

2010

**Chisago Lakes Chain of Lakes Watershed
Stream Monitoring**

Chisago Soil & Water Conservation District

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Project Objective

The Chisago Lakes Lake Improvement District (LID), the Chisago Soil & Water Conservation District (SWCD) and the Minnesota Pollution Control Agency (MPCA) partnered to collect water quality monitoring data in the Chisago Lakes Chain of Lakes Watershed during 2009 and 2010. Gathering data to help determine the amounts of nutrients and sediment that are entering local lakes from small watersheds and tributaries is necessary for the Total Maximum Daily Load (TMDL) Study that is underway. This data will help the SWCD determine the best management practices and projects to clean up impaired waters and protect unimpaired waters.

Many sites were identified as practical locations for tributary sampling. Some of the sites identified prior to the monitoring season were determined to be either not suitable for sampling due to low water levels or redundant due to the proximity to a lake sampling location. These sites were left out to save both staff and lab costs and to reduce the likelihood of skewed data.

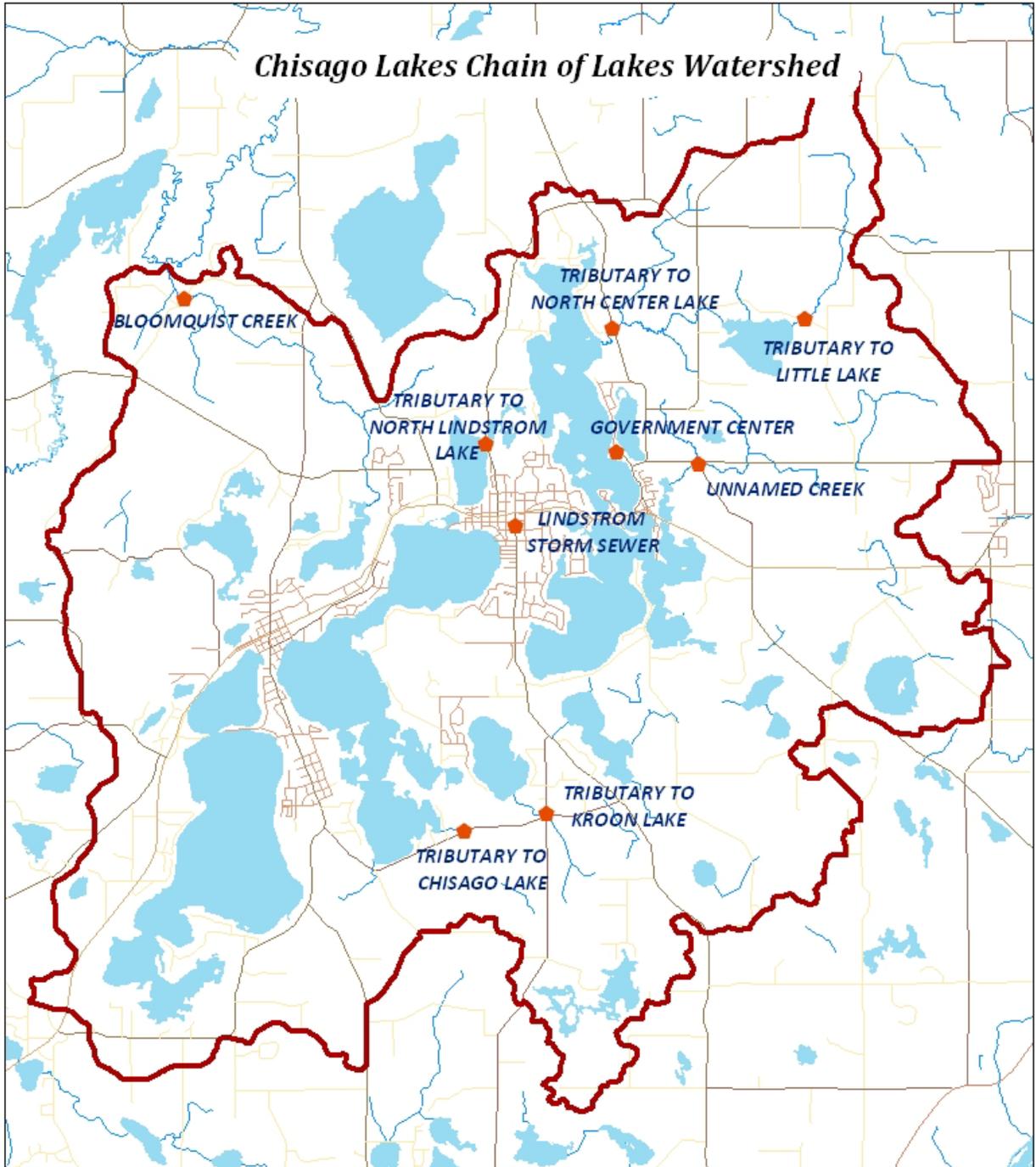
Methods

Twelve parameters were included in the sampling program, although not all parameters were sampled at each stream. When available, the MPCA standards for the North Central Hardwood Forest were used as a benchmark to judge the results by. Standards are not available for all parameters. When there is no established standard, the results are compared to the expected range for Chisago County. In some cases, a parameter has both a standard and an expected range. When this is the case, the standard is a more reliable and meaningful way to rate a stream. Orthophosphate has neither a standard nor an expected range. Orthophosphate was sampled so that the phosphorus source could be determined (inorganic or organic phosphorus). Orthophosphate results typically indicate inorganic phosphorus; therefore, by subtracting the orthophosphate from the total phosphorus, one can compare the organic versus inorganic amounts, which may suggest a source of the phosphorus.

A further explanation of the parameters, including the standards and expected ranges for each parameter, can be found on page 4.

In this report, the averages of stream data are found in a chart below a graph for each parameter on each stream. The average for 2009 includes only data from 2009. The average for 2010 is computed with only 2010 data. The overall average is an average of all data from 2009 and 2010. It is not an average of the averages.

Monitoring Locations



2008-2010 Water Quality Monitoring Sites
Monitored by the Chisago SWCD

-  Tributary Monitoring Sites
-  Lake
-  Stream



Explanation of Parameters

Parameter	Unit	MPCA Standard-North Central Hardwood Forest	Expected Range Chisago County
Ammonia Nitrogen*	mg/L	Under Development	0.02-0.28 mg/L
*Ammonia nitrogen samples lower than 0.05 are reported as 0.05 mg/L.			
Dissolved Oxygen	mg/L	No more than 50% below 5.0 mg/L	>5.0 mg/L
E. Coli	org/100 mL	Average 126 organisms/100 mL	No Range
Nitrate + Nitrite	mg/L	Under Development	0.01-0.18 mg/L
Orthophosphate	mg/L	No Standard	No Range
pH	mg/L	No more than 50% below 7.0	7.9-8.3
Temperature	°F	The daily average shall not exceed 86.0° F	35.6-69.8
Total Kjeldahl Nitrogen	mg/L	Under Development	0.5-3.0 mg/L
Total Phosphorus	mg/L	Under Development	0.06-0.15
Total Suspended Solids	mg/L	Proposed at No more than 10% above 30.0 mg/L	4.8-16.0
Transparency	cm	Average <20 cm	No Range
Turbidity	NTU	Average 25 NTU	3.0-8.5 NTU

Definitions

Ammonia Nitrogen - An inorganic form of nitrogen contained in fertilizers, septic system effluent, and animal wastes. It is also a product of bacterial decomposition of organic matter. Ammonia nitrogen becomes a concern if high levels of the un-ionized form are present, which can be toxic to aquatic organisms. The presence of un-ionized ammonia is a function of the ammonia nitrogen concentration, pH, and temperature. Conversion of ammonia nitrogen to nitrite nitrogen by nitrification requires large quantities of oxygen which can kill aquatic organisms due to the lowered dissolved oxygen concentrations in water. Samples are reported in mg/L. The lowest reported amount is 0.05 mg/L; samples less than this amount are reported as 0.05 mg/L.

Dissolved Oxygen (DO) - The concentration of molecular oxygen (O₂) dissolved in water. The DO level represents one of the most important measurements of water quality and is a critical indicator of a water body's ability to support healthy ecosystems. Levels above 5 mg/L are considered optimal, and most fish cannot survive for prolonged periods at levels below 3 mg/L. Microbial communities in water use oxygen to breakdown organic materials, such as manure, sewage and decomposing algae. Low levels of dissolved oxygen can be a sign that too much organic material is in a water body. DO is reported as mg/L.

Escherichia coli (E. coli) - A subgroup of fecal coliform bacteria that is present in the intestinal tracts and feces of warm-blooded animals. It is used as an indicator of the potential presence of pathogens. Although most strains of E. coli are harmless and live in the intestines of healthy humans and animals, the E. coli O157:H7 strain produces a powerful toxin and can cause severe illness. E. coli is reported as the number of organisms per 100 mL sample.

Nitrate + Nitrite - Nitrate (NO₃) plus nitrite (NO₂) as nitrogen. In lakes, most nitrate/nitrogen is in NO₃ form. Elevated levels of nitrates/nitrogen are often caused by over application of fertilizers that leach into waterbodies. It is measured in mg/L.

Orthophosphate - Water-soluble inorganic form of phosphorus in the form PO₄. Primary sources include water treatment facilities, feedlot runoff, failing septic systems. This form of phosphorus is more readily available for algae growth. Orthophosphate is measured in mg/L.

pH - A measure of acidity, with 7 being neutral. Numbers under 7 are acidic and numbers over 7 are alkaline. There is no unit associated with pH.

Temperature - A specific degree of hotness or coldness as indicated on or referred to a standard scale. Lakes in Chisago County meet the standard for temperature if the daily average temperature does not exceed 86.0 °F.

Total Kjeldahl Nitrogen - The sum of organic nitrogen and ammonia in a water body. Measured in milligrams per liter (mg/L). High measurements of TKN typically results from sewage and manure discharges to water bodies.

Total Phosphorus - A nutrient essential to the growth of organisms and commonly the limiting factor of primary productivity of surface water bodies. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus and can contribute to the eutrophication of surface water bodies (MPCA). The lower the reading, the clearer the water. Total phosphorus is measured in mg/L.

Total Suspended Solids - Very small particles remaining dispersed in a liquid such as wastewater due to turbulent mixing that can create turbid or cloudy conditions. Total suspended solids cause interference with light penetration, build up of sediment, and potential reduction in aquatic habitat. Solids also carry nutrients that cause algal blooms and other toxic pollutants that are harmful to fish. The lower the reading, the clearer the water.

Transparency Tube - A measure of water clarity in a 100 cm tube with a black and white disk at the bottom. Letting water out of the tube until you can see the disk will give you the transparency reading. The higher the reading, the clearer the water is.

Turbidity - Turbidity in water is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms. In streams, a major cause of elevated turbidity is disturbed and eroding soils carried by storm run-off to streams. Once in the stream system, elevated turbidity reduces the depth of photosynthesis and the feeding ability of aquatic organisms. When soils settle out in downstream reaches with slower flow, bed substrate becomes embedded, removing essential habitat for aquatic insects and other organisms. Turbidity is expressed in NTU (Nephelometric Turbidity Units).



BLOOMQUIST CREEK is a small creek that is a direct tributary to the Sunrise River. This creek runs through a very large wetland complex. During high flow situations the creek is the outlet from the Chisago Lakes Chain of Lakes Watershed. Bloomquist Creek also collects water from the Chisago Lakes Joint Sewage Treatment Commission, which is the wastewater treatment facility for the cities of Stacy, Chisago City, Lindstrom, Center City and Wyoming. This is the largest stream within the Chisago Lakes Chain of Lakes Watershed and flows year round. The water in Bloomquist Creek is generally clear. In the summer months when low flows are present, water north of the sampling point is stagnant and is often covered in duckweed.

Summary of Stream

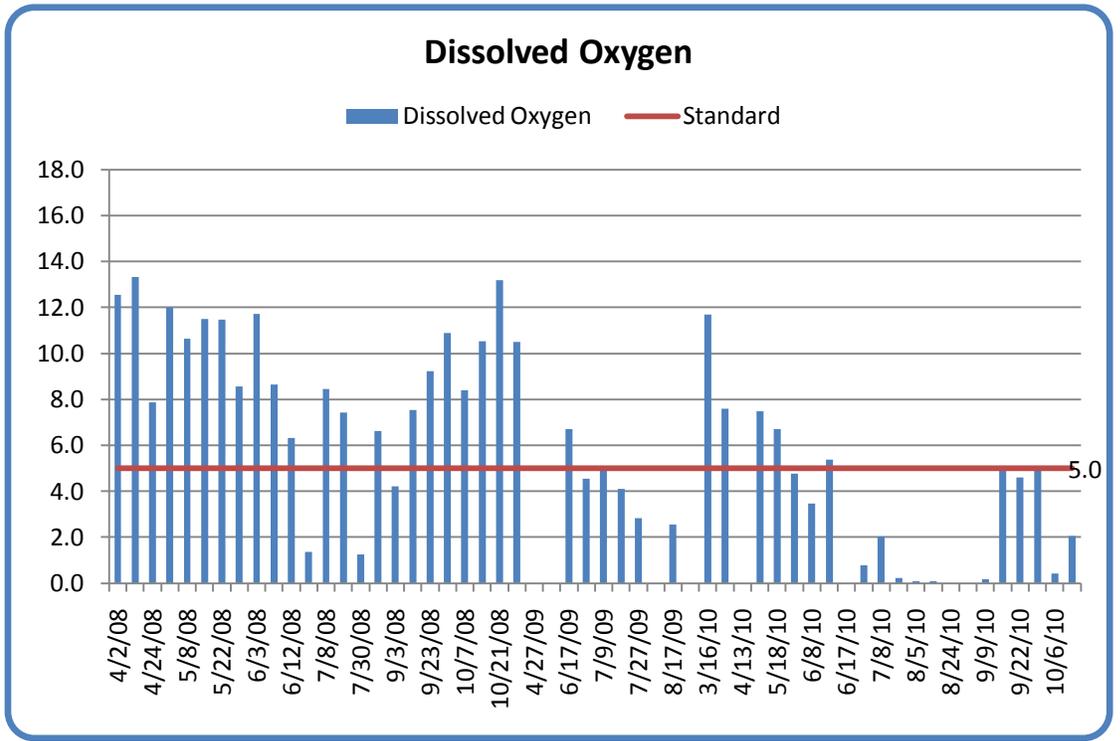
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	6.4 mg/L	No more than 50% below 5.0 mg/L	Yes	Over 5.0 mg/L	Yes
Temperature	56.3 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	2.78 mg/L	N/A	N/A	0.02-0.28 mg/L	No
Nitrate + Nitrite	0.21 mg/L	N/A	N/A	0.01-0.18 mg/L	No
Total Kjeldahl Nitrogen	3.9 mg/L	N/A	N/A	0.5-3.0 mg/L	No
pH	7.6	No more than 50% below 7.0	Yes	7.9-8.3	No (Below)
Total Phosphorus	0.67 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.61 mg/L	N/A	N/A	N/A	N/A
E. coli	142 org/100 ml	<126 organisms/100 ml	No	N/A	N/A
Total Suspended Solids	10.1 mg/L	No more than 10% above 30.0 mg/L	Yes	4.8-16.0 mg/L	Yes
Transparency	89.2 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	12.9 NTU	<25.0 NTU	Yes	3.0-8.5 NTU	No

Dissolved Oxygen

Expected Range: Over 5.0 mg/L

Standard: No More Than 50% Readings Below 5.0 mg/L

Seventeen out of forty eight readings (35%) were below 5.0 mg/L, indicating that Bloomquist Creek is meeting the standard. Low levels could be affected by high ammonia nitrogen levels.



2008 Average	2009 Average	2010 Average	Overall Average
8.9 mg/L	5.2 mg/L	3.7 mg/L	6.4 mg/L
Standard: No More Than 50% of Readings Below 5.0 mg/L			

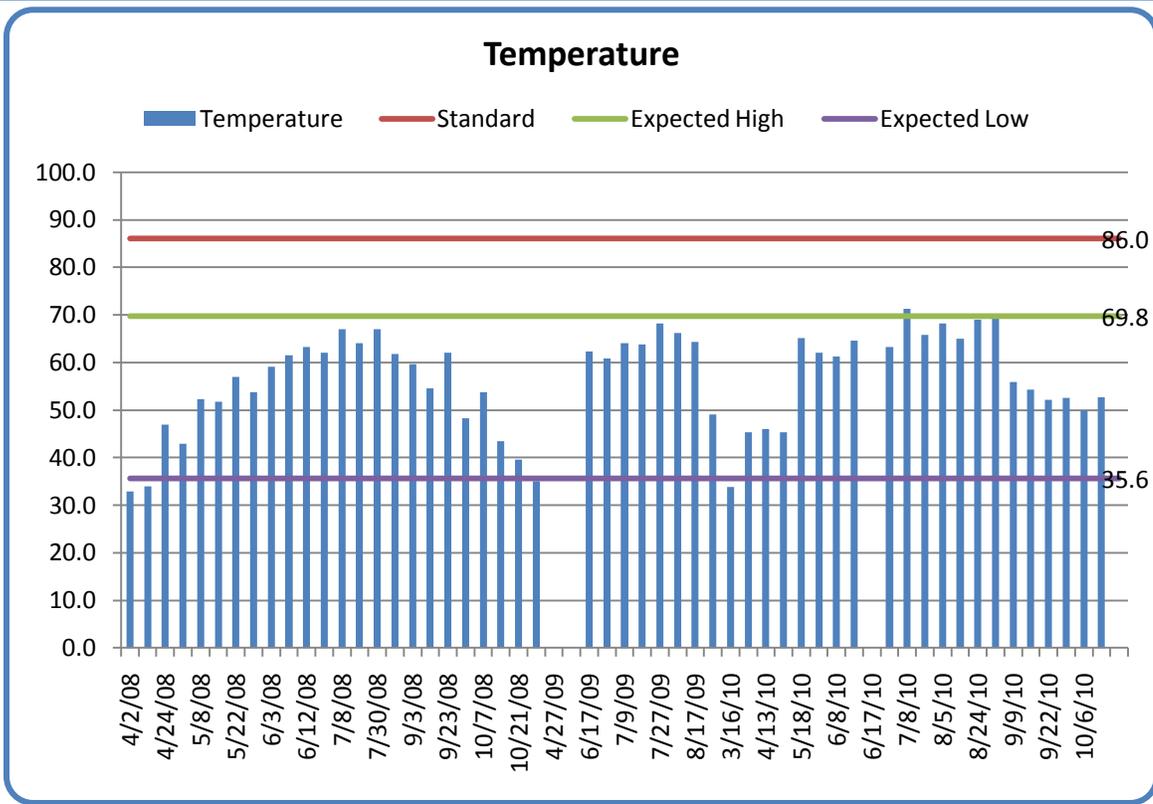
Temperature

Temperature

Expected Range: 35.6-69.8 °F

Standard: The daily average shall not exceed 86.0 °F

Most individual samples, along with all of the averages, fell within the expected range.



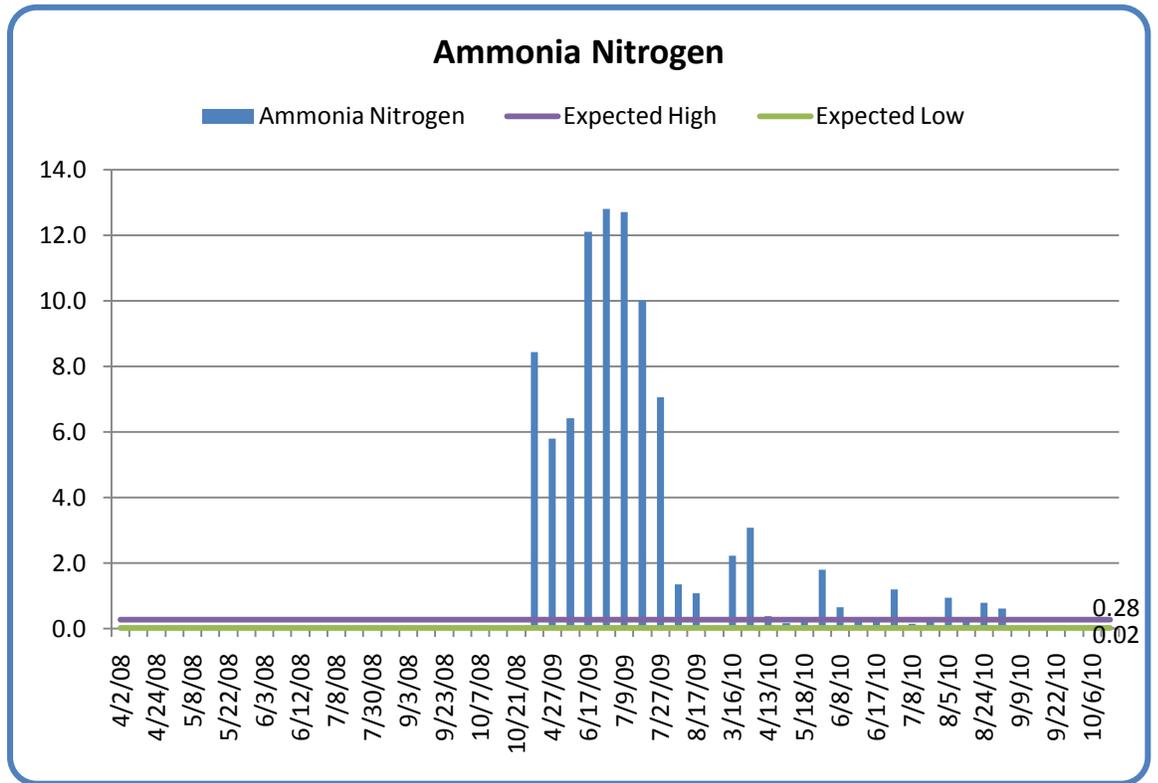
2008 Average	2009 Average	2010 Average	Overall Average
53.9 °F	59.3 °F	57.8 °F	56.3 °F
Standard: The daily average shall not exceed 86.0 °F			

Ammonia Nitrogen

Expected Range: 0.02-0.28 mg/L

Standard: Currently No Standard

The results are far higher than the expected range. The Chisago Lakes Joint Sewage Treatment Commission has been issued an ammonia limit for effluent from the facility. This chart cannot be directly compared to other Ammonia Nitrogen charts due to a change in scale.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	7.07 mg/L	0.63 mg/L	2.78 mg/L
Expected Range: 0.02-0.28 mg/L			

Nitrate + Nitrite

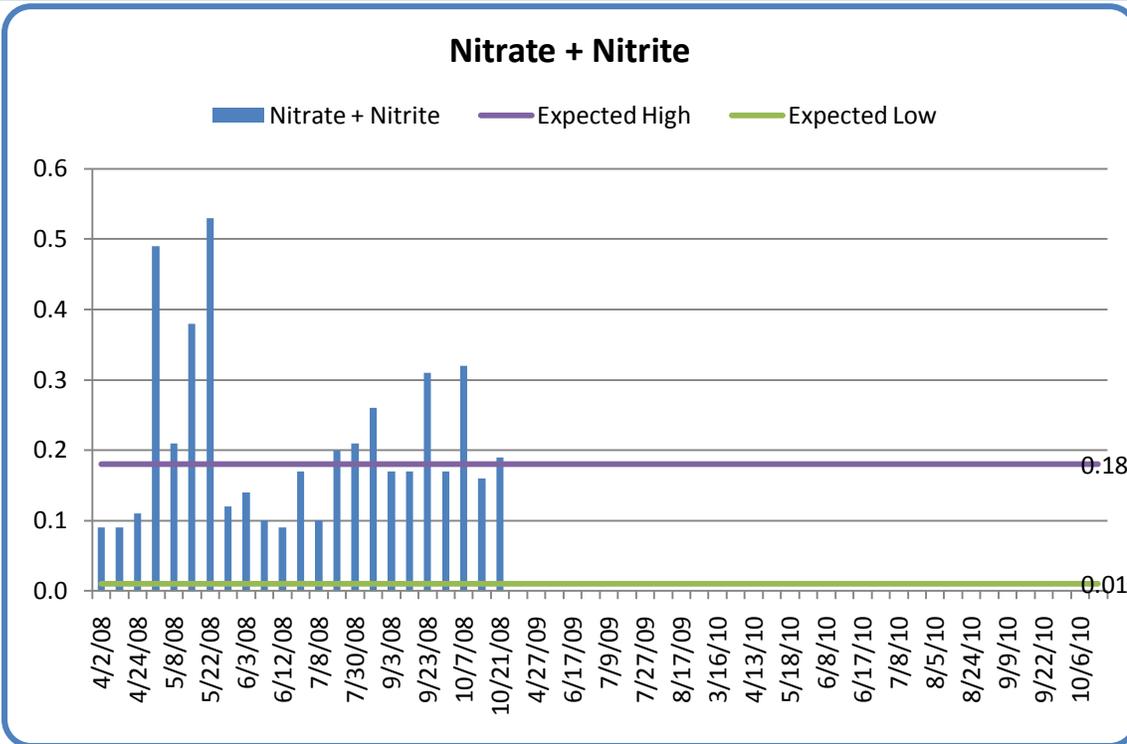
Nitrate + Nitrite

Expected Range: 0.01-0.18 mg/L

Standard: Under Development

Nitrate plus Nitrite samples were only taken in 2008 and only for Bloomquist Creek.

The average reading exceeded the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
0.21 mg/L	NO DATA	NO DATA	0.21 mg/L
Expected Range: 0.01-0.18 mg/L			

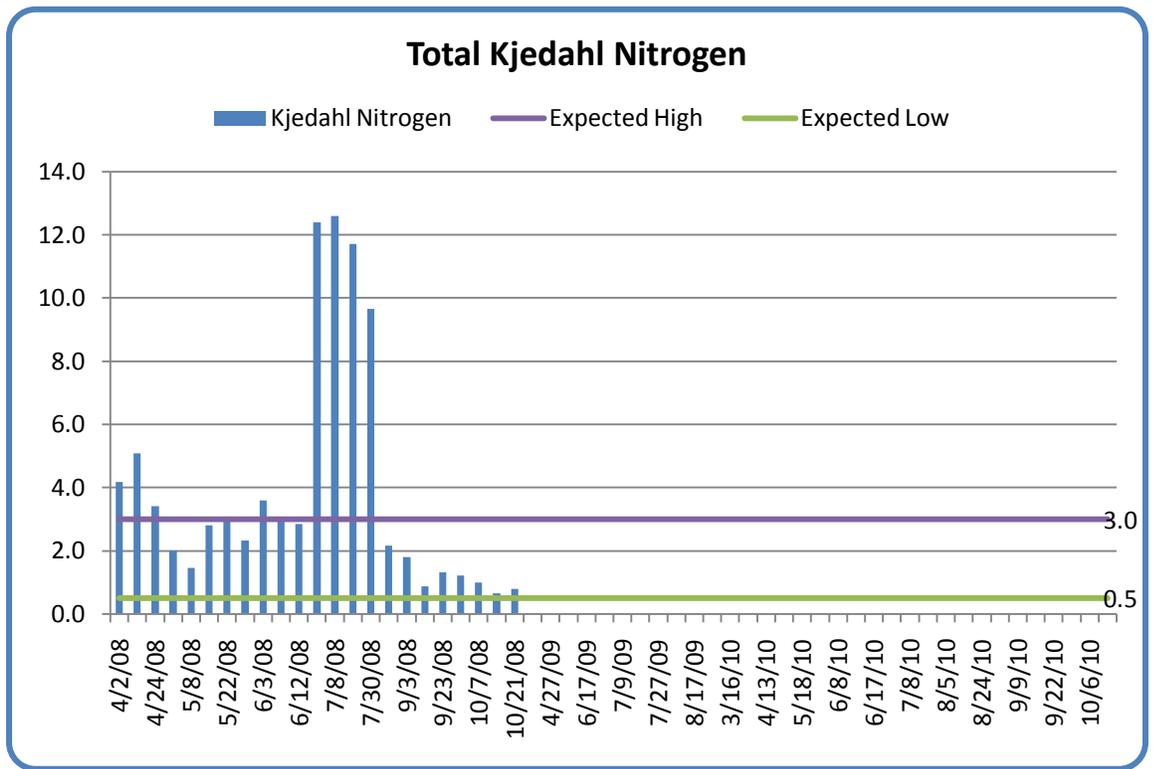
Total Kjedadl Nitrogen

Expected Range:
0.5-3.0 mg/L

Standard: Under
Development

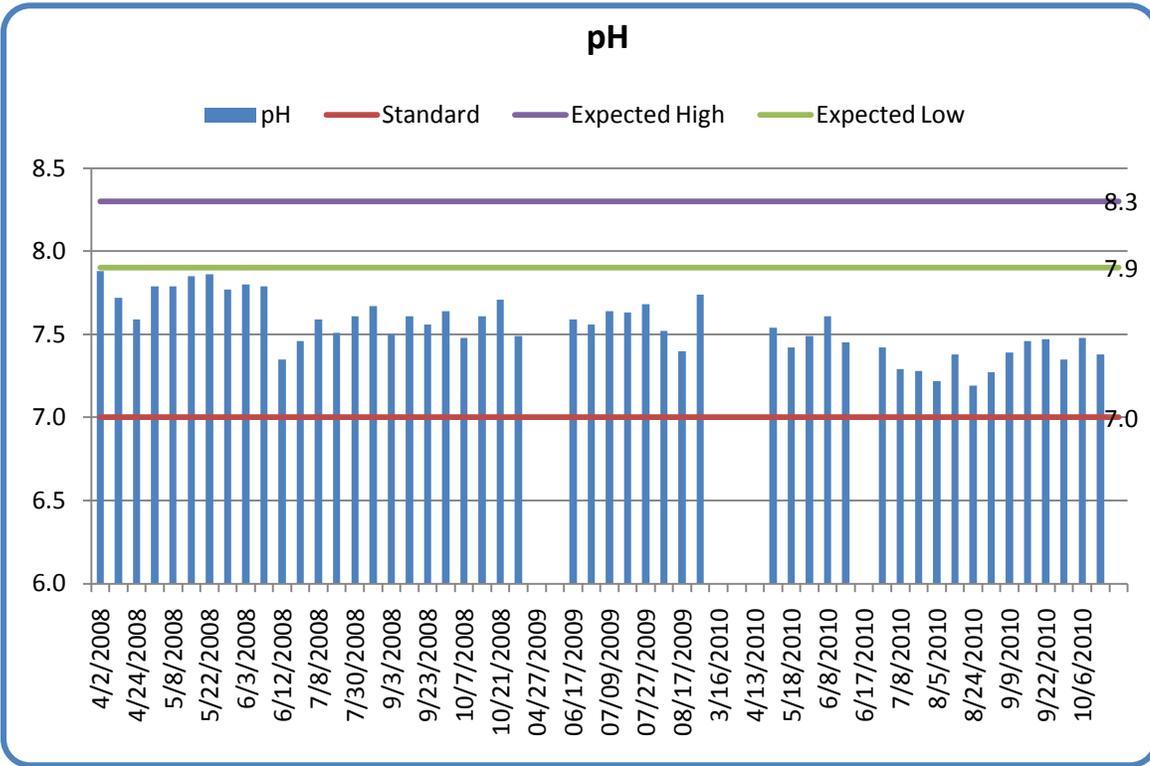
Total Kjedadl Nitrogen readings were only taken in 2008 and only at Bloomquist Creek.

The average exceeded the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
3.9 mg/L	NO DATA	NO DATA	3.9 mg/L

Expected Range: 0.5-3.0 mg/L



pH

Expected Range:
7.9-8.3

Standard: No More Than 50% Readings Below 7.0

No readings were below 7.0, meaning this creek meets the standard, although all of the readings are below the expected range.

2008 Average	2009 Average	2010 Average	Overall Average
7.7	7.6	7.4	7.6

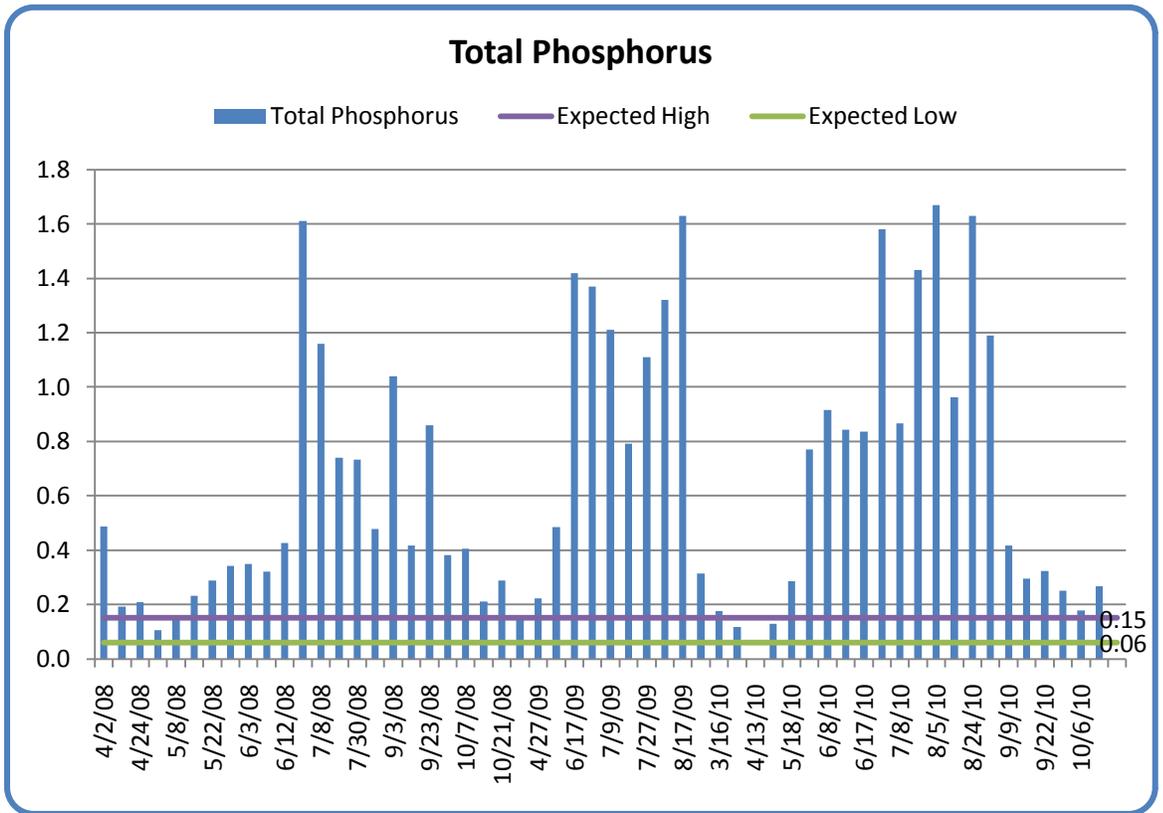
Standard: No More Than 50% of Readings Below 7.0

Total Phosphorus

Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

Most of the samples and the averages were well above the expected range. Low water could cause the wetland complex to collect TP until higher flows cause a flush to enter Bloomquist Creek.



