FINAL REPORT

OWEB GRANT #212-2062
South Umpqua Watershed Monitoring
and
OWEB GRANT #214-2046
South Umpqua Collaborative Monitoring

All harmful algae bloom data is reported in
Final Report – DEQ #041-12
South Umpqua Water Quality/HABs Monitoring

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Editor's notes:

- Bolded text referring to Maps, Photos, Graphs, Tables and Appendixes are active links that when clicked will jump to the appropriate page.
- It was necessary to upload this document as a pdf. Because of this some graphics may appear pixelated. If you would like to obtain a better copy feel free to contact Joe@UmpquaRivers.org.

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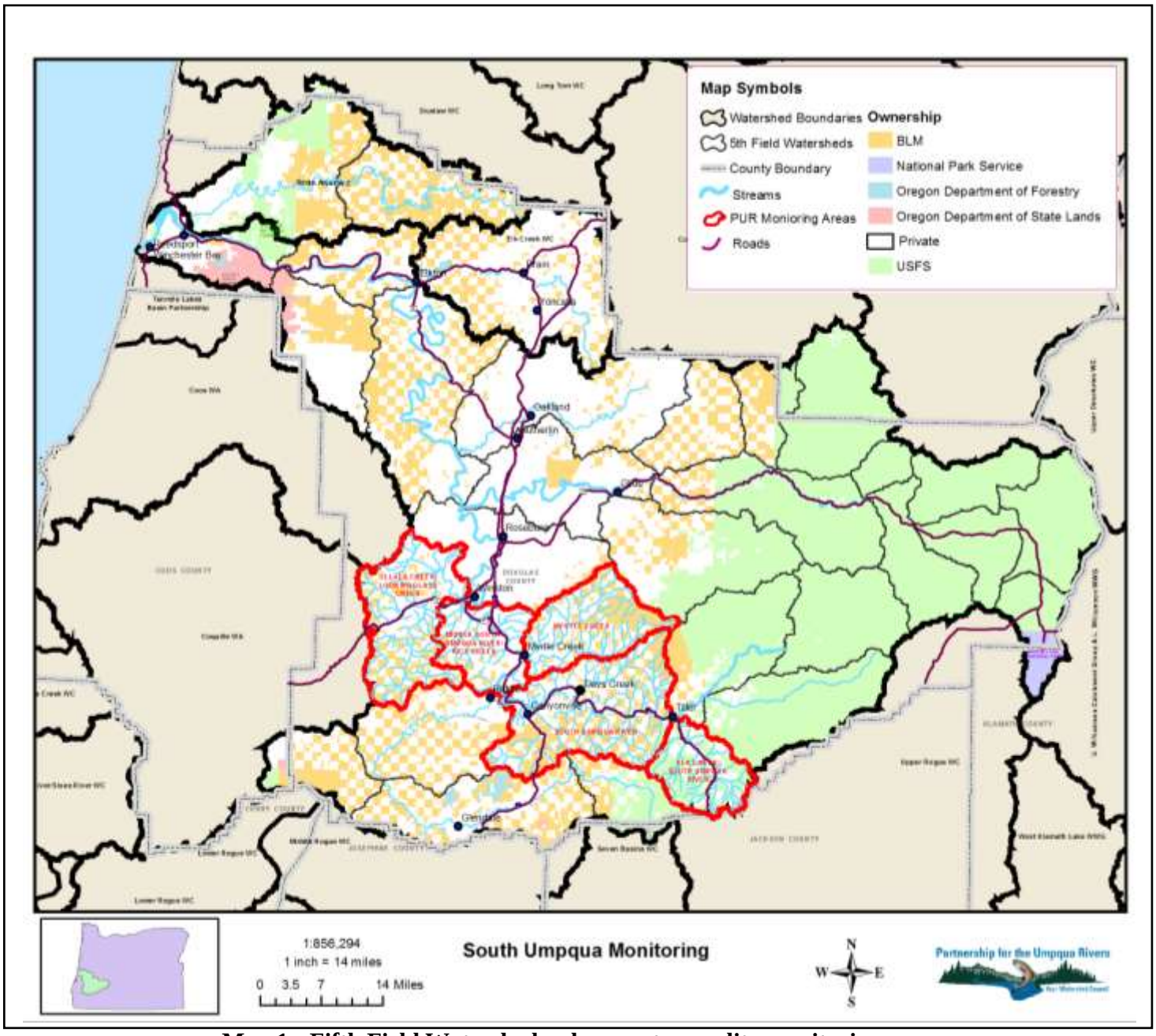
Project Overview

This report is a comprehensive account of the monitoring results of a previous OWEB report: OWEB Grant #209-2052 – PUR Water Quality Monitoring, August 2012, which reported all of PUR's monitoring from 2004 to 2010. In addition, it reports the results from Grants: 212-2062 - South Umpqua Watershed Monitoring & 214-2046 - South Umpqua Collaborative Monitoring 2014-2015, these grants collected further monitoring data in the South Umpqua, Myrtle Creek, Elk Creek/Tiller Watersheds as well as reporting monitoring data of the Olalla/Lookingglass Watershed and Days Creek Watershed. Rather than just report the new monitoring data, we have added it to the previously reported data in order to display a longer dataset which now comprises data collected from 2004-2015, 10 years of monitoring in the Myrtle Creek Watershed, nine years of monitoring in the South Umpqua region and four years of monitoring in the Elk Creek/Tiller Watershed. Three years of new monitoring in the Olalla/Lookingglass watershed which was collected entirely under these grants. All water quality data collected between 2004 and 2015 was collected by PUR's volunteer monitoring participants assisting PUR's Monitoring Coordinator and/or PUR's Assistant Monitoring Coordinator.

Olalla/Lookingglass watershed was one of the new areas that PUR monitored under these grants. Both ODA and ODEQ have identified this area as a priority for reducing levels of E. coli in drinking water source areas, and reducing nutrients and other factors contributing to the formation of harmful algae blooms. Improving these parameters will also lead to better water quality for salmonids. PUR was involved as landowner contacts were made to discuss instream work as well as riparian restoration. Through continued monitoring of these sites we hope to demonstrate improved water quality over time.

The objectives of water quality monitoring were to:

- Establish an approved Quality Assurance Project Plan (QAPP) with DEQ
- Gather data on temperature, turbidity, conductivity, dissolved oxygen, pH, total coliform and *E. coli* bacteria that will lead to scientifically-based understanding of current and changing watershed conditions;
- Provide current water quality information to PUR's project planning team to support restoration planning;
- Collect and provide water quality data to complement others' work;
- Collect and provide data where none is currently being gathered;
- Gather data where future restoration efforts are being planned so that "pre" water quality parameters can be recorded;
- Track areas of previous restoration efforts to detect a quantifiable change in water quality parameters as a result of our restoration projects;
- Maintain a close working relationship with other watershed stakeholders and act as the lead to share, gather and upload data to the Umpqua Basin Explorer website;
- Provide "A" quality data to the ODEQ database.



Map 1. Fifth Field Watersheds where water quality monitoring occurred under this report.

Monitoring Methods

Representativeness of Data:

Though our data will be compared from site to site, month to month and year to year, it must be stated that, except for the continuous temperature data, all water quality data are from grab sampling. As much as was possible, sampling runs were conducted at the same time of day and in the same direction, upstream or downstream, as previous runs. By taking monthly measurements it was possible to get some indication of annual changes, but even these monthly changes can be greatly affected by diurnal changes. Streamflow, pH, dissolved oxygen, trace elements, nutrients suspended particles as well as temperature are known to vary greatly over the course of a 24-hour period. Many of these changes are due to the effect of the sun either directly or indirectly – weather changes, seasonal changes, photosynthesis, rainfall, snowmelt, and streamflow. Other changes can be caused by human influence, such as the release of effluent from waste water treatment plants, release of water from reservoirs and irrigation withdrawals. “The amplitude of the diel changes can be as large as changes occurring on annual timescales” (Nimick, Gammons, & and Parker, 2011). Certainly, it would have been ideal to deploy data loggers for all water quality parameters and monitor 24 hours a day. With only one multi-parameter probe available, this would have severely limited the number of sites that could be monitored. Thus, we settled for grab sampling and report the data for what it is; a snap shot of water quality conditions at a particular place at a specific time. Data exceeding ODEQ standards is reported but conditions producing these exceedances may very well have occurred far more often than just at the time of our grab sampling.

Water Quality Parameters

Monitoring of all parameters followed standard methods as described in *Oregon Plan for Salmon and Watersheds Water Quality Monitoring Technical Guide Book*, *The EPA Guide to Volunteer Monitoring, YSI Product Training Manual* and the manufacturers' equipment manual recommendations. In 2007 PUR purchased a YSI Sonde multi-parameter device with funds received by the Council that were dedicated to improvement of water quality. In 2014 we were able to obtain a newer EXO2 DEQ with updated technology and the ability to take more sensors. DEQ uses Sondes for some of their data collection and approved its use in our *Quality Assurance Project Plan, 2008 Addendum* and since then has reapproved the use of our Sonde in *Quality Assurance Project Plan for the Partnership for the Umpqua Rivers October 15, 2014.* Parameters and methods used are listed in Table 1.

