

**Appendix B:**  
**Surface Water Parameters**



## SURFACE WATER PARAMETERS

### STREAM CLASSIFICATION CODE (Title 25, PA Code)

EV	Exceptional value
HQ-CWF	High Quality Cold Water Fishery
HQ-TSF	High Quality Trout Stocking Fishery
CWF	Cold Water Fishery
MF	Migratory Fishes
TSF	Trout Stocking Fishery

### **Volume of Flow -**

Flow is essential in determining the dilution factor for any potential discharge. It is also an indicator of recent weather patterns. Volumes of flow would be higher than normal after a period of heavy precipitation. This is important because during a test period which may occur after heavy rains, the quality of the stream may appear degraded due to non-point source run off. It is also important that the testing period occur during a low flow since pollutants would have the most damaging effect during low flow.

### **pH -**

The pH of a solution refers to its hydrogen ion activity. Measurement of pH is one of the most important and frequently used tests in water chemistry. The pH value of most natural waters falls within the range of 4 to 9. The pH scale ranges from 0 (acid) to 14 (base). The majority of waters are slightly basic because of the presence of carbonates and bicarbonates. A departure from the normal pH for a particular body of water can be caused by the influx of acid or alkaline industrial wastes (acid deposition in the form of rain or snow). It is a common practice for water treatment plants to adjust the pH. Most fish can tolerate pH values from 5.0 to 9.0, however the best fishing waters fall within the range 6.5 to 8.2.

### **Specific Conductance -**

Conductivity is a numerical expression of an aqueous ability to carry an electrical current. It is an indication of the dissolved inorganic solids in the water. The higher the specific conductance, the more impurities are in the water. Freshly distilled water has a conductivity of 0.5 to 2.0 micromhos/cm. The conductivity of the drinking water in the U.S. generally ranges from 50 to 1,500 micromhos/cm.

**Dissolved Oxygen -**

D.O. is a measure of oxygen that is dissolved in water. Different levels of D.O. are necessary to support various types of aquatic life. These levels in natural and wastewaters are dependent on the physical, chemical and biochemical activities prevailing in the water body. The minimum D.O. levels are as follows:

HQ-CWF	7.0 mg/l
CWF	5.0. mg/l
TSF	(February 15 <sup>th</sup> – July 31 <sup>st</sup> ) 6.0 mg/l; Remainder of year 5.0

**Temperature -**

Temperature is essential in determining if acceptable standards exist for a particular stream classification. Elevated temperatures from heated water discharges may have a significant ecological effect. It is also important in determining what the direct effect on fish and other aquatic life will be as a result of temperature fluctuation. The specific temperature requirements are as follows:

<b>Symbol</b>	<b>Protected Water Uses</b>	<b>Specific Criteria</b>	
EV	Exceptional Value	Must maintain Existing Quality	
HQ-CWF	High Quality and Cold Water Fish	7/1- 8/30	18.9 C (66F)
HQ-TSF	High Quality and Trout Stocking	7/1-7/31	23.3 C (74F)
		8/1-8/15	26.7 C (80F)
		8/16-8/30	30.6 C (87F)
CWF	Cold Water Fish	7/1-8/30	18.9 C (66F)
TSF	Trout Stocking	7/1-7/31	23.3 C (74F)
		8/1-8/15	26.7 C (80F)
		8/16-8/30	30.6 C (87F)

**Total Hardness -**

Hardness is defined as the total amount of calcium and magnesium salts that are present in the water. Water can be defined by its total hardness as follows:

Soft Water	0 - 60 mg/l
Moderately Hard Water	60 - 120 mg/l
Hard Water	120 - 180 mg/l
Very Hard Water	180 mg/l and up

**Total Alkalinity -**

Alkalinity measures the water's ability to buffer acid or acid neutralizing capacity. It indicates the water's ability to protect fish and other aquatic life against sudden changes in pH. The best fishing waters are those with alkalinity of 100 - 120 mg/l. The minimum level of total alkalinity for aquatic life is 20 mg/l except where natural conditions are less. Stream alkalinity can be influenced by rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges.

