

**NINETEEN MILE BROOK WATERSHED BASELINE ENVIRONMENTAL
ASSESSMENT:
2009 STREAM GAGING PROGRAM**

FINAL

DECEMBER 2009

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ASSESSMENT: 2009 STREAM GAGING PROGRAM**

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Prepared for
TUFTONBORO CONSERVATION COMMISSION
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INTRODUCTION

In Spring of 2009, the Tuftonboro, NH Conservation Commission (TCC) agreed to contract with Normandeau Associates, Inc. (Normandeau) to provide additional environmental consulting services relative to aquatic resources of Nineteen Mile Brook and its immediately adjacent watershed. In 2008, Normandeau completed a baseline assessment of aquatic resources in Nineteen Mile Brook, upstream and downstream of the neighboring Town of Wolfeboro's (Wolfeboro) newly permitted subsurface discharge (rapid infiltration basins – RIBs) site (Normandeau 2008). Wolfeboro began using the RIBs in March of 2009, discharging up to 600,000 gallons per day (0.6 million gallons per day - MGD) of treated municipal wastewater.

Although chemical impacts to Nineteen Mile Brook were expected from operation of the RIBs, it was not clear when and to what extent those impacts might be measureable in the Brook, primarily because of variable time-of-travel from the RIBs to the Brook and the unknown uptake capacity of sand and gravel deposit receiving the wastewater for some water quality parameters. However, groundwater modeling conducted by Wolfeboro's hydrogeology consultant (Wright-Pierce 2007) indicated that the time required for water to travel from the RIBs to Nineteen Mile Brook could be two or three months after activating the RIBs. Although the water loading impact from the RIBs to Nineteen Mile Brook was not expected to be readily measurable during times of moderate to high stream flow, increased stream flow downstream of zone of influence of the RIBs should be apparent and measurable during typical low flow conditions likely to present during late summer. Because limited resources during 2009 did not allow evaluation of both water quality and quantity in Nineteen Mile Brook, the TCC decided to focus on water quantity for the 2009 summer season.

STUDY PLAN

The study plan was to install continuously recording water level and temperature monitors for the typical low flow period of July through September at three locations: 1) upstream of the RIBs; 2) immediately downstream of the zone of influence of the RIBs; and 3) at the Rte. 109A bridge downstream of the RIBs and Whitten Pond. Water level measurements were to be "calibrated" to stream flow by occasional flow gaging using traditional (USGS) flow gaging methods.

PROJECT STUDY AREA

Nineteen Mile Brook is located in the Towns of Wolfeboro and Tuftonboro in the Central New Hampshire lakes region (Figure 1). The brook flows generally east to west, passing through Whitten Pond and discharging into Nineteen Mile Bay in Lake Winnepesaukee. The majority of the brook and its watershed are located within the Town of Tuftonboro. The wastewater disposal site is located in the Town of Wolfeboro adjacent to the Tuftonboro/Wolfeboro town line, and the RIBs are located as close as ~100 feet to the line (Figure 2). Nineteen Mile Brook is located about 750 feet downgradient of the infiltration basins. The specific water level monitoring sites are shown in Figure 3 and are more or less co-located with water quality sampling sites (from 2008) NMB 1, NMB 2 and NMB 3. The Town of Wolfeboro has also established flow gaging and water quality sampling stations in approximately the same locations as our three water leveling monitoring stations.