Parameter	Method
E. coli & total coliform	IDEXX Colilert method, manufacturer's protocol
Turbidity	Nephelometric, Hach 2100P, following manufacturer protocols
Field Turbidity	YSI EXO 2 Sonde datalogger or YSI Optical wiping turbidity sensor in 6920V2 Sonde datalogger, following manufacturer's protocols
Dissolved Oxygen	Hach kit Modified Winkler Method, manufacturer protocols
Dissolved Oxygen	YSI Dissolved Oxygen 550A Meter following manufacturer's protocols
Dissolved Oxygen	YSI EXO 2 Sonde datalogger or YSI ROX Optical Dissolved Oxygen Sensor in 6920V2 Sonde datalogger, following manufacturer's protocols
Temperature	NIST thermometer and Sonde thermometer
Continuous Temperature	Onset Data Loggers
Conductivity	YSI Conductivity Meter Model 30 following manufacturer's protocols
Conductivity	YSI EXO 2 Sonde datalogger or YSI Conductivity Sensor in 6920V2 Sonde datalogger, following manufacturer's protocols
pH	Orion pH probe and meter
pH	YSI EXO 2 Sonde datalogger or YSI Low Ionic Water pH sensor Combination pH and Gel Reference, manufacturer protocols

Table 1. Parameters monitored and methods used in PUR's water quality monitoring.

Parameter	Precision	Accuracy	Measurement Range
Temperature	±1.0°C	±0.5°	-5 to 35°C
pH	±0.3 SU	±0.2 SU	0 to 14 SU
Turbidity	±5% of Std. Value	±5% of Std. Value	0 to 1000 NTU
Conductivity	±10% of Std. Value	±7% of Std. Value	0 to 4999 μS/cm
Dissolved Oxygen	±0.3 mg/l	0.2 mg/l	1 to 14.6 mg/l
E. coli	±0.6 log		0 to >2420 MPN
Photo Points		± 3 feet	

Table 2. Precision and accuracy of water quality parameters measured.

Precision: Duplicate sample results were used to determine the precision of water quality measurements for each sampling event. Differences between duplicate values were compared against precision requirements outlined in the DEQ Data Quality Matrix to assign data precision classifications (http://www.deq.state.or.us/lab/wqm/docs/Accuracy_DQL_Calculator.xls).

Accuracy: Accuracy for pH, turbidity, and conductivity were determined by measuring standards before and after each sampling event. Deviations from standards were compared to accuracy ranges defined in the Data Quality Matrix to assign an accuracy classification for samples collected for each parameter. Temperatures were obtained with a NIST traceable thermometer that is calibrated by Oregon DEQ annually.

Split Samples: Split samples were conducted with the Oregon DEQ at least twice a year to further assess quality assurance.

Representativeness: Site selections were carefully chosen stream reaches that did not have contributing factors such as pond outflow or beaver dams upstream of collection sites. Samples were, when possible, collected from the center of the stream channel where the water is well mixed and, thus, most representative of the stream conditions.

Comparability: We hoped to insure comparability with similar projects by following standardized sampling protocols and procedures developed by state agencies. We also performed split samples at least twice a year ensure that our techniques produced results comparable to those of Oregon DEQ.

Turbidity Overview:

Turbidity in a stream appears cloudy to the human eye due to suspended particles. These particles could be silt or clay from sediment runoff, but could also be from microscopic organisms. Measuring turbidity is fairly easy with a light source and a detector such is supplied in the HACH kit and the YSI optical sensor used by PUR. These devises are able to measure the amount of light scattered by the particles in the water which is then picked up by a detector. The result is expressed in nephelometric turbidity units or NTUs. High turbidity levels are a problem for both public and private drinking water systems. Furthermore, fish may experience trouble breathing if particles get into their gills. Fish and other aquatic creatures have trouble feeding due to diminished vision. Fish eggs and fry may suffocate if fine particles are deposited into the gravels where they are developing. Migrating salmon will choose to avoid waters with high turbidity and may even stop their migration until the waters clear. Several researchers have reported that turbidity levels in the 60-70 NTU range will disrupt the feeding behaviors of juvenile coho. Fry that have newly emerged are even more susceptible and have demonstrated reduced growth and a tendency to emigrate from streams with levels of 25-50 NTU. "Effects on salmonids will differ based on their developmental stage. Suspended sediments may affect salmonids by altering their physiology, behavior, and habitat, all of which may lead to physiological stress and reduced survival rates" (Bash, 2001).

The result of turbidity can even affect stream temperature. The deposition of fines has been shown to decrease streambed connectivity and reduce the exchange of ground water and surface water across the stream bed. "Sediment may alter the dynamics of heating, cooling, and temperature buffering. The two-way exchange between the stream channel and the hyporheic zone is perhaps the most important buffer to high stream temperatures" (Poole and Berman 2001 referenced by Bash, 2001).

Interpreting the results of turbidity data is more difficult than collecting it. Natural background levels can differ by unique individual watershed processes and historical changes to the watershed. For examples, headwater streams tend to be less turbid than mainstems. Grab sample monitoring makes it all the more difficult to draw conclusions because it is only a single moment in time and does not give a complete picture over space and time. DEQ standards for turbidity are currently under revision. As DEQ reports, "The current turbidity standard is outdated and inadequate to fully protect Oregon's waters from potential effects from turbidity. The current provisions, adopted in 1976, require no more than a ten percent increase over natural background turbidity levels. At low natural turbidity levels that are prevalent in Oregon waters much of the year, a ten percent increase is within the error range of measurement and does not correspond with an impact on beneficial uses. In addition, the expression of the standard has made it challenging to implement across all of DEQ's water quality programs" (Appendix B: ODEQ Current Turbidity Rule) (Turbidity Rulemaking Fact Sheet, 2010). Appendix C: British Columbia Turbidity and Suspended Sediment Standards: has been included to provide specific levels that experts view of concern for various beneficial uses.

For the purpose of this report we provide the percentage of grab sample readings at an individual site that exceed 10 NTU. This serves only as an indicator of sites that could use further

investigation to determine if stream improvement projects might contribute to more favorable conditions for salmonids and other aquatic organisms.

The Oregon Watershed Assessment Manual recommends using 50 NTUs as the turbidity evaluation criteria for watershed assessments. At this level, turbidity interferes with sight-feeding aquatic organisms and provides an indication of the biological effect of suspended sediment. Seven out of 454 (1.5%) South Umpqua River turbidity samples exceeded 50 NTUs.[61] Additional monitoring is necessary to determine if turbidity levels are of concern in tributaries. (Geyer, South Umpqua Watershed Assessment and Action Plan, 2003)

pH Overview:

The negative logarithm of the hydrogen ion concentration of a solution is defined as pH with the scale from 0 to 14. This scale indicates the acidity or alkalinity of a solution, with pH 7.0 being neutral. As you climb the scale from 7 the solution becomes more basic or caustic. From 7 down the scale to 0 it becomes more acidic. In a logarithmic scale, each whole unit of incremental change is equal to a ten-fold increase or decrease in acidity or alkalinity. See **Appendix D: pH Scale** for a scale indicating the pH of common products.

The equipment used to measure pH consists of a meter and an electrode. The electrode measures the amount of positive hydrogen ions in the water by running a very low electric current through the water. The electrode placed in the stream then develops an electrical potential that is proportional to the pH of the solution. A reference electrode is needed to complete the circuit and provide a stable reference potential. The voltage is then passed to the meter, amplified, and converted to the pH scale. Because temperature influences the electrical potential of pH electrodes, pH probes must be equipped with a thermometer and automatic temperature compensation. Inaccuracy can be a problem when measuring low ionic strength waters common in the Umpqua. Ions need to be present in order to pass the low electric current. PUR purchased a special pH probe from YSI that is made to work in low ionic strength streams. This not only increases the accuracy, but also reduces the time for the equipment to become stable when moved from one stream to the next.

The following is DEQ's pH criteria for the Umpqua Basin, a summarization from the 303(d) Listing criteria at http://www.deq.state.or.us/wq/assessment/docs/methodology0406.pdf

Parameter	Criteria	Assessment Method	Data Requirements
pH	6.5 ≤ pH ≤ 8.5 Estuarine and fresh waters	Greater than 10 percent of the samples are outside the range of the appropriate criterion and a minimum of at least two samples outside the range of the appropriate criterion for the time period of interest.	A minimum of 5 representative data points available per site collected on separate days for each time period of interest. Time periods are Summer: June 1 through September 30; Fall-Winter-Spring (FWS): October 1 to May 31

Table 3. DEQ pH criteria for the Umpqua Basin.

Evaluating grab sample pH data is difficult. As with other parameters, grab samples provide only a momentary snap-shot. Levels of pH cycle daily and seasonally. Photosynthesis of aquatic plants during the day takes the sun's energy and consumes carbon dioxide (an acid) producing a base - hydroxide. Therefore, during the day, pH levels become more basic (rise). At night the reverse occurs and plants respire releasing carbon dioxide making the waters more acidic; peaking just before dawn. During summer there can be increased plant growth and nutrients that greatly increase this diurnal affect. Increasing acidity can have additional affects because it acts as a solvent and may leach toxic metals from sediments and substrate depending on local conditions. An unexplained change in pH might be an indication of contamination of the water by possible toxic materials from a spill or urban runoff and should be investigated.

Streams tend to have a narrow range of pH values that typically fall between 6 and 9. The level of the pH in freshwater streams is important for all forms of wildlife and humans. Aquatic organisms generally prefer a pH range between 6.5 and 8.5 and suffer when the pH lies outside this range. It is important to have safe pH ranges for juvenile development. "Chronic effects from low pH can occur at levels that are not toxic to adult fish but that impair reproduction including altered spawning behavior, reduced egg viability, decreased hatchability and reduced survival of the early life stages" (Carter, 2008). Persistent high pH levels can be harmful to salmonids by reducing their activity and feeding levels. Extremely low or high levels can even cause death.

Dissolved Oxygen Overview:

Oxygen is as necessary to aquatic life as it is to life on land. The amount of oxygen found in water is called dissolved oxygen (DO). Many factors influence how much oxygen water can contain as well as how it gets there. Temperature (oxygen is more soluble at colder temperatures), atmospheric pressure (increasing altitude results in less pressure and therefore less ability of water to hold dissolved oxygen), and salinity (increasing salt concentration results in lower DO) all affect DO. Turbulent water can also increase DO as does photosynthesis of aquatic plants during the day. At night, aquatic plant respiration consumes the DO. Decomposition of organic matter also uses up dissolved oxygen. Once again grab sampling can only provide a snap-shot of that moment in time of day, season of year, and current stream condition.