2008 Average

2009 Average

2010 Average

Overall Average

0.50 mg/L

0.91 mg/L

0.72 mg/L

0.67 mg/L

Expected Range: 0.06-0.15 mg/L

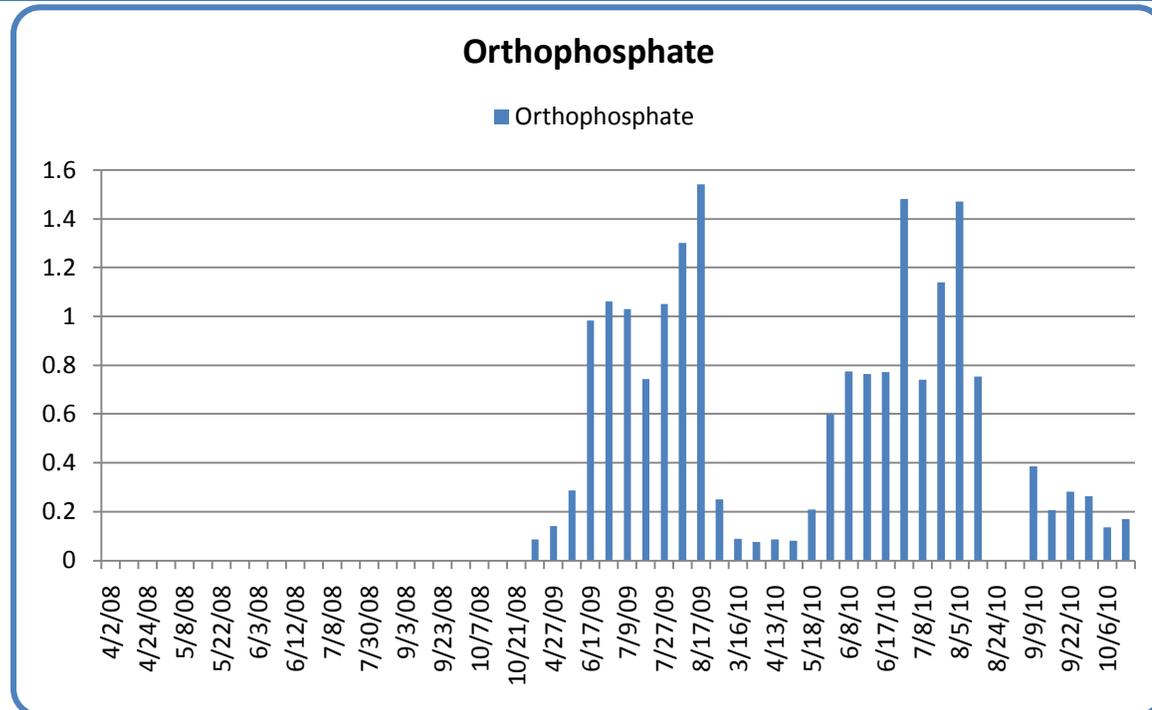
Orthophosphate

Orthophosphate

Expected Range:
Currently No
Expected Range

Standard: Currently
No Standard

Inorganic phosphorus levels appear to be the main source contributing to the total phosphorus levels in this stream.



2008 Average

2009 Average

2010 Average

Overall Average

NO DATA

0.77 mg/L

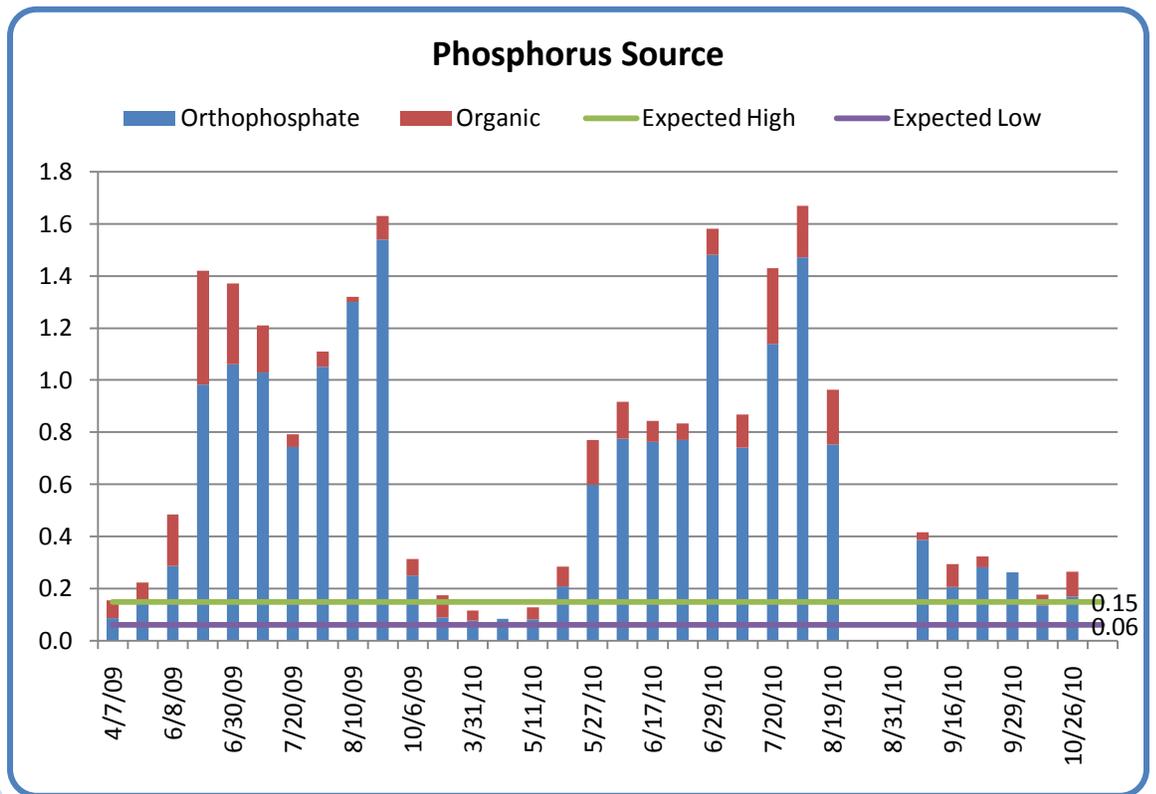
0.52 mg/L

0.61 mg/L

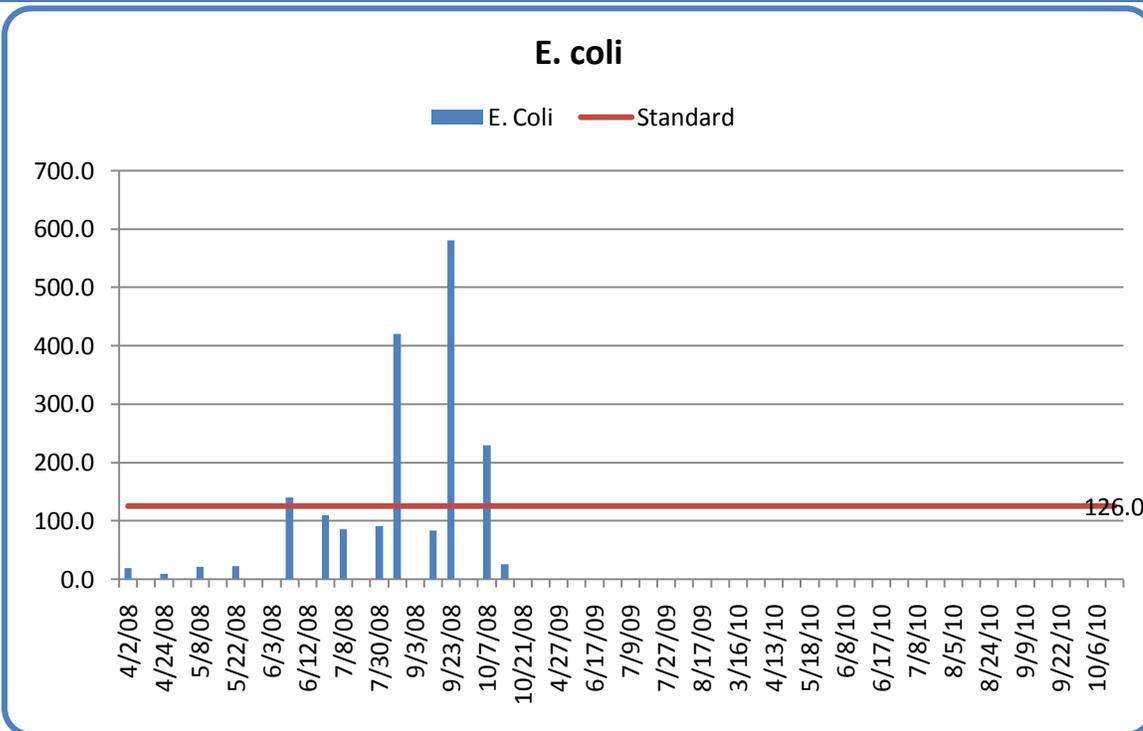
Standard/Expected Range: Currently None

Phosphorus Source:

Inorganic phosphorus (orthophosphate) makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is inorganic.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.14 mg/L	0.20 mg/L	0.06 mg/L
Inorganic	NO DATA	0.77 mg/L	0.52 mg/L	0.61 mg/L



E. coli

*Expected Range:
Currently No
Expected Range*

*Standard: Average
Reading of 126.0
organisms per 100.0
ml*

E. coli readings were only taken in 2008 and only for this creek.

The average reading did exceed the standard.

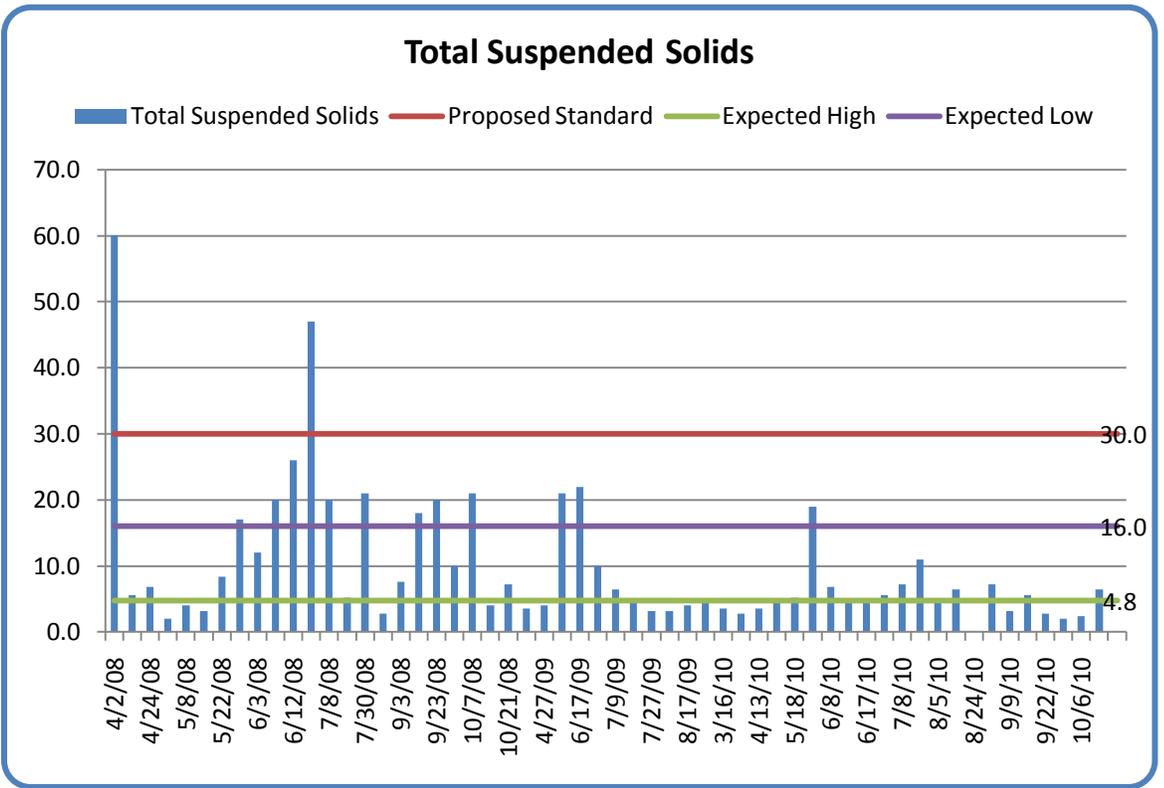
2008 Average	2009 Average	2010 Average	Overall Average
142.0 org/100 ml	NO DATA	NO DATA	142.0 org/100 ml
Standard: The average reading should not exceed 126.0 organisms per 100.0 ml			

Total Suspended Solids

Expected Range:
4.8-16.0 mg/L

Standard: Proposed
at No More Than
10% Readings Above
30.0 mg/L

The yearly and
overall averages fell
within the expected
range. The
proposed standard
would be met.



2008 Average	2009 Average	2010 Average	Overall Average
15.2 mg/L	7.9 mg/L	5.7 mg/L	10.1 mg/L
Proposed Standard: No more than 10% readings above 30.0 mg/L			

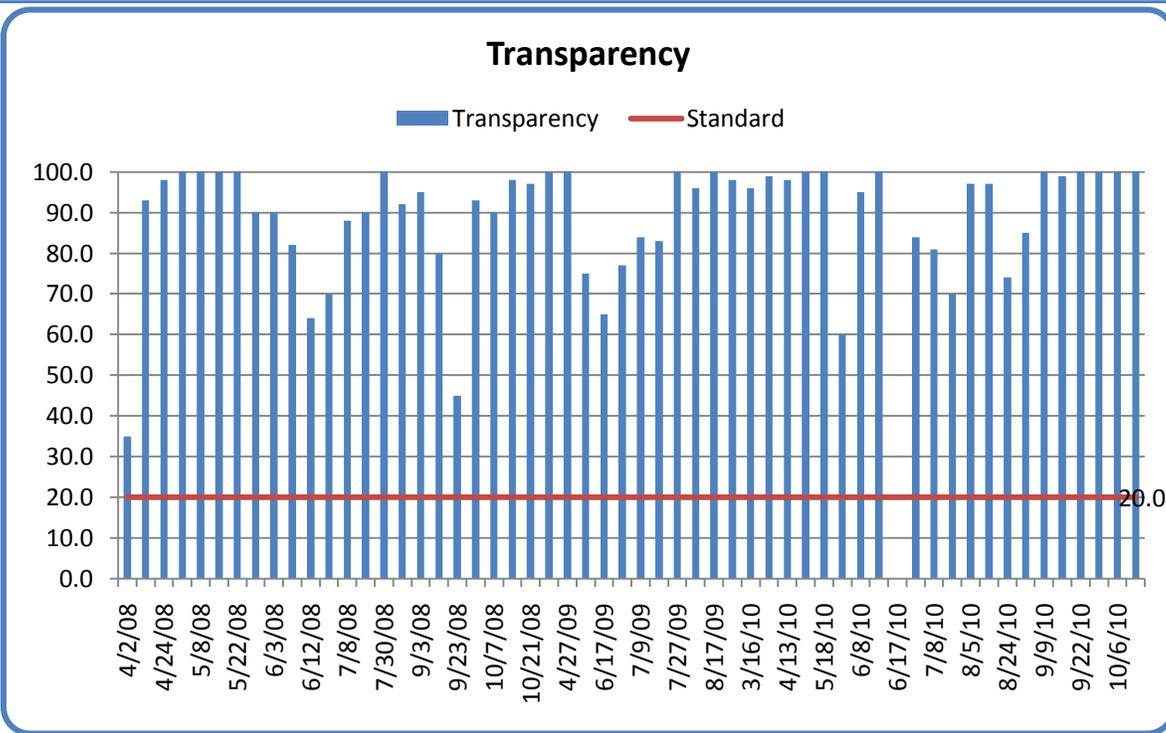
Transparency

Transparency

Expected Range:
Currently No
Expected Range

Standard: Average
Reading Over 20.0
cm

Transparency is
very good, with
most samples
over 70.0 cm and
all samples
meeting the
standard.



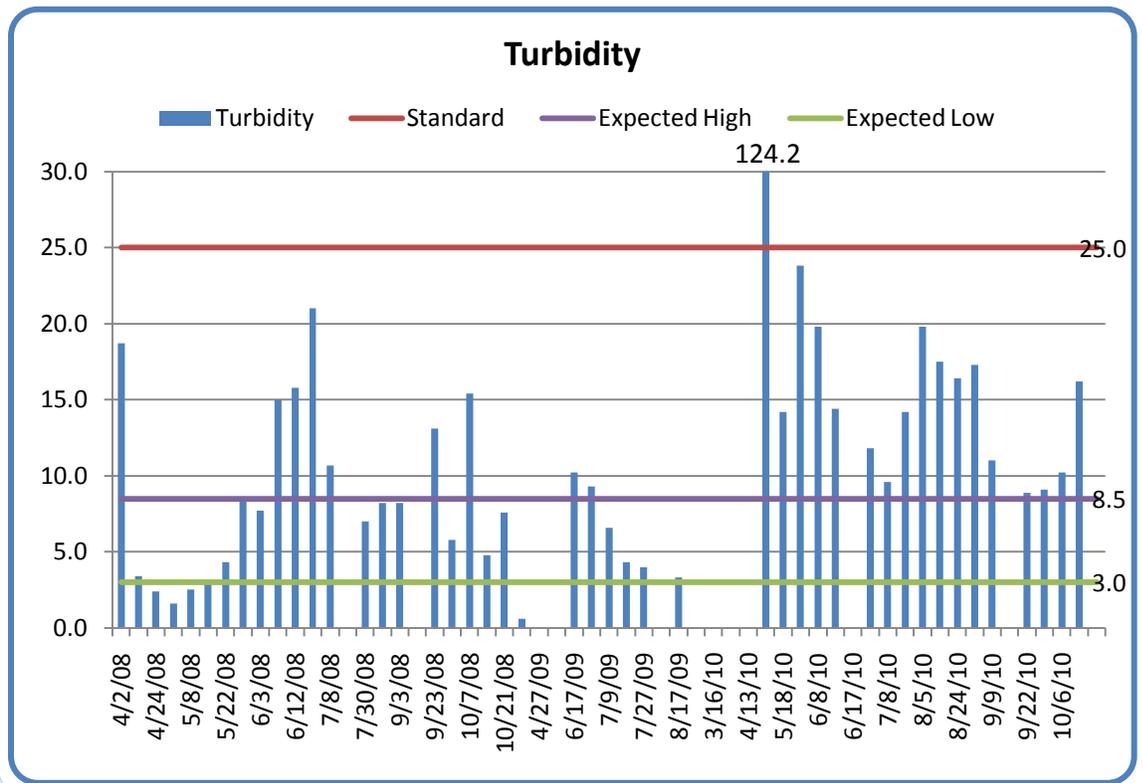
2008 Average	2009 Average	2010 Average	Overall Average
86.5 cm	88.9 cm	92.1 cm	89.2 cm
Standard: The average reading should be over 20 cm			

Turbidity

Expected Range:
3.0-8.5 NTU

Standard: Average Reading Not Over
25.0 NTU

Even with one outlier in the sample, this creek meets the standard. Excluding the outlier, the overall average would be even lower, at 9.6 NTU.



2008 Average	2009 Average	2010 Average	Overall Average
8.8 NTU	5.5 NTU	21.1 NTU	12.9 NTU
Standard: The average reading should not exceed 25.0 NTU			

TRIBUTARY TO CHISAGO LAKE is a small tributary that enters the south end of Chisago Lake. This creek has a small rural watershed and therefore, does not have a large amount of flow. Often, this creek appears rust-colored from large amounts of tannins. Tannin is an indication of breaking down organic matter (leaves, grass and peat) in the watershed and the water. This can make the phosphorus and nitrogen levels high. Samples were only taken when the water was flowing which was generally after rain events, therefore, most of the readings are higher than baseline numbers.

Summary of Stream

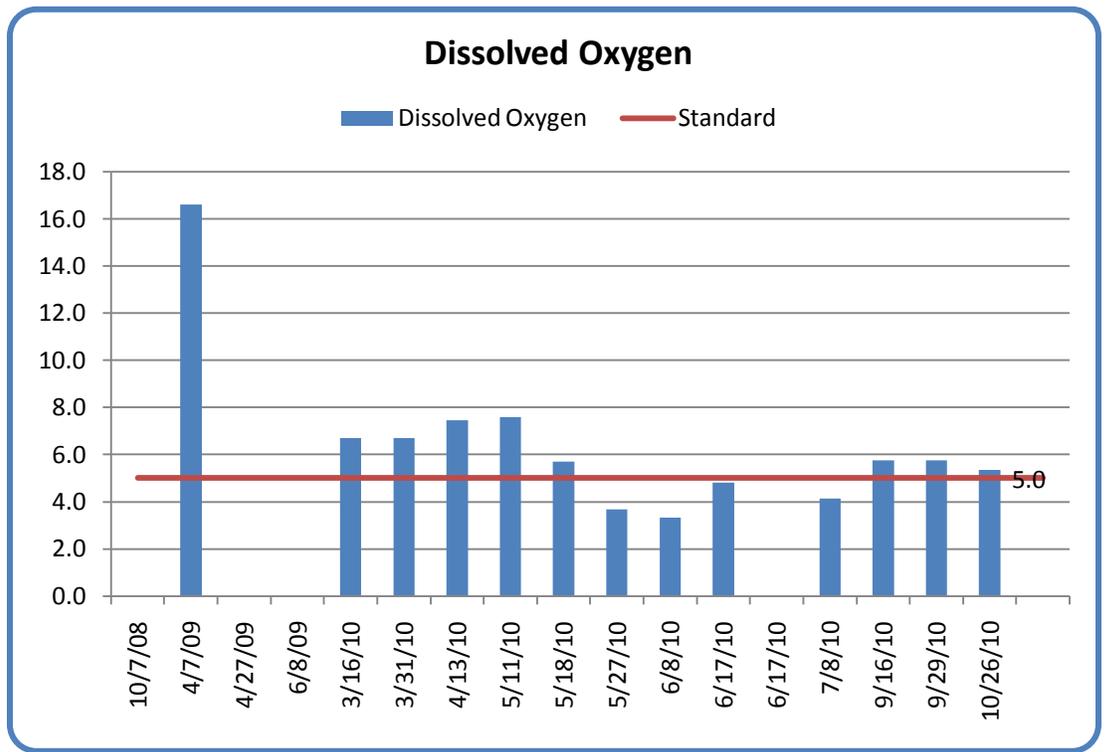
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	6.4 mg/L	No more than 50% below 5.0 mg/L	Yes	Over 5.0 mg/L	Yes
Temperature	52.9 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	0.09 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
pH	7.1	No more than 50% below 7.0	Yes	7.9-8.3	No (Below)
Total Phosphorus	0.27 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.10 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	61.2 mg/L	No more than 10% above 30.0 mg/L	No	4.8-16.0 mg/L	No
Transparency	65.0 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	11.5 NTU	<25.0 NTU	Yes	3.0-8.5 NTU	No

Dissolved Oxygen

Expected Range: Over 5.0 mg/L

Standard: No More Than 50% Readings Below 5.0 mg/L

Four of thirteen (30%) readings were below 5.0 mg/L, which means this stream is currently meeting the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	16.6 mg/L	5.6 mg/L	6.4 mg/L
Standard: No more than 50% of readings below 5.0 mg/L			

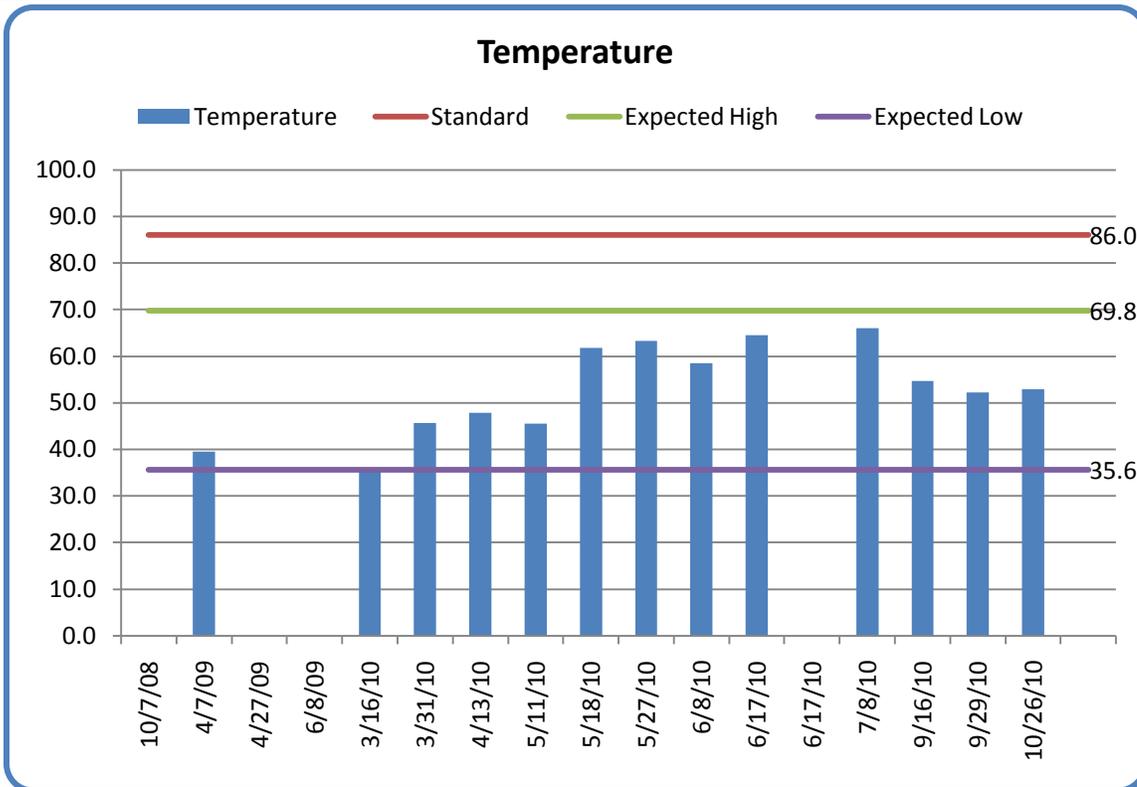
Temperature

Temperature

Expected Range: 35.6-69.8°F

Standard: The daily average shall not exceed 86.0°F

All of the readings are within the expected range.



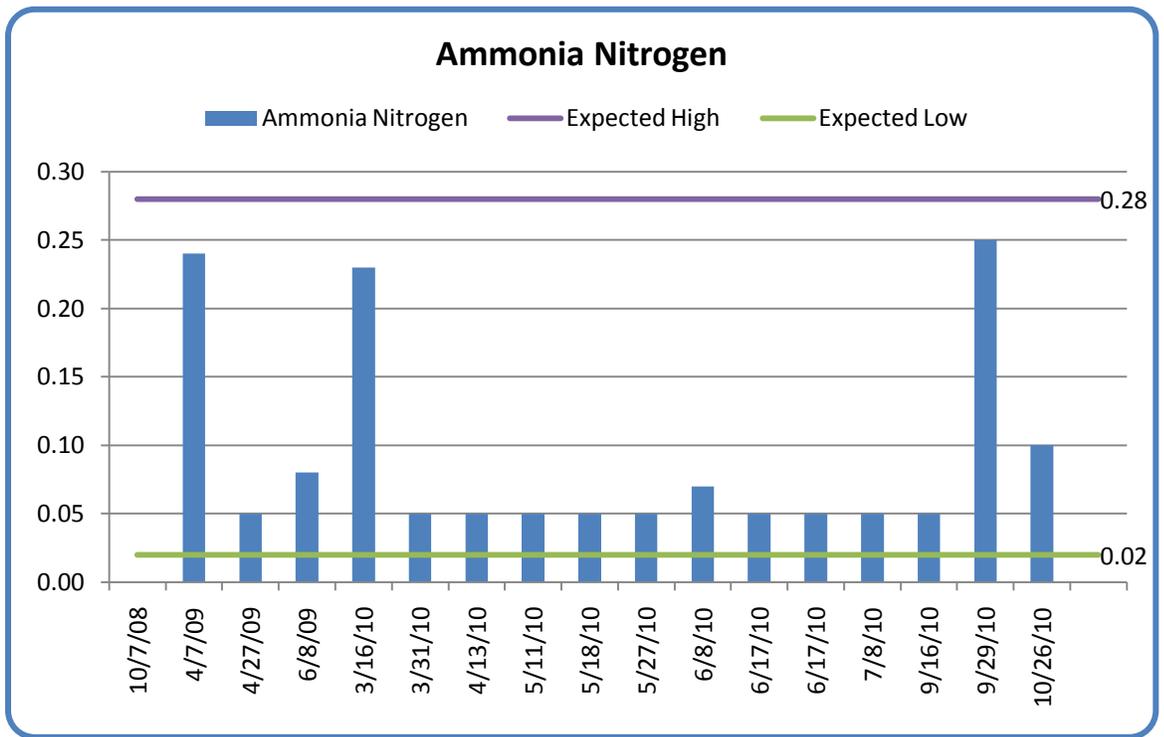
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	39.5°F	54.1°F	52.9°F
Standard: The daily average shall not exceed 86.0°F			

Ammonia Nitrogen

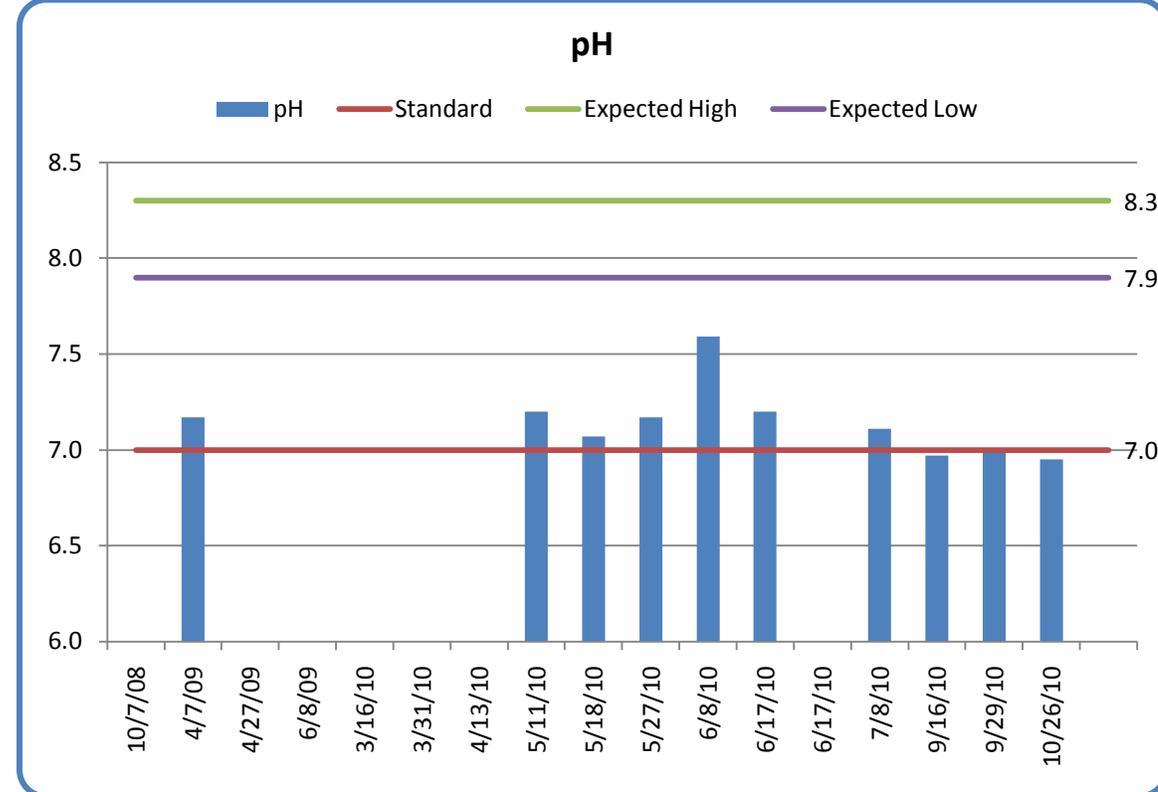
Expected Range:
0.02-0.28 mg/L

Standard: Currently
No Standard

All readings were within the expected range. The averages are on the low end of the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.12 mg/L	0.08 mg/L	0.09 mg/L
Expected Range: 0.02-0.28 mg/L			



pH

Expected Range:
7.9-8.3

Standard: No More Than 50% Readings Below 7.0

Only two readings were below 7.0, meaning this stream meets the pH standard.

All readings were well below the expected range.