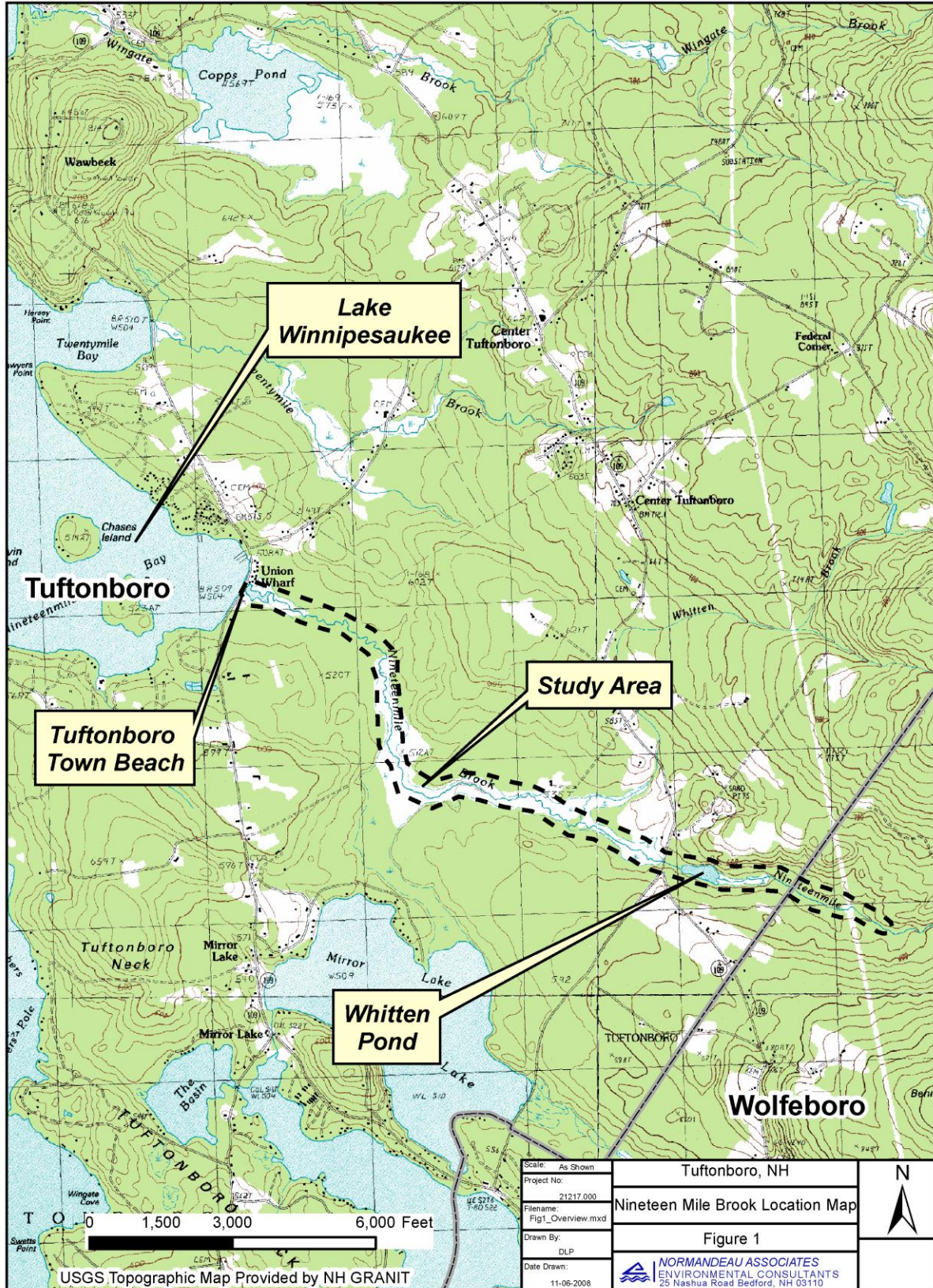


Figure 1. Nineteen Mile Brook location map

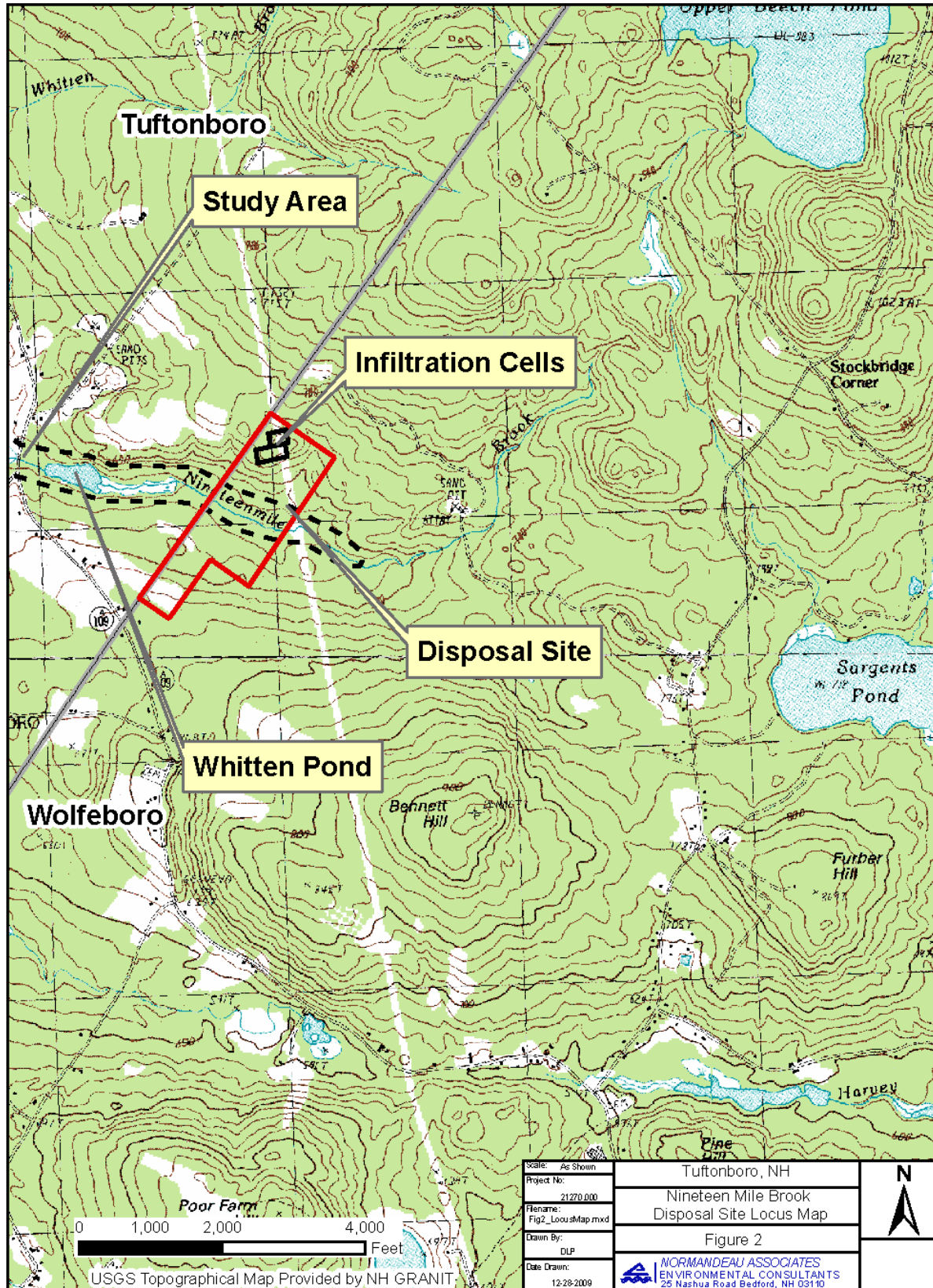


Figure 2. Nineteen Mile Brook disposal site locus map

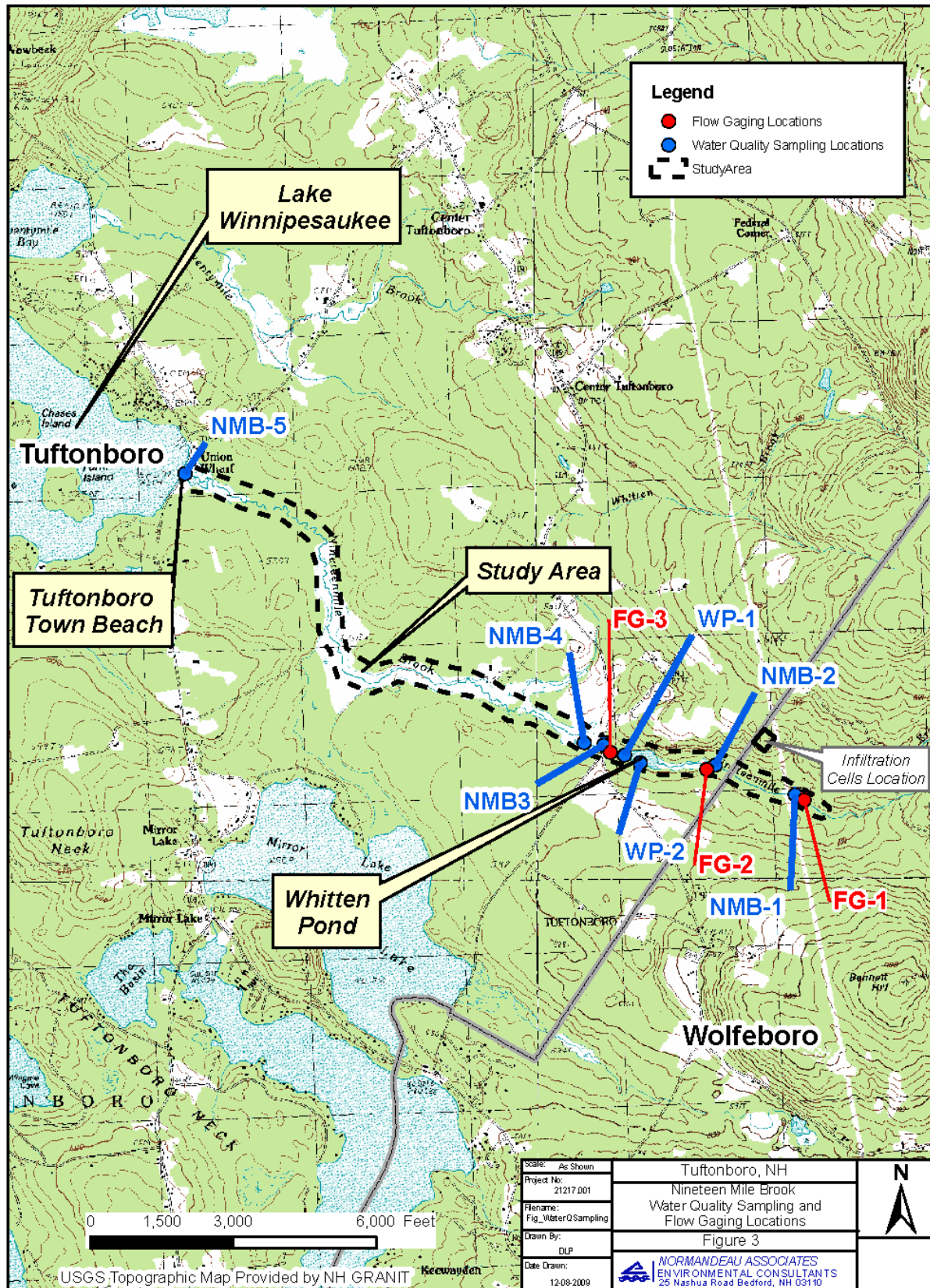


Figure 3. Nineteen Mile Brook water quality and water level sampling locations

STUDY RESULTS

Onset Hobo® Water Level Recorders were installed on July 1, 2009 at the three sites shown in Figure 3. These recorders are capable of measuring depth in a range of 0 – 13 feet and are accurate to ±0.01 feet with a resolution of 0.005 feet. The units also record temperature with an accuracy and resolution of 0.67 and 0.18 °F, respectively. Each unit was programmed to record water level and temperature at 15 minute intervals. After each unit was installed, stream flow was manually gaged at each site using traditional USGS flow gaging methods (flow meter and top set wading rod) to establish a stage/discharge relationship that could be used at the end of the monitoring period to convert water level data collected by the water level recorders to stream flow data.

Each site was revisited on August 16, 2009 and October 13 2009 to download data from the water level recorders and to manually gage stream flow. The water level recorders were removed on October 13, 2009 after successfully recording water level and temperature for nearly 3 ½ months at each location.