Appendix E: Dissolved Oxygen Evaluation Flow Chart contains DEQ's flow chart depicting the evaluation process to determine which dissolved oxygen criteria would apply to any particular water body. Though not as thorough, it easier to understand in the following summarization from the 303(d) Listing criteria at:
http://www.deq.state.or.us/wq/assessment/docs/methodology0406.pdf

Parameter	Criteria	Assessment Method	Data Requirements
Dissolved Oxygen	*Spawning*: DO ≥ 11.0 mg/l or 95 % saturation; *Cold-water:* ≥ 8.0 mg/l or 90% as an absolute minimum; *Cool-water*: ≥ 6.5 mg/l; *Warm-water*: 5.5 mg/l.	For 10 or more samples greater than 10 percent of the samples may not exceed the appropriate criterion and a minimum of at least two exceedances of the criterion for the time period of interest. For 5 to 9 samples in the time period of interest, there may be no exceedances of the appropriate criteria.	A minimum of 5 representative data points available per site collected on separate days per applicable time period. Applicable time periods and fish use available on DEQ's Water Quality Standards web page.

Table 4. DEQ Dissolved Oxygen criteria for the Umpqua Basin.

Dissolved oxygen is critical at all life stages of salmonids but, as is indicated in the criteria during time of spawning, there is the greatest need for high DO for survival of the eggs placed in the gravel. Without 11.0 mg/l egg development will be impaired or stopped altogether. Reduced DO concentrations can adversely affect swimming performance of migration salmonids. Sustained swimming speed dropped sharply when DO fell to 6.5-7.0 mg/l (Bjornn T. a., 1991 pg.85).

Conductivity Overview:

Conductivity is a measure of water's ability to conduct an electric current. It is measured in units of current called microsiemens (µS) per centimeter (cm) or µS/cm. Conductivity increases with the amount of dissolved ions present in water and with increasing temperature.

Conductivity probes come with a built in temperature probe and software that corrects the reading for the effect of temperature, normalizing conductivity to 25°C. This is then called specific conductance. Conductivity varies 2% with each 1°C change in temperature. Conductivity is affected by the natural local conditions/geology. Because it is a measure of the ions dissolved in the water, conductivity increase in areas with soils that will dissolve easily such as clay soils. Increases in conductivity may be an indication of human influences, such as leaking septic systems or spills of substances containing salts (ionic compounds, not just sodium chloride) that reach the streams. There are many types of soluble salts that increase conductivity when they are dissolved in water. Examples include potassium chloride, calcium chloride, and magnesium chloride. Acids and bases will also increase the conductivity of a solution. Organic compounds have a very low ability to conduct current, so substances like oil, and sugar have a very low conductivity.

There are no established standards for conductivity; however, "Conductivity is useful as a general measure of stream water quality. Each stream tends to have a relatively constant range of conductivity that, once established, can be used as a baseline for comparison with regular conductivity measurements. Significant changes in conductivity could then be an indicator that a discharge or some other source of pollution has entered a stream." "Studies in inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 uS/cm" (EPA, 2012).

E. coli Overview:

E. coli is monitored as an indicator species of bacteria. It would be extremely difficult and expensive to monitor for many of the organisms that carry disease. Therefore, only *E. coli* was chosen for monitoring because its presence is an indication of fecal contamination and a warning that other pathogens may also be present. It can also be an indicator that best management practices of livestock are not being observed, of failing septic systems, of a large concentration of warm-blooded wildlife contaminating the water, or of a malfunctioning or overloaded wastewater treatment plant.

E. coli is easily measured with EPA approval by using the protocol and supplies from IDEXX Laboratories, Inc. A sample is collected in a sterile 100 milliliter (ml) bottle, kept on ice, and returned to a laboratory for analysis. The results are expressed in terms of a most probable number (MPN) of *E. coli* organisms in a 100 ml sample. The standard is a little difficult to comprehend, but a level greater than or equal to 126 MPN/100 ml determined five times in a 30-day period could cause a stream to be listed. A single reading greater than 406 MPN/100 ml could also trigger a listing.

The 303(d) Listing criteria for *E. coli* by Oregon Department of Environmental Quality listed at http://www.deq.state.or.us/wq/assessment/docs/methodology0406.pdf is shown below. The national Environmental Protection Agency uses a more conservative, lower criteria of 235 MPN/100 ml. In this report we will indicate both the 406 and the 235 criteria for comparison. The 235 MPN/100 ml criteria will be used as an indicator for evaluating streams in need of further investigation.

There are many possible sources of E. coli and other fecal bacteria in water. These can be divided into "point sources" and "non-point sources." The legal definition of a point source is one for which there is an operational permit, such as the outlet for a wastewater treatment plant. Stream contamination can also come from non-point sources, or ones for which there is no operational permit, such as animal waste. Although septic systems require an installation permit, there is no annual operational permit. These sources are considered non-point even if it is clear that, for example, a single failing septic field adjacent to a stream is causing high fecal bacteria levels. Upland areas with concentrated fecal waste can be non-point sources that contribute significantly to bacteria levels because bacteria are washed down into streams during rain events.

According to the Oregon Water Quality Standards, a stream is considered water quality-limited for bacteria when one of two events occurs: 1) 10% of two or more samples taken from the same stream have *E. coli* concentrations exceeding 406 bacteria per 100 ml of water; and 2) the average *E. coli* concentration of five samples taken within a 30-day period exceeds 126 bacteria per 100 ml of water.

> **Bacteria taken from various locations along the South Umpqua River within the Lower South Umpqua Watershed. Twenty out of 130 samples (15%) exceed 126 bacteria per 100 ml. Five samples (3.8%) exceed 406 bacteria per 100 ml. The South Umpqua River from the mouth to stream mile 15.9 (the confluence with Roberts Creek) is 303(d) listed for fecal coliform in the fall, winter, and spring. From stream mile 15.9 to 57.7 (the confluence with Days Creek), the South Umpqua River is 303(d) listed all year.[59] Additional monitoring is necessary to determine if Lower South Umpqua Watershed tributaries have water quality-limiting levels of bacteria. (Geyer, South Umpqua Watershed Assessment and Action Plan, 2003)**

Temperature Overview:

Stream temperature is an important factor affecting all aquatic organisms including fish. For salmonids (salmon and trout), which are coldwater fish, healthy growth is supported by water temperatures ranging from 40-64.4°F, outside this range they generally don't grow in size and extreme temperatures can be lethal (The Oregon Plan for Salmon and Watersheds, 1999, pp. 6-1). These temperature extremes can affect every life stage of the salmonids (Bjornn & Reiser, 1991, pp. 106, 112). Temperature and dissolved oxygen (DO) are inversely proportional, therefore, as stream temperature increases the amount of DO available decreases (The Oregon Plan for Salmon and Watersheds, 1999, pp. 6-1). Decreases in DO may metabolically stress salmonids and also increase the likelihood of disease (The Oregon Plan for Salmon and Watersheds, 1999, pp. 6-1) (see DO section for a discussion of DO results for this study).
As water temperature increases to stressful levels, salmonids seek cold water refugia (The Oregon Plan for Salmon and Watersheds, 1999, pp. 6-1) and (Nielsen, Lisle, & Ozaki, 1994). Extremely high water temperatures can be lethal to coldwater fish. One study found the upper lethal limits for steelhead was 75.0°F and for cutthroat trout was 73.0°F (Bell, 1990, p. 11.4). The upper lethal limit for young coho salmon and Chinook salmon acclimated to 70°F was 78.8°F, measured as 50% mortality after 16.7 hours (Brett, 1952, pp. 282-3). Many of our

monitoring sites exceeded these potentially lethal temperatures for steelhead and cutthroat and some even exceeded the higher lethal temperatures for coho and Chinook. However, unlike in these lab studies, in natural streams there is diurnal temperature fluctuation associated with night cooling, so these high stream temperatures are not sustained.
The driving factors for stream temperature are stream characteristics, such as flow, surface area, and radiant energy; the most important source being solar radiation. Solar radiation is reduced by shading and cloud cover and increased by solar input, which is often reflected by higher air temperatures. Streams in the Umpqua basin have been anthropogenically altered by removal of riparian vegetation, water withdrawals, and altered stream characteristics.

Since cloud cover and air temperatures vary daily and annually, there is also annual variability in stream temperatures and in seven-day average maximum (7DAM) stream temperatures. Stream temperature generally increases as it flows downstream due to decreased shading as the stream widens and increased surface area (Murphy & Meehan, 1991, pp. 35-36). In addition, stream temperatures may increase lower in the watershed due to a decreasing portion of cooler ground water inflow and increasing air temperature at lower elevations. The Umpqua Basin Stream Characterization project continuously monitored 269 stream temperature sites in the Umpqua basin from 1998 to 2001 and found a relationship between the sites distance to the drainage divide and the 7DAM stream temperature (Smith, K., 2003, p. 3). When graphed comparing miles to divide vs. temperature, the lower edge of the data cluster would be considered optimal sites (Smith, K., 2003, p. 3). A line denoting these optimal sites for each sub-basin was figured and termed the cold limit line (Smith, K., 2003, p. 3). These cold-limit lines for the different Umpqua sub-basins (Smith, K., 2003, Appx. 1) were used to compare stream temperatures for sites along a stream as distance to divide increases Five reference streams in the Umpqua Basin Stream Characterization Project have been monitored for 12-13 years (Dammann, D.M., 2015, p. 3); The 7DAM stream temperatures of these sites have varied annually between 6.1 to 8.3°F depending on the site during the 12-13 year period of record (**Appendix F: Annual 7 Day Average Maximum Stream Temperature for Umpqua Basin Stream Characterization Project Reference Sites from 1998-2015 .** During the years of this study (2005-2015) the 7DAM stream temperature of the reference sites varied between 5.0 to 7.4°F depending on the site. This annual variability complicates the comparison of stream temperatures, especially when there is a short or inconsistent period of record.