- Nitrogen -** Nitrate plus nitrite as nitrogen. The maximum recommended level of nitrate plus nitrite for water supply is 10 mg/l as Nitrogen.
- Nitrate (NO<sub>3</sub>) -** Nitrate is found only in small amounts in domestic wastewater and is a major ingredient in farm fertilizer. During precipitation events, varying amounts of this chemical wash into nearby waterways. Nitrates stimulate the growth of plankton (tiny animals, plants or bacteria), which provide food for fish. This may cause an increase in the fish population, however, if algae grows too quickly, dissolved oxygen levels in the water will be reduced and the fish may not be able to respire.
- Nitrite (NO<sub>2</sub>) -** Nitrite is the intermediate stage between nitrate and ammonia. It is relatively short-lived because it is quickly converted to nitrates by bacteria. However, nitrites produce a serious illness in fish even though they don't exist for very long in the environment. Nitrite concentrations in drinking water seldom exceed 0.1 mg/l. It can be expected that levels below 0.2 mg/l are representative of normal conditions.
- Ammonia (NH<sub>3</sub>) -** Ammonia is naturally present in surface and ground water and in wastewater. Pure ammonia is strong smelling and colorless. It is manufactured synthetically from nitrogen and hydrogen or it is produced from coal gas. In nature ammonia is formed by the action of bacteria on proteins and urea. Ammonia concentrations of 0.06 mg/l can cause gill damage in fish; 0.1 mg/l may indicate domestic or agricultural wastes and 0.2 mg/l and above is lethal to trout.
- Total Phosphorous -** Phosphorous occurs in natural waters and wastewaters almost solely in the form of phosphate. If organically bound with/or condensed, occurring in particles, detritus, or found within the bodies of aquatic organisms, then referred to as orthophosphates. Phosphates enter waterways from human and animal wastes, phosphate rich rocks, waste from laundries, cleaning and industrial processes and from fertilizer.
- Phosphorous is essential to the growth of organisms and it can be the nutrient that limits the productivity of a body of water. If phosphates are present in high concentrations in streams the algae and water weeds grow more rapidly, choking the waterways and utilizing large amounts of oxygen. The recommended maximum level is 0.1 mg/l for rivers and streams.

- Chlorides -** Chlorides are salts that contain chlorine and metal. Common chlorides are sodium chloride, calcium chloride and magnesium chloride. Most good fishing waters have a chloride concentration of less than 170 mg/l. The recommended maximum chloride levels are 150 mg/l for special protection waters and 250 mg/l for water supply.
- Total Acidity -** Acidity can be defined as a solution's ability to neutralize bases. Acidity of water is significant because acids contribute to corrosiveness and influence certain biological processes. Measuring acidity can also reflect changes in the quality of the source water.
- Solids -** The term solids or residue refers to the matter suspended or dissolved in water. Residue may affect water and effluent quality in many different ways. It can affect the palatability of drinking water or the aesthetic quality of bathing waters. For these reasons wastewater treatment processes remove solids from the discharge.
- T.D.S. -** Total dissolved solids (T.D.S.), also termed total filterable residue refers to the portion of residue that passes through a filter of a particular size. The maximum recommended value for T.D.S. is 750 mg/l.
- T.S.S. -** Total suspended solids (T.S.S.), also termed total non-filterable residue refers to the portion of residue that cannot pass through a filter of a particular size.
- Fecal Coliform -** Coliform bacteria are common in the intestines of both warm and cold-blooded animals and aid in the digestion of food. Some of these coliform bacteria pass out of the body with the stool. Fecal coliform counts of 200/100 mls or less are desirable during summer months (Clesceri et. al, 1998).