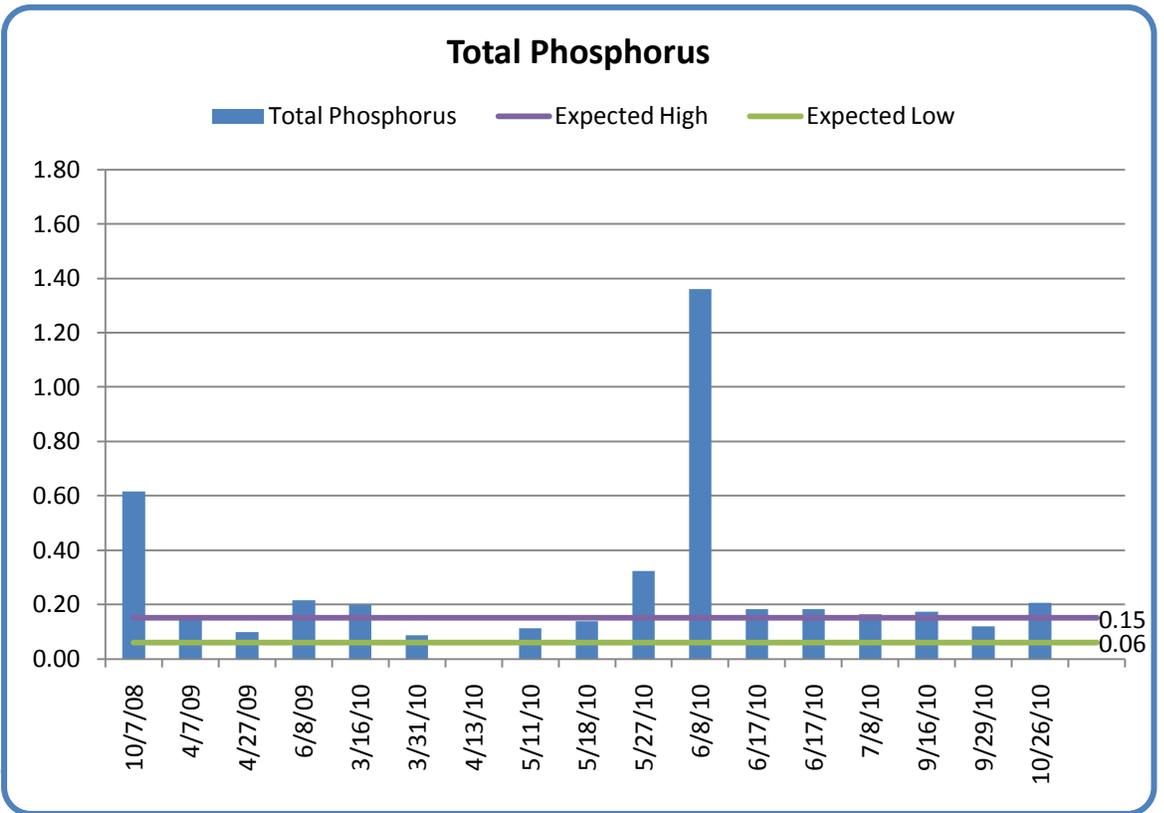
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	7.2	7.1	7.1
Standard: No more than 50% of readings below 7.0			

Total Phosphorus

Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

The 2008 and 2010 sample averages were well over the upper limited of the expected range, which brought the overall average well above the expected range as well. Without the outlier, the overall average is 0.20, still above the range.



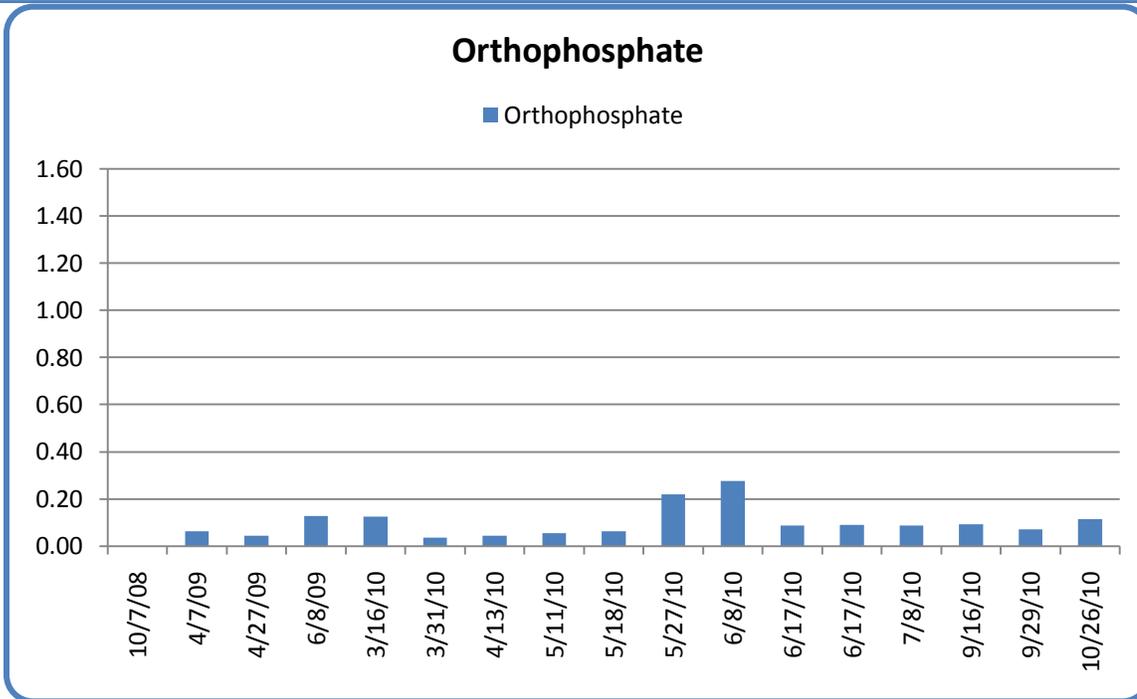
2008 Average	2009 Average	2010 Average	Overall Average
0.62 mg/L	0.16 mg/L	0.27 mg/L	0.27 mg/L
Expected Range: 0.06-0.15 mg/L			

Orthophosphate

Orthophosphate

Expected Range:
Currently No
Expected Range

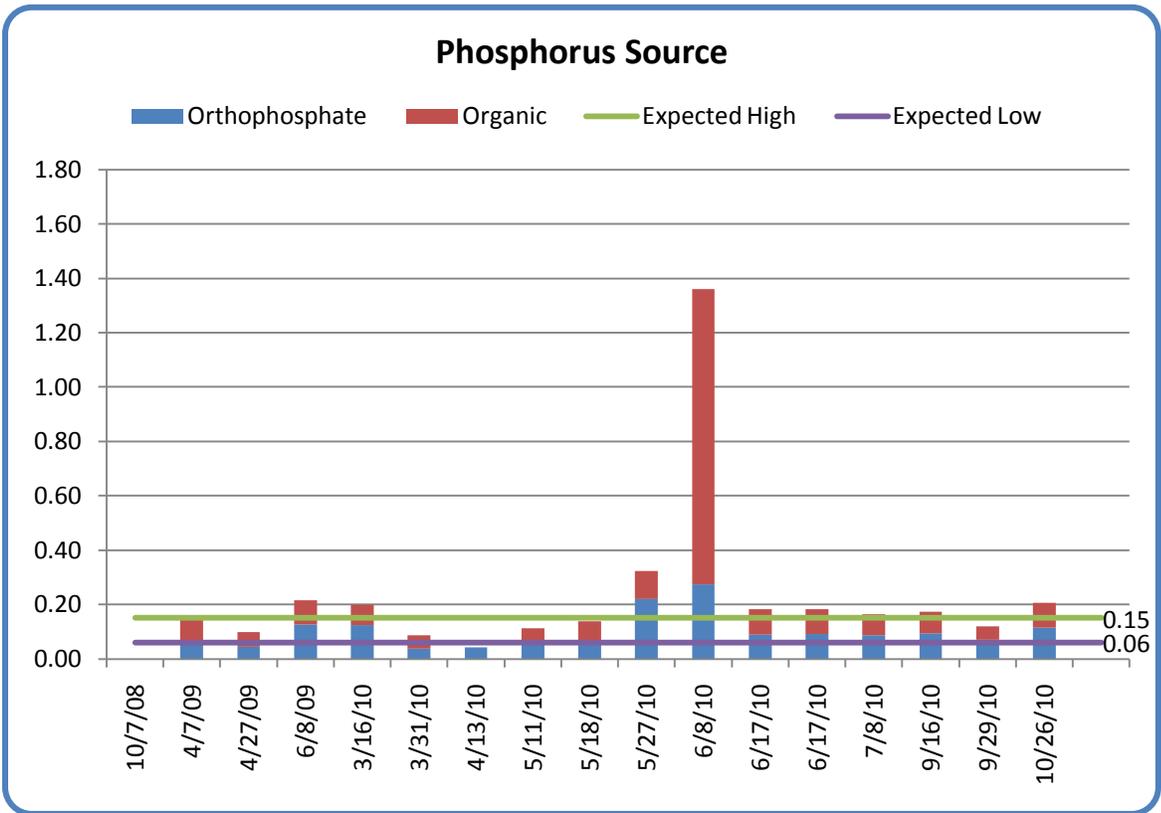
Standard: Currently
No Standard



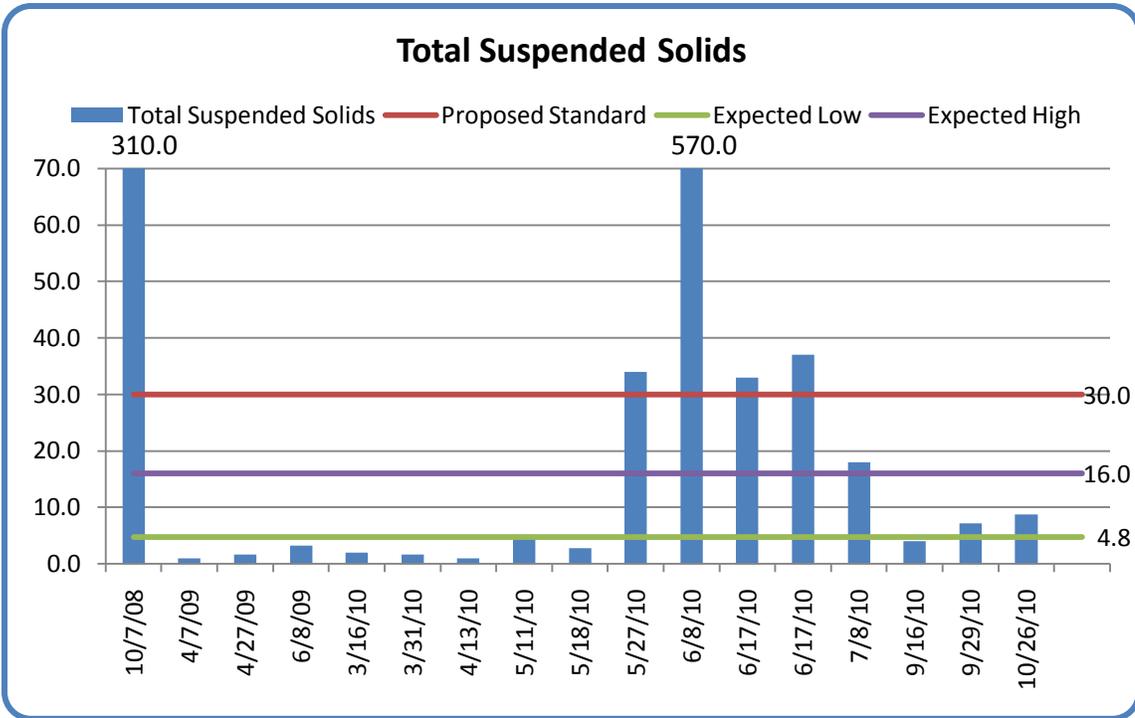
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.08 mg/L	0.11 mg/L	0.10 mg/L
Expected Range/Standard: Currently none			

Phosphorus Source:

Inorganic phosphorus (orthophosphate) makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is inorganic.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.77 mg/L	0.17 mg/L	0.17 mg/L
Inorganic	NO DATA	0.78 mg/L	0.11 mg/L	0.10 mg/L



Total Suspended Solids

Expected Range: 4.8-16.0 mg/L

Standard: Proposed at No More Than 10% Readings Above 30.0 mg/L

Nearly 30% of readings were above 30.0 mg/L, meaning this stream does not meet the standard. Two readings were significantly higher than all others.

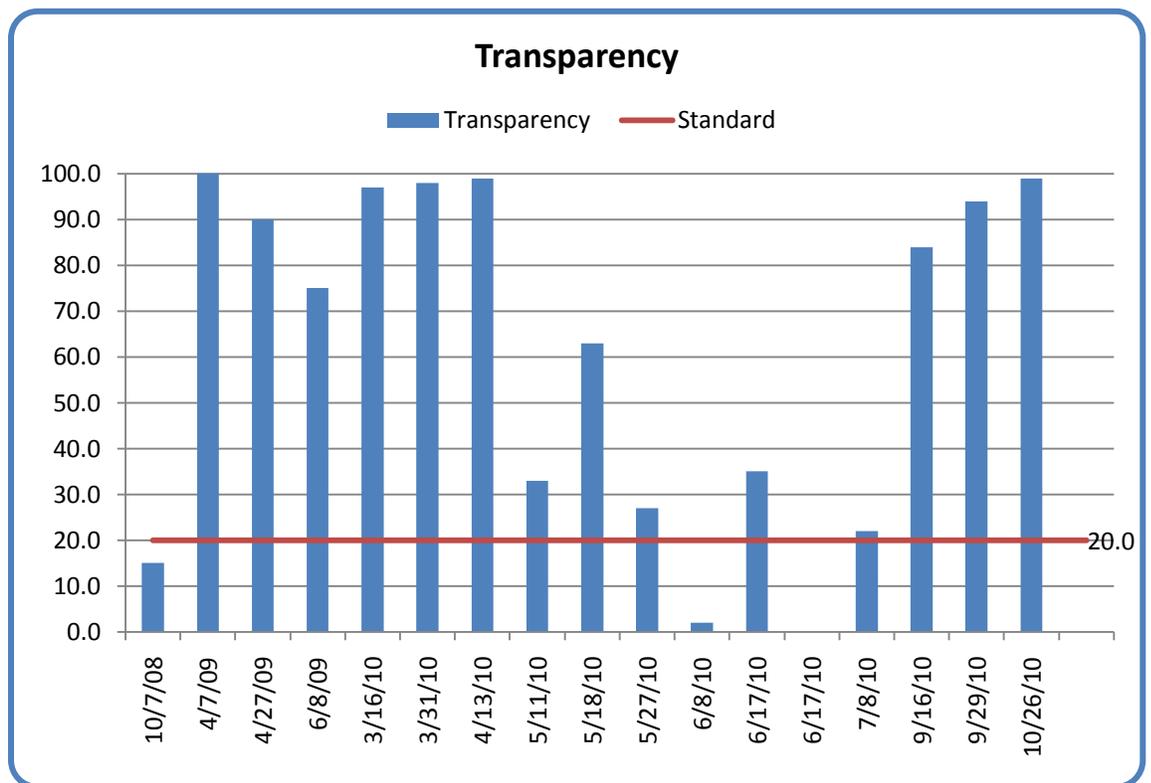
2008 Average	2009 Average	2010 Average	Overall Average
310.0 mg/L	1.9 mg/L	55.7 mg/L	61.2 mg/L
Proposed Standard: No more than 10% of samples above 30.0 mg/L			

Transparency

Expected Range:
Currently No
Expected Range

Standard: Average
Reading Over 20.0
cm

The single reading
from 2008 was
below 20.0 cm, but
the overall average
is well above the
standard.



2008 Average

2009 Average

2010 Average

Overall Average

15.0 cm

88.0 cm

63.0 cm

65.0 cm

Standard: The average reading should be over 20 cm

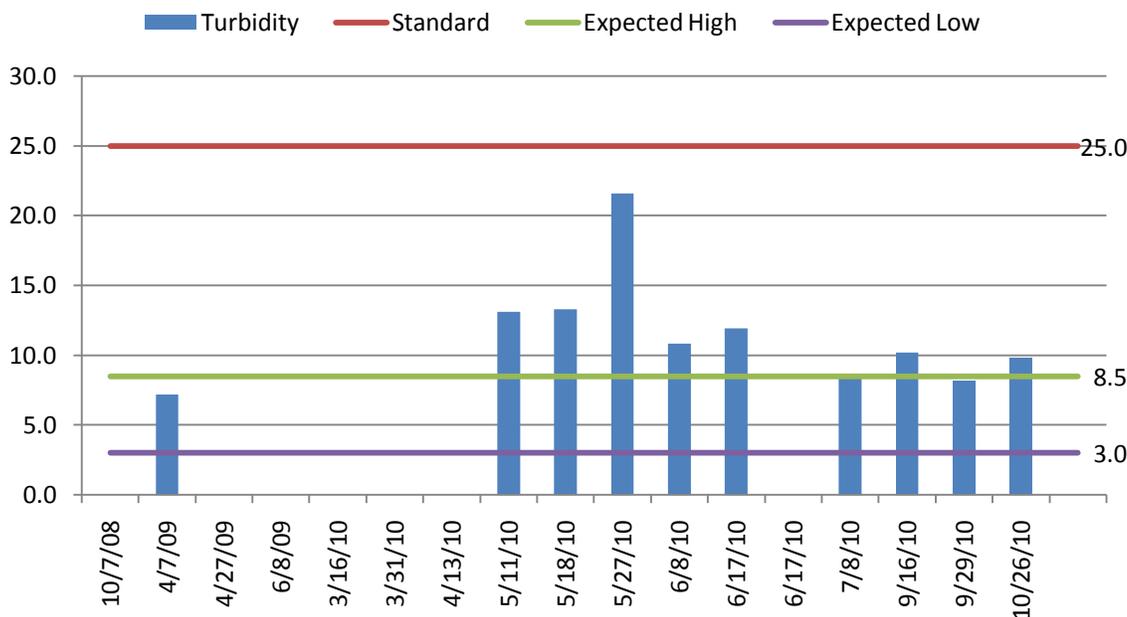
Turbidity

Turbidity

Expected Range:
3.0-8.5 NTU

Standard: Average
Reading Not Over
25.0 NTU

While most of the
readings were
above the expected
range, the averages
met the standard.



2008 Average

2009 Average

2010 Average

Overall Average

NO DATA

7.2 NTU

12.0 NTU

11.5 NTU

Standard: The average reading should not exceed 25.0 NTU



TRIBUTARY TO KROON LAKE is a small tributary draining a rural area of Chisago Lakes Township. The stream is often red or rusty colored, meaning that there are a lot of tannins in the water column. Tannin is an indication of breaking down organic matter (leaves, grass and peat) in the watershed and the water. This can make the phosphorus and nitrogen levels high. The small tributary is the outlet from Boo Lake to Kroon Lake. Boo Lake is a large open water wetland with large amounts of vegetation. It is possible that Boo Lake collects pollutants during low water years and flushes out pollutants in higher water situations. Samples were only taken when the water was flowing which was generally after rain events, therefore, most of the readings are higher than baseline numbers.

Summary of Stream

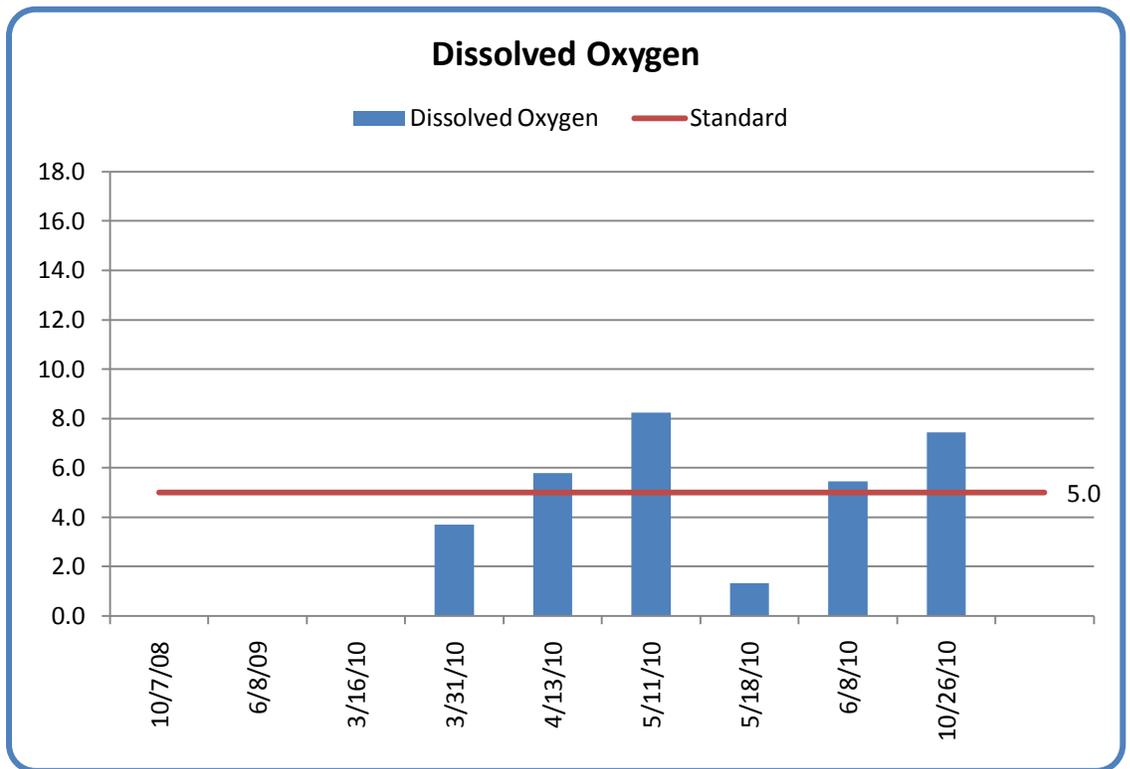
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	5.3 mg/L	No more than 50% below 5.0 mg/L	Yes	Over 5.0 mg/L	Yes
Temperature	52.3 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	0.09 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
pH	7.1	No more than 50% below 7.0	Yes	7.9-8.3	No (Below)
Total Phosphorus	0.96 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.20 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	49.2 mg/L	No more than 10% above 30.0 mg/L	No	4.8-16.0 mg/L	No
Transparency	50.0 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	28.2 NTU	<25.0 NTU	No	3.0-8.5 NTU	No

Dissolved Oxygen

Expected Range: Over 5.0 mg/L

Standard: No More Than 50% Readings Below 5.0 mg/L

Data was only collected in 2010. Two of six readings were below 5.0 mg/L, which means this stream meets the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	5.3 mg/L	5.3 mg/L
Standard: No more than 50% of readings below 5.0 mg/L			

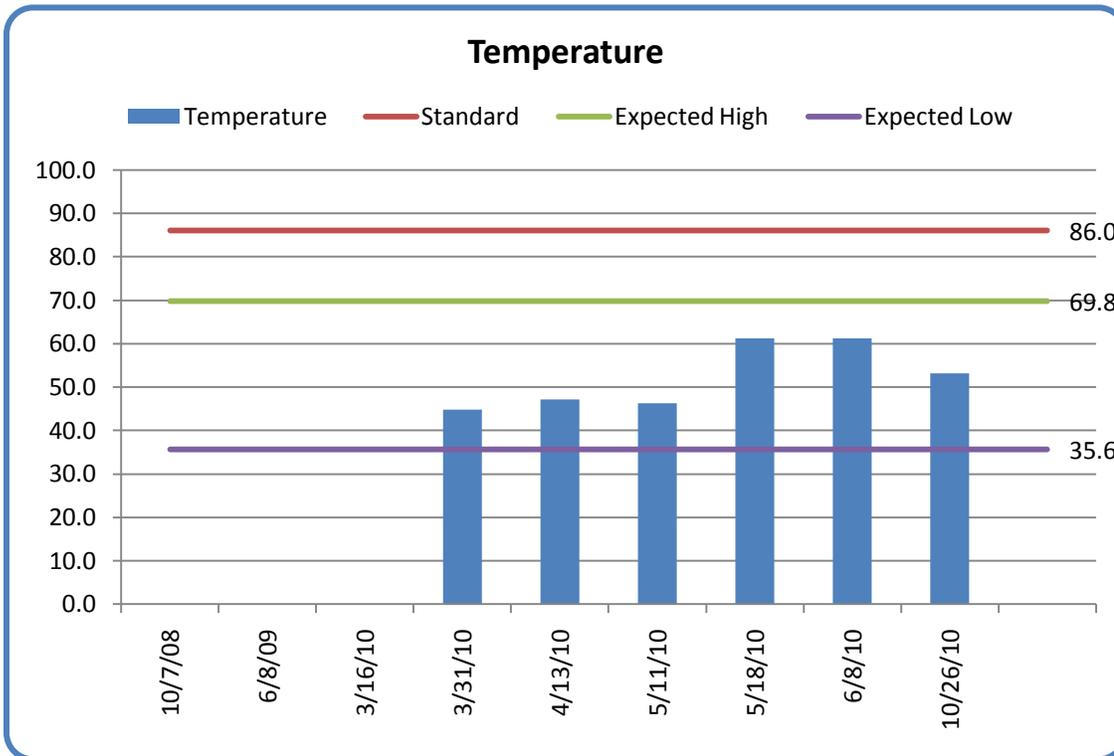
Temperature

Temperature

Expected Range: 35.6-69.8 °F

Standard: The daily average shall not exceed 86.0°F

Data was only collected in 2010. All readings were within the expected range.



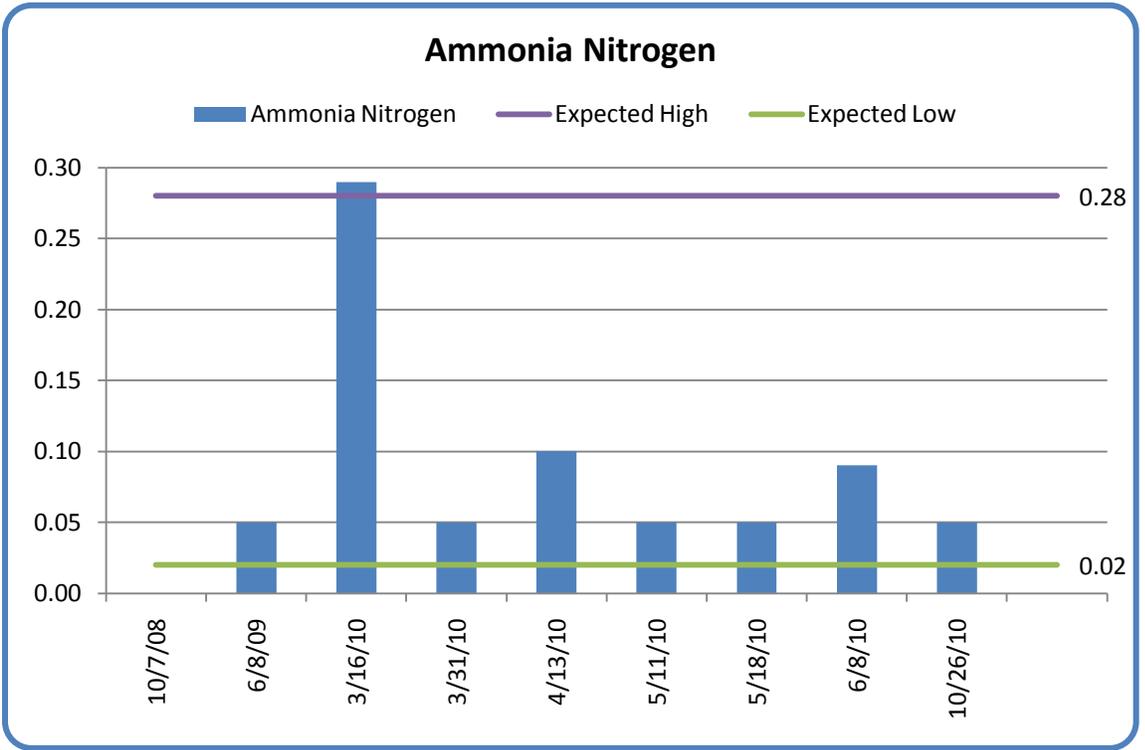
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	52.3°F	52.3°F
Standard: The daily average shall not exceed 86.0°F			

Ammonia Nitrogen

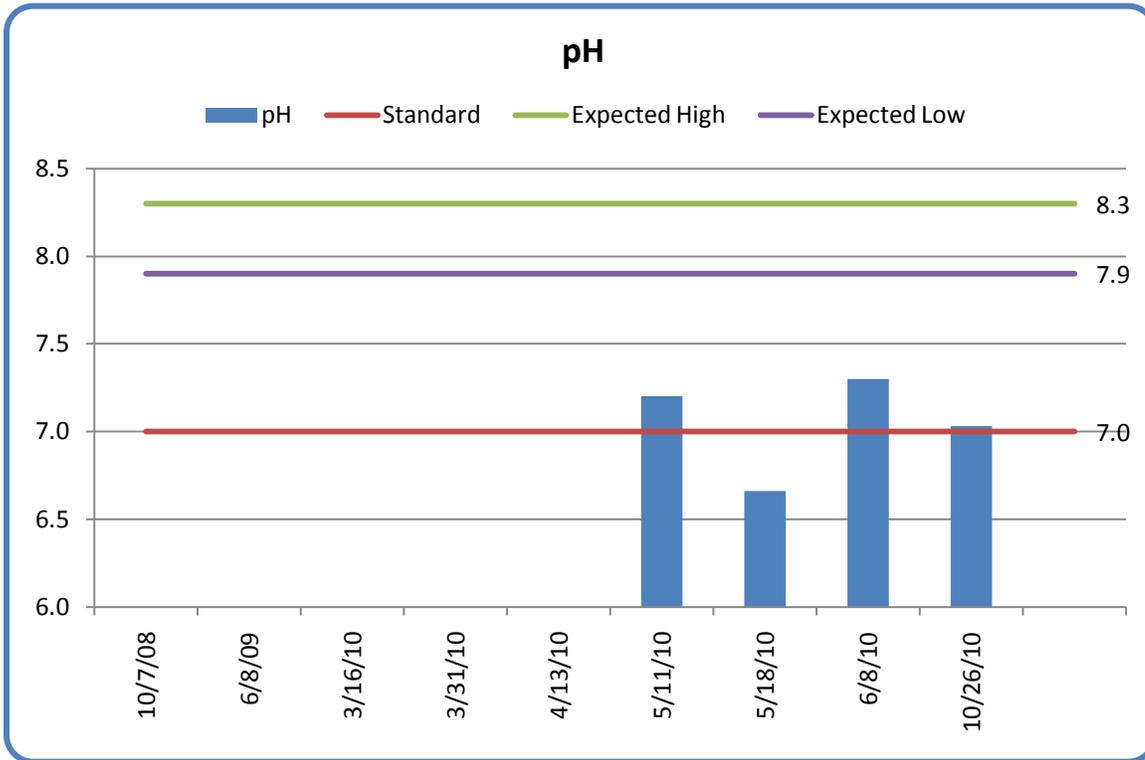
Expected Range: 0.02-0.28 mg/L

Standard: Currently No Standard

All but one reading were within the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.05 mg/L	0.10 mg/L	0.09 mg/L
Expected Range: 0.02-0.28 mg/L			



pH

Expected Range: 7.9-8.3

Standard: No More Than 50% Readings Below 7.0

Only four samples were taken, but the average does meet the standard.

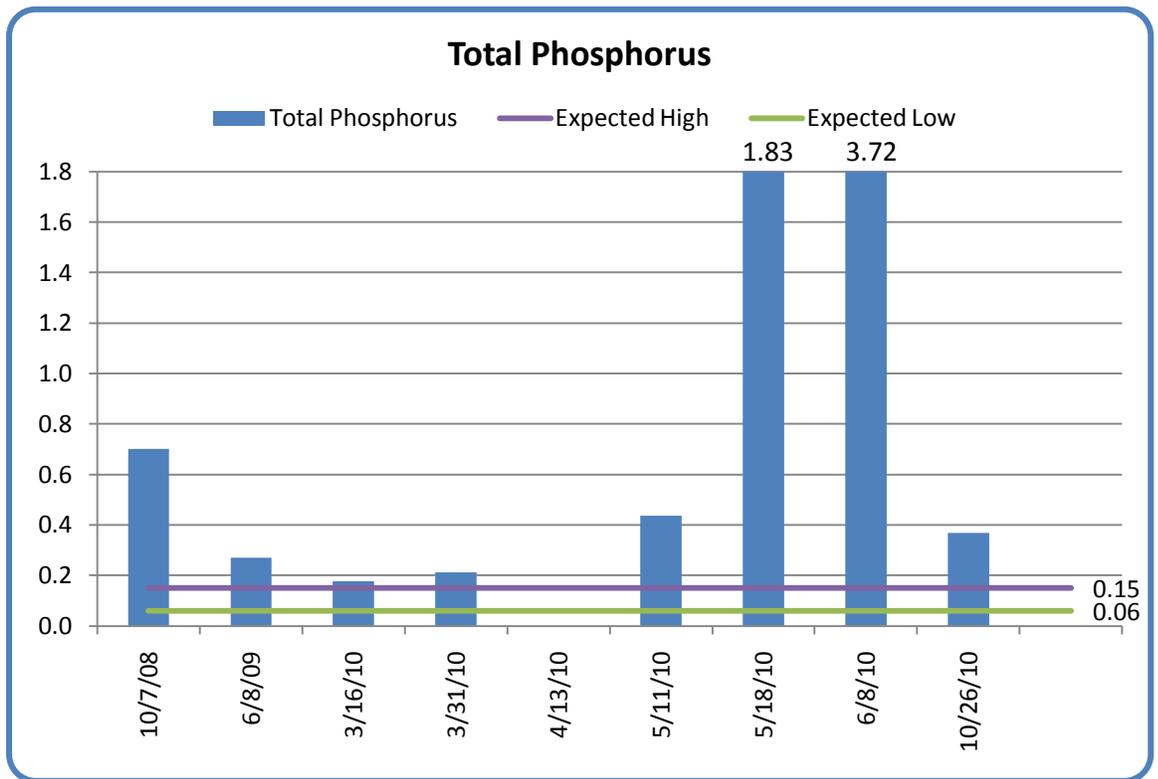
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	7.1	7.1
Standard: No more than 50% of the readings below 7.0			

Total Phosphorus

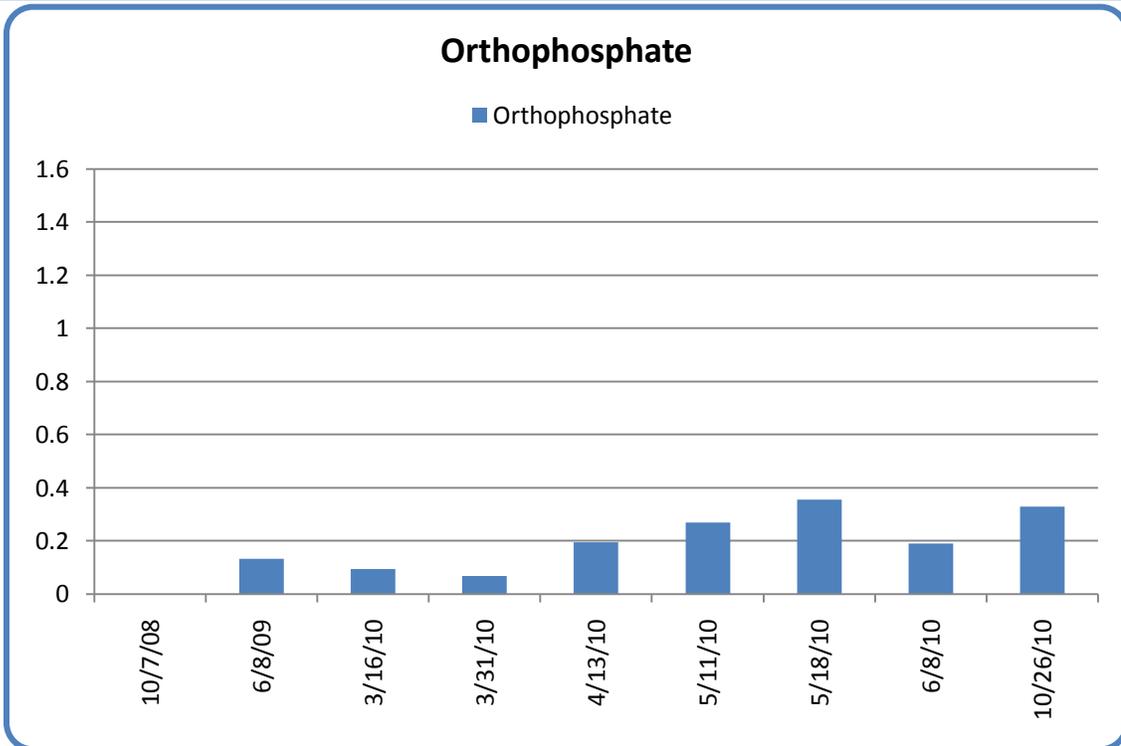
Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

All samples were above, some well above, the expected range. Large rain events in 2010 could have caused flushes of phosphorus from Boo Lake. The majority is organic phosphorus.