While this report was being prepared the Oregon Administrative Rules containing OARs were being changed and updated as of December 15, 2016 (ODEQ, WATER QUALITY STANDARDS: BENEFICIAL USES, POLICIES, AND CRITERIA FOR OREGON, 2016, pp. 1-94). We have made every effort to address the changes made that were not available to us as we prepared to submit this this report by December 31, 2016. Specifically, the changes to using biological criteria for temperature, was the biggest change and is detailed in section 340-041-0028 in the new policies (ODEQ, WATER QUALITY STANDARDS: BENEFICIAL USES, POLICIES, AND CRITERIA FOR OREGON, 2016). Appendix I contains the two maps: Figure 320A for determining a stream's designation as either "Core Cold-Water Habitat" or "Salmon & Trout Rearing and Migration"; and Figure 320B from which it can be determined a streams "Designated Salmon and Steelhead Spawning Use." Knowing these two piece of information about a stream one can then determine the appropriate biological criteria for temperature based on Seven-Day Average Maximum Temperature (7DAM) as recommended under section 340-041-0028. In the

Temperature Section, under each of our Watersheds reported here, we include a GIS created map of Figure 320B zoomed in to better determine under which Spawning Designation period the streams of that watershed fall in relation to our monitoring sites.

We have continuous data loggers' temperature for a number of our monitoring sites from which the 7DAM can be determine for the summer which is covered under the Migration and Rearing standard. However, at many sites we only have grab sample temperature readings for summer and at none of our sites have we done continuous data loggers' data for the winter Spawning period.
For the purpose of this report, in order to provide information to our stream restoration planners, we have reported not only the 7DAM data which meets the Oregon Standard Requirements for measurement, but also included whether our grab sample monitoring caught an exceedance of the absolute, one-time temperature value. There is no way that this information is inferred to be used for criteria purposes. Since we only measure monthly it could very well be that it may fall within a 7DAM and hold some value so we present it in our rating tables for informational purposes only.

Continuous Temperature:

Continuous summer temperatures were monitored from 2005-2015 using the protocol in the Water Quality Monitoring Technical Guide Book (The Oregon Plan for Salmon and Watersheds, 1999, pp. 6-1 to 6-12). Onset water temperature recorders (Tidbit, Hobo, or Tidbit v2 models) were placed in streams in late spring or early summer and retrieved late summer or early fall depending on flows and logistical concerns. Water temperature recorders were tied to rocks to prevent movement of the devices and hidden in the streams. Careful site selection was made to ensure there would be flow and good mixing (not stagnant) at the site in late summer when flows are the lowest in order to ensure the site would be representative of the stream at that location.

Prior to stream placement of water temperature recorders, pre-deployment accuracy checks were performed on all devices according to established protocols (The Oregon Plan for Salmon and Watersheds, 1999, pp. 6-5 to 6-7) and later modified by DEQ in 2010. Water temperature recorders are placed in warm and ice water baths comparing temperatures to National Institute of Standards and Technology (NIST) certified VWR Traceable Digital Thermometers that are inspected annually for accuracy by the DEQ Lab. Post-deployment accuracy checks are completed after retrieval of the water temperature recorders using the same method. Field accuracy checks are also conducted comparing NIST certified VWR Traceable Digital Thermometer temperatures to that of the water temperature recorders, when possible, at the time of deployment, mid-season, and at the time of retrieval. Care is taken to check the temperature with the digital thermometer near the location of the water temperature recorder.

Water Quality Data Analysis

Grab Sample Reporting:

All grab sample data was entered into ODEQ's Volunteer Water Quality Grab Sample Data Submittal Excel Spreadsheet which is available for download from their website (www.deq.state.or.us/lab/wqm/volmonresources.htm).

"The workbook contains two required worksheets. 1) **Worksheet1: Project Information-** This required worksheet includes specific project information needed to add the data into the DEQ database. 2) **Worksheet 2 Raw Data-** This worksheet contains all the fields needed to describe monitoring stations and result values in the DEQ database. The first six rows describe the monitoring location. The date and time define when the site was visited. The remaining rows are for entering the raw data results and all the information needed to describe each result in the DEQ database--including data quality. Each parameter has a family of 6 or 7 columns containing information needed for upload to the DEQ database: result value, duplicate value, precision, accuracy (not for all parameters), data quality level, method and parameter comment" (DEQ, 2010).

Only data which ranked as "A" or "B" quality was included for analysis in this report. (See **Appendix G: Oregon DEQ Data Quality Matrix**) Almost all of the data was "A"; in only a few cases were the data rated "B." Graphs were produced to compare individual sites and temporal changes. Box plots were used to summarize individual sites over the course of the period of record. (See **Appendix H: Interpreting a Box Plot** for help in understanding box plots.) For this report we did not discard any "outliers"; the data was carefully reviewed and notes recorded at the time of sampling considered. It was felt that particularly low or high values were real and denoted a natural occurrence that was indicative of the particular watershed. Scatter plots were used to display sites' values over time and compared to DEQ' standard criteria. Site values were summarized and presented in a table, when there was enough data to warrant doing so, by percent of measurements exceeding the parameter's standard criteria. For this report two time periods were used: 1. June through September and 2. October through May. This differs from the often used Summer (June, July, August) and Fall/Winter/Spring (September through May) that others have employed. The weather conditions in the study area seem to lend themselves to this division as the month of September lends itself to inclusion as a summer month far better than skewing the Fall/Winter/Spring grouping with the warm September conditions.

Continuous Temperature:

All continuous temperature data collected were downloaded from the water temperature recorders with Onset's HOBOware Pro software and summarized using Microsoft Excel software. Continuous temperature data was compared to ODEQ temperature criteria for continuous summer temperature (ODEQ, 2011, p. 46) and Figure 320A & 320B (ODEQ, 2003) See **Appendix I:**

Figure 320A - Umpqua Basin Fish Use Designations from ODEQ 2003 and

Figure 320B - Umpqua Basin Salmon and Steelhead Spawning Use Designations from ODE, using ODEQ's Temperature macro (for Microsoft Excel software) modified by Kent Smith for Excel 2007/2010 and for ODEQ's current temperature criteria (ODEQ, 2011, p. 46). All pre-deployment accuracy checks, post-deployment accuracy checks, and field audits were compiled on ODEQ's ExampleContinuousSample.xls workbooks (ODEQ, 2009) and submitted to the ODEQ lab.

In the analysis, degrees Fahrenheit were chosen as the unit of temperature instead of degrees Celsius because PUR works with partners that use Fahrenheit as the standard of measure. For ease of communication to the public, and greater understanding, degrees Fahrenheit were chosen as the unit of measure.

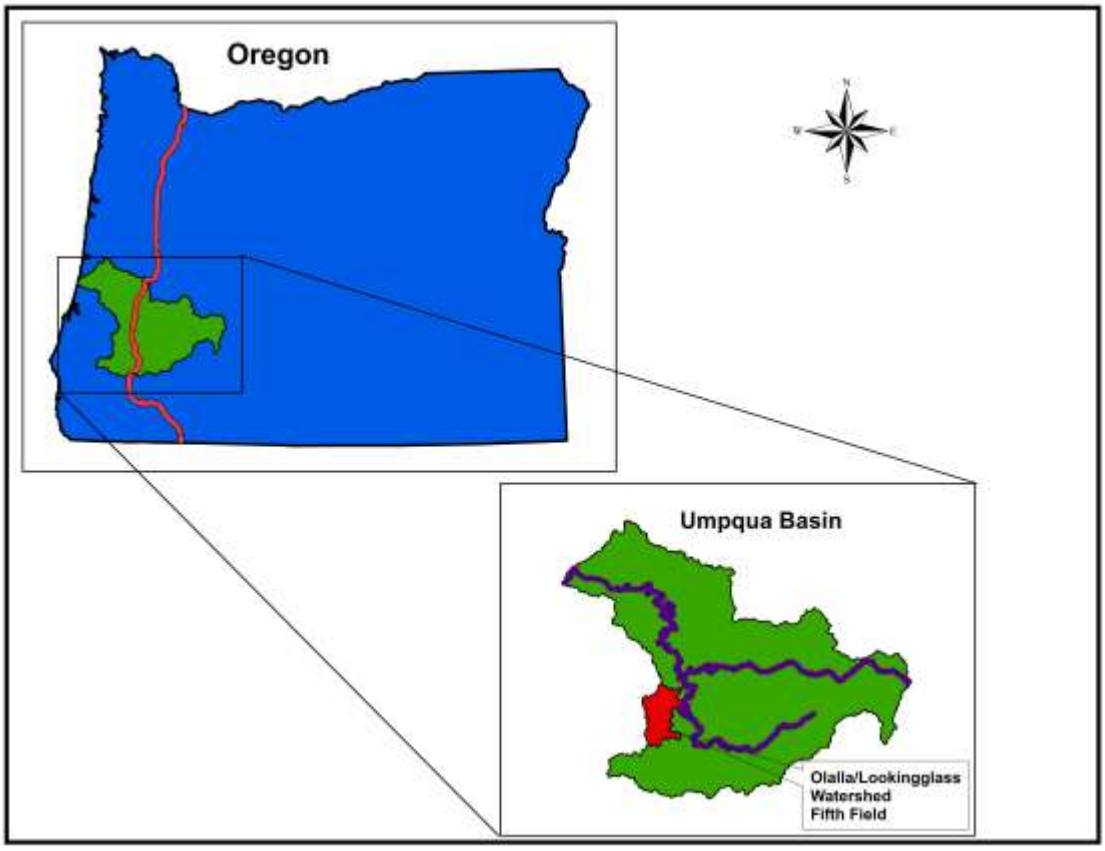
Data was compared to that collected from a previous PUR large scale basin wide temperature study, Umpqua Basin Stream Temperature Characterization Project (Smith, K., 2003) and annual updates 2005-2010 (Smith, K., 2005), (Dammann, D.M. and K. Smith, 2006), (Dammann, D.M., 2014), (Dammann, D.M., 2008), (Dammann, D.M., 2009), and (Dammann, D.M., 2010).