Stream flow was determined from the water level data by first correcting for barometric pressure, as obtained from the Concord Airport and then converting corrected water level to stream flow based on the stage/discharge relationships established at each site by our manual gaging. It should be noted that we did not gage during high flow events. Thus, we could not estimate stream flow during those times when streamflow was above approximately 4.0 cubic feet per second per square mile (cfsm). This limitation does not significantly affect the results since streamflow was only above 4.0 cfsm occasionally during the study period and for short times and the primary interest was during low flow periods.

Table 1 provides the results of the manual stream gaging for each site. It can be seen that stream flow ranged from less than 1 cfs to slightly greater than 4 cfs at FG-1 to a range of about 3 cfs to greater than 8 cfs at FG-3. Watershed yield (cfsm) was virtually the same at all sites on 7/1/2009. However, by early fall, watershed yield was greater at FG-2 than at FG-1 and greater yet at FG-3.

Table 1 Manually Determined Stage and Stream Flow at the Nineteen Mile Brook Gaging Sites

Date	FG-1 (upstream of RIBs)			FG-2 (immediately downstream of RIBs)			FG-3 (Route 109A Bridge)		
	Stage	Stream flow		Stage	Stream flow		Stage	Stream flow	
	(ft)	(ft ³ /s)	(cfsm)	(ft)	(ft ³ /s)	(cfsm)	(ft)	(ft ³ /s)	(cfsm)
7/1/2009	0.854	4.36	4.23	0.750	7.41	4.07	1.29	8.21	4.00
8/19/2009	0.417	0.81	0.79	0.333	1.59	0.88	1.00	2.95	1.44
10/12/2009	0.583	1.05	1.02	0.458	1.98	1.09	0.992	2.57	1.25

