5 shows a discharge data summary for the North Fork Clover Creek at Golden Given Road. The North Fork raises and falls sharply that is probably a result of significant precipitation inputs. Continuous stream discharge will be compared to precipitation for the up and coming quarterly reports.

Temperature Data Logger Deployment

On May 14th and 21st, temperature data loggers were installed at each sampling site (Table 3) except for NFCB1.1LB and NFCB1.1RB that are outfall to the North Fork Clover Creek. Air temperature data loggers were deployed at the majority of the sampling locations for quality assurance purposes. The data loggers will be downloaded on a monthly basis until late September to early October when they will be recovered from the streams.

Spring Storm Event Sampling

Spring storm sampling has yet to be conducted. Storms were difficult to capture because of timing, insufficient amounts of precipitation, or lack of an antecedent dry period. For example, the recent storms that occurred during the last half of May did not have sufficient antecedent dry periods where zero to trace amounts of precipitation were observed.

The spring storm event may be captured no later than June 19th. After this, another sampling opportunity may occur in the spring of 2014.

Project Schedule and Upcoming Tasks

Field data collection will continue over the next four months including:

- Bi-weekly sampling of FC and stream discharge measurements
- Downloading temperature data loggers
- Assessing riparian conditions using canopy photos, ortho-photos, and height/density measurements
- Logging continuous DO concentrations at six locations for a 72 hour period
- Sampling FC during a spring and summer storm event
- Compare stream hydrographs to precipitation

Attachment(s): Tables and Figures:

Table 1. Clover Creek watershed sampling locations.

Table 2. 303(d) listed reaches addressed in the Clover Creek study.

Table 3. Water quality criteria and beneficial uses in the Clover Creek watershed.

Table 4. Fecal coliform sampling results (#/100mL).

Table 5. Stream discharge measurements in the Clover Creek watershed.

Figure 1. Clover Creek TMDL sampling locations.

Figure 2. USGS discharge at the North Fork Clover Creek at Golden Given Road.

Cc: Windy Kruse, Water Quality Specialist III, Pierce County Surface Water Management

Tables

Table 1. Clover Creek watershed sampling locations.

Map ID	Site ID	Site Description	Latitude	Longitude
1	12CLO0.4	Clover Ck at Gravely Lk Dr SW	47.1560283	-122.5231217
2	12CLO1.4	Clover Ck at Pacific Hwy SW	47.1459917	-122.5103583
3	12CLO1.9	Clover Ck at 47 th Ave SW	47.1433467	-122.4994567
4	12CLO3.5	Clover Ck 1980 ft. d/s of Perimeter Rd at JBLM	47.13367305	-122.472765
6	12CLO4.6	Clover Ck at Spanaway Loop Rd S	47.14345922	-122.4594648
12	12CLO7.1	Clover Ck u/s of 138 th St E	47.13128465	-122.4263154
16	12CLO8.7	Clover Ck at 25 th Ave E	47.1277317	-122.396245
17	12CLO9.8	Clover Ck at 152 nd St E	47.1185067	-122.3814833
18	12CLO11.0	Clover Ck at Military Rd E	47.10428904	-122.3766933
19	12CLO12.0	Clover Ck at Canyon Rd E near headwaters	47.1021316	-122.3573064
5	12MOR0.1	Morey Pond outlet to bypass at JBLM	47.13326896	-122.4727272
9	12MOR0.9	Morey Creek at Spanaway Loop Rd S	47.12778	-122.45866
11	12NFC0.0	NF Clover Ck at B St S	47.13446094	-122.4291162
15	12NFC1.0	NF Clover Ck u/s of USGS gage Brookdale Rd	47.13395347	-122.4095402
14	12NFCB0.0	NF Clover Ck branch at Brookdale Rd E	47.13409742	-122.4095695
13	12NFCB1.1	NF Clover Ck branch at 121 st	47.14737659	-122.4098005
13	12NFCB1.1LB	Left bank outfall to NF Clover Creek at 121 st	47.14737659	-122.4098005
13	12NFCB1.1R B	Right bank outfall to NF Clover Creek at 121 st	47.14737659	-122.4098005
7	12SPA0.5	Spanaway Ck at Spanaway Loop Rd S	47.1401477	-122.4592428
8	12SPA1.4	Spanaway Ck at 138 St S	47.1315217	-122.4572317
10	12SPA1.8	Spanaway Ck at Spanaway Park	47.1209117	-122.446315

Latitude and longitude datum: NAD 83 HARN

Table 2. 303(d) listed reaches addressed in the Clover Creek study.