Water Quality Monitoring Results

Olalla/Lookingglass Watershed

Area Description, Background & Monitoring Sites

The Olalla/Lookingglass fifth-field watershed is located in Douglas County, Oregon, and is approximately 103,000 acres. The watershed stretches a maximum of 20 miles north to south and 13 miles east to west. Highway 42 runs east to west through the middle of the watershed. The nearest incorporated city is Winston, just east of the watershed. Rural residential areas within the watershed include Lookingglass, Tenmile, Olalla and Reston.



Map 2. Olalla/Lookingglass Watershed area map.

Lookingglass Creek is 11 miles long in total and flows into the South Umpqua River. Olalla Creek is the longest tributary and runs for nearly 22 miles from the headwaters into Lookingglass Creek. Tenmile Creek is a major tributary to Olalla Creek and stretches for 12 miles into the watershed. Berry Creek, another tributary to Olalla Creek, maintains a constant flow through the summer because of water control at Ben Irving Reservoir.

Valley bottoms have been converted from native prairie and savanna to urban and rural residential areas, agricultural lands and grazing lands. The higher regions are dominated by Douglas-fir with grand fir and white fir on the northern aspects. Forestry makes up 76% of the land based. Agriculture constitutes 19% of the watershed. Land ownership is primarily private (72%), with public ownership (27%) administered primarily by the Bureau of Land management.

(Information from *Olalla/Lookingglass Watershed Assessment and Action Plan, Umpqua Basin Watershed Council, 2003*)

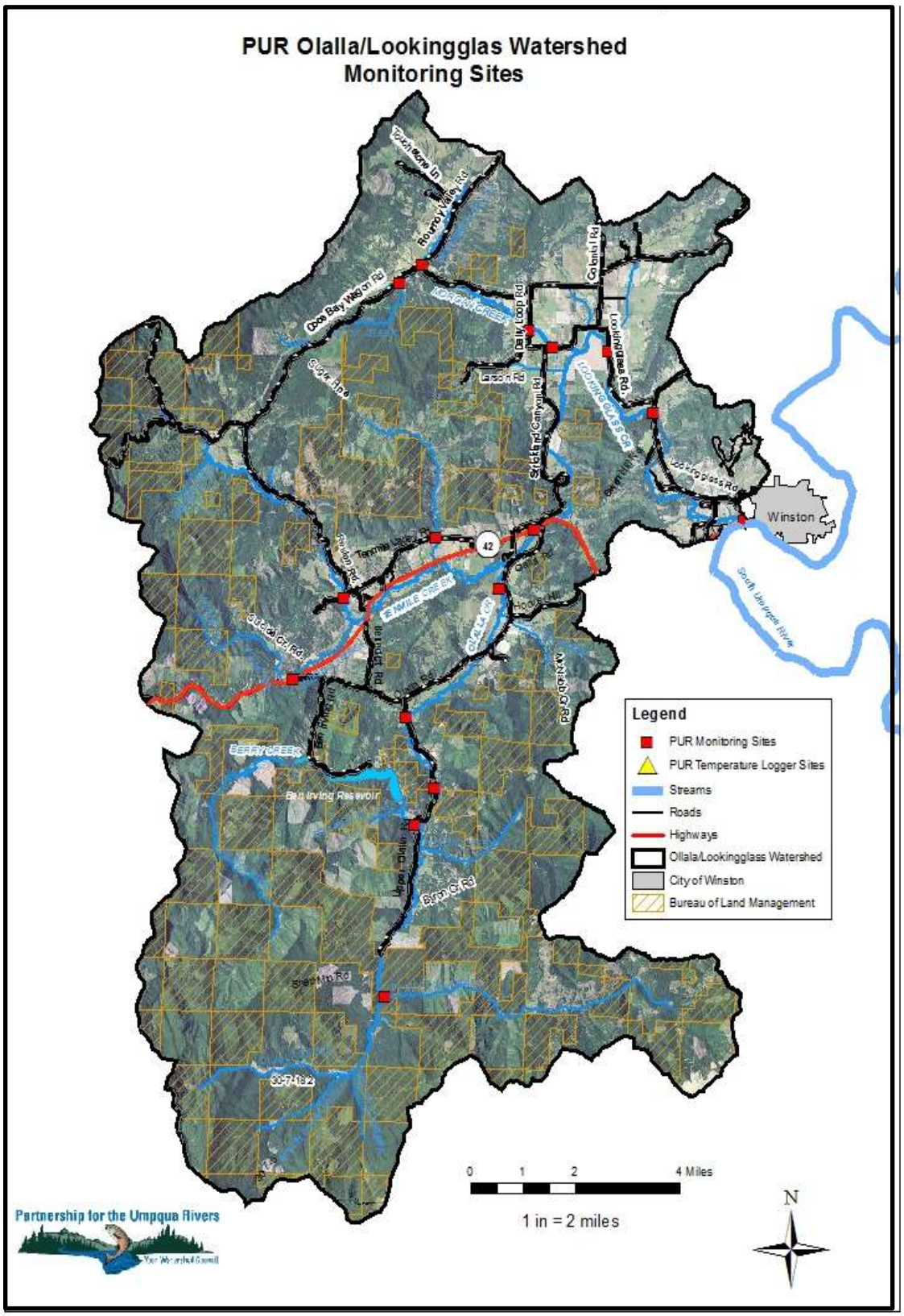
In the grab temperature section for Olalla/Lookingglass **Map 4** indicates the creeks designated as spawning and non-spawning in the watershed. Many of the tributaries are considered as not being used for fish "Spawning" but only for "Rearing & Migration" as shown in **Figure 320A - Umpqua Basin Fish Use Designations from ODEQ** 2003 (Appendix I).

Photo 1. Lookingglass Creek at Hwy 42.

Photo 2. Lookingglass Creek further upstream at Hwy 42 Bridge just below confluence of Tenmile Creek and Olalla Creek.

Site ID	Site Name	Site Location	Latitude	Longitude
OC1	Olalla Creek below Hoover Hill Rd	Olalla Creek from Private Property 1671 Olalla Rd.	43.097624N	123.520333W
OC2	Olalla Creek	Olalla Creek, at Upper Olalla Creek Road Bridge	43.062939N	123.553732W
OC2a	Upper Olalla Creek	Upper Olalla Creek, Upper Olalla Bridge Upper Most	43.04434 N	123.542339W
BC1	Berry Creek near mouth	Berry Creek at Upper Olalla Creek Road	43.034367N	123.5491W
OC3	Olalla Creek just below Thompson	Olalla Creek just below Thompson Creek	42.9996N	123.5604W
LG3	Lookingglass Creek at Hwy 42	Lookingglass Creek at Hwy 42 West of Olalla Rd.	43.113333N	123.507732W
PC1	Porter Creek near mouth	Porter on Ten Mile Valley Road Bridge	43.110453N	123.545173W
TMC1	Ten Mile Creek near mouth	Ten Mile Creek at Lockwood Rd. Bridge	43.093656N	123.578695W
SC1	Shields Creek at Hwy 42	Shields Creek at Hwy 42, below Suicide Creek	43.07153N	123.59694W
MG1	Morgan Creek	Morgan Creek at Dairy Loop Road Upper Bridge	43.161617N	123.500394W
FC1	Flournoy Creek	Flournoy Creek at Coos Bay Wagon Road	43.181812N	123.553912W
TLG1	Trib. to Lookingglass Creek	Near mouth on Lookingglass Road	43.161137N	123.481876W
LG1	Lookingglass Creek near mouth	Lookingglass Creek near mouth at Hwy 42 bridge	43.1177N	123.4283W
LG2	Lookingglass Creek at bridge	Lookingglass Creek at LG Rd below Happy Valley Rd.	43.1452N	123.4641W
MG2	Morgan Creek	Morgan Creek at Dairy Loop Road Lower Bridge	43.1615N	123.503267W
RC1	Rock Creek near mouth	Rock Creek at Colwell Hill Lane. Near mouth	43.177017N	123.561867W

Table 5. Sites in the Olalla/Lookingglass watershed monitoring 2012-2015.