Figure 4 provides the continuous watershed yield data that was determined from the continuous stage monitors and stage/discharge relationships generated from the manual gaging data. The daily average of these flow data and the stream temperature data are provided in tabular form in Appendix 1. In Figure 4, it can be seen that during the first part of July, watershed yield at all sites was similar to each other. This implies that impacts to stream flow from the RIBs was either negligible or indistinguishable from the natural stream flow during that time period. By about July 10 and

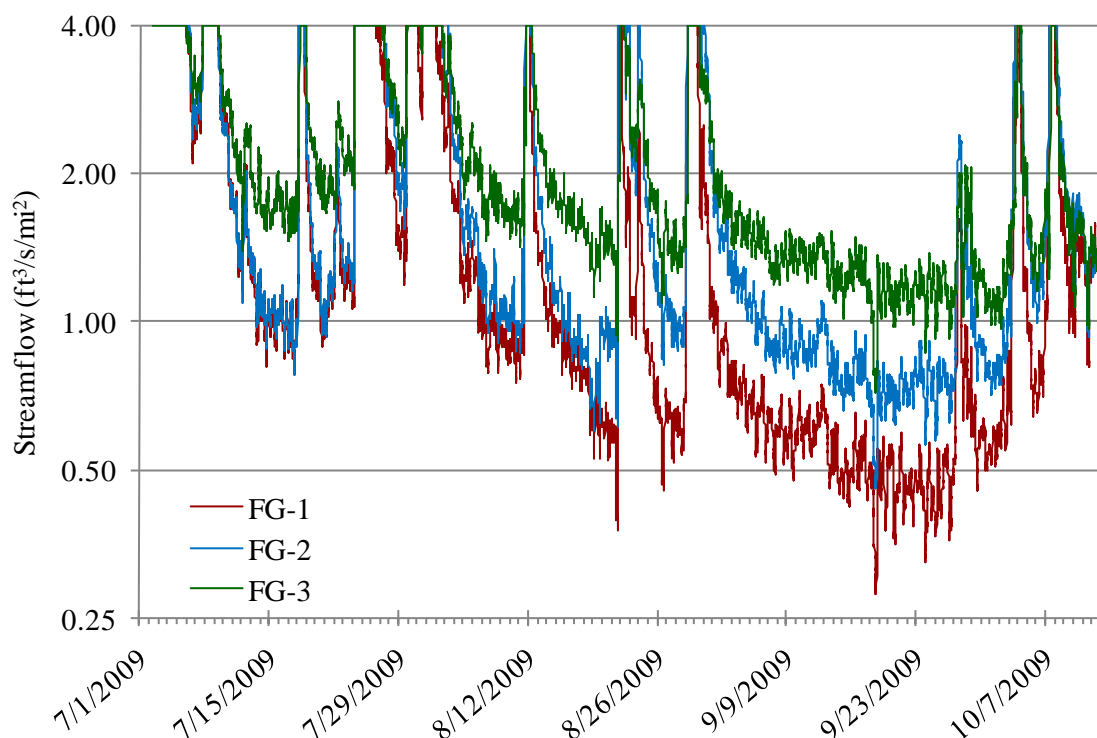


Figure 4. Nineteen Mile Brook Stream Flow, 1 July 2009 through 12 October 2009, at Selected Gaging Sites

coincident with declining stream flow, yield at FG-3 (Route 109A) began to differentiate itself from the other two sites, maintaining about 0.6 to 0.8 cfs difference between FG-3 and FG-1 throughout the rest of the monitoring period, except during brief times of higher flow.

There was no difference between FG- 2 and FG-1 during the first part of the monitoring period (July 1 to ~August 15) which suggests that if there was an impact to stream flow from the RIBs, it was negligible or more likely, indistinguishable from natural flow. However, after August 15, the watershed yield at FG-2 increased significantly when compared to FG-1. Except for during periods of high flow, the yield at FG-2 was approximately 0.3 to 0.4 cfs greater than the yield at FG-1.

RIB loading data provided by Wolfeboro indicated that during the spring, wastewater loading to the RIBs was highly variable. Although the RIBs were collectively loaded with about 800,000 gallons per day (gpd) for more than two weeks in March, from late March until mid-May, loading fluctuated from zero to 700,000+ gpd. Load was stabilized at about 400,000 gpd for most of June, increased to approximately 600,000 gpd for the first three weeks of July and then was reduced to approximately 400,000 gpd for the rest of our monitoring period. This translates to approximately 0.7 cfs at FG-2 and 0.6 cfs at FG-3 for the highest loading rates and about 0.35 cfs at FG-2 and 0.30 cfs at FG-3 for the more typical 400,000 gpd rate. Table 2 provides daily RIB loading from March 1, 2009 through October 31, 2009.

Table 2 Wastewater Loading to Wolfeboro’s Rapid Infiltration Basins (gallons per day)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	0	5000	148000	398000	530000	412005	450000	456775
2	0	402500	171000	398000	496000	423500	450000	453145
3	0	322500	87000	397000	692000	375100	450000	428340
4	700000	5000	299000	397000	597000	427433	428945	429550
5	700000	5000	178000	397000	601370	379335	430458	471598
6	750000	5000	0	398000	595925	401720	472505	437113
7	800000	514000	0	398000	601975	402325	437718	428083
8	800000	658000	4000	400000	449515	375100	428643	445885
9	800000	702000	0	56000	506083	417148	446793	464035
10	800000	652000	15000	2000	536333	386595	466758	428340
11	800000	5000	225000	0	502453	392948	428945	428340
12	800000	5000	349000	6000	392670	418660	428643	462523
13	800000	523250	294000	0	536333	375100	351505	448003
14	800000	666250	272000	0	589875	408073	448000	428038
15	800000	639750	472000	5000	589573	395973	428945	434995
16	800000	697000	231000	397000	589875	375100	435600	471598
17	800000	685000	287000	431000	589875	437113	400813	431365
18	800000	5000	335000	398000	589875	380848	324280	428340
19	800000	5000	336000	399000	596833	375100	428643	451028
20	800000	200000	336000	397000	597833	428643	451633	459195
21	800000	200000	336000	398000	596833	301558	458590	428038
22	800000	200000	336000	397000	516973	388713	428340	428038
23	800000	200000	336000	397000	428945	416845	428340	467363
24	800000	150000	336000	398000	375100	400000	467665	442255
25	5000	150000	336000	398000	383873	400000	442558	428038
26	5000	150000	336000	397000	420475	400000	428340	440138
27	5000	150000	185000	398000	375100	400000	440743	469783
28	5000	150000	403000	397000	398695	400000	469178	428340
29	5000	150000	499000	397000	408073	400000	428340	428038
30	5000	150000	351000	398000	387805	0	429853	459800
31	5000		379000		420475	100000		428945
Monthly Average	592321	278408	253935	308300	512669	374030	433693	443065