Waterbody	Parameter	Listing ID	Township Range Section
Clover Creek	Temperature	7553	19N – 2E – 11
Clover Creek	Fecal Coliform	7549	19N – 2E – 11
Clover Creek	Fecal Coliform	7548	19N – 2E – 48
Clover Creek	Fecal Coliform	7547	19N – 3E – 42
Clover Creek	Fecal Coliform	7545	19N – 3E – 47
Clover Creek	Fecal Coliform	5847	19N – 3E – 23
North Fork Clover Creek	Fecal Coliform	7558	19N – 3E – 15
North Fork Clover Creek	Fecal Coliform	5848	19N – 3E – 48
Morey Creek	Dissolved Oxygen	7543	19N – 3E – 45

Table 3. Water quality criteria and beneficial uses in the Clover Creek watershed.

Clover Creek and Spanaway Creek	
Salmonid Spawning, Rearing and Migration Habitat, Primary Contact Recreation	
Parameter	Condition
Temperature	Highest 7-DADMAX (7 day average of the daily maximum temperatures) 17.5° C
Dissolved Oxygen	Lowest 1 day minimum 8 mg/L
Bacteria	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies/100 mL, with not more than 10% of all samples (or any single sample when less than 10 sample points exist) obtained for calculating the geometric mean value > 200 colonies/100 mL.
Morey Creek and North Fork Clover Creek	
Core Summer Salmonid Habitat, Extraordinary Primary Contact Recreation	
Parameter	Condition
Temperature	Highest 7-DADMAX (7 day average of the daily maximum temperatures) 16.0° C
Dissolved Oxygen	Lowest 1 day minimum 9.5 mg/L
Bacteria	Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 mL, with not more than 10% of all samples (or any single sample when less than 10 sample points exist) obtained for calculating the geometric mean value > 100 colonies/100 mL.

Table 4. Fecal coliform sampling results (#/100mL).

Map ID	Station ID	3/12/13	3/26/13	4/9/13	4/23/13	5/7/13	5/21/13	number of samples	Geometric mean	Percent of data exceeding criteria (%)	Max	Min
1	CLO0.4	49	47	140	31	-	Laboratory results pending	4	56	0	140	31
2	CLO1.4	52	19	160	27	-		4	45	0	160	19
3	CLO1.9	35	29	250	41	-		4	57	25	250	29
4	CLO3.5	43	57	130	67	-		4	68	0	130	43
6	CLO4.6	60	110	260	130	-		4	122	25	260	60
12	CLO7.1	28	37	84	55	-		4	47	0	84	28
16	CLO8.7	39	32	84	14	-		4	35	0	84	14
17	CLO9.8	47	17	56	20	-		4	31	0	56	17
18	CLO11.0	12	2	21	12	-		4	9	0	21	2
19	CLO12.0	10	2	25	6	-		4	7	0	25	2
5	MOR0.1	10	10	11	1	-		4	6	0	11	1
9	MOR0.9	-	-	23	2	-		2	7	0	23	2
11	NFC0.0	75	10	240	44	-		4	53	25	240	10
15	NFC1.0	23	36	180	35	-		4	48	25	180	23
14	NFCB0.0	55	27	140	68	-		4	61	25	140	27
13	NFCB1.1	110	16	300	120	-		4	89	75	300	16
7	SPA0.5	17	15	21	7	-		4	14	0	21	7
8	SPA1.4	13	11	47	5	-		4	14	0	47	5
10	SPA1.8	10	1	5	2	-		4	3	0	10	1
13	NFCB1.1LB	200	2	27	-	-		3	22	33	200	2
13	NFCB1.1R B	420	96	87	-	-	3	152	33	420	87	

Bold values exceed Washington State water quality criteria

Table 5. Stream discharge measurements in the Clover Creek watershed.