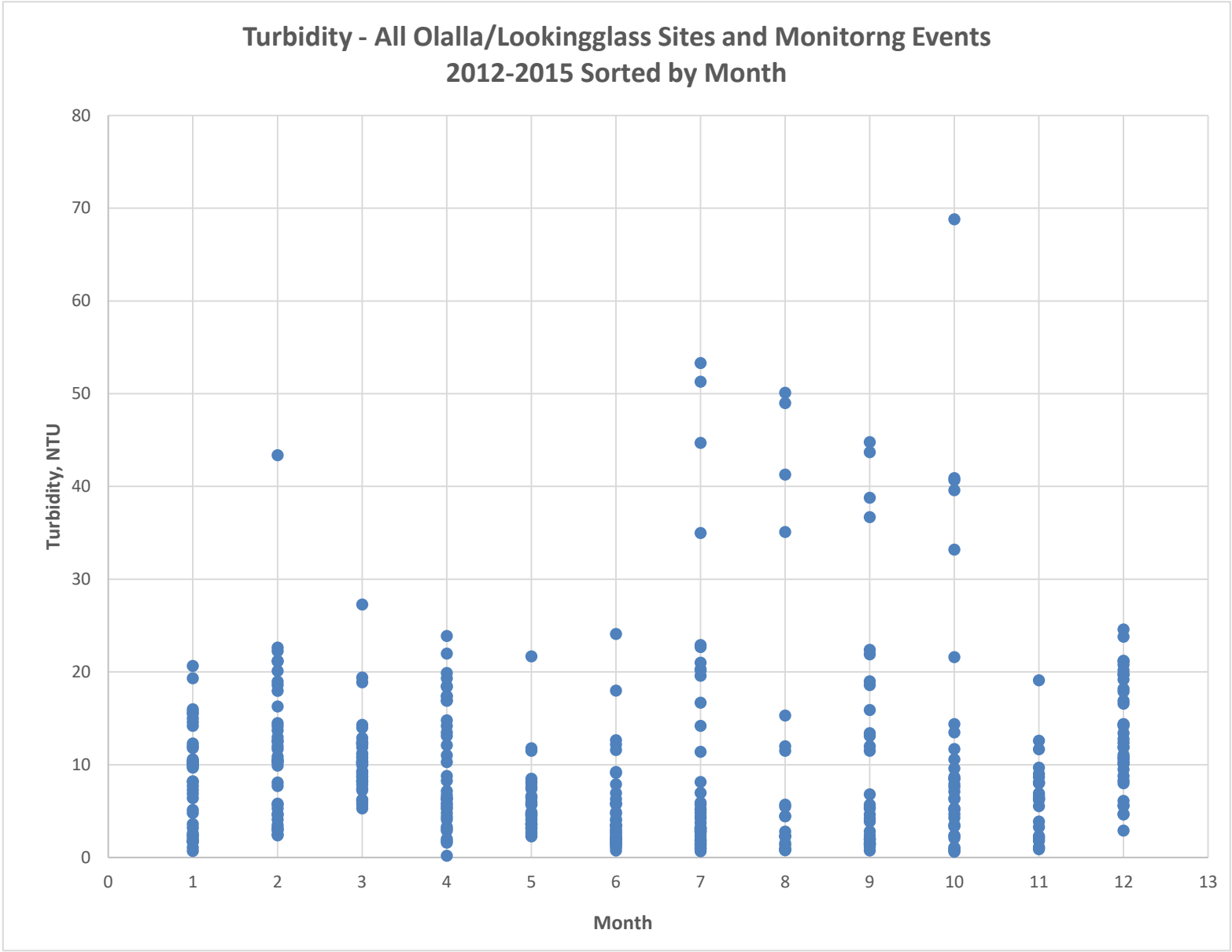


Map 3. Olalla/Lookingglass Watershed monitoring sites.

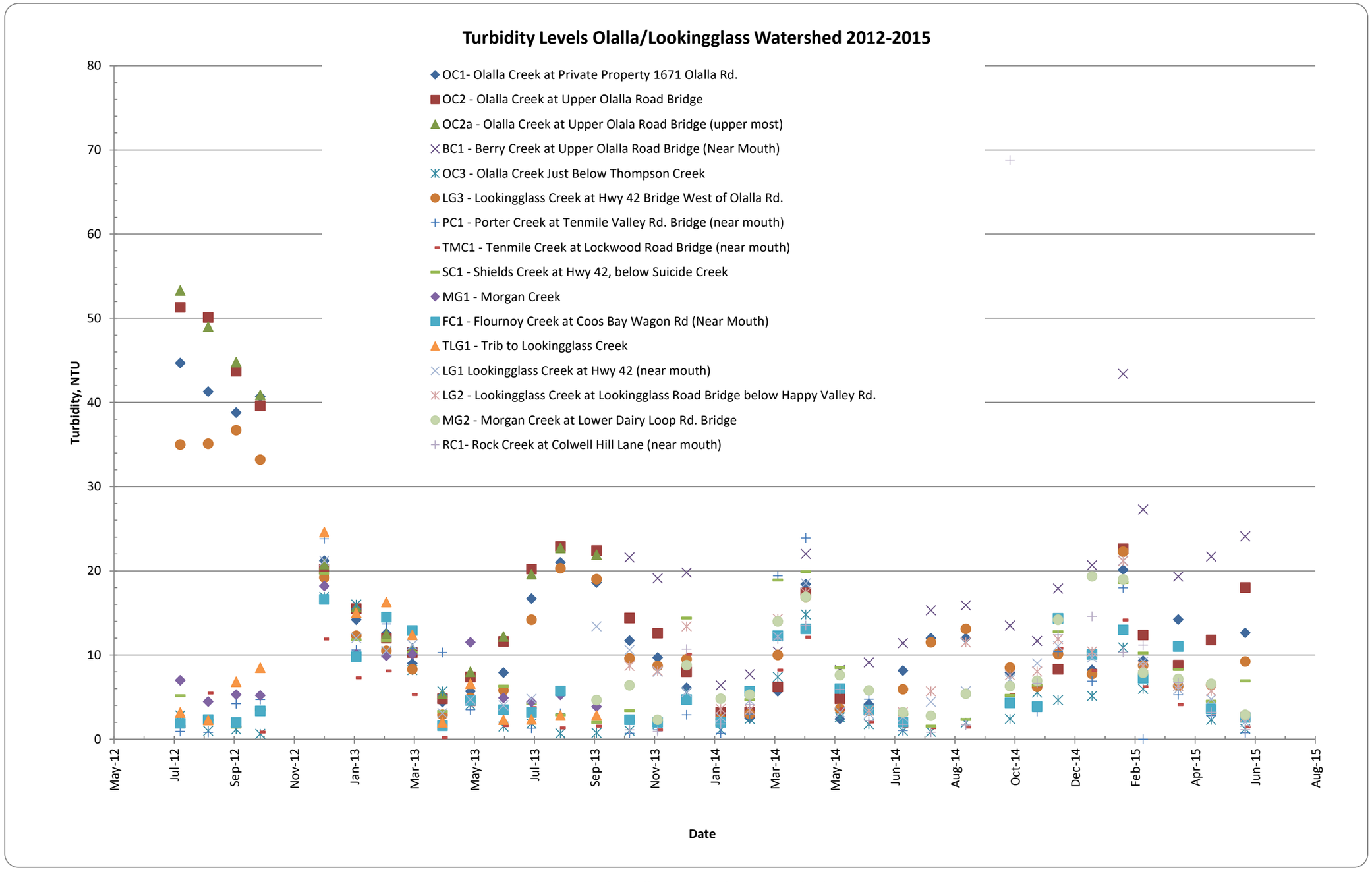
RESULTS – Olalla/Lookingglass Watershed

Turbidity

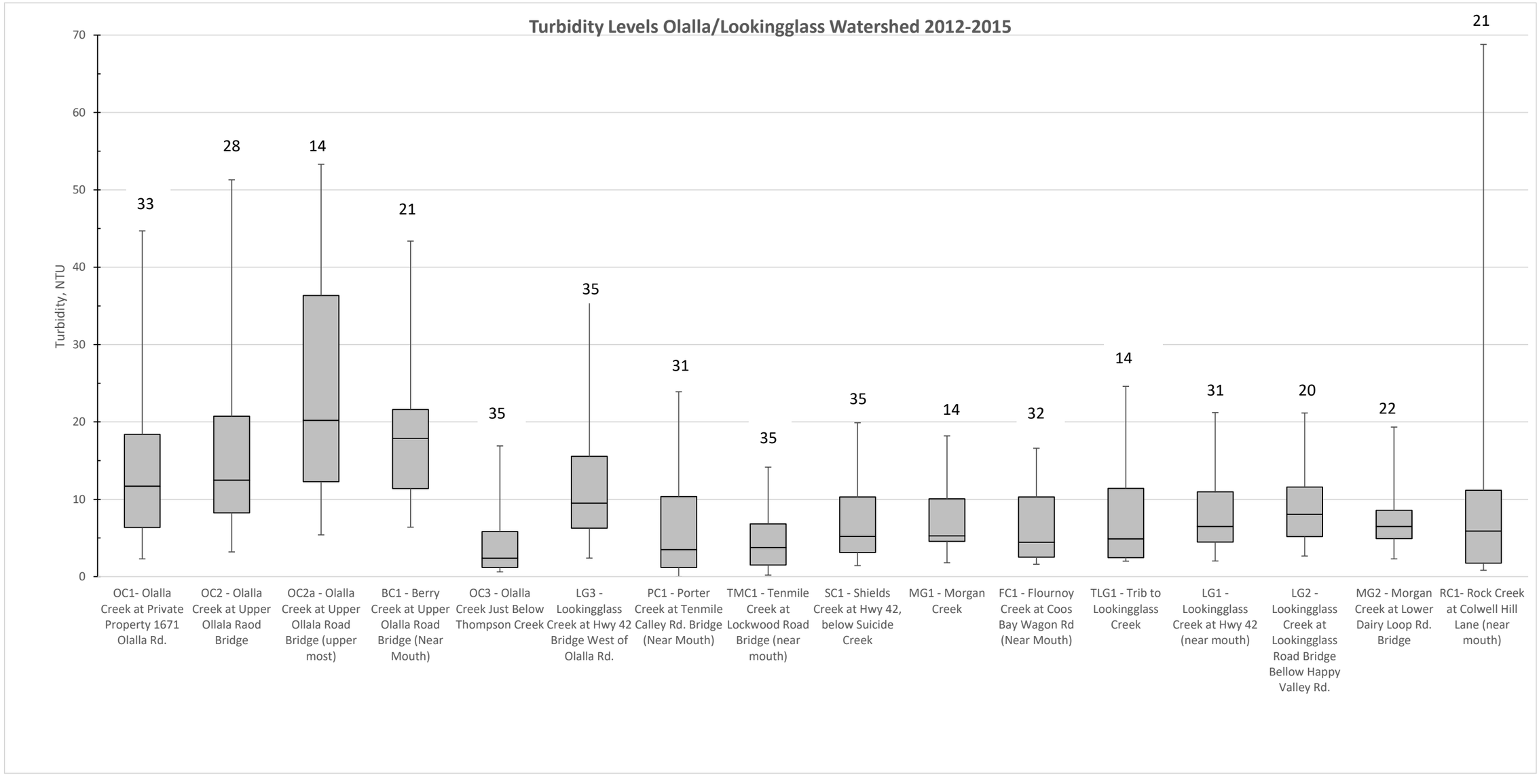
Turbidity is a major issue in the Olalla/Lookingglass Watershed as is evident in Photo 2 on page 33. Where it is common in most watersheds for turbidity to be elevated in the winter months, especially with storm events, turbidity in the Olalla/Lookingglass Watershed demonstrated highest levels in July through October (see **Graph 1**). This summer/fall increase was detected mainly in Olalla Creek at all three sites. This is likely due to the influence of the Ben Irving Reservoir on Berry Creek that flows into Olalla Creek and the soil conditions in this geographical area.