DISCUSSION

The flow data collected for Nineteen Mile Brook together with the RIB data present in Table 2 do not provide a clear picture of the hydrologic influences on stream flow in the immediate study area and in particular, do not clearly show the influence of the RIBs on stream flow. Watershed yield at FG-3

was almost always 0.6 to 0.8 cfsm higher than FG-1, only 0.3 to 0.6 cfsm of which could be explained by the RIBs. Similarly, there was no indication of RIB influence at FG-2 during the July 1 to August 15 period, even though FG-2 was clearly located downstream of the zone of influence predicted by the Wright-Pierce hydrogeologic modeling. Since the Wright-Pierce hydrogeologic modeling predicted a water time-of-travel from RIB to Nineteen Mile Brook of 2 to 3 months and because the RIBs become active in March of 2009, a flow response in Nineteen Mile Brook would clearly have been expected by the 1st of July. However, none was seen until August 15.

After August 15, however, a consistent flow response at FG-2 of about 0.30 to 0.35 cfsm as compared to FG-1 was documented. This compares almost exactly to the 400,000 gpd discharge rate from the RIBs which makes it enticing to conclude that the data document the influence of the RIBs. Given the lack of definitiveness of the data for FG-3 and for the July 1 to August 15 time period for FG-2, we think a definitive conclusion is premature and not strongly supported. Other factors may also play significant roles watershed hydrology including temporary water storage and subsequent release in Whitten Pond and its associated adjacent and upstream wetlands and in upgradient sand and gravel deposits and in seasonal evapotranspiration that may not be uniform throughout the watershed.

Even so, the data clearly show differences in watershed yields throughout the study, some of which is likely, arguably definitely, related to wastewater loading of the RIBs. Longer term stream flow monitoring would likely improve our ability to quantify the water loading impact of the Wolfeboro RIBs on stream flow in Nineteen Mile Brook.

LITERATURE CITED

- Normandeau Associates, Inc. 2008. Nineteen Mile Brook Watershed Baseline Environmental Assessment: Aquatic Biota and Water Quality. 37pp.
- Wright-Pierce 2007. Subsurface Wastewater Disposal Feasibility Study. Whitten West Site, Wolfeboro, NH. Phase 3 Hydrogeological Report. 337pp.

APPENDIX 1

Daily Stream Flow and Water Temperature Data for Nineteen Mile Brook Gaging Sites FG-1, FG-2 and FG-3.

FG-1 (upstream of RIBs) July 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
7/1/2009	-	-	-	-
7/2/2009	57.3	2.26	>4.36	>4.23
7/3/2009	58.5	1.24	>4.36	>4.23
7/4/2009	61.6	0.99	>4.36	>4.23
7/5/2009	59.7	1.01	>4.36	>4.23
7/6/2009	60.7	0.82	3.41	3.31
7/7/2009	58.6	0.77	2.89	2.80
7/8/2009	57.4	1.07	>4.36	>4.23
7/9/2009	57.1	0.86	>4.36	>4.23
7/10/2009	60.2	0.75	2.57	2.50
7/11/2009	61.6	0.65	1.75	1.70
7/12/2009	62.9	0.68	2.00	1.94
7/13/2009	61.9	0.55	1.17	1.14
7/14/2009	60.9	0.52	1.05	1.02
7/15/2009	60.5	0.52	1.05	1.02
7/16/2009	60.2	0.52	1.06	1.03
7/17/2009	63.8	0.52	1.06	1.03
7/18/2009	61.7	1.16	>4.36	>4.23
7/19/2009	63.8	0.62	1.59	1.54
7/20/2009	63.8	0.57	1.27	1.24
7/21/2009	62.3	0.55	1.20	1.16
7/22/2009	61.4	0.68	1.95	1.89
7/23/2009	62.1	0.57	1.27	1.23
7/24/2009	59.3	2.68	>4.36	>4.23
7/25/2009	61.7	1.37	>4.36	>4.23
7/26/2009	61.7	0.89	>4.36	>4.23
7/27/2009	64.0	0.81	3.36	3.26
7/28/2009	65.3	0.71	2.25	2.19
7/29/2009	66.7	0.63	1.64	1.59
7/30/2009	65.5	1.12	>4.36	>4.23
7/31/2009	62.6	0.77	2.87	2.79

FG-1 (upstream of RIBs) August 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
8/1/2009	63.5	1.05	>4.36	>4.23
8/2/2009	63.1	0.84	3.79	3.68
8/3/2009	64.7	0.78	2.99	2.90
8/4/2009	64.1	0.67	1.88	1.82
8/5/2009	66.0	0.59	1.40	1.36
8/6/2009	63.6	0.58	1.31	1.28
8/7/2009	62.9	0.50	0.97	0.94
8/8/2009	60.9	0.51	1.03	1.00
8/9/2009	60.2	0.49	0.94	0.91
8/10/2009	64.3	0.50	0.98	0.95
8/11/2009	64.7	0.55	1.20	1.17
8/12/2009	63.6	0.74	2.54	2.47
8/13/2009	63.3	0.59	1.41	1.37
8/14/2009	64.5	0.56	1.23	1.20
8/15/2009	66.2	0.51	1.02	0.99
8/16/2009	66.9	0.51	1.01	0.98
8/17/2009	68.1	0.49	0.92	0.90
8/18/2009	68.6	0.46	0.83	0.81
8/19/2009	69.8	0.43	0.72	0.70
8/20/2009	66.9	0.41	0.68	0.66
8/21/2009	67.1	0.39	0.62	0.60
8/22/2009	67.1	0.67	1.94	1.88
8/23/2009	67.7	0.54	1.15	1.11
8/24/2009	68.2	0.56	1.25	1.22
8/25/2009	66.9	0.47	0.87	0.85
8/26/2009	66.4	0.37	0.57	0.55
8/27/2009	61.2	0.39	0.64	0.62
8/28/2009	58.8	0.39	0.63	0.61
8/29/2009	58.6	1.73	4.36	4.23
8/30/2009	60.0	0.77	2.85	2.77
8/31/2009	60.9	0.63	1.64	1.59