2008 Average	2009 Average	2010 Average	Overall Average
0.70 mg/L	0.27 mg/L	1.12 mg/L	0.96 mg/L
Expected Range: 0.06-0.15 mg/L			



Orthophosphate

Expected Range:
Currently No
Expected Range

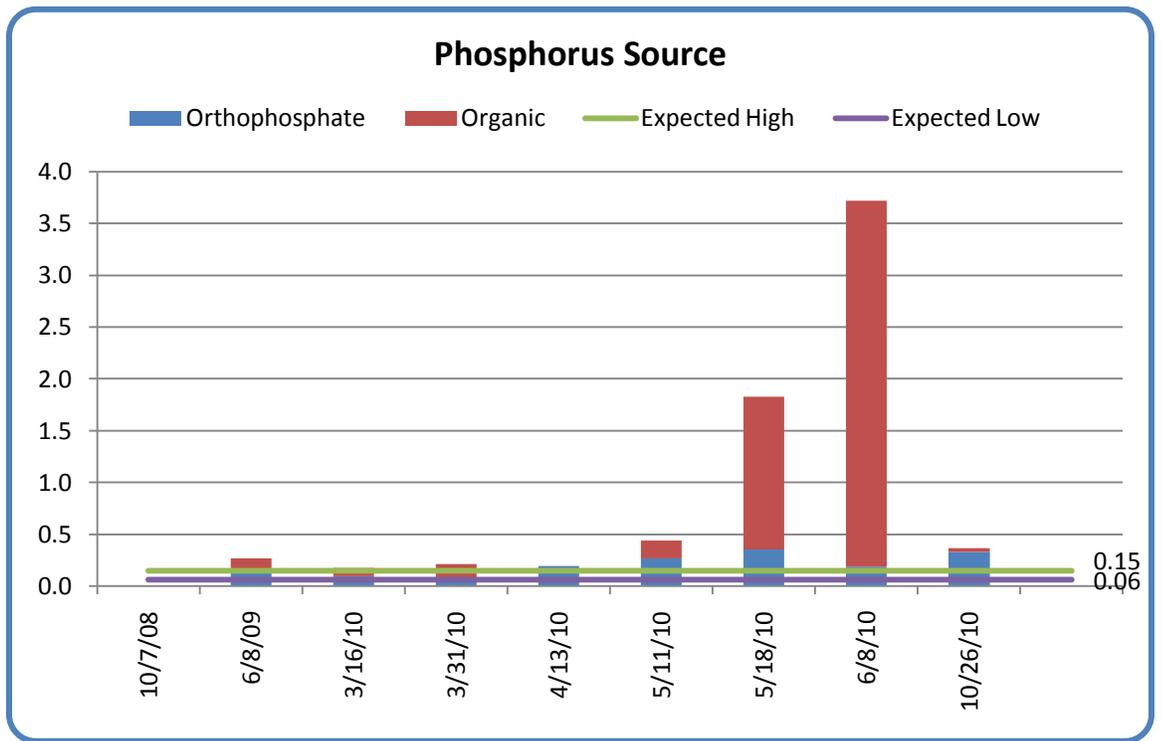
Standard: Currently
No Standard

2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.13 mg/L	0.21 mg/L	0.20 mg/L
Expected Range/Standard: Currently none			

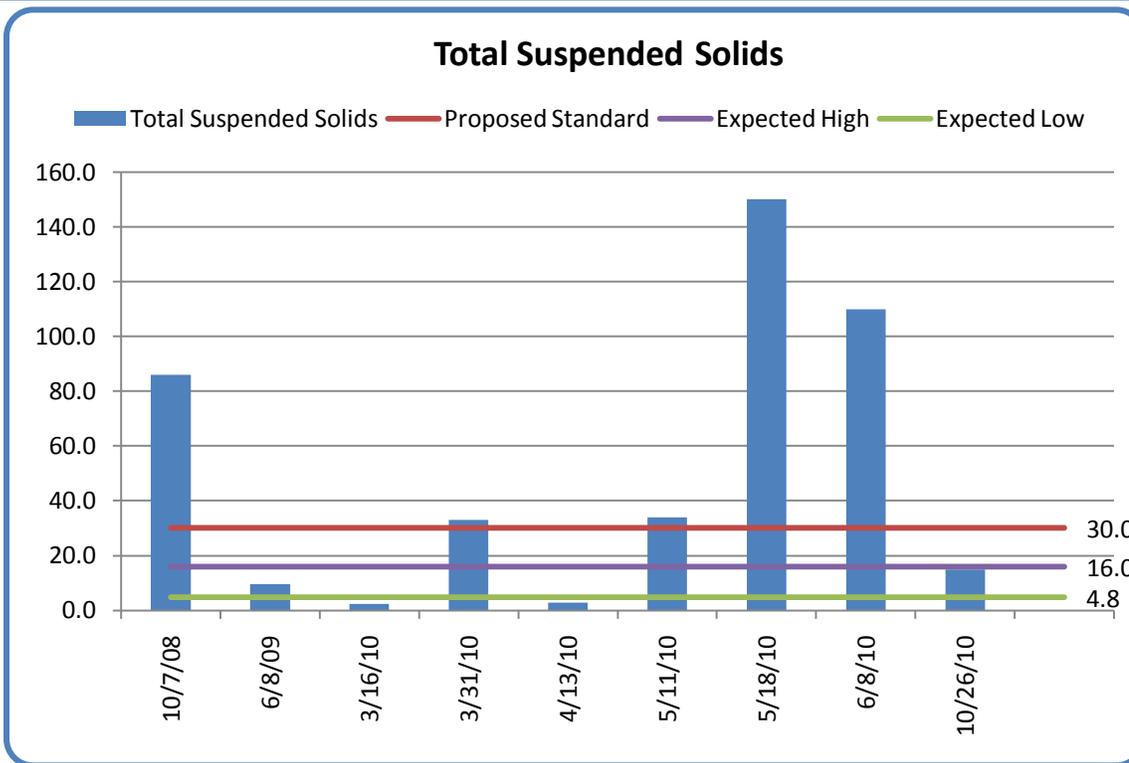
Phosphorus Source:

Large flushes of organic phosphorus from Boo Lake could have occurred during large rain events in 2010. The majority of the total phosphorus is organic.

This graph cannot be directly compared to other Phosphorus Source charts in this report due to a change in scale.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.14 mg/L	0.91 mg/L	0.76 mg/L
Inorganic	NO DATA	0.13 mg/L	0.21 mg/L	0.20 mg/L



Total Suspended Solids

Expected Range: 4.8-16.0 mg/L

Standard: Proposed at No More Than 10% Readings Above 30.0 mg/L

Fifty-five percent of readings were above 30.0 mg/L, which means this stream is not meeting the standard. This chart cannot be directly compared to others in this report due to different scales.

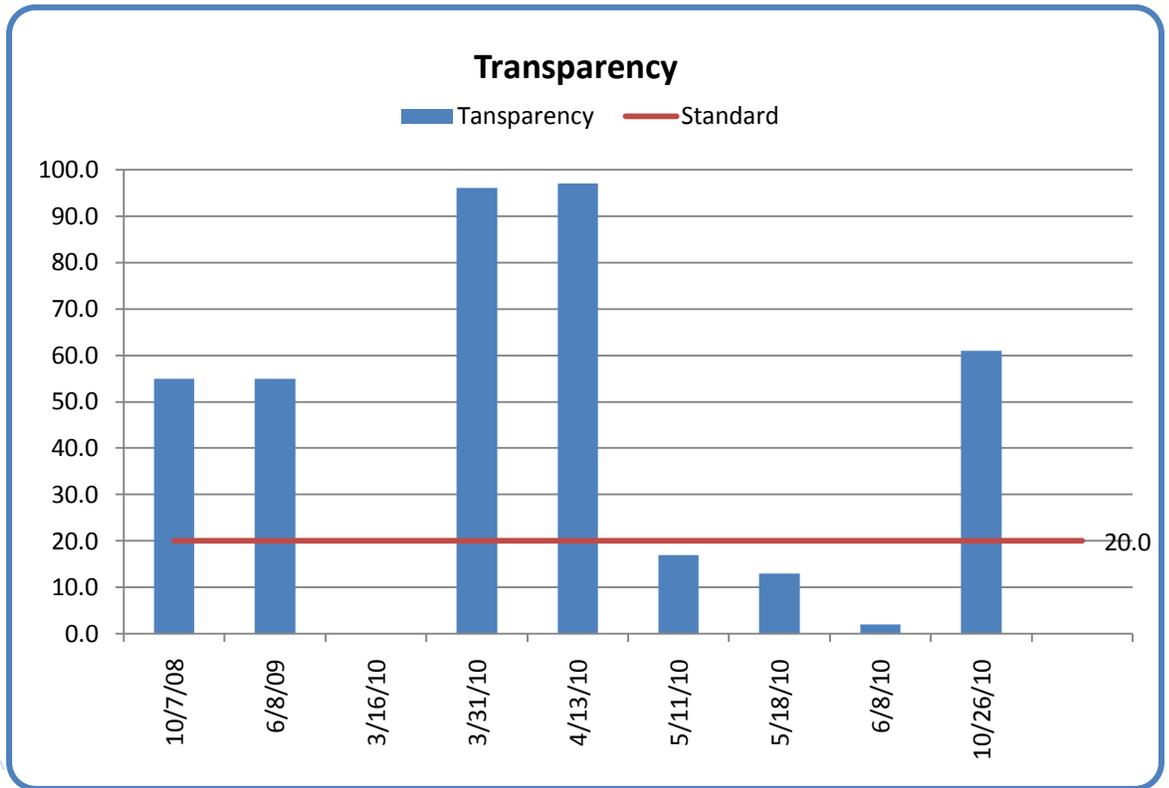
2008 Average	2009 Average	2010 Average	Overall Average
86.0 mg/L	9.6 mg/L	49.6 mg/L	49.2 mg/L
Proposed Standard: No more than 10% of readings above 30.0 mg/L			

Transparency

*Expected Range:
Currently No
Expected Range*

*Standard: Average
Reading Over 20.0
cm*

All averages were well above 20.0 cm, indicating that this stream is meeting the standard for transparency.



2008 Average	2009 Average	2010 Average	Overall Average
55.0 cm	55.0 cm	48.0 cm	50.0 cm

Standard: The average reading should be over 20.0 cm

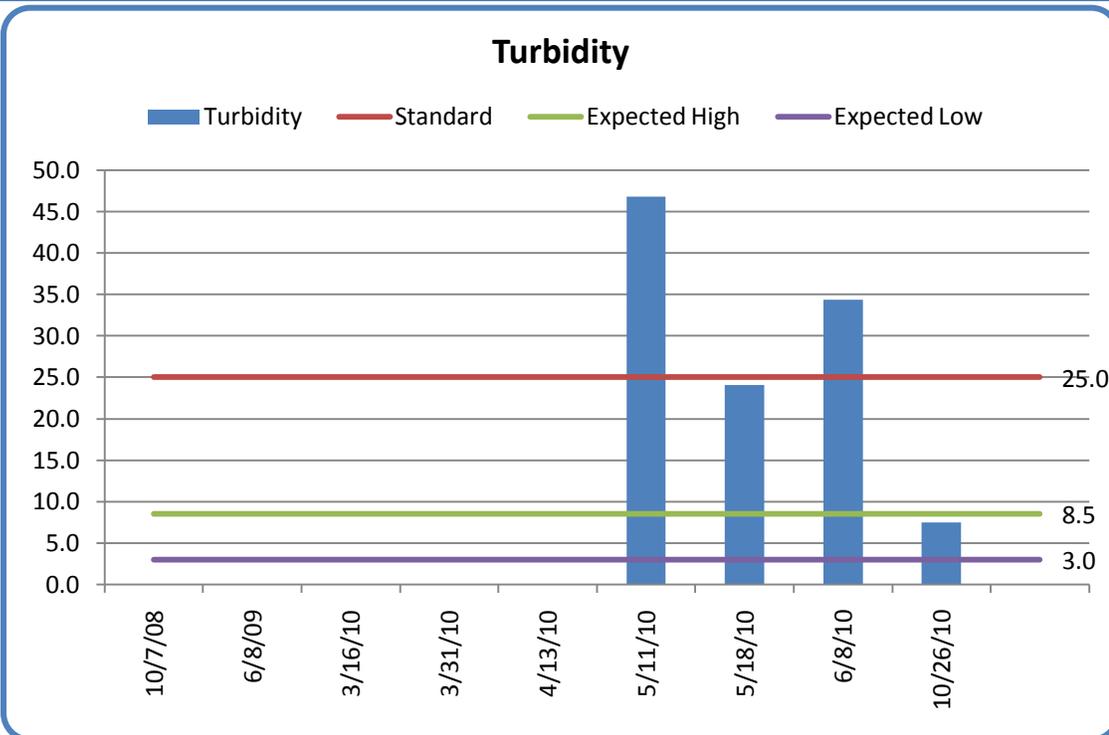
Turbidity

Turbidity

*Expected Range: 3.0-
8.5 NTU*

*Standard: Average
Reading Not Over 25.0
NTU*

Data was only collected in 2010, but the average did exceed 25.0 NTU. This stream does not meet the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	28.2 NTU	28.2 NTU

Standard: The average reading should not exceed 25.0 NTU



TRIBUTARY TO NORTH CENTER LAKE is a small creek that drains the area between Little Lake and North Center Lake. This stream always flows; however, during low flow the water is only an inch deep or less. This low water level makes it hard to take accurate samples without getting stream substrate in the sample bottle. Directly upstream from this monitoring location is a wetland complex. Further upstream in the watershed, the stream runs through a wooded buffer. Overall, the water is clear with a tint of rust from breaking down tannins, likely from large amounts of leaf litter in the watershed.

Summary of Stream

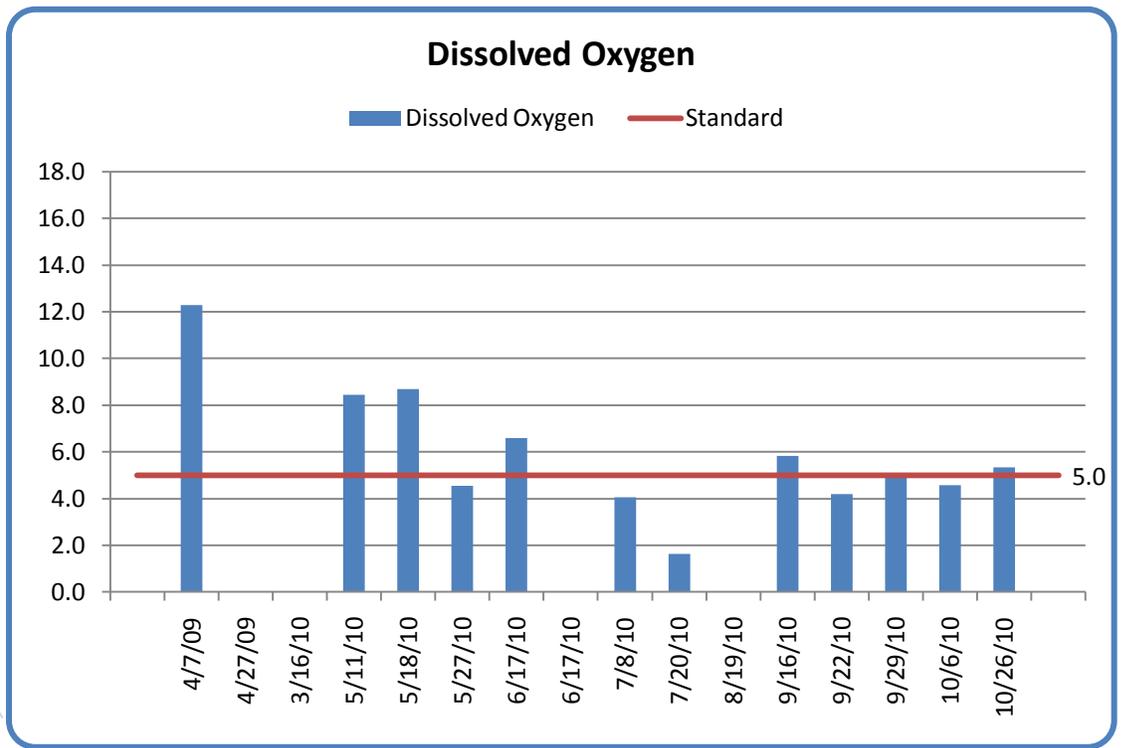
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	5.9 mg/L	No more than 50% below 5.0 mg/L	Yes (Barely)	Over 5.0 mg/L	Yes
Temperature	59.4 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	0.08 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
pH	6.8	No more than 50% below 7.0	No	7.9-8.3	No (Below)
Total Phosphorus	0.45 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.33 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	5.9 mg/L	No more than 10% above 30.0 mg/L	Yes	4.8-16.0 mg/L	Yes
Transparency	74.0 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	15.5 NTU	<25.0 NTU	Yes	3.0-8.5 NTU	No

Dissolved Oxygen

Expected Range: Over 5.0 mg/L

Standard: No More Than 50% Readings Below 5.0 mg/L

Exactly 50% of readings were below 5.0 mg/L. The average reading was above 5.0 mg/L. This stream is just barely meeting the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	12.3 mg/L	5.4 mg/L	5.9 mg/L
Standard: No more than 50% of readings below 5.0 mg/L			

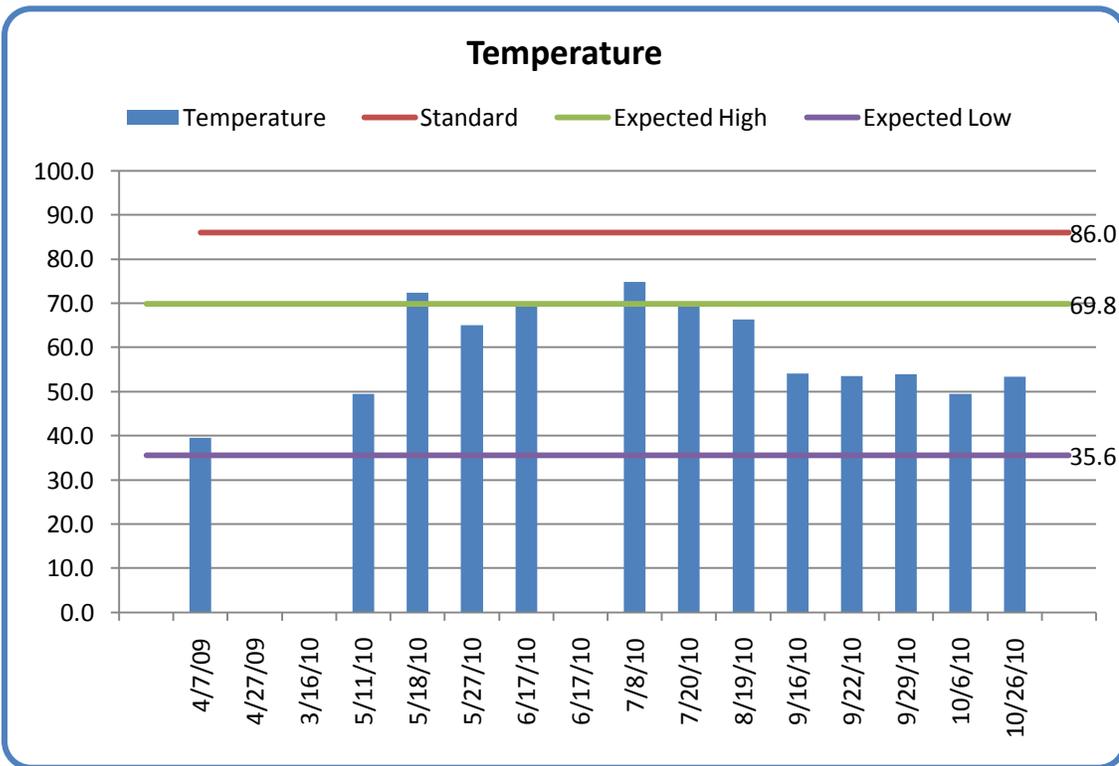
Temperature

Temperature

Expected Range: 35.6-69.8 °F

Standard: The daily average shall not exceed 86.0°F

All but two samples were within the expected range.



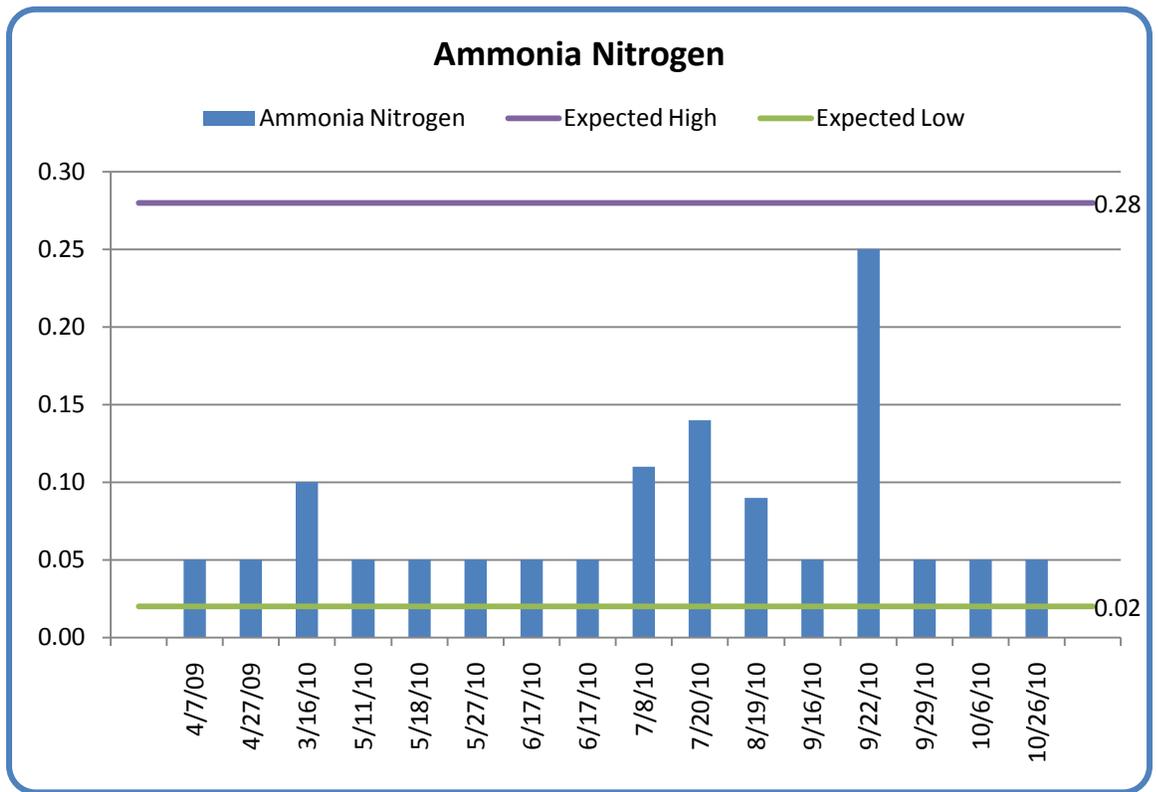
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	39.5°F	61.0°F	59.4°F
Standard: The daily average shall not exceed 86.0°F			

Ammonia Nitrogen

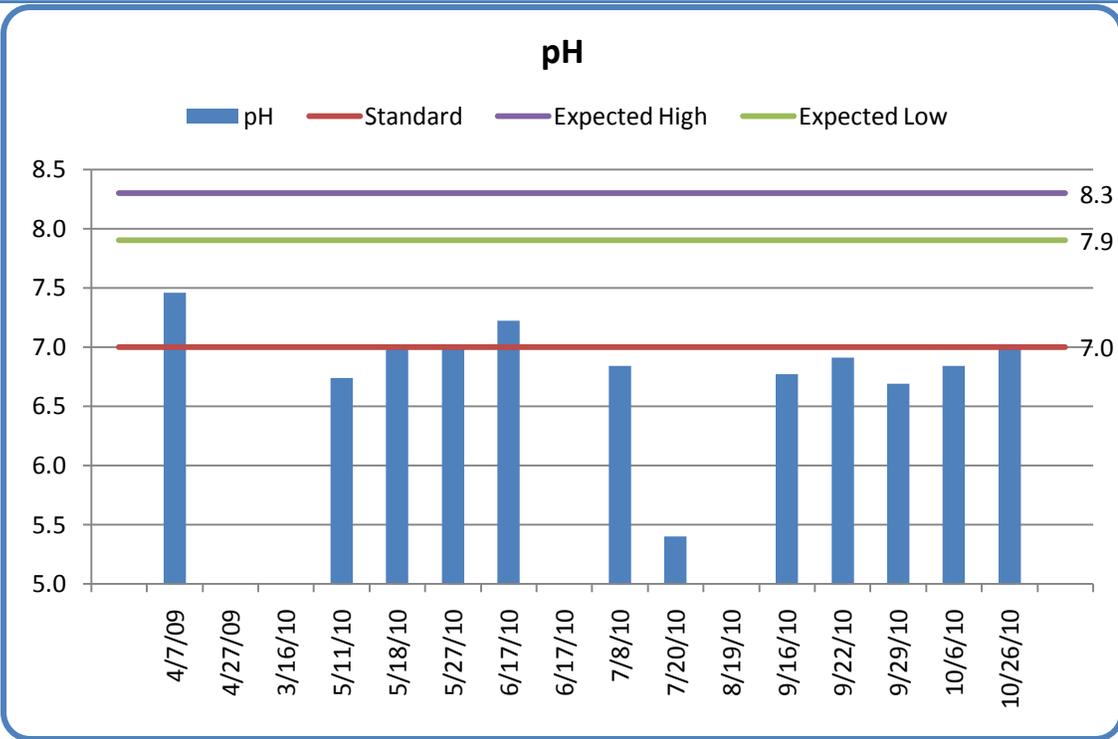
Expected Range:
0.02-0.28 mg/L

Standard: Under
Development

All samples were
within the expected
range.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.05 mg/L	0.08 mg/L	0.08 mg/L
Expected Range: 0.02-0.28 mg/L			



pH

Expected Range: 7.9-
8.3

Standard: No More
Than 50% Readings
Below 7.0

More than 50% of the
samples, as well as the
2010 average and the
overall average, were
below 7.0, meaning
this creek does not
meet the standard.

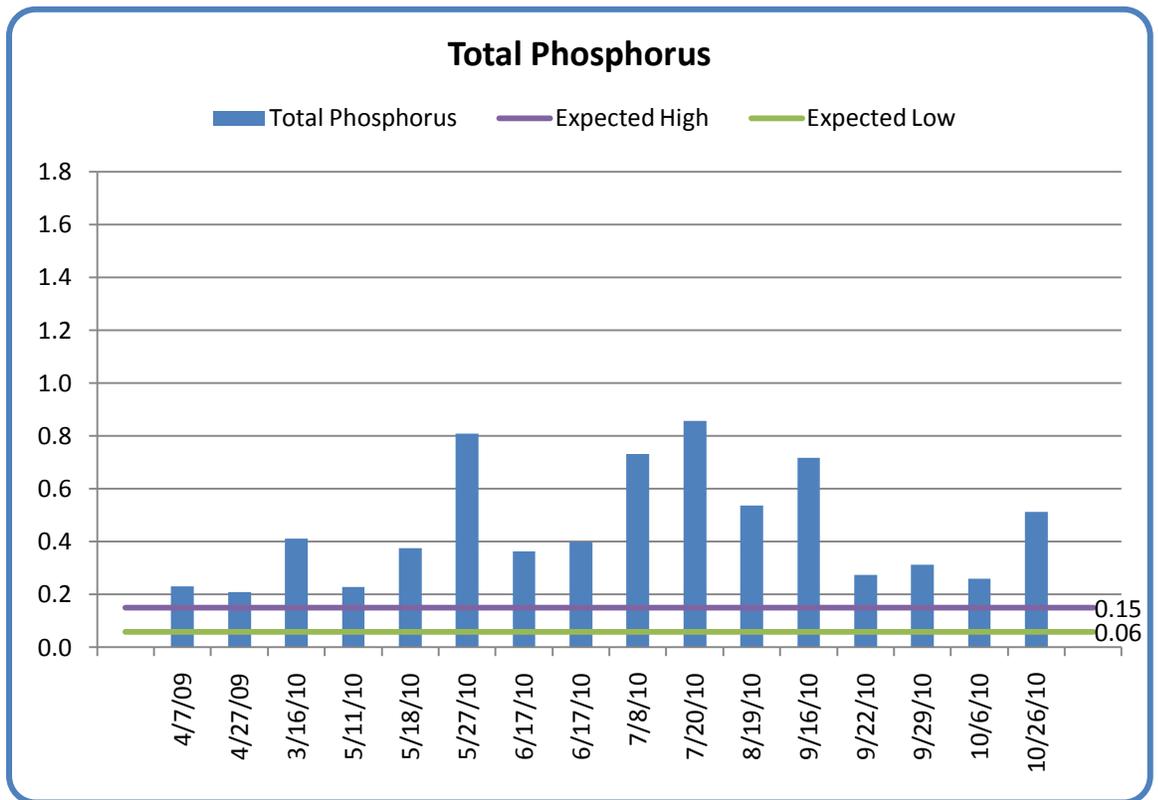
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	7.5	6.8	6.8
Standard: No more than 50% of readings below 7.0			

Total Phosphorus

Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

All samples were
above the expected
range.