Graph 1. Turbidity levels Olalla/Lookingglass Watershed 2012-2015 all sites all data sorted by month.



Graph 2. Turbidity Levels Olalla/Lookingglass Watershed 2012-2015.



Graph 3. Box Plots of Turbidity Levels Olalla/Lookingglass Watershed 2012-2015. The number above each site's plot indicates the number of sampling events.

Turbidity Levels Year Round Monitoring Events by Site Olalla/Lookingglass Watershed

Olalla\Lookingglass Watershed		10 NTU or Greater	
Station ID - Site Description	Total # of Samples	Count	% of Samples
OC1- Olalla Creek at Private Property 1671 Olalla Rd.	33	17	52%
OC2 - Olalla Creek at Upper Olalla Road Bridge	28	18	55%
OC2a - Olalla Creek at Upper Olalla Road Bridge (upper most)	14	12	86%
BC1 - Berry Creek at Upper Olalla Road Bridge (Near Mouth)	21	17	81%
OC3 - Olalla Creek Just Below Thompson Creek	35	5	14%
LG3 - Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.	35	15	43%
PC1 - Porter Creek at Tenmile Valley Rd. Bridge (near mouth)	31	9	29%
TMC1 - Tenmile Creek at Lockwood Road Bridge (near mouth)	35	4	11%
SC1 - Shields Creek at Hwy 42, below Suicide Creek	35	11	31%
MG1 - Morgan Creek	14	4	29%
FC1 - Flournoy Creek at Coos Bay Wagon Rd (Near Mouth)	32	9	28%
TLG1 - Tributary to Lookingglass Creek	14	4	29%
LG1 Lookingglass Creek at Hwy 42 (near mouth)	31	9	29%
LG2 - Lookingglass Creek at Lookingglass Road Bridge below Happy Valley Rd.	20	6	30%
MG2 - Morgan Creek at Lower Dairy Loop Rd. Bridge	22	3	14%
RC1- Rock Creek at Colwell Hill Lane (near mouth)	21	8	38%

Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	< 10 NTU
	Low Concern	Between 1 % and 9% of samples ≥10NTU
	High Concern	Between 10% and 20% ≥10 NTU
	Extreme Concern	20% or more ≥10 NTU

Table 6. Turbidity levels year-round Olalla/Lookingglass Watershed Sites 2012-2015.

Turbidity Levels, Summer and Winter, Olalla/Lookingglass Watershed Sites

SITE	Summer (May 1 - Sept.30)			Winter (Oct 1-April 30)		
	Total # Samples	# > 10 NTU	% > 10 NTU	Total # Samples	# > 10 NTU	% > 10 NTU
Olalla Creek at Private Property 1671 Olalla Rd.	15	10	**67%**	18	7	**39%**
Olalla Creek at Upper Olalla Road Bridge	11	9	**82%**	17	9	**53%**
Olalla Creek at Upper Olalla Road Bridge (upper most)	8	**7**	**88%**	6	**5**	**83%**
Berry Creek at Upper Olalla Road Bridge (near mouth)	7	5	**71%**	14	12	**86%**
Olalla Creek Just Below Thompson Creek	15	0	**0%**	20	4	**20%**
Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.	15	7	**53%**	20	8	**40%**
Porter Creek at Tenmile Valley Rd. Bridge (near mouth)	12	0	**0%**	19	9	**47%**
Tenmile Creek at Lockwood Road Bridge (near mouth)	15	0	**0%**	20	5	**25%**
Shields Creek at Hwy 42, below Suicide Creek	15	0	**0%**	20	11	**55%**
Morgan Creek	8	1	**13%**	6	3	**50%**
Flournoy Creek at Coos Bay Wagon Rd (near mouth)	12	12	**0%**	20	9	**45%**
Tributary to Lookingglass Creek	8	0	**0%**	6	4	**67%**
Lookingglass Creek at Hwy 42 (near mouth)	11	1	**9%**	19	8	**42%**
Lookingglass Creek at LG Bridge below Happy Valley Rd.	6	1	**17%**	14	5	**36%**
Morgan Creek at Lower Dairy Loop Rd. Bridge	8	0	**0%**	14	3	**21%**
Rock Creek at Colwell Hill Lane (near mouth)	7	0	**0%**	14	8	**57%**

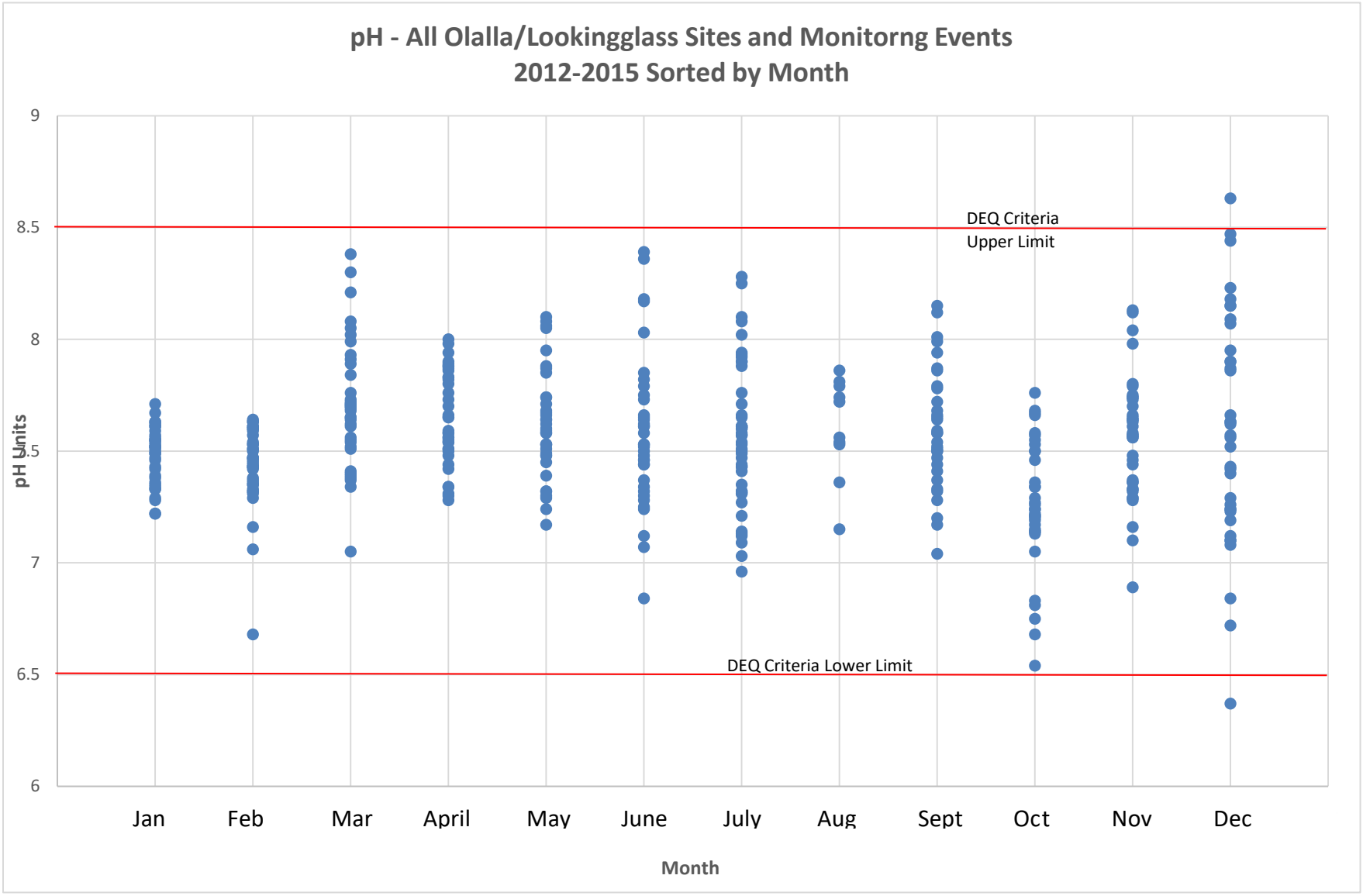
Rating	Color	Turbidity
No Concern		All samples < 10 NTU
Low Concern		Between1 % and 9% of samples 10NTU or greater
High Concern		Between 10% and 20% of samples 10 NTU or greater
Extreme Concern		20% or more of samples 10 NTU or greater

Table 7. Turbidity levels summer and winter Olalla/Lookingglass Watershed sites 2012-2015 with Color Key.