Table 1. This table describes the chemical parameters detected during the 2008 Water Quality Study.\*Meter malfunction ND-Not Detected

SiteID	SampleDate	SampleTime	StreamName	Weather	Volume of Flow(cfs)	Water Temperature©	Dissolved Oxygen(mg/l)	pH (Field)	pH (Lab)	Specific Conductance (u/cm)	Total Hardness	Total Alkalinity (mg/l)	Nitrogen (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Ammonia (mg/l)	Total Phosphorous(mg/l)	Chloride (mg/l)	Total Acidity	Total Dissolved Solids(mg/l)	Total Suspended Solids	Fecal Coliform (mls)
BUSHCR08	7/22/08	1145	Bushkill Creek	Cloudy	52.3	23.9	*	7.62	6.7	82	26	15	0.12	0.12	ND	ND	ND	10	ND	41	ND	40
BRODCR14	7/28/08	815	Brodhead Creek	Clear	126	18.6	9.7	7.79	6.6	130	28	15	0.19	0.19	ND	ND	ND	22	ND	65	ND	120
BRODCR16	7/28/08	930	Brodhead Creek	Clear	95.5	66.4	10.48	7.6	6.8	145	32	17	0.2	0.2	ND	ND	ND	23	ND	72	ND	80
BRODCR17	7/28/08	1000	Brodhead Creek	Clear	98.5	68.2	11.56	8.49	7.5	174	40	25	0.21	0.21	ND	ND	ND	26	ND	87	ND	70
MCMICR30	7/28/08	1100	McMichael Creek	Clear	111	19.9	10.36	7.87	7.4	243	56	39	0.41	0.36	0.05	0.2	0.2	34	ND	122	ND	960
BRODCR18	7/28/08	1215	Brodhead Creek	Clear	246	20.5	10.59	8.42	7.8	198	49	30	0.36	0.35	0.01	ND	0.1	28	ND	99	ND	450
BRODCR13	7/28/08	1300	Brodhead Creek	Clear	222	21.3	10.84	7.88	7.9	210	53	32	0.34	0.33	0.01	ND	0.1	28	ND	105	ND	410
LAKECR02	7/29/08	800	Lake Creek	Clear	5.11	18.3	8	7.68	7.1	242	83	61	0.43	0.43	ND	ND	ND	22	ND	121	ND	240
LAKECR01	7/29/08	900	Lake Creek	Clear	2.67	18.7	8.21	7.73	7.3	257	95	69	0.39	0.39	ND	ND	ND	21	ND	128	ND	241
MCMICR32	7/29/08	930	McMichael Creek	Clear	11	18.4	8.98	7.27	7	88	24	12	0.37	0.37	ND	ND	ND	12	ND	45	ND	242
MCMICR33	7/29/08	1030	McMichael Creek	Cloudy	28	19.3	9.94	7.78	7.2	157	54	32	0.24	0.24	ND	ND	ND	16	ND	78	ND	243
POCOCR14	7/29/08	1115	Pocono Creek	Cloudy	31.4	20.6	10.9	8.32	7.6	261	54	31	0.29	0.29	ND	ND	ND	46	ND	130	ND	244
MCMICR20	7/29/08	1200	McMichael Creek	Cloudy	40.6	20.6	9.59	7.48	7.3	181	56	33	0.21	0.21	ND	ND	ND	19	ND	91	ND	245
BRODCR01	8/4/08	815	Brodhead Creek	Cloudy	15.3	16.6	9.2	7.36	0	83	0	0	0	0	0	0	0	0	0	41	0	246
PARACR08	8/4/08	900	Paradise Creek	Cloudy	28.2	18.6	9.76	7.95	6.5	226	39	21	0.45	0.45	ND	ND	ND	47	ND	113	ND	247
DEHO CR04	8/4/08	1000	Devils Hole Creek	Cloudy	11.2	15.6	9.7	7.11	6.5	67	18	7	0.45	0.45	ND	ND	ND	9.9	ND	33	ND	248
DEHO CR05	8/4/08	1045	Devils Hole Creek	Cloudy	3.22	13.9	10.03	6.75	6.4	65	18	4	0.65	0.65	ND	ND	ND	11	ND	33	ND	249
TANKCR02	8/4/08	1115	Tank Creek	Cloudy	0.49	17.5	9.22	7.49	6.7	219	60	25	0.24	0.24	ND	ND	ND	42	ND	109	11	250
HAWKRU01	8/4/08	1200	Hawkey Run	Cloudy	6.6	17.9	8.98	6.64	6.4	117	23	8.5	0.27	0.27	ND	ND	ND	23	ND	59	ND	251
AQUACR11	8/5/08	815	Aquashicola Creek	Cloudy	0.81	14.8	10.42	7.48	7.3	289	125	99	1.3	1.29	0.01	ND	ND	14	ND	145	ND	252
AQUACR12	8/5/08	900	Aquashicola Creek	Cloudy	11.3	18.3	9.87	8.05	7.4	189	87	75	0.21	0.21	ND	ND	ND	6.7	ND	95	ND	253
BUCKCR07	8/5/08	1000	Buckwha Creek	Cloudy	11.9	19.1	10.19	7.63	7.2	117	40	28	0.61	0.61	ND	ND	ND	11	ND	58	ND	254
BUCKCR06	8/5/08	1100	Buckwha Creek	Cloudy	5.34	19.5	10.81	7.81	7.1	110	39	26	0.65	0.65	ND	ND	ND	11	ND	55	ND	255
BUCKCR01	8/5/08	1200	Buckwha Creek	Cloudy	3.23	16.6	9.2	7.36	7	83	38	25	0.7	0.7	ND	ND	ND	11	ND	41	ND	256