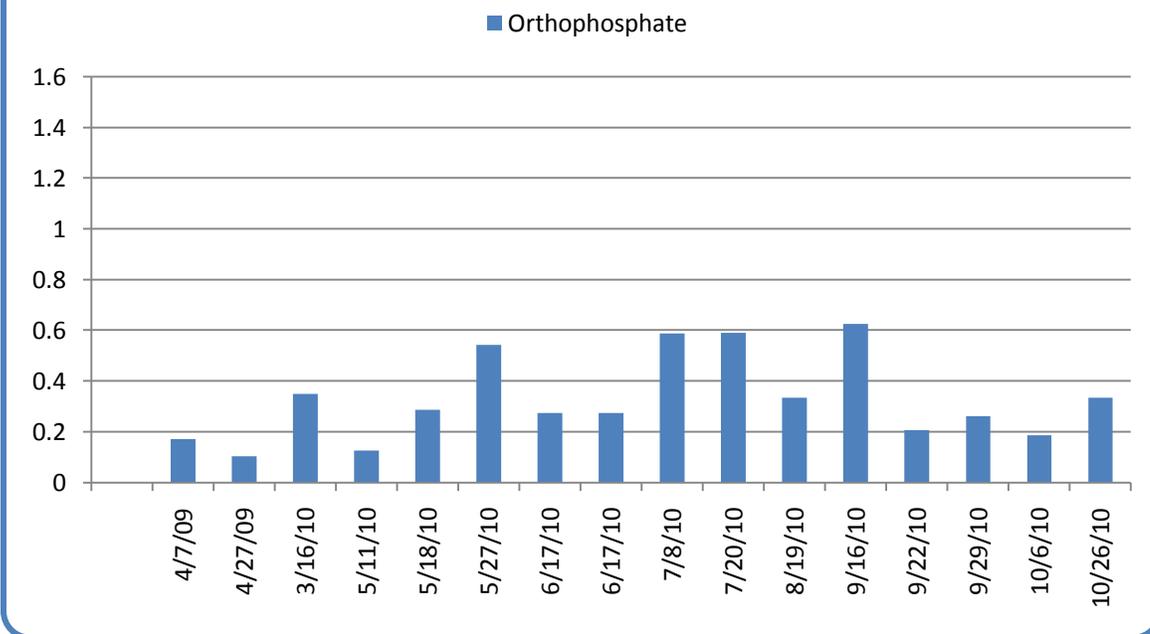
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.22 mg/L	0.49 mg/L	0.45 mg/L
Expected Range: 0.06-0.15 mg/L			

Orthophosphate

Orthophosphate

Expected Range:
Currently No
Expected Range

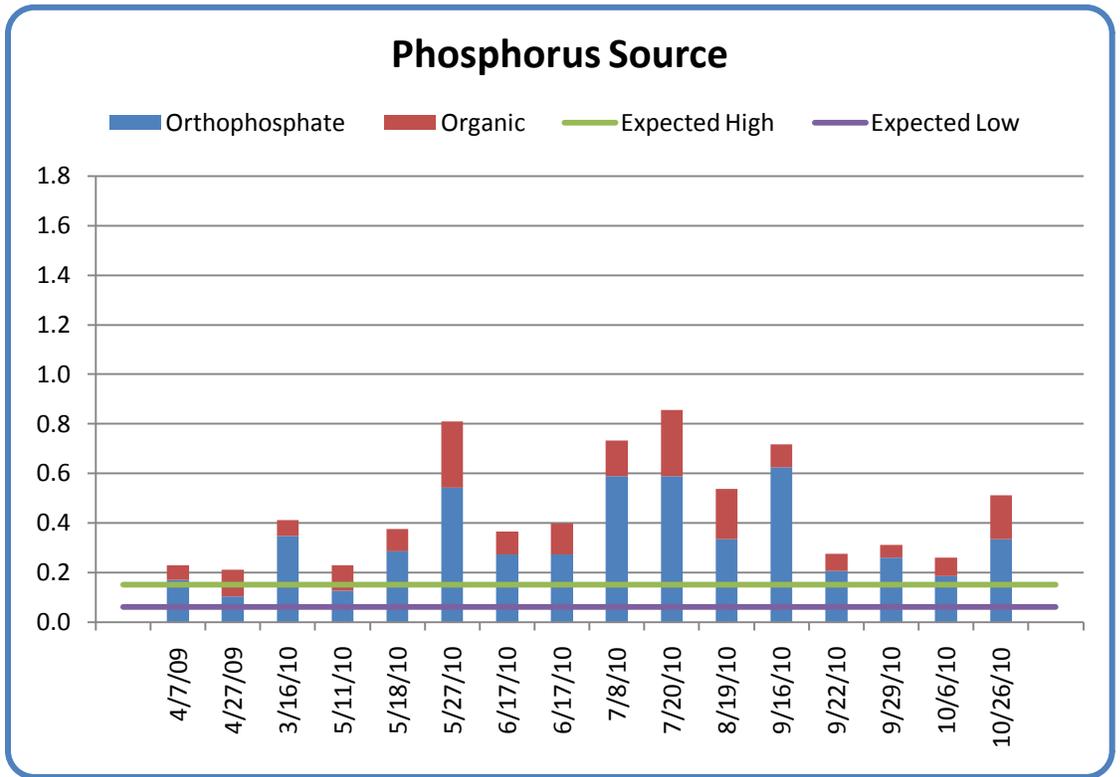
Standard: Currently
No Standard



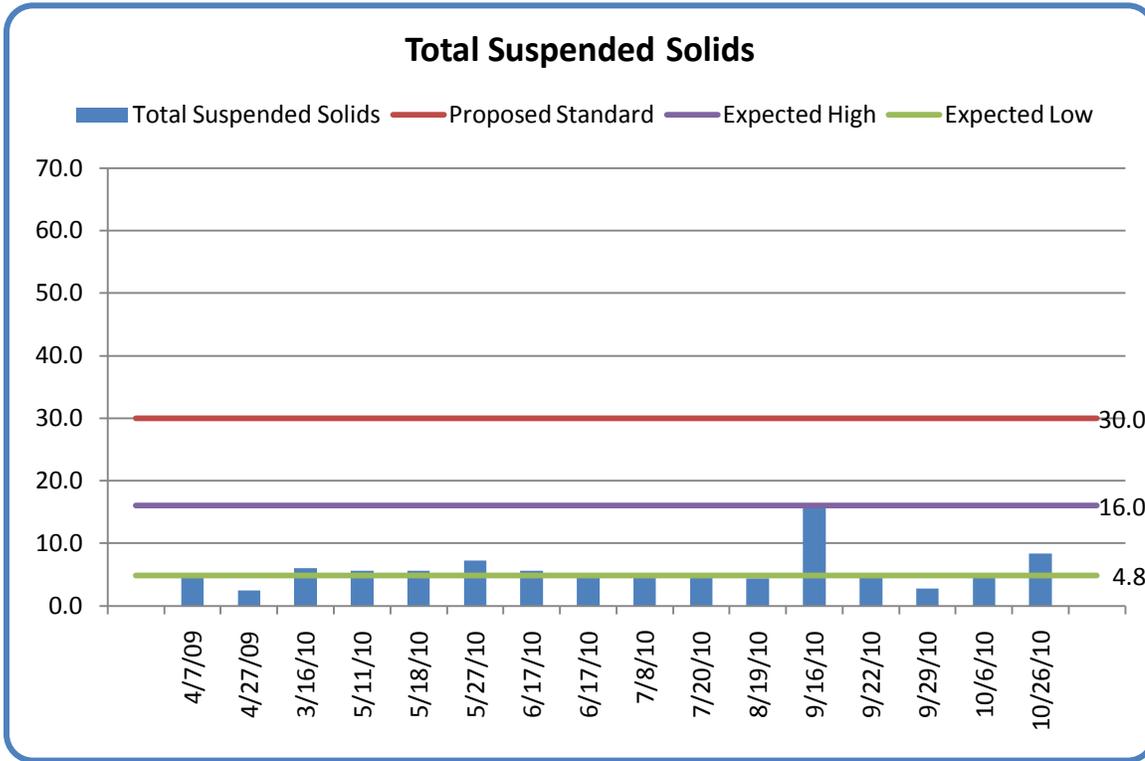
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.14 mg/L	0.36 mg/L	0.33 mg/L
Expected Range/Standard: Currently none			

Phosphorus Source:

Inorganic phosphorus (orthophosphate) makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is inorganic.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.08 mg/L	0.13 mg/L	0.12 mg/L
Inorganic	NO DATA	0.14 mg/L	0.36 mg/L	0.33 mg/L



Total Suspended Solids

Expected Range: 4.8-16.0 mg/L

Standard: Proposed at No More Than 10% Readings Above 30.0 mg/L

Most samples were within the expected range. This stream meets the standard for Total Suspended Solids.

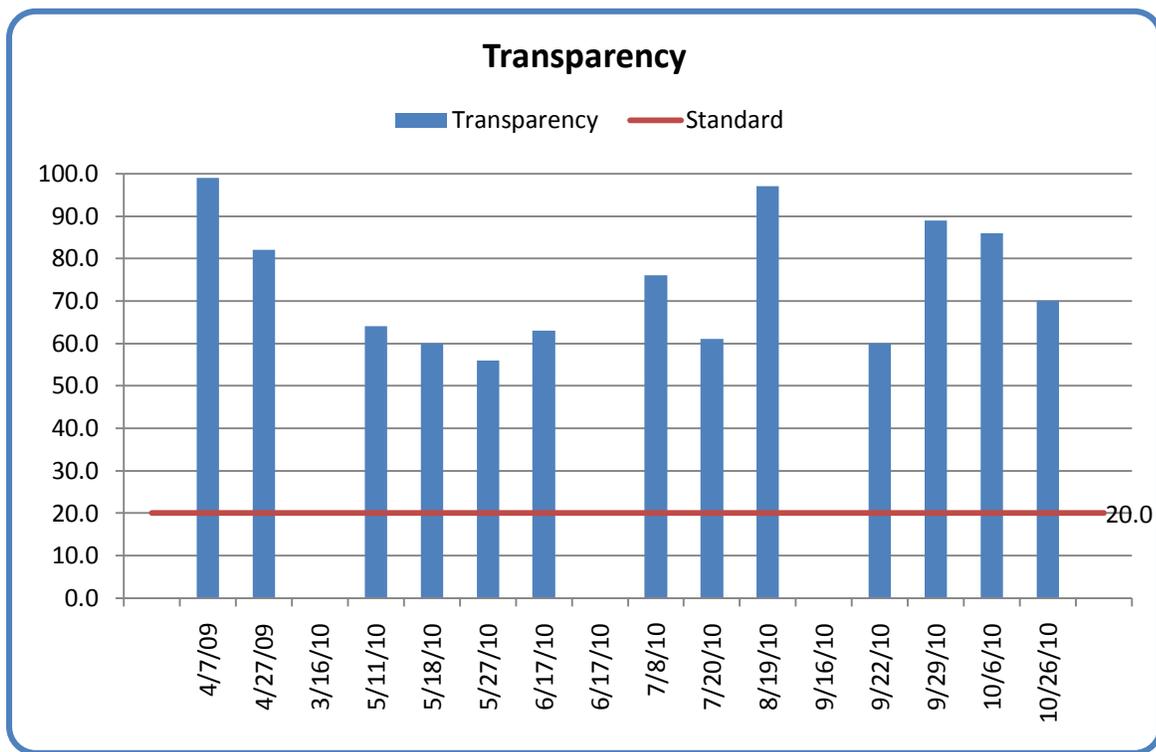
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	3.6 mg/L	6.2 mg/L	5.9 mg/L
Proposed Standard: No more than 10% of readings above 30.0 mg/L			

Transparency

Expected Range:
Currently No
Expected Range

Standard: Average
Reading Over 20.0
cm

This stream meets
the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	91.0 cm	71.0 cm	74.0 cm
Standard: Average reading over 20.0 cm			

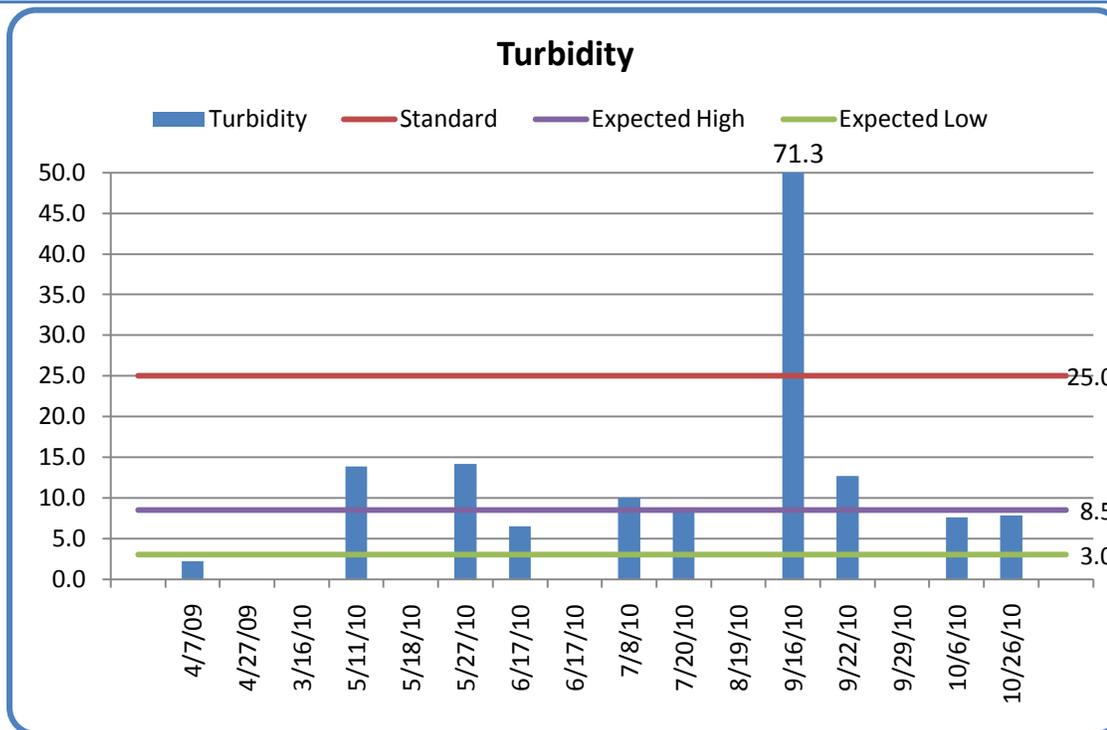
Turbidity

Turbidity

Expected Range: 3.0-
8.5 NTU

Standard: Average
Reading Not Over 25.0
NTU

This stream meets the
standard, although one
reading was very high.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	2.2 NTU	17.0 NTU	15.5 NTU
Standard: Average reading not over 25.0 NTU			



TRIBUTARY TO LITTLE LAKE is a small creek that drains into Little Lake in the northeast portion of the Chisago Lakes Chain of Lakes Watershed. This creek's watershed is rural with both animal and cropland agriculture. There is also a large wetlands complex in the upper portion of the watershed. The large wetland complex could be flushing out the phosphorus that it collected during the low flow times of 2007-2009 during the higher flows of 2010.

Summary of Stream

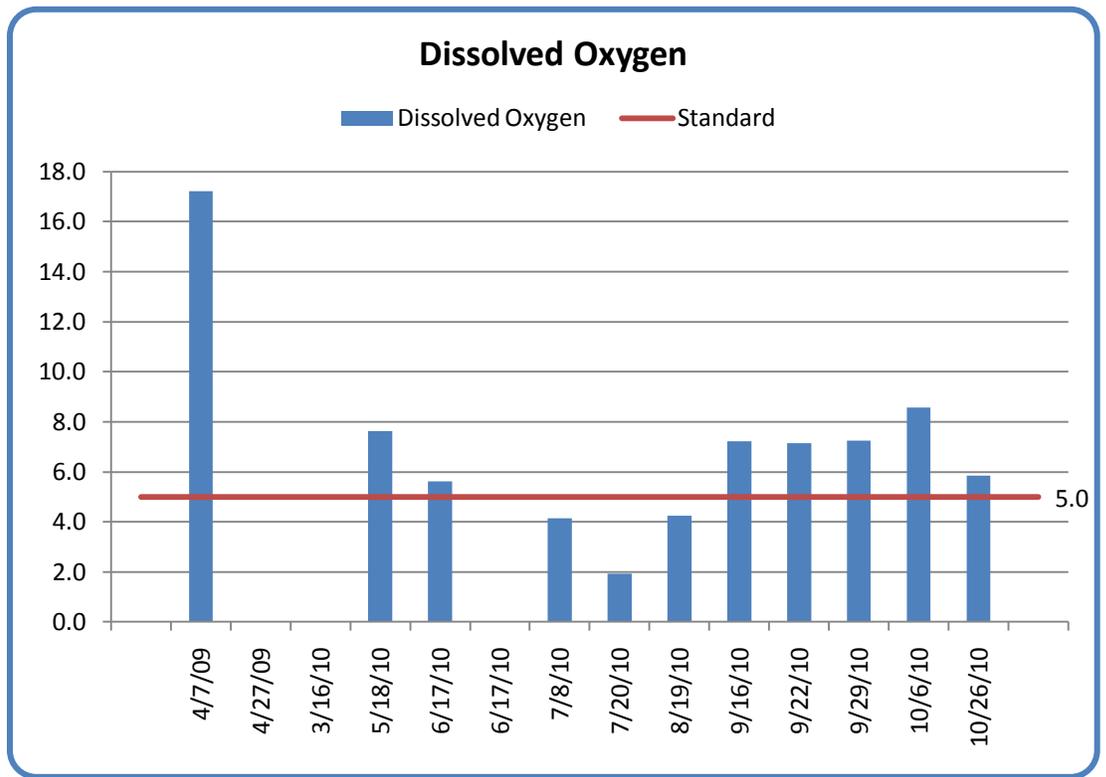
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	7.0 mg/L	No more than 50% below 5.0 mg/L	Yes	Over 5.0 mg/L	Yes
Temperature	60.3 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	0.11 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
pH	6.9	No more than 50% below 7.0	No	7.9-8.3	No (Below)
Total Phosphorus	0.80 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.65 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	13.1 mg/L	No more than 10% above 30.0 mg/L	Yes	4.8-16.0 mg/L	Yes
Transparency	56.0 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	14.0 NTU	<25.0 NTU	Yes	3.0-8.5 NTU	No

Dissolved Oxygen

Expected Range: Over 5.0 mg/L

Standard: No More Than 50% Readings Below 5.0 mg/L

This stream meets the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	17.2 mg/L	6.0 mg/L	7.0 mg/L
Standard: No more than 50% of readings below 5.0 mg/L			

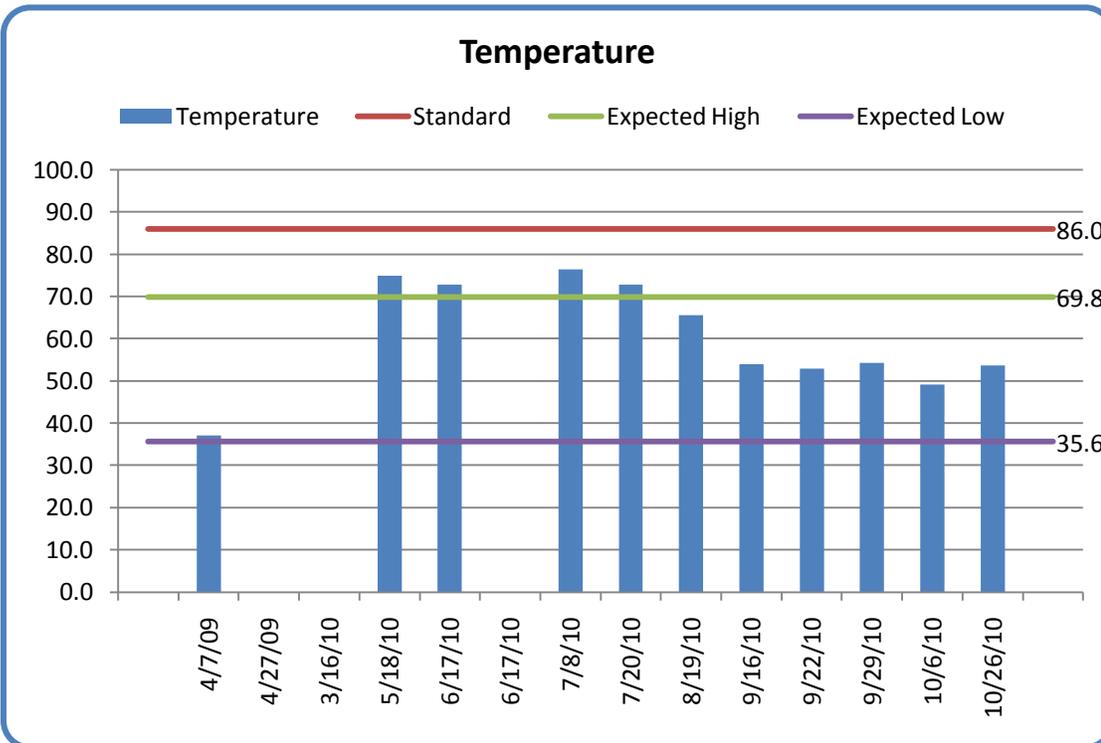
Temperature

Temperature

Expected Range: 35.6-69.8 °F

Standard: The daily average shall not exceed 86.0 °F

Four samples exceeded the expected range.



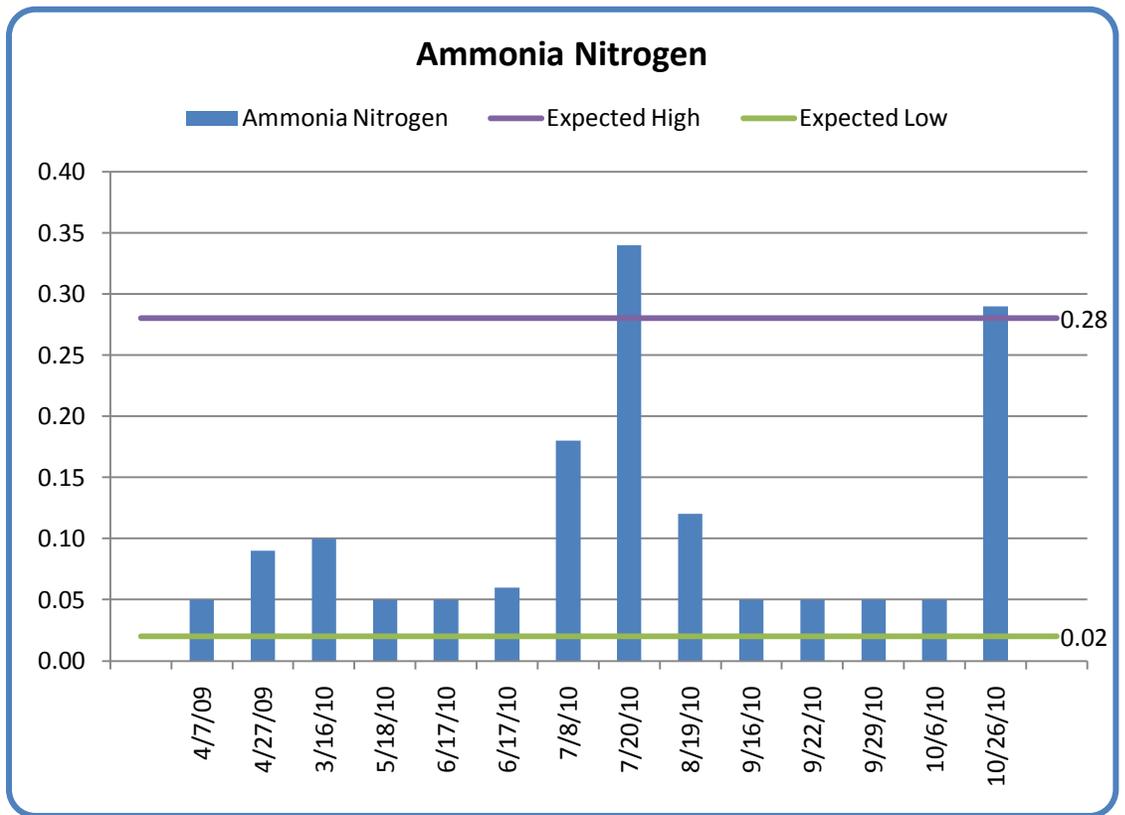
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	37.1 °F	62.6 °F	60.3 °F
Standard: The daily average shall not exceed 86.0 °F			

Ammonia Nitrogen

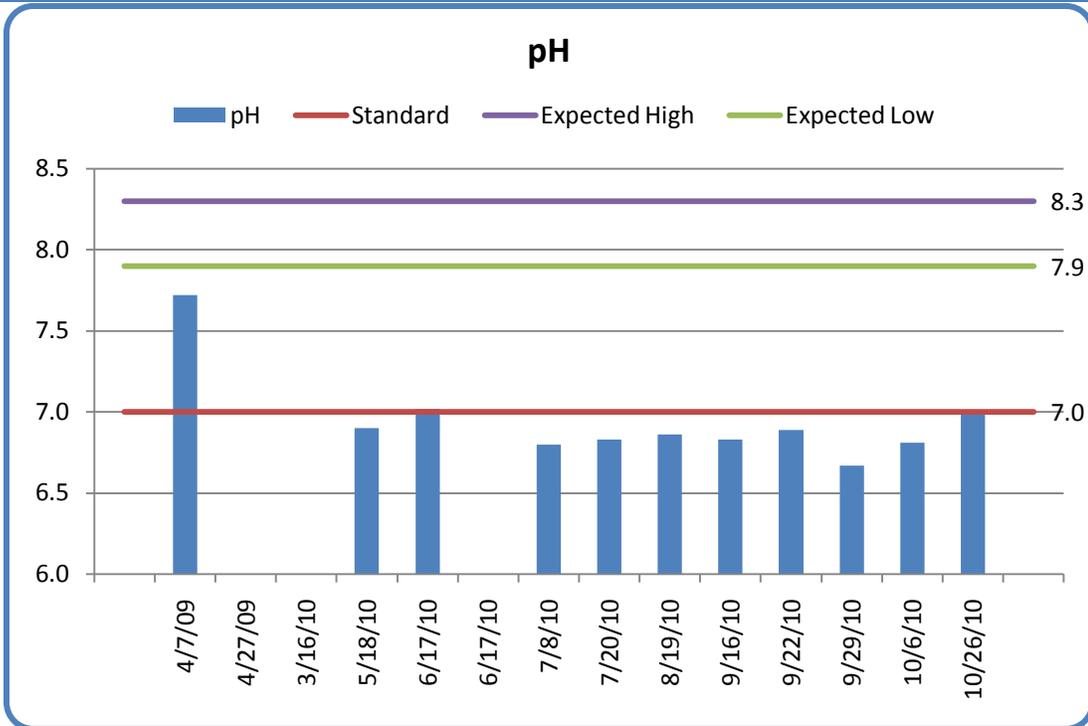
Expected Range: 0.02-0.28 mg/L

Standard: Under Development

All but two samples were within the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.07 mg/L	0.12 mg/L	0.11 mg/L
Expected Range: 0.02-0.28 mg/L			



pH

Expected Range: 7.9-8.3

Standard: No More Than 50% Readings Below 7.0

All but one sample were below 7.0. All 2010 samples were below 7.0, as was the 2010 average and the overall average.

This stream does not meet the standard.

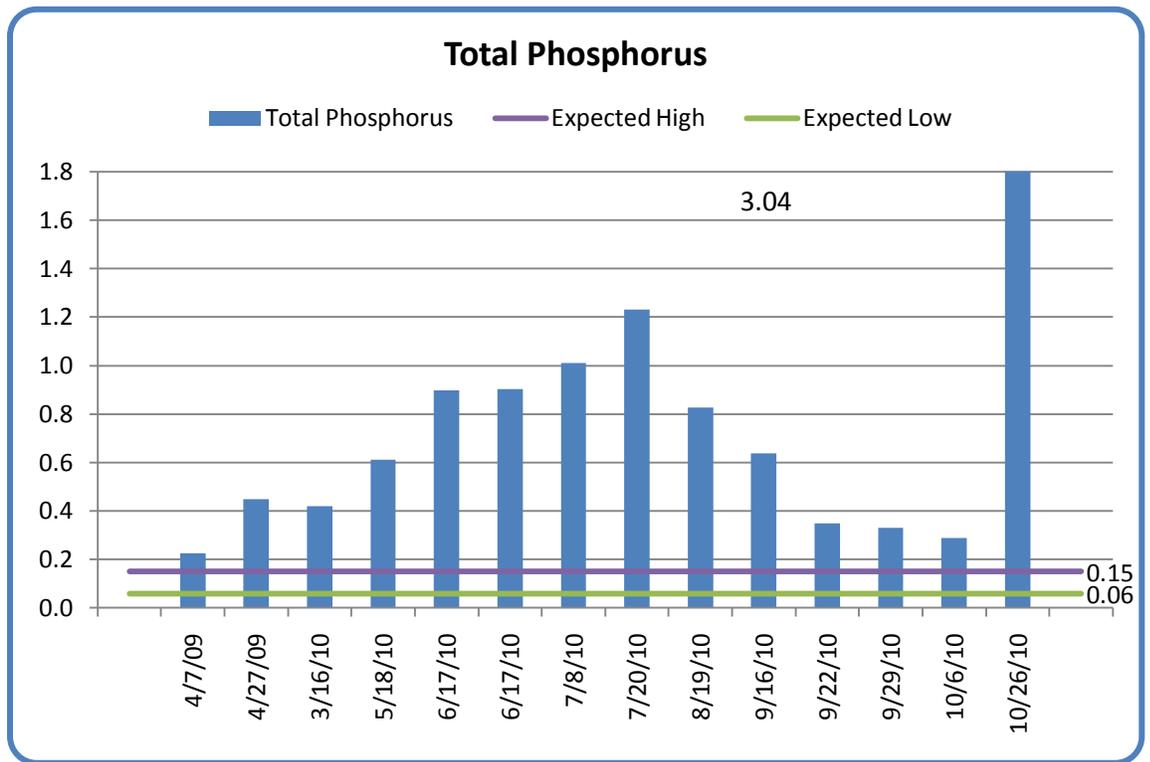
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	7.7	6.9	6.9
Standard: No more than 50% of readings below 7.0			

Total Phosphorus

Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

All readings were
above the expected
range. Several
readings were well
above the highest
expected value.



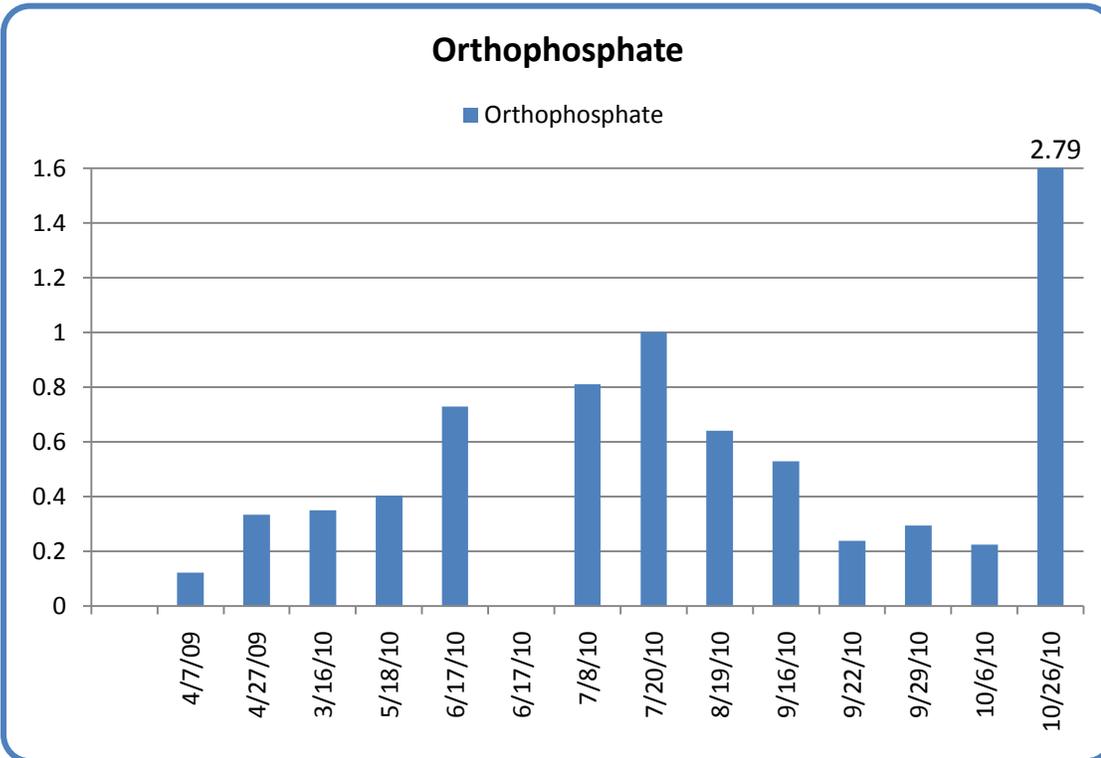
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.34 mg/L	0.88 mg/L	0.80 mg/L
Expected Range: 0.06-0.15 mg/L			

Orthophosphate

Orthophosphate

Expected Range:
Currently No Expected
Range

Standard: Currently No
Standard

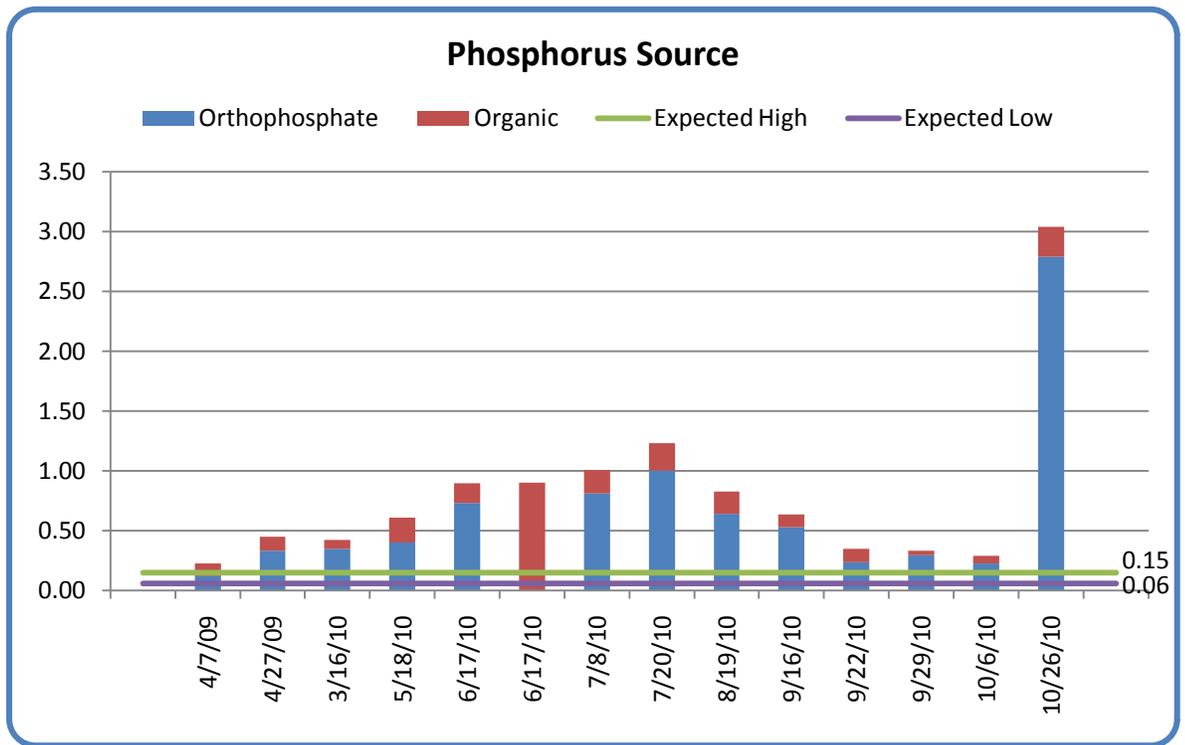


2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.23 mg/L	0.73 mg/L	0.65 mg/L
Expected Range/Standard: Currently none			

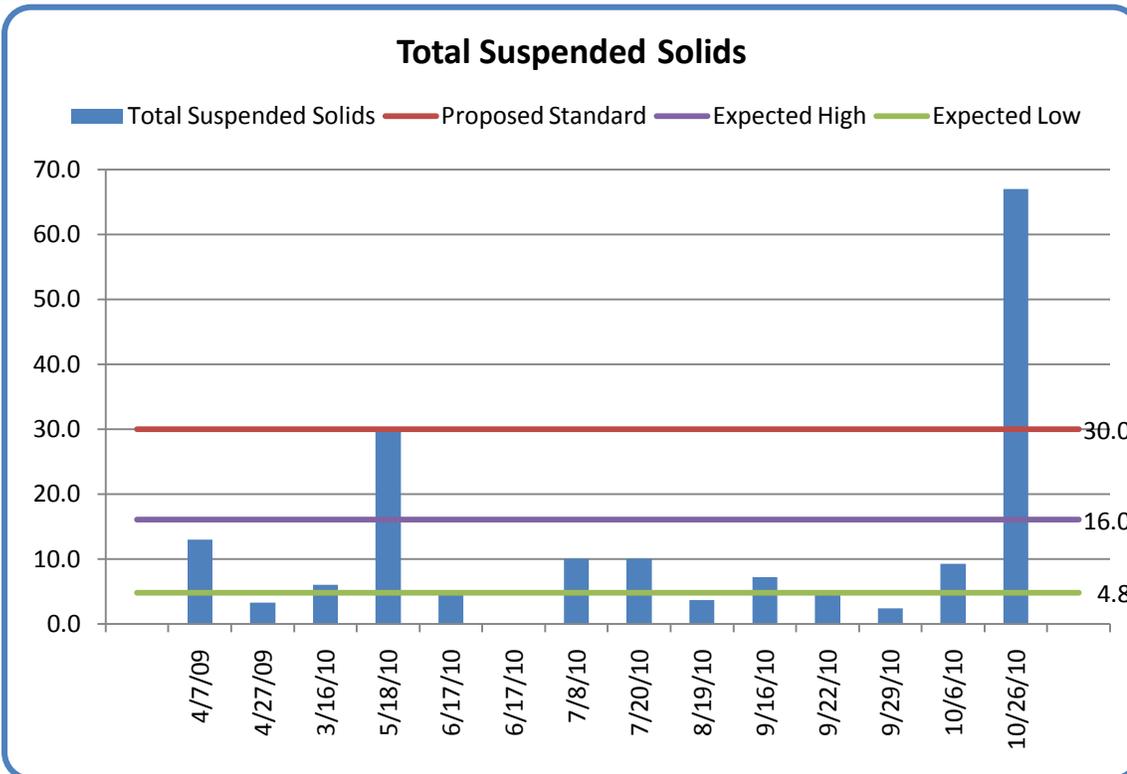
Phosphorus Source:

Inorganic phosphorus (orthophosphate) makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is inorganic.