FG-1 (upstream of RIBs) September 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
9/1/2009	57.6	0.52	1.04	1.01
9/2/2009	58.1	0.50	0.97	0.94
9/3/2009	59.5	0.42	0.72	0.70
9/4/2009	61.4	0.43	0.74	0.72
9/5/2009	61.1	0.42	0.71	0.69
9/6/2009	58.0	0.44	0.76	0.73
9/7/2009	55.2	0.38	0.60	0.58
9/8/2009	57.8	0.41	0.67	0.65
9/9/2009	59.2	0.40	0.65	0.63
9/10/2009	55.4	0.41	0.69	0.67
9/11/2009	54.1	0.41	0.68	0.66
9/12/2009	57.4	0.39	0.64	0.62
9/13/2009	60.5	0.36	0.56	0.55
9/14/2009	57.3	0.37	0.59	0.57
9/15/2009	58.1	0.35	0.53	0.51
9/16/2009	55.9	0.38	0.61	0.59
9/17/2009	54.8	0.38	0.61	0.59
9/18/2009	53.4	0.25	0.36	0.35
9/19/2009	52.8	0.35	0.55	0.53
9/20/2009	50.1	0.34	0.52	0.50
9/21/2009	51.2	0.35	0.54	0.52
9/22/2009	52.9	0.34	0.51	0.49
9/23/2009	57.4	0.36	0.55	0.53
9/24/2009	59.5	0.33	0.50	0.49
9/25/2009	53.8	0.34	0.51	0.49
9/26/2009	49.2	0.34	0.51	0.50
9/27/2009	51.2	0.59	1.40	1.36
9/28/2009	56.2	0.49	0.94	0.91
9/29/2009	56.4	0.37	0.57	0.56
9/30/2009	53.3	0.37	0.59	0.57

FG-1 (upstream of RIBs) October 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
10/1/2009	49.6	0.38	0.60	0.59
10/2/2009	48.0	0.42	0.72	0.70
10/3/2009	50.3	0.71	2.23	2.17
10/4/2009	53.1	0.69	2.04	1.98
10/5/2009	52.4	0.47	0.88	0.85
10/6/2009	51.3	0.47	0.85	0.83
10/7/2009	51.5	1.10	>4.36	>4.23
10/8/2009	51.9	0.74	2.53	2.46
10/9/2009	50.3	0.55	1.16	1.13
10/10/2009	52.8	0.61	1.47	1.43
10/11/2009	46.7	0.52	1.05	1.02
10/12/2009	44.7	0.59	1.37	1.33
10/13/2009	-	-	-	-
10/14/2009	-	-	-	-
10/15/2009	-	-	-	-
10/16/2009	-	-	-	-
10/17/2009	-	-	-	-
10/18/2009	-	-	-	-
10/19/2009	-	-	-	-
10/20/2009	-	-	-	-
10/21/2009	-	-	-	-
10/22/2009	-	-	-	-
10/23/2009	-	-	-	-
10/24/2009	-	-	-	-
10/25/2009	-	-	-	-
10/26/2009	-	-	-	-
10/27/2009	-	-	-	-
10/28/2009	-	-	-	-
10/29/2009	-	-	-	-
10/30/2009	-	-	-	-
10/31/2009	-	-	-	-

FG-2 (immediately downstream of RIBs) July 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
7/1/2009	-	-	-	-
7/2/2009	57.3	2.48	>7.41	>4.07
7/3/2009	57.8	1.24	>7.41	>4.07
7/4/2009	60.2	0.92	>7.41	>4.07
7/5/2009	59.0	0.94	>7.41	>4.07
7/6/2009	58.5	0.73	6.63	3.64
7/7/2009	57.6	0.68	5.36	2.94
7/8/2009	56.8	0.97	>7.41	>4.07
7/9/2009	56.2	0.74	6.92	3.80
7/10/2009	57.8	0.63	4.41	2.42
7/11/2009	58.8	0.53	2.98	1.64
7/12/2009	60.5	0.57	3.53	1.94
7/13/2009	59.0	0.44	2.18	1.20
7/14/2009	57.8	0.42	1.96	1.08
7/15/2009	57.4	0.42	2.00	1.10
7/16/2009	57.1	0.41	1.95	1.07
7/17/2009	60.2	0.40	1.85	1.02
7/18/2009	60.9	1.14	>7.41	>4.07
7/19/2009	60.9	0.54	3.18	1.75
7/20/2009	60.2	0.48	2.49	1.37
7/21/2009	59.0	0.45	2.21	1.21
7/22/2009	59.3	0.59	3.84	2.11
7/23/2009	59.3	0.47	2.40	1.32
7/24/2009	59.0	2.65	>7.41	>4.07
7/25/2009	60.9	1.38	>7.41	>4.07
7/26/2009	60.4	0.86	>7.41	>4.07
7/27/2009	61.9	0.77	>7.41	>4.07
7/28/2009	62.3	0.66	5.04	2.77
7/29/2009	63.1	0.58	3.66	2.01
7/30/2009	64.7	1.15	>7.41	>4.07
7/31/2009	61.1	0.76	>7.41	>4.07