Table 2. This table describes the chemical parameters detected during the 2008 Water Quality Study.\* Meter malfunction ND-Not Detected

SiteID	SampleDate	SampleTime	StreamName	Weather	Volume of Flow(cfs)	Water Temperature	Dissolved Oxygen(mg/l)	pH (Field)	pH (Lab)	Specific Conductance (u/cm)	Total Hardness	Total Alkalinity (mg/l)	Nitrogen (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Ammonia (mg/l)	Total Phosphorous(mg/l)	Chloride (mg/l)	Total Acidity	Total Dissolved Solids (mg/l)	Total Suspended Solids	Fecal Coliform (ms)
BUCKCR05	8/5/08	1230	Buckwha Creek	Cloudy	0	20.2	10.6	7.6	7.0	118	38	26	0.47	0.5	ND	ND	ND	12	ND	59	ND	257
POCOCR20	8/6/08	815	Pocono Creek	Cloudy	5.7	15.1	7.97	7	6.4	122	18	10	0.1	0.1	ND	ND	ND	22	ND	61	ND	258
POCOCR16	8/6/08	900	Pocono Creek	Cloudy	14.2	16.1	9.92	7.4	6.6	181	34	20	0.27	0.3	ND	ND	ND	35	ND	90	ND	90
POCOCR17	8/6/08	930	Pocono Creek	Cloudy	12	16.7	9.21	7.4	6.7	189	38	21	0.4	0.4	ND	ND	ND	37	ND	94	ND	50
SCOTCR04	8/6/08	1030	Scotrun Creek	Cloudy	5.21	18.5	8.25	7.1	6.7	309	58	33	0.46	0.5	ND	ND	ND	55	ND	154	ND	380
CRCRPO04	8/6/08	1100	Cranberry Creek	Cloudy	2.89	19.3	7.39	6.7	6.5	138	34	16	0.22	0.2	ND	ND	ND	25	ND	69	ND	470
POCOCR18	8/6/08	1145	Pocono Creek	Cloudy	39.3	19.7	9.77	7.9	7	250	52	29	0.62	0.6	ND	ND	ND	43	ND	125	ND	1000
BUSHCR10	8/7/08	830	Bushkill Creek	Cloudy	113	20.6	8.6	7.3	6.4	23	13	6	ND	ND	ND	ND	ND	4	ND	12	ND	20
BUSHCR09	8/7/08	915	Bushkill Creek	Cloudy	99.3	20.3	9.24	7.3	6.4	52	18	10	ND	ND	ND	ND	ND	6	ND	26	ND	60
MARSCR08	8/7/08	1045	Marshalls Creek	Cloudy	8.19	20.6	7.49	7.4	0	174	0	0	0	0	0	0	0	0	0	87	0	0
MARSCR09	8/7/08	1115	Marshalls Creek	Cloudy	7.59	20.9	8.86	8	0	187	0	0	0	0	0	0	0	0	0	93	0	0
CHERC14	8/7/08	1200	Cherry Creek	Cloudy	8.02	20.4	9.96	8.5	7.8	287	138	105	0.23	0.2	ND	ND	ND	7	ND	143	ND	190