This chart cannot be directly compared to others in this report because of a change in scale.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.11 mg/L	0.15 mg/L	0.15 mg/L
Inorganic	NO DATA	0.23 mg/L	0.73 mg/L	0.65 mg/L



Total Suspended Solids

Expected Range:
4.8-16.0 mg/L

Standard: Proposed at No More Than 10% Readings Above 30.0 mg/L

Only one reading is above 30.0 mg/L and only two readings are above the expected range. This stream meets the standard.

2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	8.1 mg/L	14.1 mg/L	13.1 mg/L
Proposed Standard: No more than 10% of readings above 30.0 mg/L			

Transparency

Expected Range:

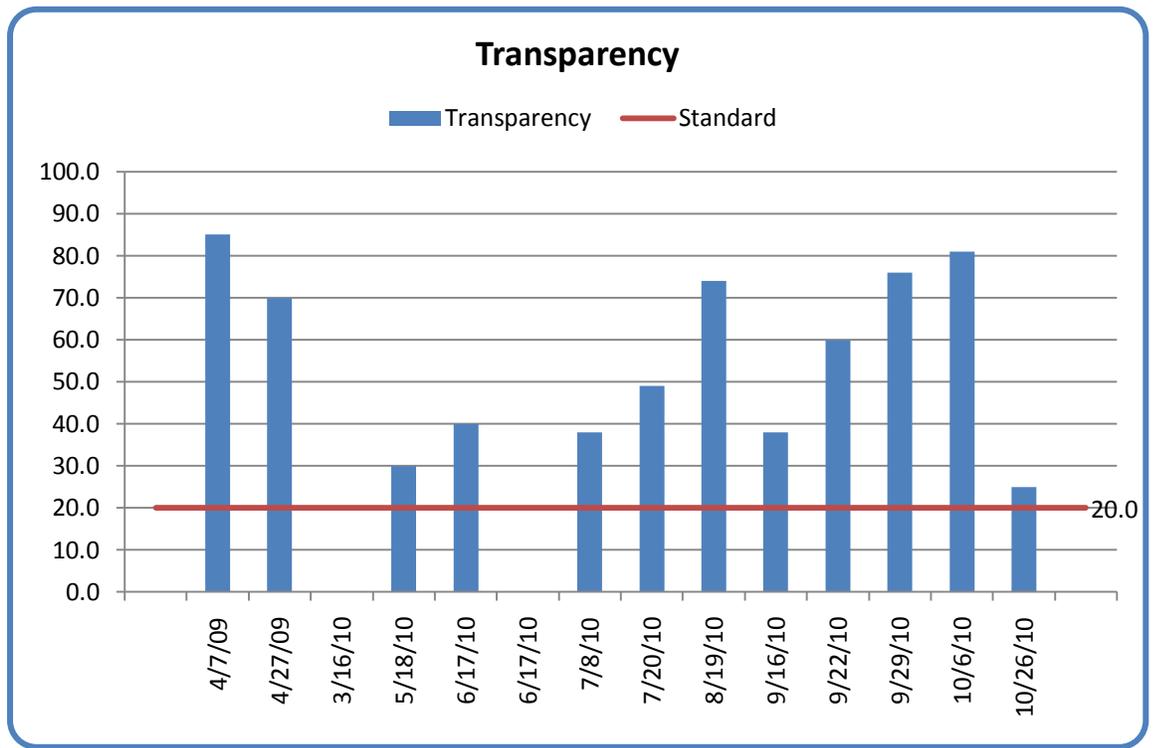
Currently No

Expected Range

Standard: Average

Reading Above 20.0
cm

The average meets
the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	78.0 cm	51.0 cm	56.0 cm
Standard: Average reading over 20.0 cm			

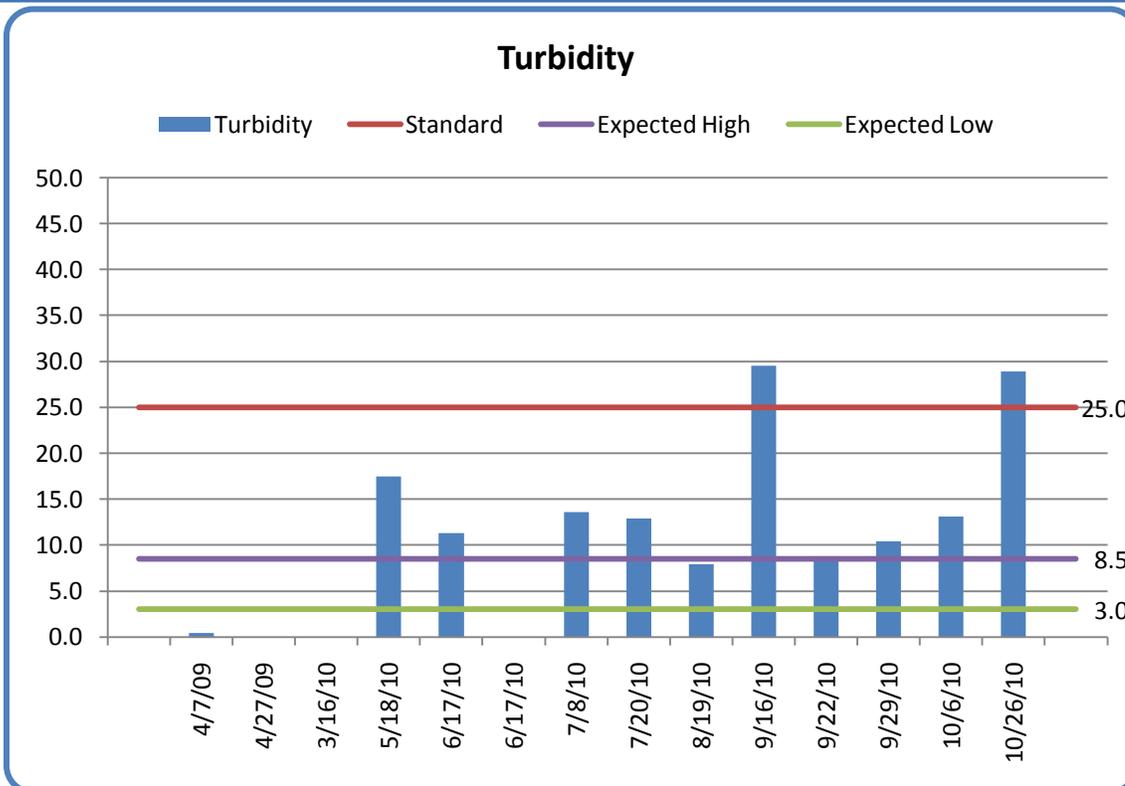
Turbidity

Turbidity

Expected Range: 3.0-
8.5 NTU

Standard: Average
Reading Not Over
25.0 NTU

Although two
samples are above
30.0 mg/L and most
samples exceed the
expected range, the
average meets the
standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.4 NTU	15.4 NTU	14.0 NTU
Standard: Average reading not over 25.0 NTU			



UNNAMED CREEK is a small creek that is a tributary to the backwaters of South Center Lake. The creek runs through a rural watershed. At this sampling point, the water was extremely low in 2008 and 2009 which allowed the stream bed to grow large amounts of vegetation. This vegetation and the low water levels could have made more organic matter present in the water column than would have been present if higher flows were present more often.

Summary of Stream

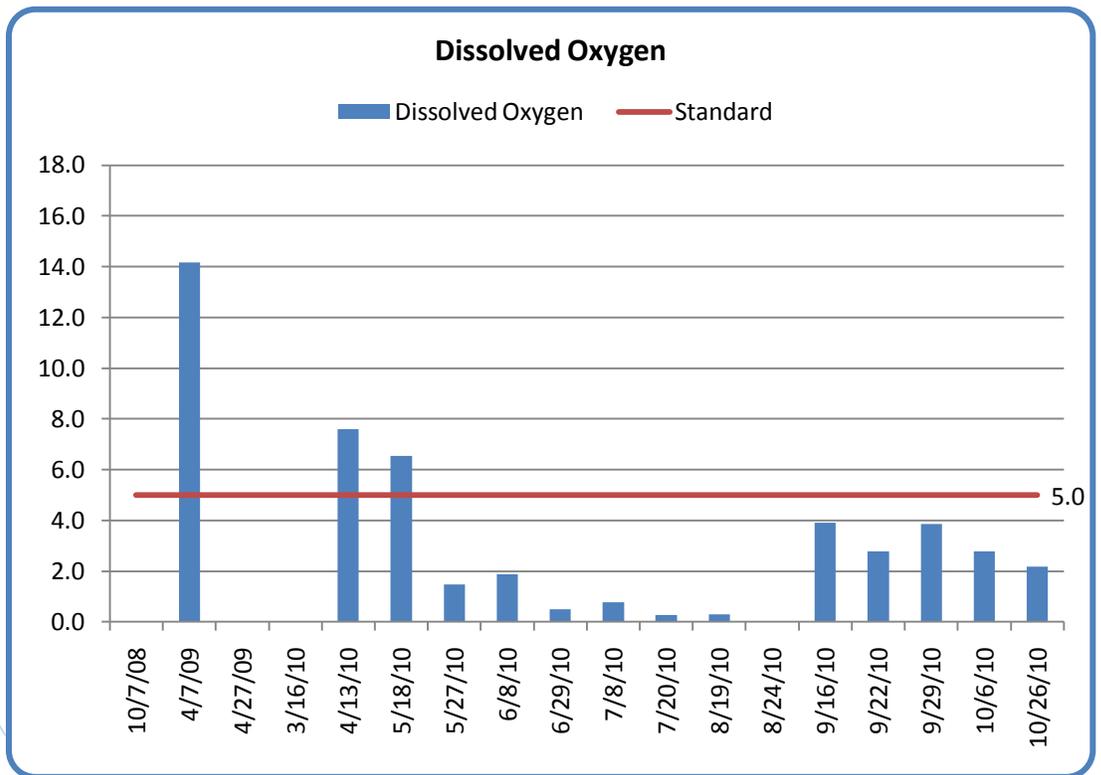
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	3.5 mg/L	No more than 50% below 5.0 mg/L	No	Over 5.0 mg/L	No
Temperature	59.7 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	0.08 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
pH	6.9	No more than 50% below 7.0	No	7.9-8.3	No (Below)
Total Phosphorus	1.02 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.55 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	7.4 mg/L	No more than 10% above 30.0 mg/L	Yes	4.8-16.0 mg/L	Yes
Transparency	65.0 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	11.1 NTU	<25.0 NTU	Yes	3.0-8.5 NTU	No

Dissolved Oxygen

Expected Range: Over 5.0 mg/L

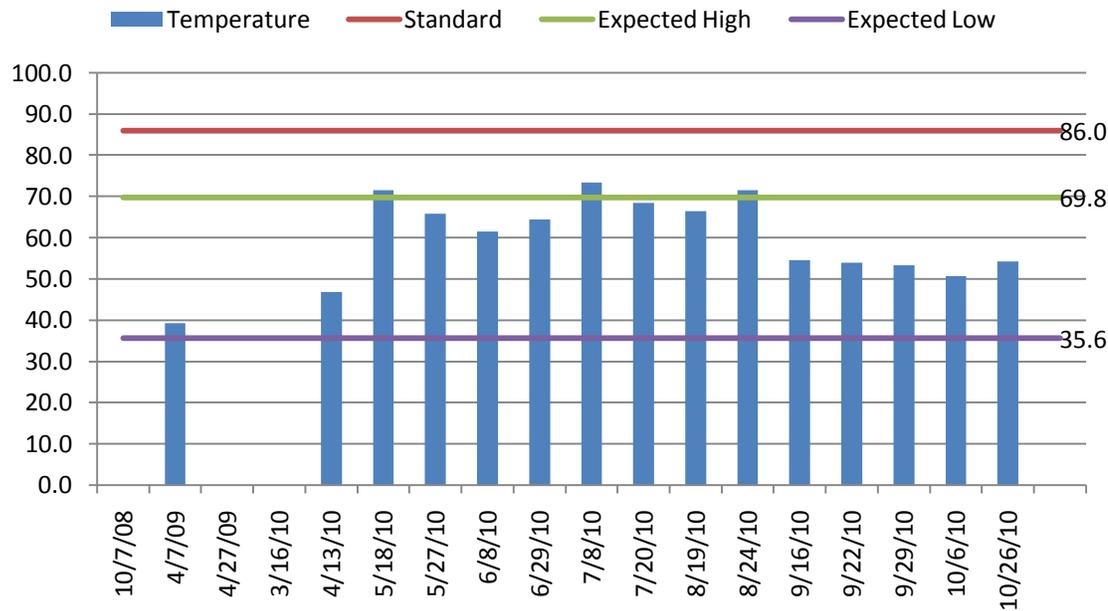
Standard: No More Than 50% Readings Below 5.0 mg/L

Eleven out of thirteen samples (85%) were below 5.0 mg/L, meaning this stream did not meet the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	14.2 mg/L	2.7 mg/L	3.5 mg/L
Standard: No more than 50% of readings below 5.0 mg/L			

Temperature



Temperature

Expected Range: 35.6-69.8 °F

Standard: The daily average shall not exceed 86.0°F

Most readings were within the expected range.

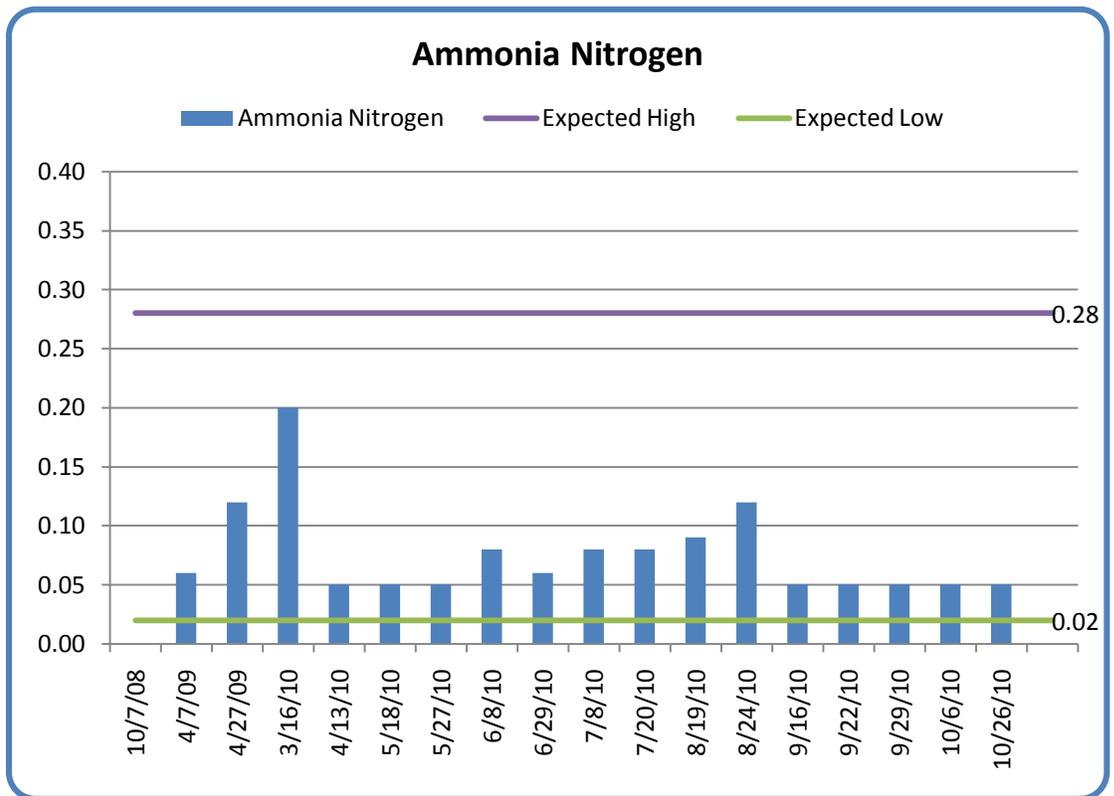
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	39.3°F	61.2°F	59.7°F
Standard: The daily average shall not exceed 86.0°F			

Ammonia Nitrogen

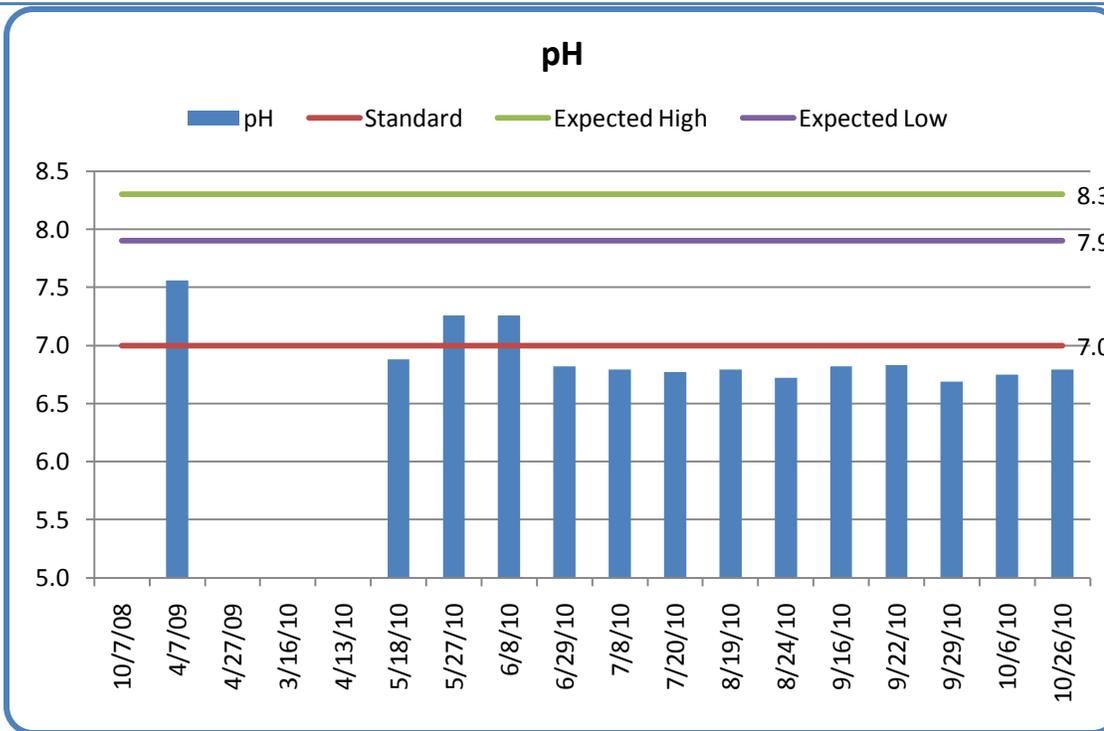
Expected Range: 0.02-0.28 mg/L

Standard: Under Development

All readings were within the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.09 mg/L	0.07 mg/L	0.08 mg/L
Expected Range: 0.02-0.28 mg/L			



pH

Expected Range: 7.9-8.3

Standard: No More Than 50% Below 7.0

Only three out of fourteen (21%) were above 7.0. This stream does not meet the standard.

2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	7.6	6.9	6.9
Standard: No more than 50% of readings below 7.0			

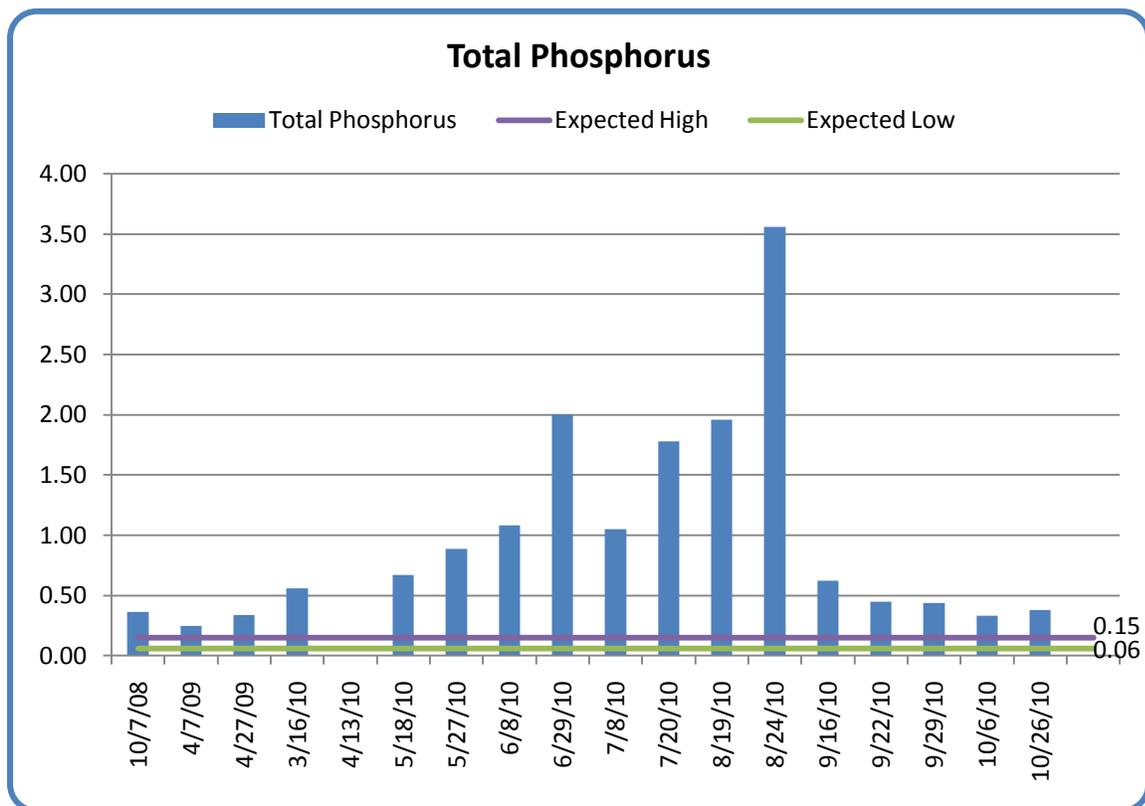
Total Phosphorus

Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

All samples exceeded the expected range. June, July, and August readings were especially high.

This chart cannot be directly compared to others in this report due to a change in scale.



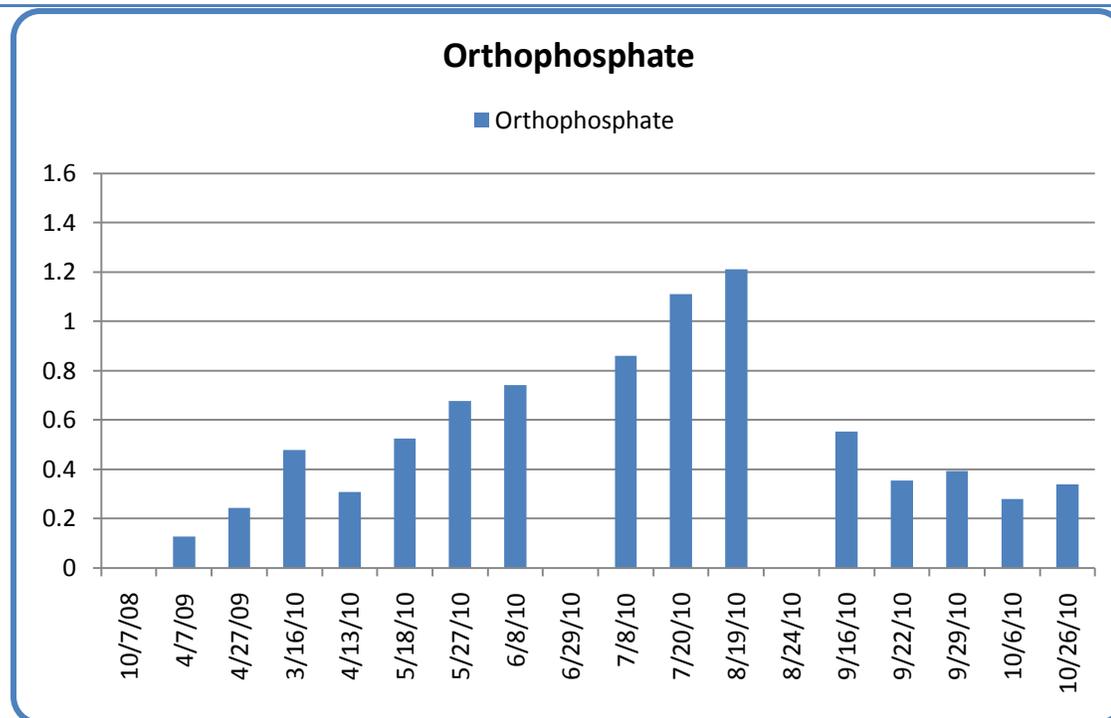
2008 Average	2009 Average	2010 Average	Overall Average
0.36 mg/L	0.29 mg/L	1.13 mg/L	1.02 mg/L
Expected Range: 0.06-0.15 mg/L			

Orthophosphate

Orthophosphate

Expected Range:
Currently No Expected
Range

Standard: Currently No
Standard

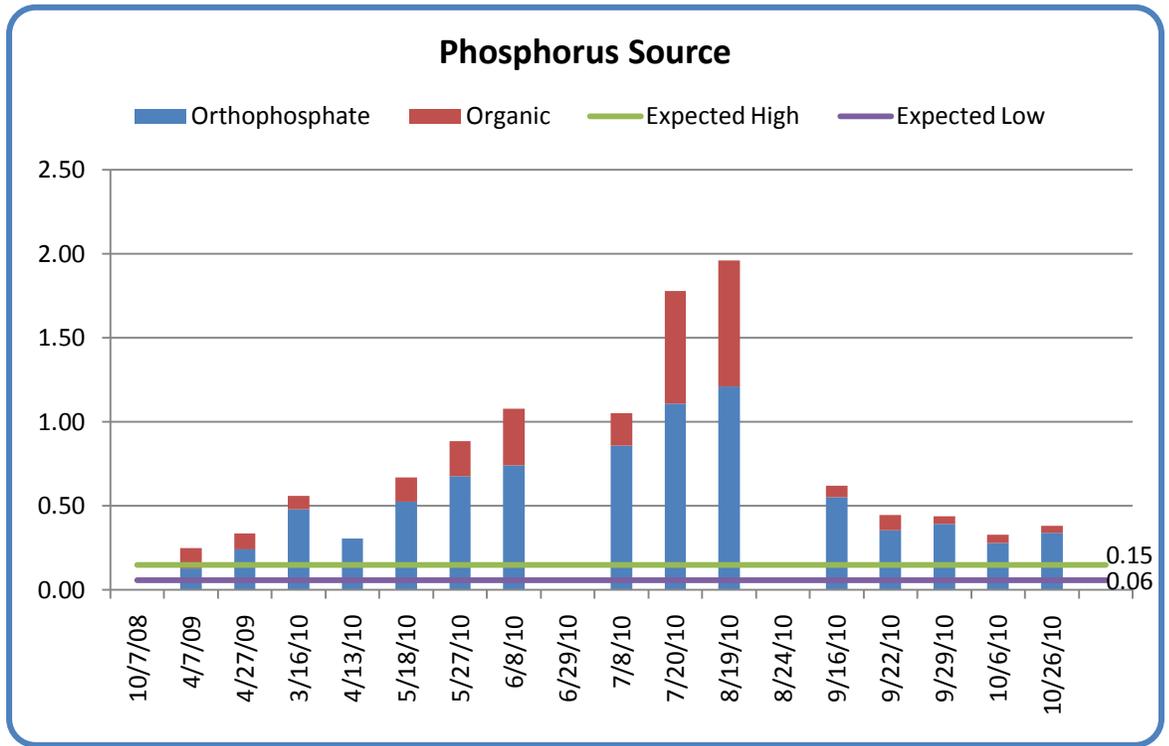


2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.19 mg/L	0.60 mg/L	0.55 mg/L
Expected Range/Standard: Currently none			

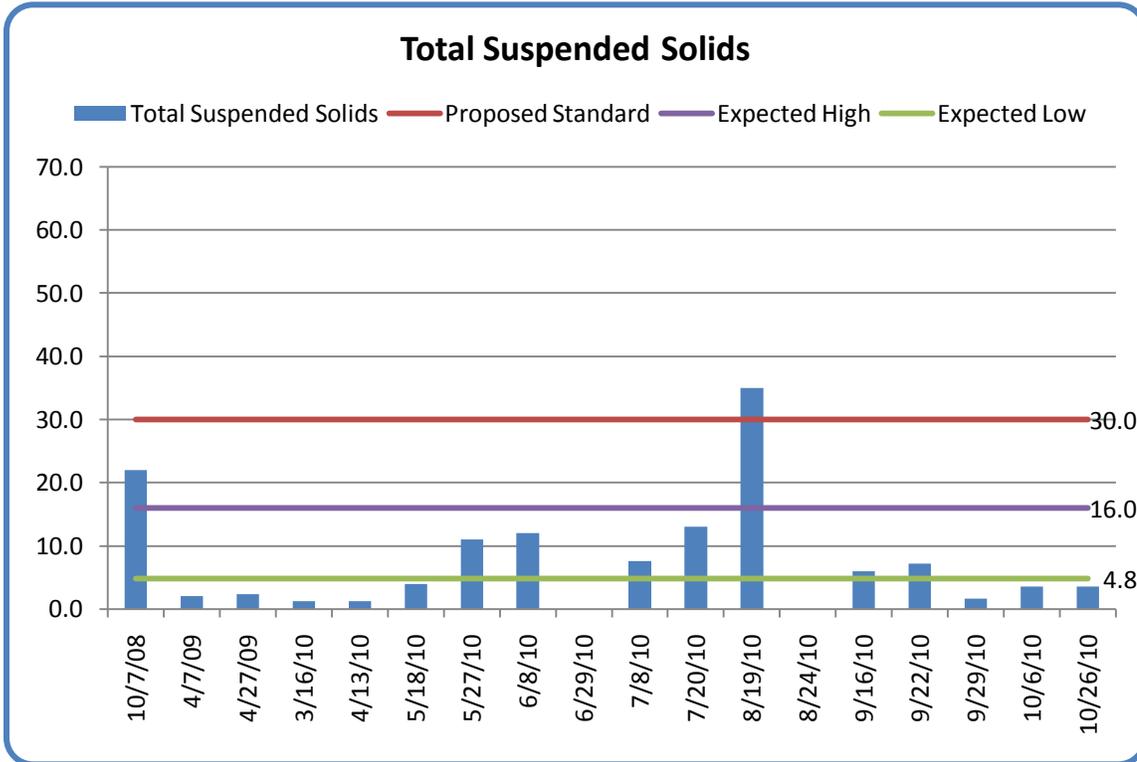
Phosphorus Source:

Inorganic phosphorus (orthophosphate) makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is inorganic.

This chart cannot be directly compared to others in this report due to a change in scale.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.11 mg/L	0.52 mg/L	0.48 mg/L
Inorganic	NO DATA	0.16 mg/L	0.60 mg/L	0.55 mg/L



Total Suspended Solids

Expected Range:
4.8-16.0 mg/L

Standard: Proposed at No More Than 10% Above 30.0 mg/L

Only one sample was above 30.0 mg/L. This stream meets the standard.