FG-2 (immediately downstream of RIBs) August 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
8/1/2009	62.1	1.07	>7.41	>4.07
8/2/2009	61.6	0.82	>7.41	>4.07
8/3/2009	62.4	0.74	6.90	3.79
8/4/2009	61.2	0.61	4.14	2.27
8/5/2009	63.1	0.54	3.17	1.74
8/6/2009	60.5	0.52	2.91	1.60
8/7/2009	59.7	0.43	2.05	1.13
8/8/2009	58.0	0.43	2.10	1.15
8/9/2009	57.6	0.41	1.94	1.06
8/10/2009	61.1	0.43	2.05	1.13
8/11/2009	61.9	0.48	2.50	1.37
8/12/2009	62.1	0.71	6.12	3.36
8/13/2009	61.1	0.55	3.24	1.78
8/14/2009	61.2	0.49	2.60	1.43
8/15/2009	62.4	0.44	2.19	1.20
8/16/2009	62.9	0.42	2.00	1.10
8/17/2009	63.8	0.40	1.88	1.03
8/18/2009	64.1	0.37	1.67	0.92
8/19/2009	65.2	0.34	1.45	0.80
8/20/2009	62.8	0.41	1.89	1.04
8/21/2009	62.9	0.37	1.67	0.92
8/22/2009	65.2	0.75	7.00	3.85
8/23/2009	65.3	0.61	4.12	2.27
8/24/2009	65.9	0.64	4.64	2.55
8/25/2009	63.6	0.51	2.85	1.57
8/26/2009	62.9	0.39	1.80	0.99
8/27/2009	58.6	0.41	1.90	1.04
8/28/2009	56.9	0.40	1.81	0.99
8/29/2009	58.5	1.99	>7.41	>4.07
8/30/2009	58.6	0.85	>7.41	>4.07
8/31/2009	59.2	0.69	5.72	3.14

FG-2 (immediately downstream of RIBs) September 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfs)
9/1/2009	55.9	0.55	3.34	1.83
9/2/2009	56.1	0.53	3.03	1.66
9/3/2009	57.4	0.44	2.16	1.19
9/4/2009	59.2	0.46	2.28	1.25
9/5/2009	59.0	0.43	2.08	1.14
9/6/2009	56.1	0.43	2.06	1.13
9/7/2009	54.1	0.37	1.62	0.89
9/8/2009	56.1	0.41	1.89	1.04
9/9/2009	57.4	0.40	1.82	1.00
9/10/2009	54.3	0.39	1.76	0.96
9/11/2009	53.6	0.38	1.71	0.94
9/12/2009	56.6	0.39	1.74	0.96
9/13/2009	58.5	0.35	1.53	0.84
9/14/2009	56.1	0.36	1.55	0.85
9/15/2009	56.9	0.34	1.47	0.81
9/16/2009	55.4	0.37	1.66	0.91
9/17/2009	54.7	0.37	1.63	0.89
9/18/2009	53.3	0.23	0.97	0.53
9/19/2009	52.8	0.34	1.46	0.80
9/20/2009	50.6	0.32	1.35	0.74
9/21/2009	51.5	0.34	1.44	0.79
9/22/2009	53.1	0.33	1.43	0.79
9/23/2009	56.9	0.37	1.62	0.89
9/24/2009	58.3	0.35	1.53	0.84
9/25/2009	53.6	0.34	1.45	0.79
9/26/2009	50.1	0.32	1.37	0.75
9/27/2009	51.7	0.55	3.33	1.83
9/28/2009	55.4	0.50	2.71	1.49
9/29/2009	56.1	0.38	1.68	0.92
9/30/2009	53.6	0.36	1.56	0.86

FG-2 (immediately downstream of RIBs) October 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
10/1/2009	50.1	0.34	1.48	0.81
10/2/2009	49.2	0.38	1.71	0.94
10/3/2009	51.0	0.61	4.09	2.25
10/4/2009	53.3	0.68	5.33	2.93
10/5/2009	52.4	0.48	2.48	1.36
10/6/2009	51.9	0.46	2.30	1.27
10/7/2009	51.5	1.13	>7.41	>4.07
10/8/2009	52.1	0.68	5.43	2.99
10/9/2009	50.8	0.52	2.96	1.63
10/10/2009	52.9	0.53	3.05	1.67
10/11/2009	47.8	0.43	2.04	1.12
10/12/2009	46.0	0.46	2.35	1.29
10/13/2009	-	-	-	-
10/14/2009	-	-	-	-
10/15/2009	-	-	-	-
10/16/2009	-	-	-	-
10/17/2009	-	-	-	-
10/18/2009	-	-	-	-
10/19/2009	-	-	-	-
10/20/2009	-	-	-	-
10/21/2009	-	-	-	-
10/22/2009	-	-	-	-
10/23/2009	-	-	-	-
10/24/2009	-	-	-	-
10/25/2009	-	-	-	-
10/26/2009	-	-	-	-
10/27/2009	-	-	-	-
10/28/2009	-	-	-	-
10/29/2009	-	-	-	-
10/30/2009	-	-	-	-
10/31/2009	-	-	-	-

FG-3 (Route 109A bridge) July 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
7/1/2009	-	-	-	-
7/2/2009	57.6	2.32	>8.21	>4.01
7/3/2009	58.6	1.83	>8.21	>4.01
7/4/2009	61.1	1.46	>8.21	>4.01
7/5/2009	60.0	1.49	>8.21	>4.01
7/6/2009	61.6	1.26	7.18	3.50
7/7/2009	60.0	1.23	6.47	3.16
7/8/2009	57.6	1.55	>8.21	>4.01
7/9/2009	57.4	1.29	>8.21	>4.01
7/10/2009	60.7	1.20	5.93	2.89
7/11/2009	64.8	1.13	4.46	2.18
7/12/2009	63.5	1.16	5.08	2.48
7/13/2009	62.8	1.06	3.53	1.72
7/14/2009	62.3	1.04	3.30	1.61
7/15/2009	60.0	1.06	3.55	1.73
7/16/2009	63.8	1.06	3.44	1.68
7/17/2009	64.3	1.06	3.46	1.69
7/18/2009	61.6	1.84	>8.21	>4.01
7/19/2009	62.9	1.15	4.94	2.41
7/20/2009	64.8	1.11	4.16	2.03
7/21/2009	64.8	1.09	3.94	1.92
7/22/2009	60.4	1.19	5.71	2.78
7/23/2009	62.6	1.11	4.27	2.08
7/24/2009	59.0	3.22	>8.21	>4.01
7/25/2009	61.6	1.98	>8.21	>4.01
7/26/2009	62.6	1.37	>8.21	>4.01
7/27/2009	64.0	1.28	7.93	3.87
7/28/2009	64.1	1.21	6.02	2.94
7/29/2009	67.1	1.16	4.96	2.42
7/30/2009	65.9	1.78	>8.21	>4.01
7/31/2009	63.1	1.28	7.87	3.84