CHERC11	8/7/08	1300	Cherry Creek	Cloudy	41.9	20.5	9.97	8.6	8	318	144	113	0.35	0.4	ND	ND	ND	11	ND	159	ND	220
LEHIRI01	8/8/08	830	Lehigh River	Cloudy	52.7	18.6	7.74	7	6.5	102	24	12	0.07	0.1	ND	ND	ND	20	ND	51	ND	40
LEHIRI02	8/8/08	900	Lehigh River	Cloudy	34.2	18.6	8.64	7.1	6.6	71	26	12	0.19	0.2	ND	ND	ND	20	ND	35	ND	90
TOBYCR14	8/8/08	1000	Tobyhanna Creek	Cloudy	122	20.5	7.85	7.2	6.5	113	22	8.5	0.06	0.1	ND	ND	ND	24	ND	57	ND	10
TUNKCR03	8/8/08	1045	Tunkhannock Creek	Cloudy	50.6	18.5	8.57	5.7	0	38	0	0	0	0	0	0	0	0	0	19	0	0
TUNKCR07	8/8/08	1130	Tunkhannock Creek	Cloudy	6.66	19.2	7.02	5.7	0	34	0	0	0	0	0	0	0	0	0	17	0	0
DOTTCR04	8/8/08	1230	Dotters Creek	Cloudy	25.2	17.2	9.61	7.1	6.6	52	18	9.5	0.69	0.7	ND	ND	ND	7	ND	ND	ND	ND
REDRU03	8/11/08	800	Red Run	Cloudy	0	12.4	*	7.3	0	170	0	0	0	0	0	0	0	0	0	89	0	0
CLEARU02	8/11/08	845	Clear Run	Cloudy	0	13.9	*	7.2	6.4	161	38	15	1.05	1.1	ND	ND	ND	33	ND	81	ND	40
DUPURU01	8/11/08	930	Duck Puddle Run	Cloudy	0	13.9	*	7.3	6.5	99	21	8.5	0.2	0.2	ND	ND	ND	21	ND	49	ND	10
TOBYCR01	8/11/08	1030	Tobyhanna Creek	Rain	35.6	16.9	*	7.6	6.8	206	34	17	0.41	0.4	ND	ND	ND	41	ND	103	ND	10
TOBYCR20	8/11/08	1115	Tobyhanna Creek	Rain	17.5	19.2	*	7.1	6.7	118	27	16	0.1	0.1	ND	ND	ND	21	ND	59	ND	40
TOBYCR19	8/11/08	1200	Tobyhanna Creek	Rain	5.31	16.6	*	7.3	6.3	49	14	4	0.13	0.1	ND	ND	ND	9	ND	24	ND	10
MARSCR10	8/12/08	815	Marshalls Creek	Cloudy	15.5	14.7	*	7.5	6.4	70	24	12	0.26	0.3	ND	ND	ND	9	ND	35	5	160
MARSCR12	8/12/08	1100	Marshalls Creek	Cloudy	31.7	15.7	*	7.7	7.1	81	28	13	0.31	0.3	ND	ND	ND	10	ND	40	ND	230
MARSCR13	8/12/08	1150	Marshalls Creek	Cloudy	83.2	16.7	*	7.8	7.3	203	75	52	0.33	0.3	ND	ND	ND	19	ND	101	ND	70
MARSCR11	8/12/08	1300	Marshalls Creek	Cloudy	26.8	14.8	*	7.3	6.6	81	27	14	0.31	0.3	ND	ND	ND	9	ND	40	5	440