2008 Average	2009 Average	2010 Average	Overall Average
22.0 mg/L	2.2 mg/L	8.2 mg/L	7.4 mg/L

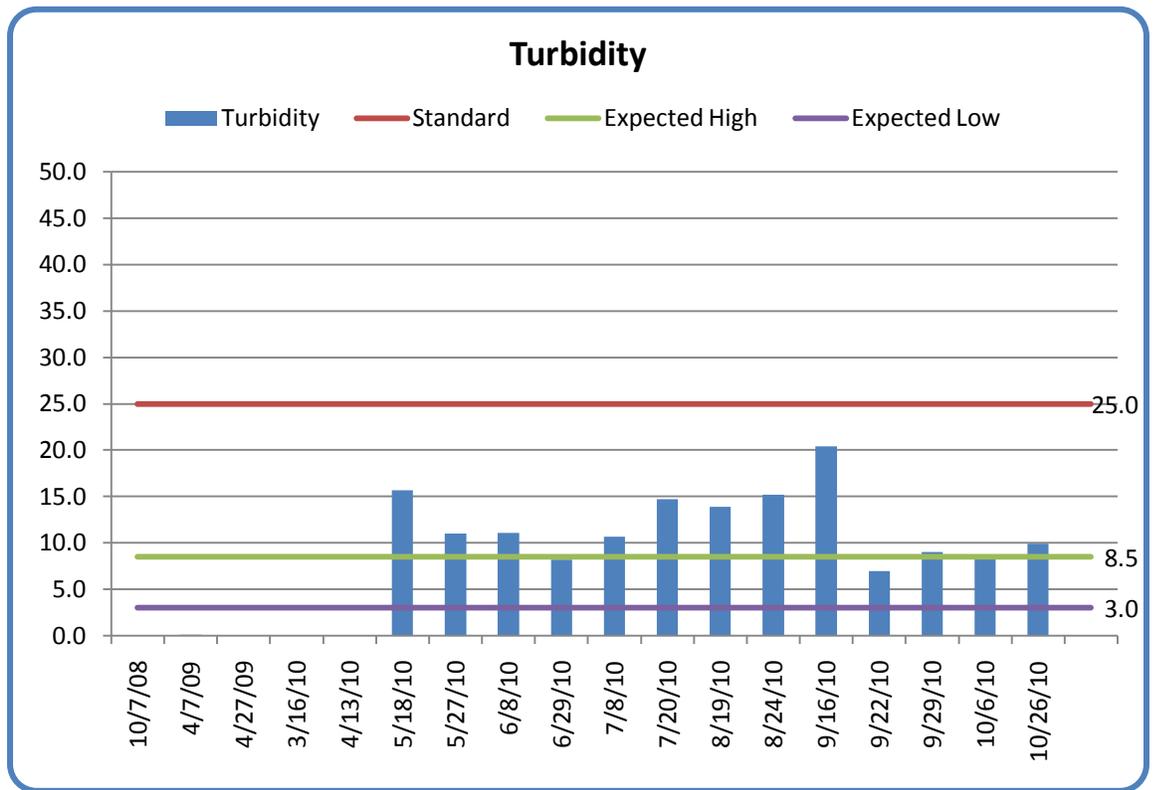
Proposed Standard: No more than 10% of readings above 30.0 mg/L

Turbidity

*Expected Range:
3.0-8.5 NTU*

*Standard: Average
Reading Not Over
25.0 NTU*

Although most samples exceeded the expected range, this stream meets the proposed standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.1 NTU	12.0 NTU	11.1 NTU

Standard: Average reading not to exceed 25.0 NTU

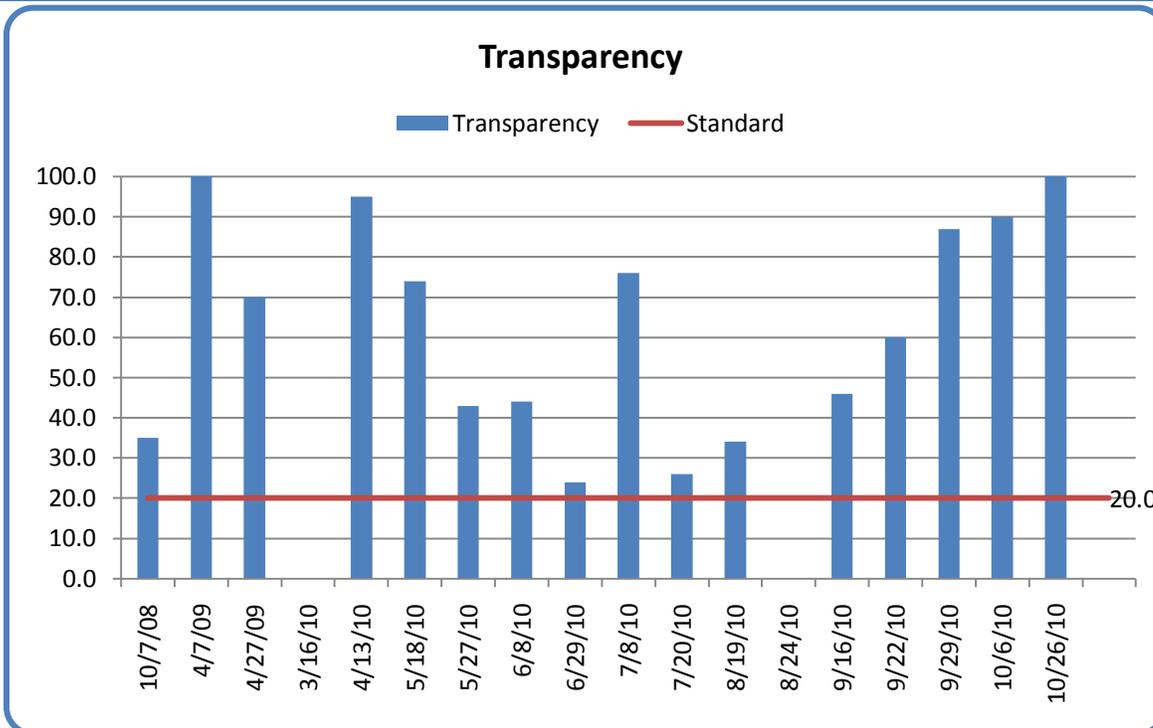
Transparency

Transparency

*Expected Range:
Currently No
Expected Range*

*Standard: Average
Reading Above 20.0
cm*

All averages meet the standard.



2008 Average	2009 Average	2010 Average	Overall Average
35.0 cm	85.0 cm	61.0 cm	65.0 cm

Standard: Average reading above 20.0 cm

LINDSTROM STORM SEWER is in downtown Lindstrom and collects stormwater from the Lindstrom City Hall to Olinda Trail in an open ditch. At Olinda Trail, the stormwater travels through a large stormwater pipe to South Lindstrom Lake. This pipe is a problem for landowners near where it outlets. The majority of the time, this stormwater ditch is stagnant. Sampling was not done often, due to the lack of flow.

Summary of Stream

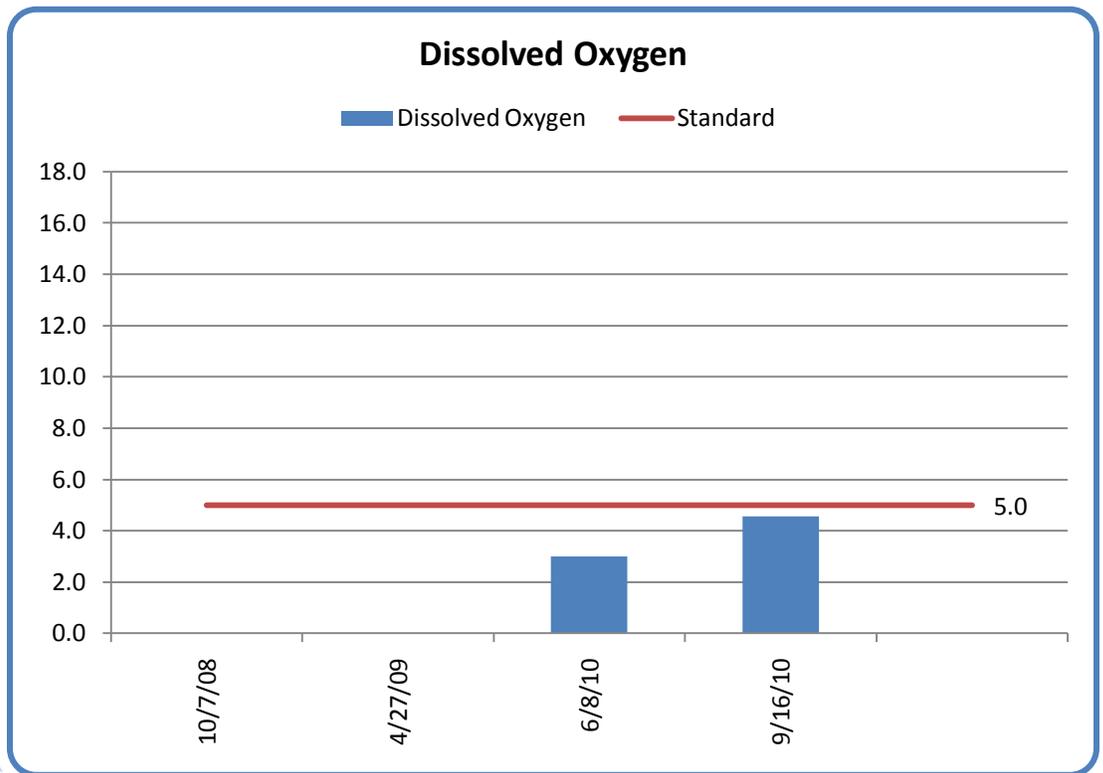
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Dissolved oxygen	3.8 mg/L	No more than 50% below 5.0 mg/L	No	Over 5.0 mg/L	No
Temperature	59.9 °F	Daily average not above 86.0 °F	Yes	35.6-69.8 °F	Yes
Ammonia Nitrogen	0.21 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
pH	7.1	No more than 50% below 7.0	Yes	7.9-8.3	No (Below)
Total Phosphorus	0.30 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.10 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	34.7 mg/L	No more than 10% above 30.0 mg/L	No	4.8-16.0 mg/L	No
Transparency	55.0 cm	>20.0 cm	Yes	N/A	N/A
Turbidity	16.0 NTU	<25.0 NTU	Yes	3.0-8.5 NTU	No

Dissolved Oxygen

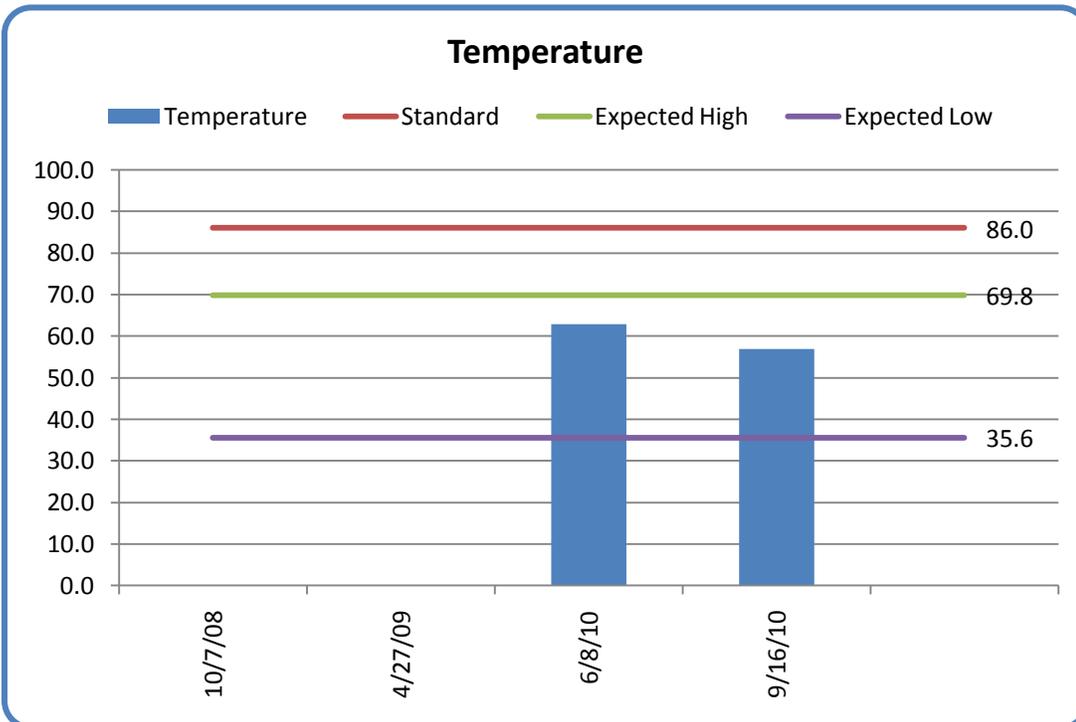
Expected Range: Over 5.0 mg/L

Standard: No More Than 50% Readings Below 5.0 mg/L

There are only two samples, but both are below 5.0 mg/L, so the water in this storm sewer does not meet the standard.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	3.8 mg/L	3.8 mg/L
Standard: No more than 50% of readings below 5.0 mg/L			



Temperature

Expected Range: 35.6-69.8 °F

Standard: The daily average shall not exceed 86.0°F

Both readings were within the expected range.

2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	59.9°F	59.9°F
Standard: The daily average shall not exceed 86.0°F			

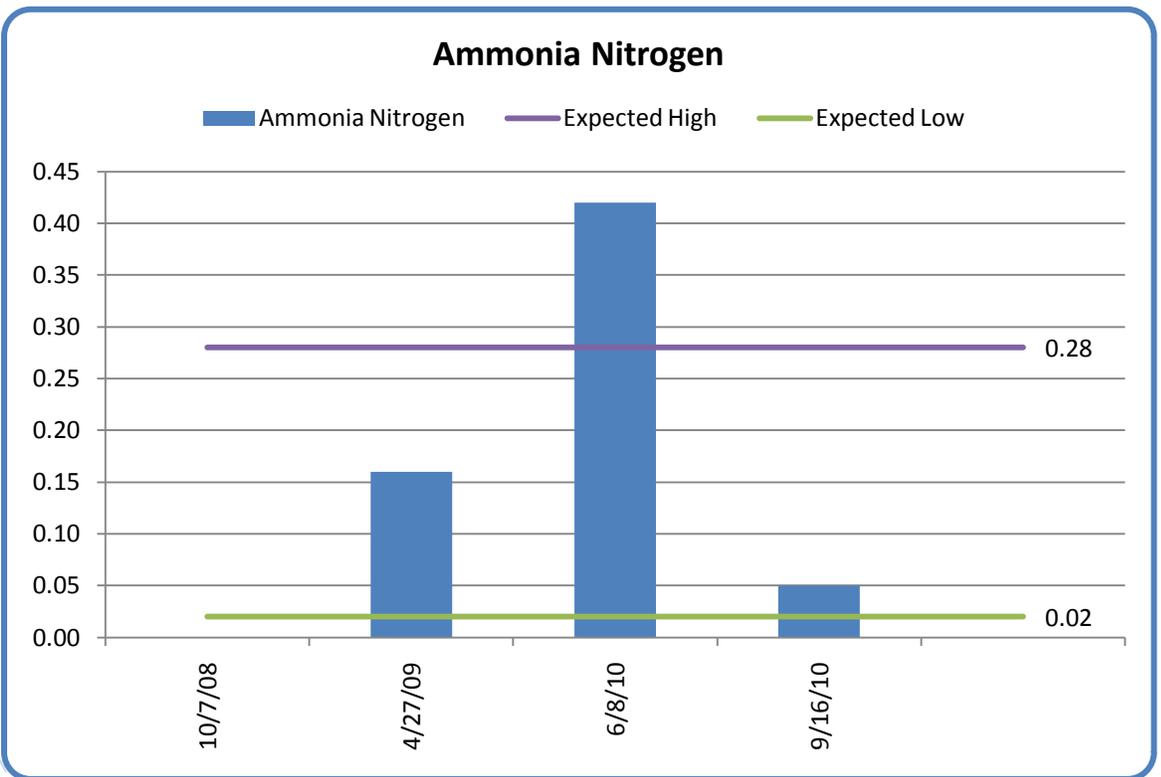
Ammonia Nitrogen

Expected Range: 0.02-0.28 mg/L

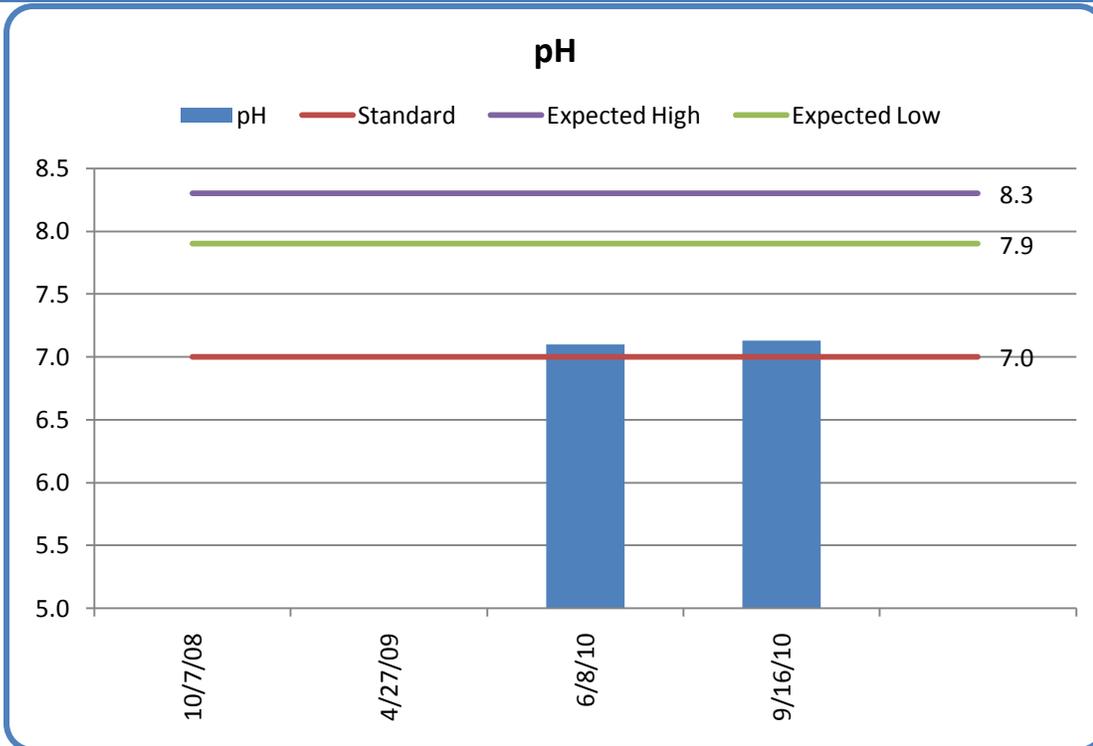
Standard: Under Development

All readings are within the expected range.

This chart cannot be directly compared to other Ammonia Nitrogen in this report due to a change in scale.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.16 mg/L	0.24 mg/L	0.21 mg/L
Expected Range: 0.02-0.28 mg/L			



pH

Expected Range: 7.9-8.3

Standard: No More Than 50% Readings Below 7.0

Both readings were slightly above 7.0, so the water meets the standard.

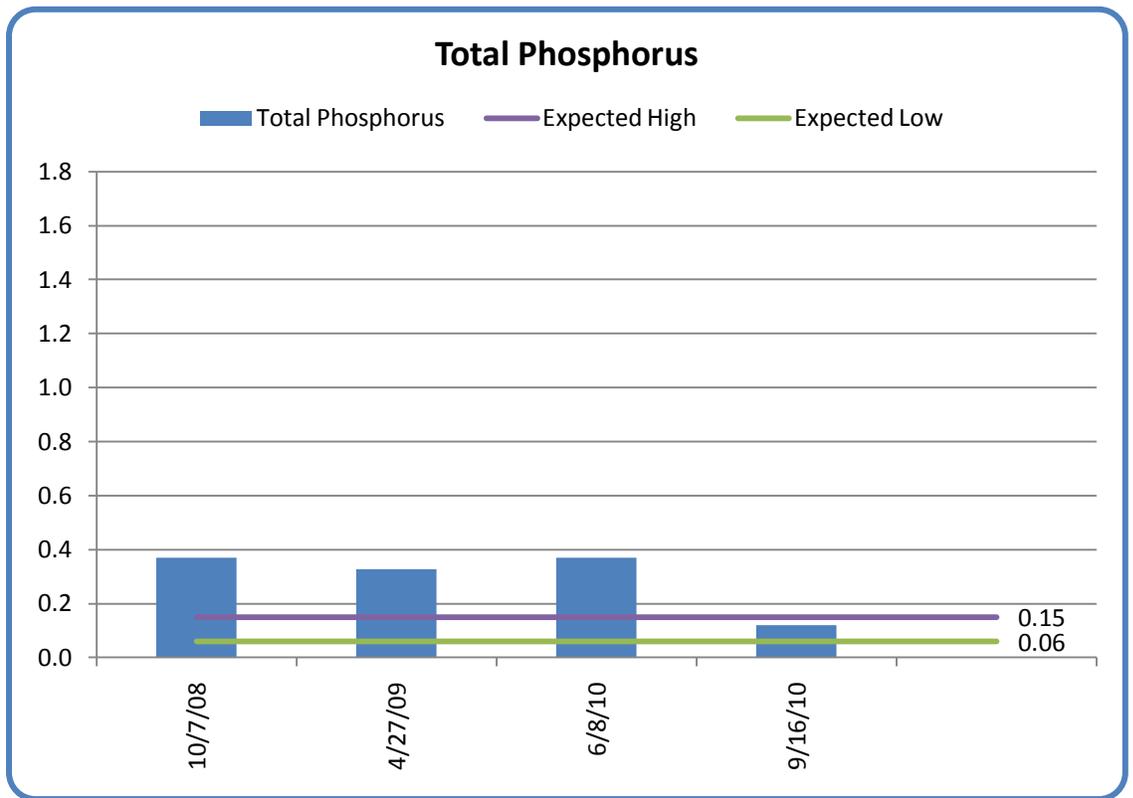
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	7.1	7.1
Standard: No more than 50% of readings below 7.0			

Total Phosphorus

Expected Range:
0.06-0.15 mg/L

Standard: Under
Development

Three of the four
samples were above
the expected range,
while only one
sample was within
the expected range.



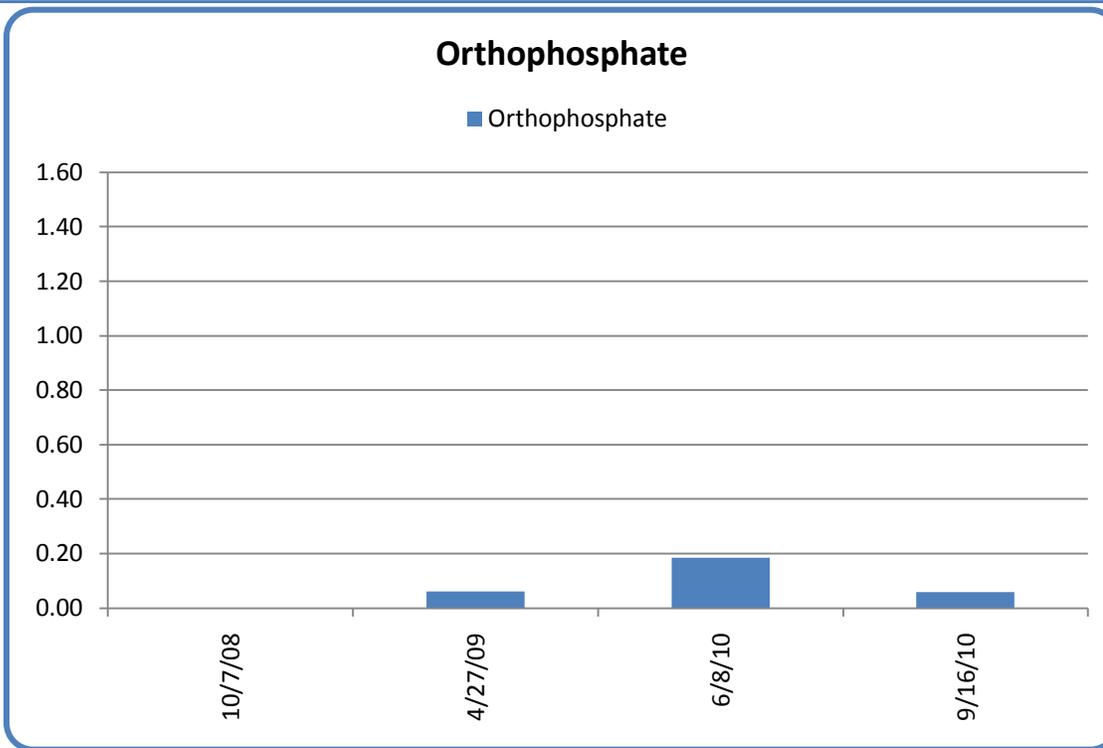
2008 Average	2009 Average	2010 Average	Overall Average
0.37 mg/L	0.33 mg/L	0.25 mg/L	0.30 mg/L
Expected Range: 0.06-0.15 mg/L			

Orthophosphate

Orthophosphate

Expected Range:
Currently No Expected
Range

Standard: Currently No
Standard

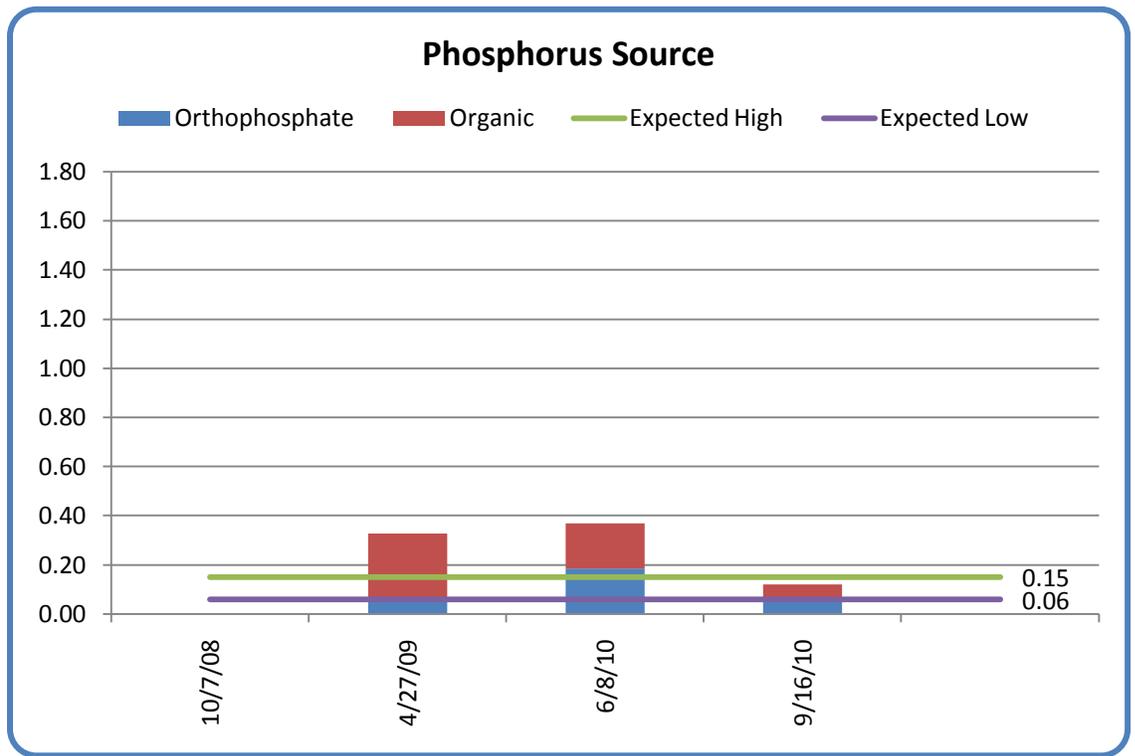


2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.06 mg/L	0.12 mg/L	0.10 mg/L
Expected Range/Standard: Currently none			

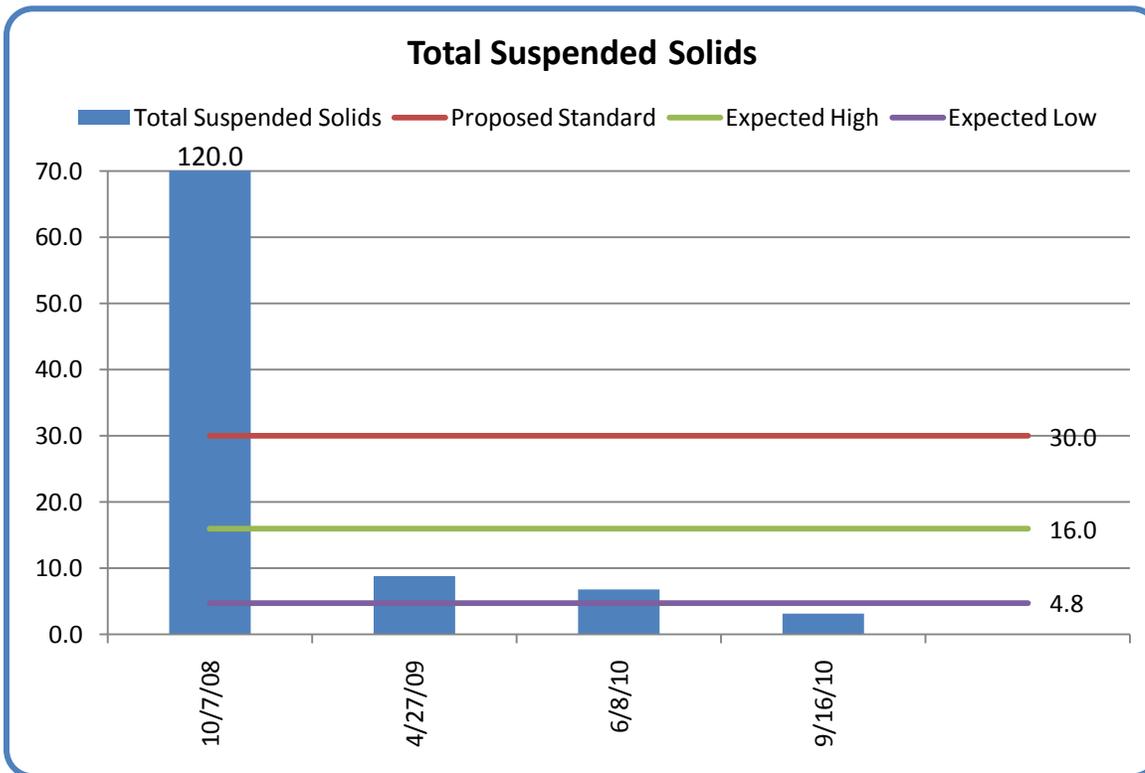
Phosphorus

Source:

Organic phosphorus makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is organic.



Source	2008	2009	2010	Overall
Organic	NO DATA	0.27 mg/L	0.12 mg/L	0.20 mg/L
Inorganic	NO DATA	0.06 mg/L	0.12 mg/L	0.10 mg/L



Total Suspended Solids

Expected Range:
4.8-16.0 mg/L

Standard: Proposed at No More Than 10% Readings Above 30.0 mg/L

The single 2008 sample was extremely high and greatly compromised the average.

2008 Average	2009 Average	2010 Average	Overall Average
120.0 mg/L	8.8 mg/L	5.0 mg/L	34.7 mg/L

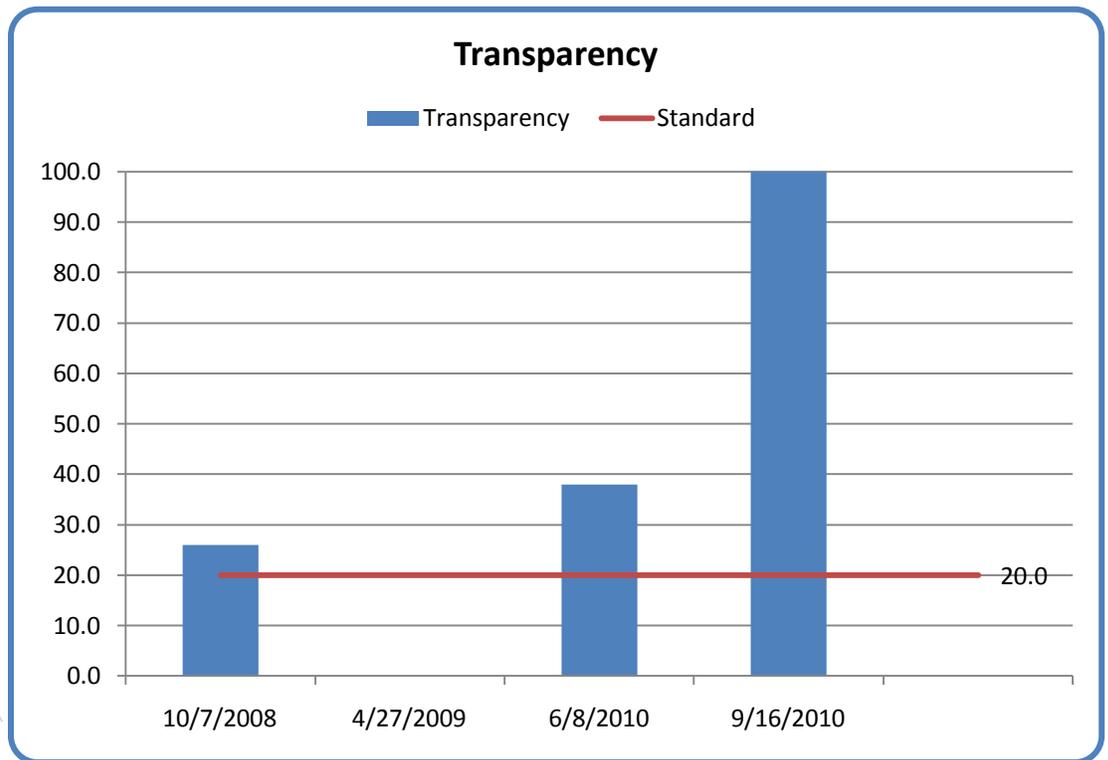
Proposed Standard: No more than 10% of readings above 30.0 mg/L

Transparency

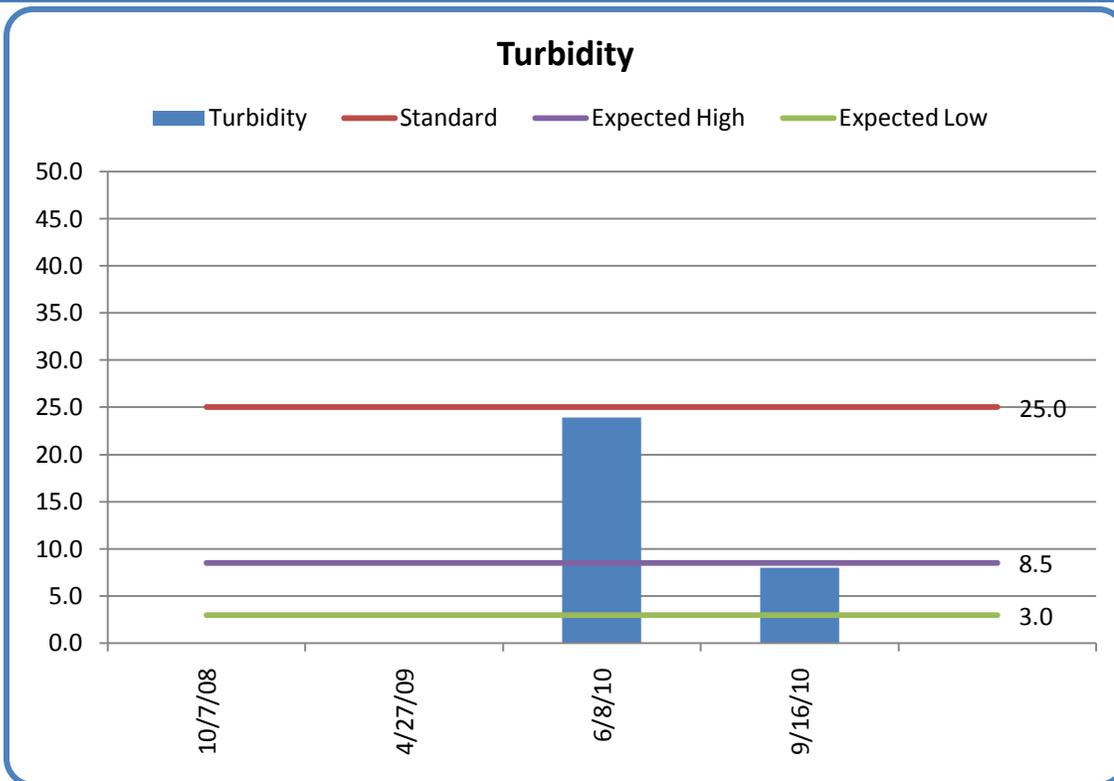
Expected Range:
Currently No Expected
Range

Standard: Average
Reading Above 20.0 cm

The water meets the
standard.