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FG-3 (Route 109A bridge) August 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
8/1/2009	63.8	1.64	>8.21	>4.01
8/2/2009	63.6	1.34	>8.21	>4.01
8/3/2009	63.3	1.28	7.79	3.80
8/4/2009	64.0	1.17	5.30	2.58
8/5/2009	65.0	1.12	4.33	2.11
8/6/2009	64.3	1.13	4.44	2.17
8/7/2009	61.9	1.05	3.31	1.62
8/8/2009	62.1	1.07	3.69	1.80
8/9/2009	63.8	1.05	3.38	1.65
8/10/2009	62.6	1.06	3.46	1.69
8/11/2009	66.5	1.08	3.76	1.83
8/12/2009	64.5	1.29	8.07	3.94
8/13/2009	64.0	1.14	4.74	2.31
8/14/2009	64.5	1.11	4.12	2.01
8/15/2009	66.2	1.07	3.68	1.79
8/16/2009	67.2	1.07	3.59	1.75
8/17/2009	67.6	1.06	3.46	1.69
8/18/2009	68.9	1.04	3.18	1.55
8/19/2009	69.6	1.01	2.87	1.40
8/20/2009	70.7	1.04	3.19	1.56
8/21/2009	69.3	0.99	2.68	1.31
8/22/2009	67.7	1.27	7.64	3.73
8/23/2009	67.1	1.16	5.05	2.46
8/24/2009	67.7	1.17	5.32	2.60
8/25/2009	67.4	1.08	3.78	1.85
8/26/2009	66.4	0.98	2.60	1.27
8/27/2009	62.9	1.01	2.85	1.39
8/28/2009	61.6	1.01	2.91	1.42
8/29/2009	58.0	2.46	>8.21	>4.01
8/30/2009	60.2	1.32	>8.21	>4.01
8/31/2009	60.2	1.20	5.92	2.89

FG-3 (Route 109A bridge) September 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
9/1/2009	59.0	1.10	4.00	1.95
9/2/2009	58.8	1.08	3.78	1.85
9/3/2009	60.2	1.02	2.98	1.46
9/4/2009	61.9	1.03	3.14	1.53
9/5/2009	61.9	1.02	3.00	1.46
9/6/2009	61.4	1.05	3.30	1.61
9/7/2009	57.1	0.98	2.62	1.28
9/8/2009	58.3	1.01	2.85	1.39
9/9/2009	60.0	1.02	2.97	1.45
9/10/2009	57.4	1.01	2.90	1.42
9/11/2009	56.4	1.01	2.90	1.41
9/12/2009	58.0	1.02	2.96	1.44
9/13/2009	59.9	0.97	2.53	1.23
9/14/2009	59.2	0.98	2.63	1.28
9/15/2009	59.9	0.98	2.56	1.25
9/16/2009	58.8	1.01	2.85	1.39
9/17/2009	57.3	1.00	2.83	1.38
9/18/2009	54.5	0.85	1.63	0.79
9/19/2009	54.5	0.98	2.55	1.24
9/20/2009	53.4	0.95	2.31	1.13
9/21/2009	54.3	0.96	2.44	1.19
9/22/2009	54.0	0.96	2.37	1.16
9/23/2009	57.4	0.99	2.66	1.30
9/24/2009	60.2	0.98	2.55	1.25
9/25/2009	58.0	0.97	2.50	1.22
9/26/2009	52.9	0.95	2.28	1.11
9/27/2009	52.6	1.04	3.29	1.61
9/28/2009	55.0	1.09	3.94	1.92
9/29/2009	58.1	0.96	2.45	1.19
9/30/2009	55.7	0.95	2.33	1.14

FG-3 (Route 109A bridge) October 2009				
Date	Temperature	Stage	Stream Flow	
	(°F)	(ft)	(ft ³ /s)	(cfsm)
10/1/2009	51.5	0.95	2.32	1.13
10/2/2009	50.3	0.97	2.54	1.24
10/3/2009	51.3	1.04	3.23	1.58
10/4/2009	52.6	1.19	5.55	2.71
10/5/2009	53.1	1.01	2.95	1.44
10/6/2009	52.6	1.02	2.98	1.46
10/7/2009	52.4	1.08	3.71	1.81
10/8/2009	51.9	1.17	5.20	2.53
10/9/2009	51.2	1.05	3.34	1.63
10/10/2009	52.2	1.03	3.11	1.52
10/11/2009	49.1	0.96	2.40	1.17
10/12/2009	46.4	1.00	2.76	1.35
10/13/2009	-	-	-	-
10/14/2009	-	-	-	-
10/15/2009	-	-	-	-
10/16/2009	-	-	-	-
10/17/2009	-	-	-	-
10/18/2009	-	-	-	-
10/19/2009	-	-	-	-
10/20/2009	-	-	-	-
10/21/2009	-	-	-	-
10/22/2009	-	-	-	-
10/23/2009	-	-	-	-
10/24/2009	-	-	-	-
10/25/2009	-	-	-	-
10/26/2009	-	-	-	-
10/27/2009	-	-	-	-
10/28/2009	-	-	-	-
10/29/2009	-	-	-	-
10/30/2009	-	-	-	-
10/31/2009	-	-	-	-