Map ID	Station ID	3/12/13	3/26/13	4/9/13	4/23/13	5/7/13	5/21/13	Number of measurements	Avg	Max	Min
1	CLO0.4	37	41	66	49	32	32	6	43	66	32
2	CLO1.4	40	43	66	48	35	36	6	44	66	35
3	CLO1.9	41	45	72	49	35	32	6	46	72	32
4	CLO3.5	42	47	85	54	34	32	6	49	85	32
6	CLO4.6	2.2	1.6	15	1.9	0.0	0.0	4	3	15	0.0
12	CLO7.1	1.4	1.5	1.7	1.9	1.9	1.8	6	2	1.9	1.4
12	CLO7.1SC*	-	-	1.5	1.7	0.97	3.2	4	2	-	-
16	CLO8.7	16	19	26	19	13	12	6	17	26	12
17	CLO9.8	17	20	24	20	14	14	6	18	24	14
18	CLO11.0	5.3	7.3	7.8	6.3	4.4	4.1	6	6	7.8	4.1
19	CLO12.0	2.6	2.5	3.6	2.8	2.2	2.5	6	3	3.6	2.2
5	MOR0.1	1.0	0.87	1.3	0.75	0.8	2.0	6	1	2.0	0.75
9	MOR0.9	-	-	1.8	1.23	1.2	2.65	4	2	2.6	1.2
11	NFC0.0	4.5	3.2	19	3.2	0.02	3.6	6	6	19	0.02
15	NFC1.0	2.1	1.0	9.3	1.1	0.0	0.26	5	2	9.3	0.00
14	NFCB0.0	4.2	2.6	8.5	2.1	0.24	3.4	6	4	8.5	0.24
13	NFCB1.1	2.5	1.4	5.0	1.3	0.30	1.7	6	2	5	0.30
7	SPA0.5	-	-	-	-	-	-	0	-	-	-
8	SPA1.4	26	28	34	28	23	24	4	27	34	23
10	SPA1.8	21	23	31	21	19	20	4	22	31	19
13	NFCB1.1LB**	-	-	-	-	-	-	0	-	-	-
13	NFCB1.1RB* *	-	-	-	-	-	-	0	-	-	-

*Side channel to Clover Creek at 138th Street

** Outfalls to North Fork Clover Creek at 121st Street

Figures



Figure 1. Clover Creek TMDL sampling locations.



USGS 12090400 NORTH FORK CLOVER CREEK NEAR PARKLAND, WA

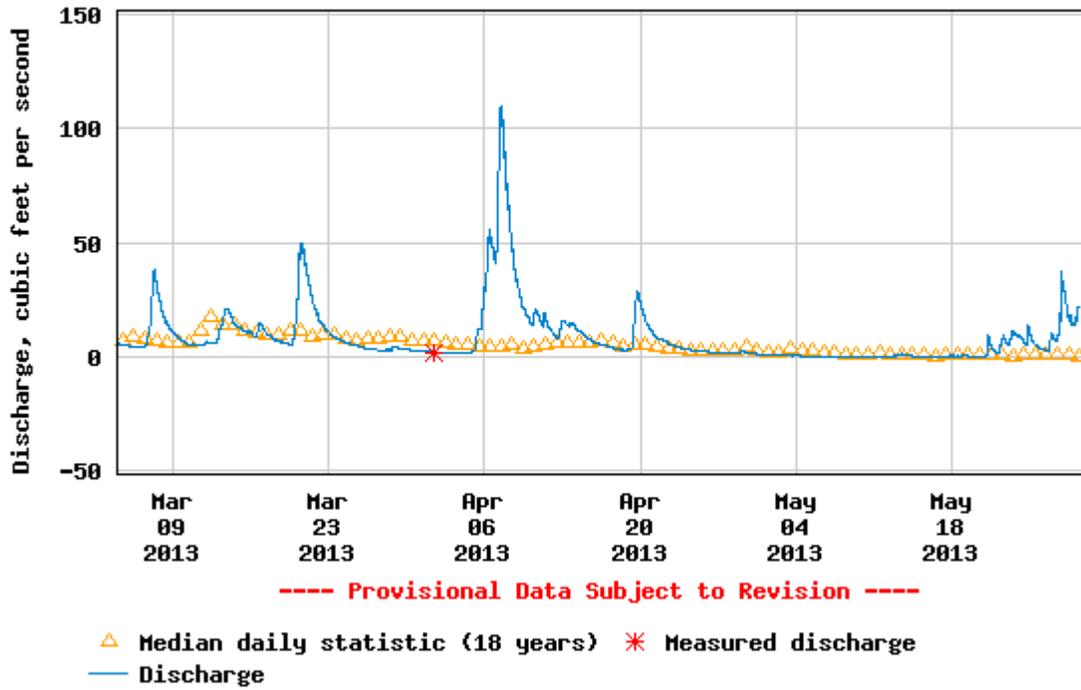


Figure 2. USGS discharge at the North Fork Clover Creek at Golden Given Road.