2008 Average	2009 Average	2010 Average	Overall Average
26.0 cm	NO DATA	69.0 cm	55.0 cm
Standard: Average reading above 20.0 cm			



Turbidity

Expected Range:
3.0-8.5 NTU

Standard: Average
Reading Not Over
25.0 NTU

One sample
exceeded the
expected range, but
the average met the
standard.

2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	NO DATA	16.0 NTU	16.0 NTU
Standard: Average reading not to exceed 25.0 NTU			



STORMWATER RUNOFF FROM THE CHISAGO COUNTY GOVERNMENT CENTER PARKING AREAS was sampled a few times. This was to view data coming off the road and parking areas in a highly impervious area. Runoff from the Government Center enters North Center Lake in several locations. Stormwater runoff carries many pollutants directly and quickly to lakes. The main concern of stormwater runoff is generally sediment which is easily carried by moving water. This data shows that pollutants are transported by stormwater.



Summary of Stream

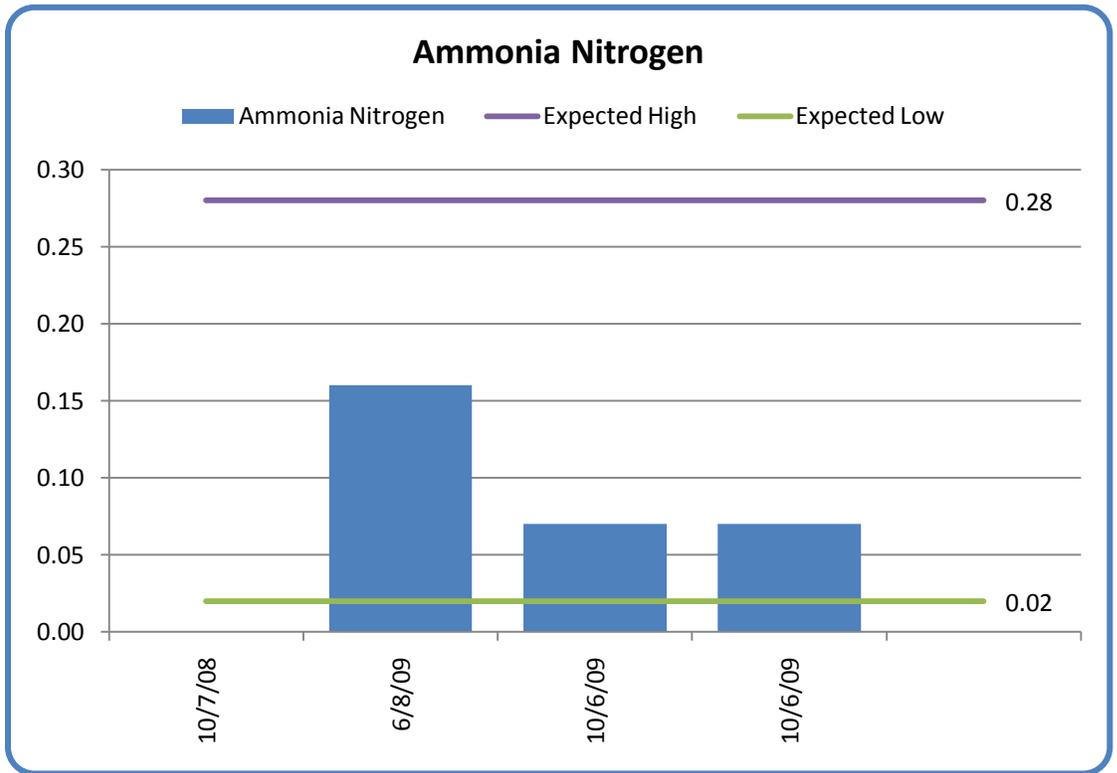
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Ammonia Nitrogen	0.10 mg/L	N/A	N/A	0.02-0.28 mg/L	Yes
Total Phosphorus	0.17 mg/L	N/A	N/A	0.06-0.15 mg/L	No
Orthophosphate	0.08 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	79.0 mg/L	No more than 10% above 30.0 mg/L	No	4.8-16.0 mg/L	No
Transparency	14.0 cm	>20.0 cm	Yes	N/A	N/A

Ammonia Nitrogen

Expected Range: 0.02-0.28 mg/L

Standard: Under Development

Three samples were taken in 2009 and they were all within the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.10 mg/L	NO DATA	0.10 mg/L
Expected Range: 0.02-0.28 mg/L			

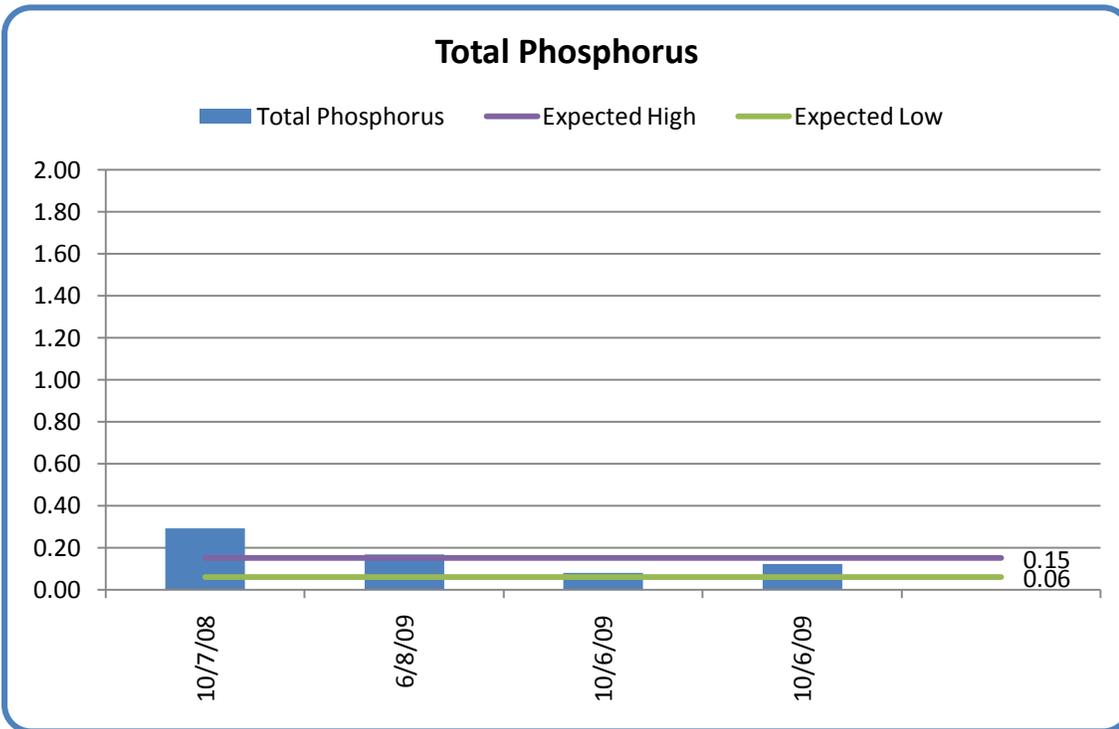
Total Phosphorus

Total Phosphorus

Expected Range: 0.06-0.15 mg/L

Standard: Under Development

The single sample from 2008 exceeded the expected range. The 2009 samples were within the expected range.



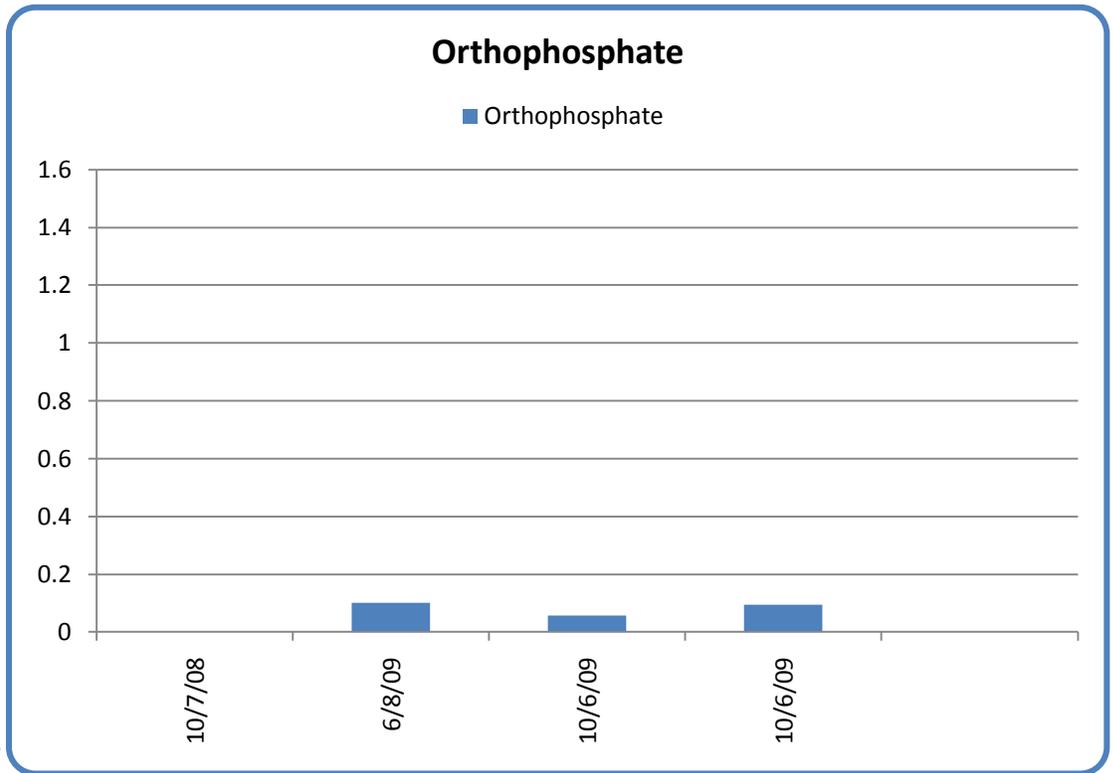
2008 Average	2009 Average	2010 Average	Overall Average
0.29 mg/L	0.12 mg/L	NO DATA	0.17 mg/L
Expected Range: 0.06-0.15 mg/L			

Orthophosphate

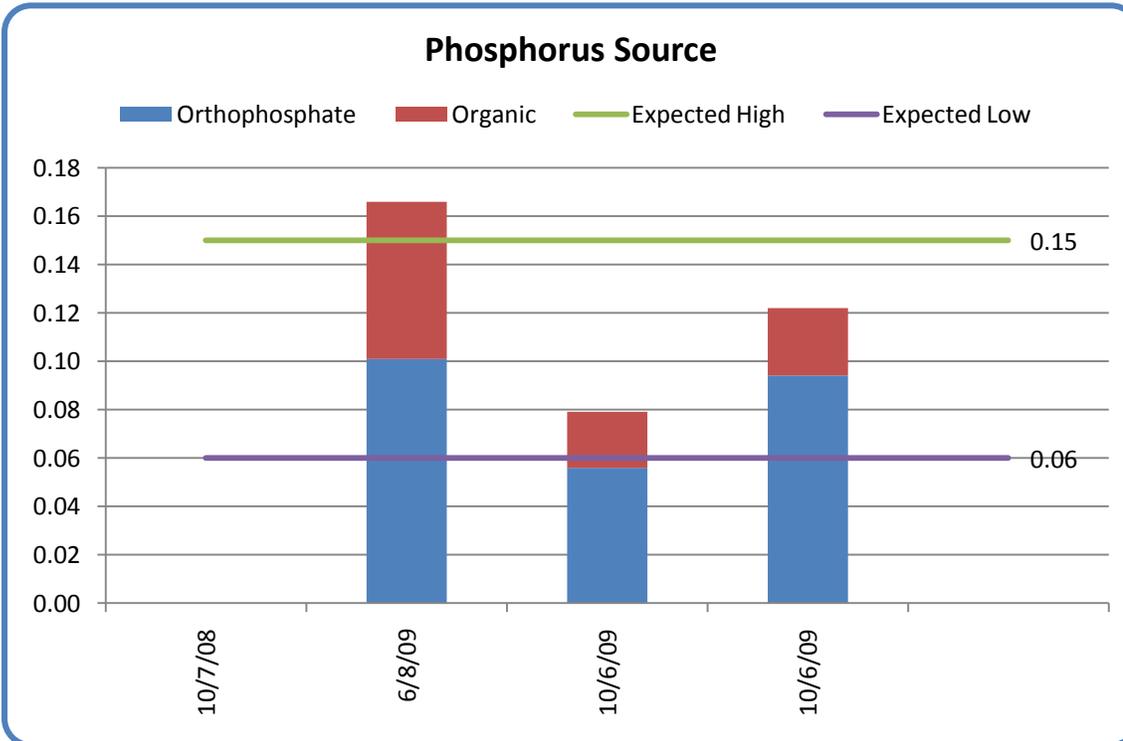
Expected Range:

Currently No Expected Range

Standard: Currently No Standard



2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.08 mg/L	NO DATA	0.08 mg/L
Expected Range/Standard: Currently none			



Phosphorus Source:

Inorganic phosphorus (orthophosphate) makes up the majority of the total phosphorus, indicating that the main source of phosphorus in this stream is inorganic.

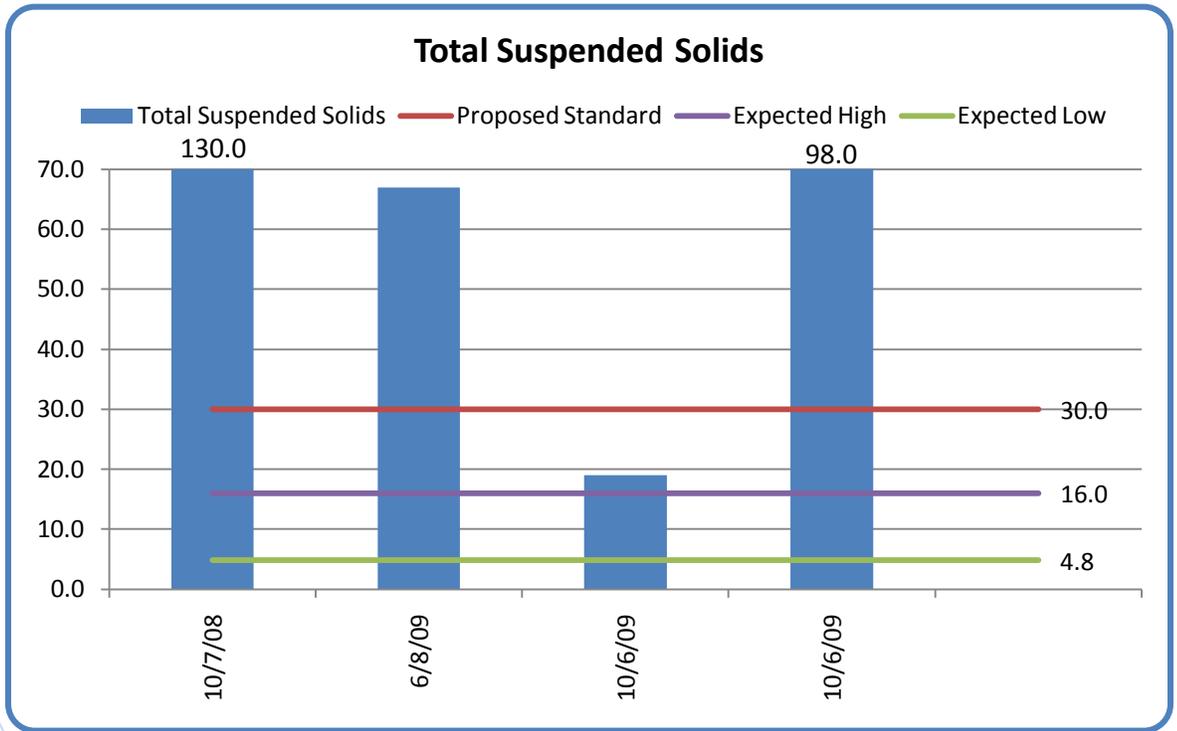
Source	2008	2009	2010	Overall
Organic	NO DATA	0.04 mg/L	NO DATA	0.04 mg/L
Inorganic	NO DATA	0.08 mg/L	NO DATA	0.08 mg/L

Total Suspended Solids

Expected Range:
4.8-16.0 mg/L

Standard: Proposed
at No More Than
10% Readings Above
30.0 mg/L

Three of four
samples far
exceeded the
expected range.
Seventy-five percent
of readings are
above 30.0 mg/L.



2008 Average	2009 Average	2010 Average	Overall Average
130.0 mg/L	61.0 mg/L	NO DATA	79.0 mg/L

Proposed Standard: No more than 10% of readings above 30.0 mg/L

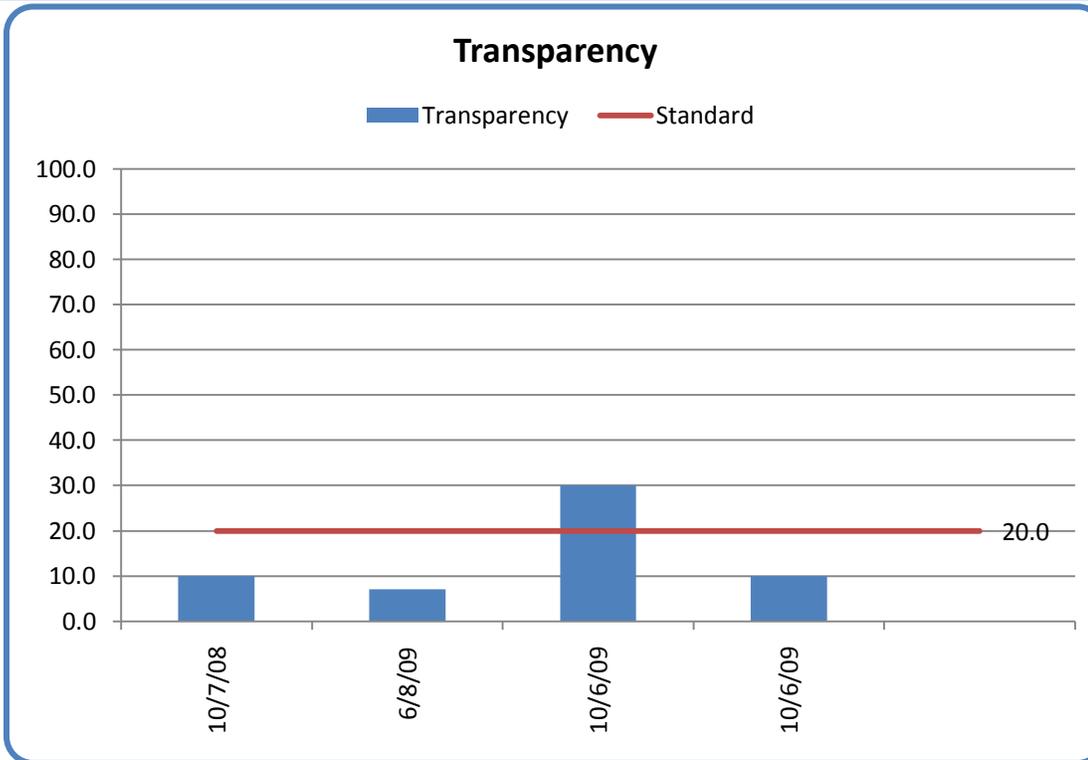
Transparency

Transparency

Expected Range:
Currently No Expected
Range

Standard: Average
Reading Above 20.0 cm

The water meets the
standard.



2008 Average	2009 Average	2010 Average	Overall Average
10.0 cm	16.0 cm	NO DATA	14.0 cm

Standard: Average reading above 20.0 cm



THE TRIBUTARY FROM NORTH CENTER LAKE connects North Center Lake to North Lindstrom Lake through a channel that has been maintained a few times in the past, but not recently. This channel was so low during the sampling seasons that very few readings were taken. The few baseline samples that were taken will need to be compared to the readings in North Center Lake and North Lindstrom Lake. If higher water levels occur, more sampling could be done to determine the water quality connections between North Center and North Lindstrom Lakes.



Summary of Stream

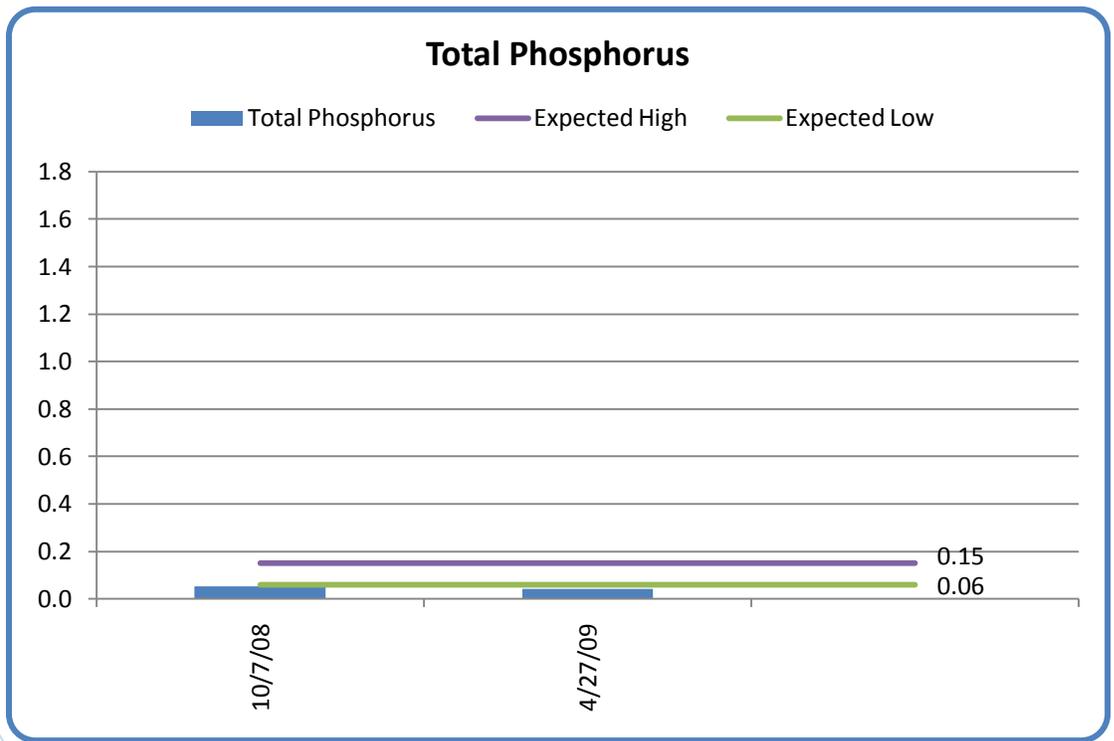
Parameter	Overall Average	Standard	Meets Average	Standard Range	Within Expected Range
Total Phosphorus	0.05 mg/L	N/A	N/A	0.06-0.15 mg/L	No (Below)
Orthophosphate	0.01 mg/L	N/A	N/A	N/A	N/A
Total Suspended Solids	6.6 mg/L	No more than 10% above 30.0 mg/L	Yes	4.8-16.0 mg/L	Yes
Transparency	80.0 cm	>20.0 cm	Yes	N/A	N/A

Total Phosphorus

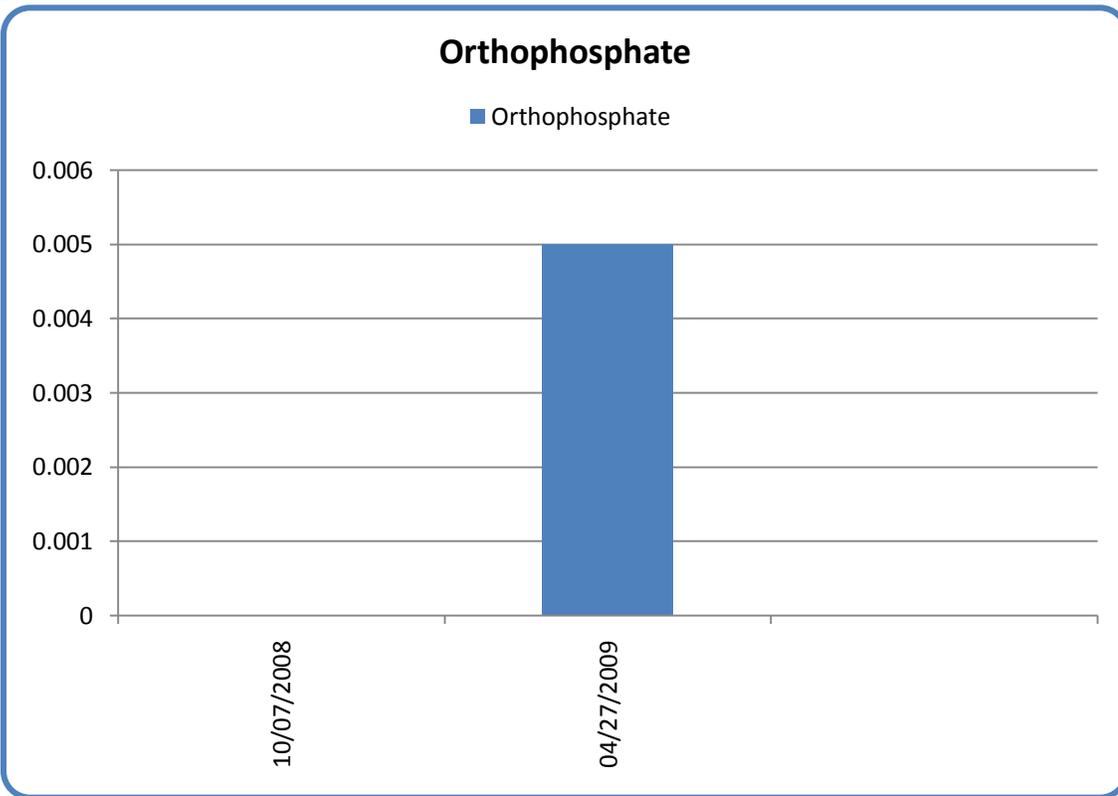
Expected Range: 0.06-0.15 mg/L

Standard: Under Development

Both samples are below the expected range.



2008 Average	2009 Average	2010 Average	Overall Average
0.05 mg/L	0.04 mg/L	NO DATA	0.05 mg/L
Expected Range: 0.06-0.15 mg/L			



Orthophosphate

Expected Range: Currently No Expected Range

Standard: Currently No Standard

The sample was so low that it fails to register on a chart with the same scale as other Orthophosphate charts in this report, so a different scale was used.

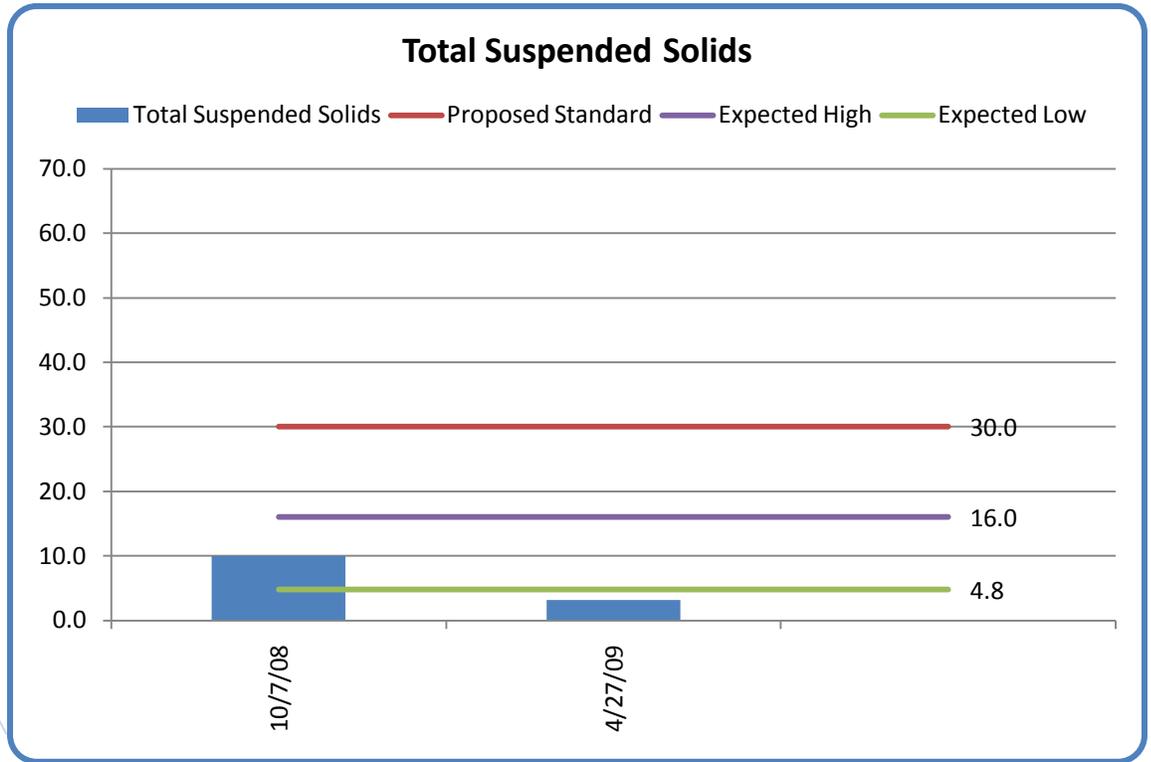
2008 Average	2009 Average	2010 Average	Overall Average
NO DATA	0.01 mg/L	NO DATA	0.01 mg/L
Expected Range/Standard: Currently none			

Total Suspended Solids

Expected Range: 4.8-16.0 mg/L

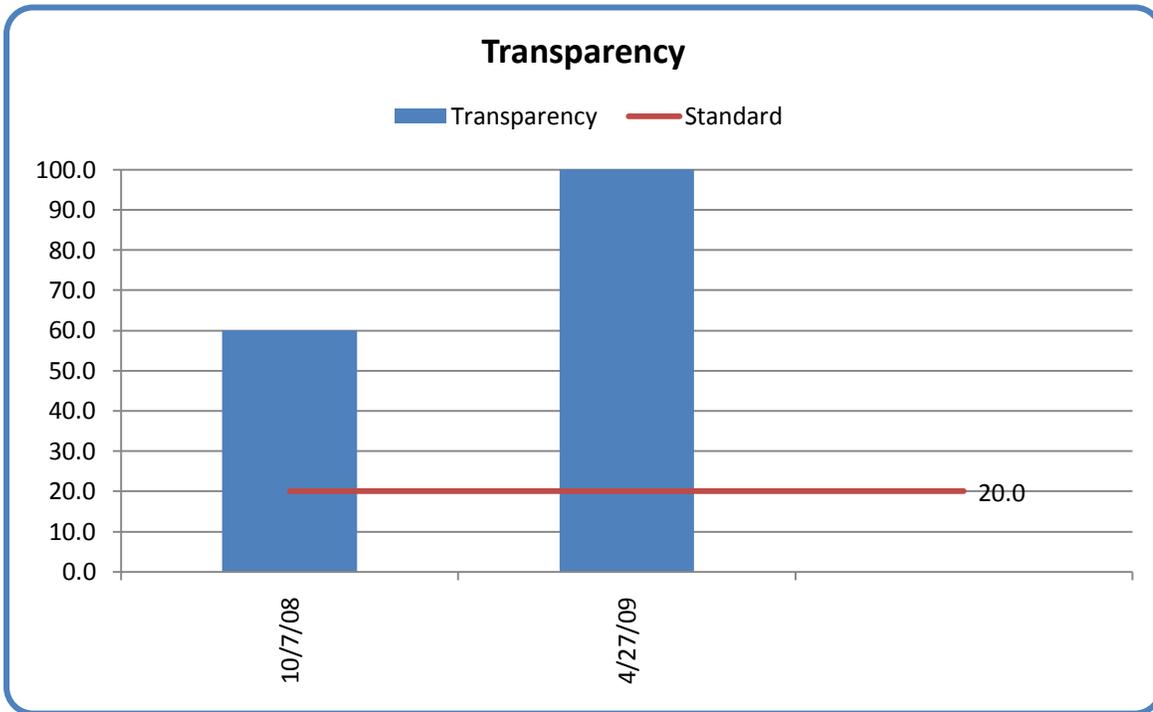
Standard: Proposed at No More Than 10% Readings Above 30.0 mg/L

One sample is within the expected range and one is below the expected range. No samples exceed 30.0 mg/L.



2008 Average	2009 Average	2010 Average	Overall Average
10.0 mg/L	3.2 mg/L	NO DATA	6.6 mg/L

Proposed Standard: No more than 10% above 30.0 mg/L



Transparency

Expected Range: Currently No Expected Range

Standard: Average Reading Above 20.0 cm

The average reading is well above 20.0 cm. This stream meets the standard.

2008 Average	2009 Average	2010 Average	Overall Average
60.0 cm	100.0 cm	NO DATA	80.0 cm

Standard: Average reading above 20.0 cm