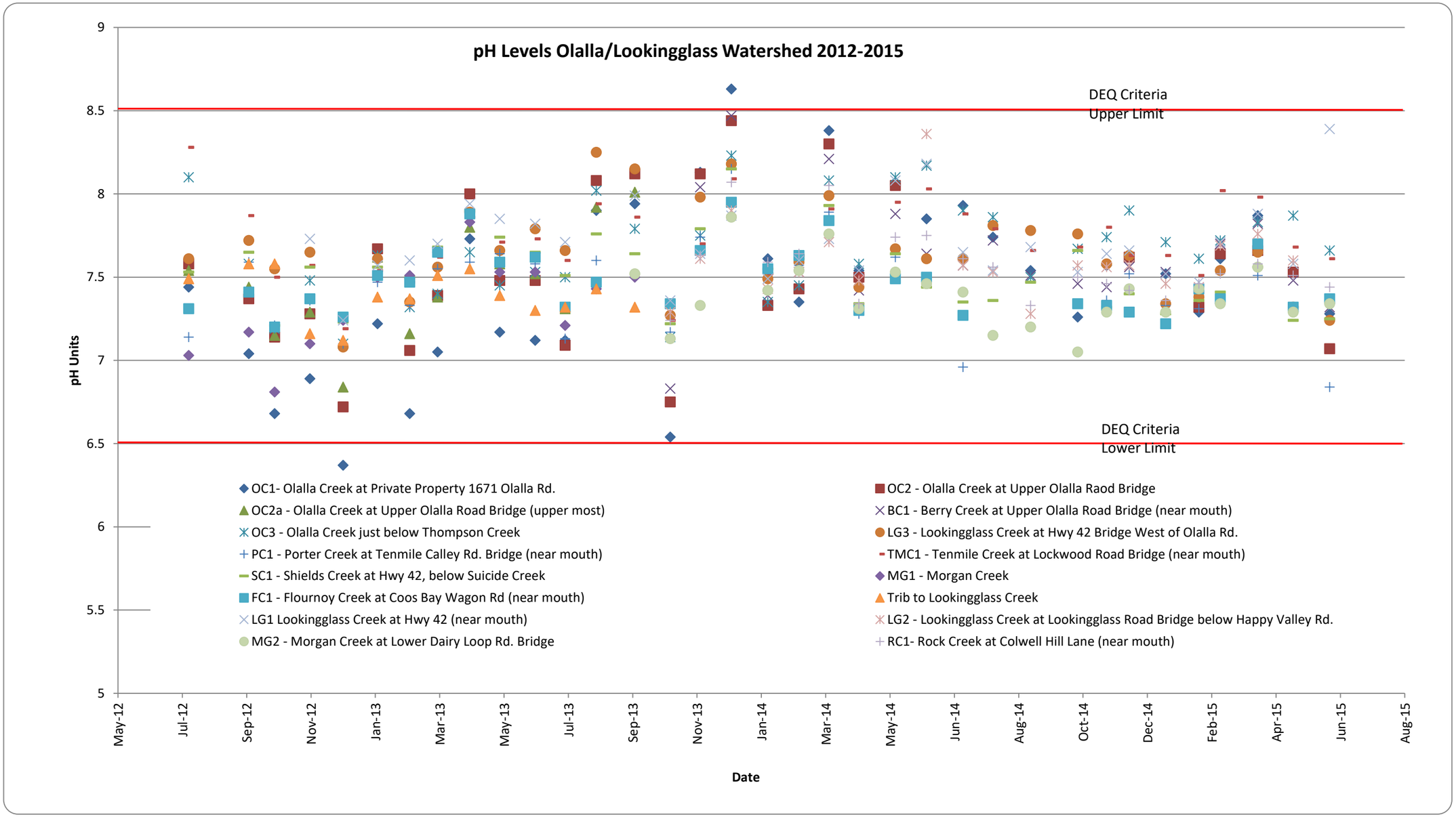
RESULTS – Olalla/Lookingglass Watershed

pH

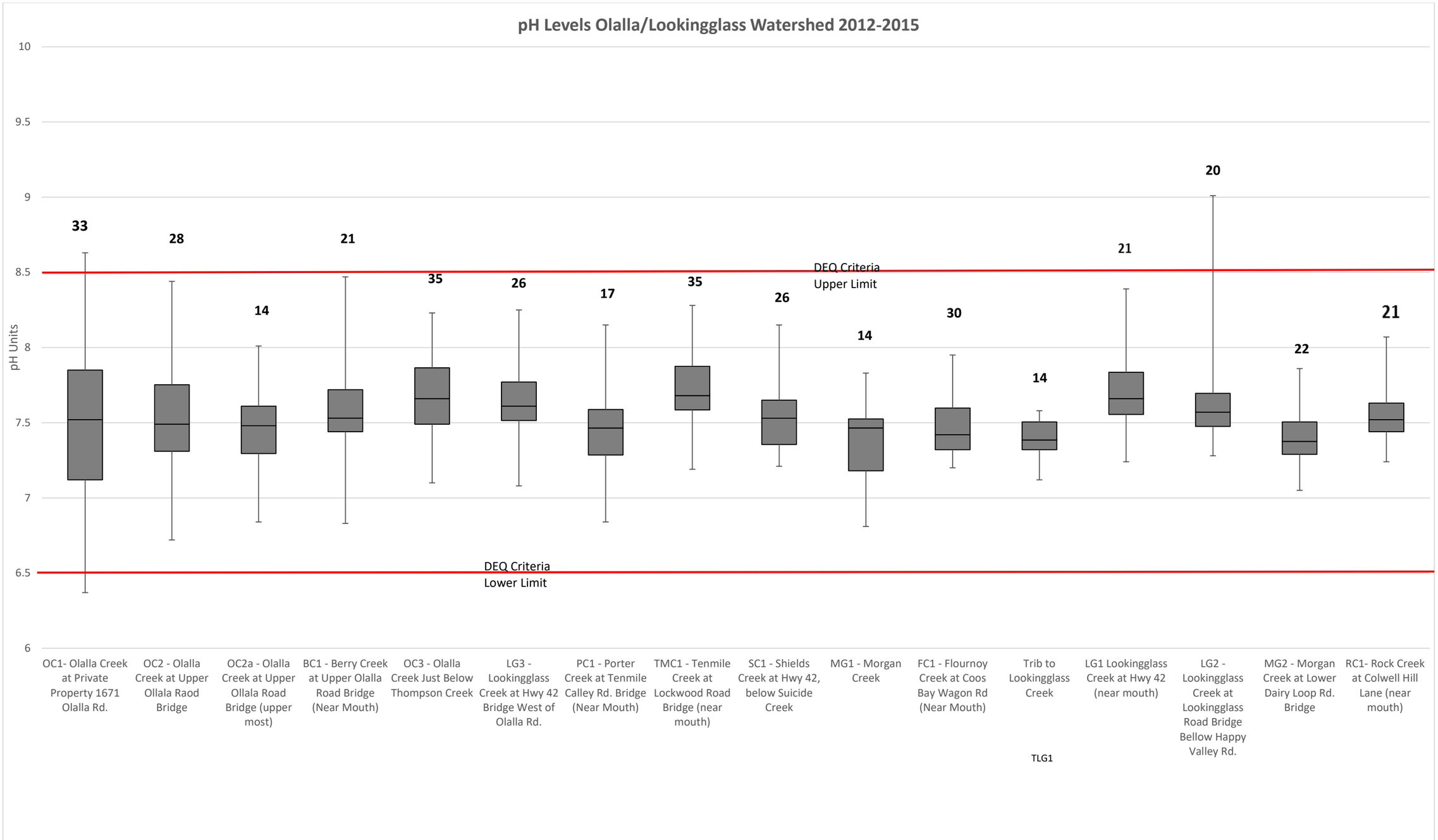
Generally, there were no major pH concerns in this watershed during the timeframe we conducted monthly monitoring. Only OC1 Olalla Creek at Private Property 1671 Olalla Rd. had one pH level above 8.5 and one below 6.5 and LG2 Lookingglass Creek at LG Bridge below Happy Valley Rd. had one above 8.5. There may well have been further fluctuations that we missed due to diurnal fluctuations. It is of note that pH values varied significantly at all time of the year, see **Graph 4** and **Graph 5**.



Graph 4. pH levels Olalla/Lookingglass Watershed 2012-2015 all sites all data sorted by month.



Graph 5.pH levels Olalla/Lookingglass watershed monitoring sites 2012-2015.



Graph 6. Box and Whisker plots of pH levels for Olalla/Lookingglass monitoring sites 2012-2015, the number above indicates the number of monitoring events for that site.

pH Levels Olalla/Lookingglass Watershed Sites

SITE	Upper pH RATING	Lower pH RATING
OC1 Olalla Creek at Private Property 1671 Olalla Rd.		
OC2 Olalla Creek at Upper Olalla Road Bridge		
OC2a Olalla Creek at Upper Olalla Road Bridge (upper most)		
BC1 Berry Creek at Upper Olalla Road Bridge (near mouth)		
OC3 Olalla Creek just below Thompson Creek		
LG3 Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.		
PC1 Porter Creek at Tenmile Valley Rd. Bridge (near mouth)		
TMC1 Tenmile Creek at Lockwood Road Bridge (near mouth)		
SC1 Shields Creek at Hwy 42, below Suicide Creek		
MG1 Morgan Creek		
FC1 Flournoy Creek at Coos Bay Wagon Rd (near mouth)		
TLG1 Tributary to Lookingglass Creek		
LG1 Lookingglass Creek at Hwy 42 (near mouth)		
LG2 Lookingglass Creek at LG Bridge below Happy Valley Rd.		
MG2 Morgan Creek at Lower Dairy Loop Rd. Bridge		
RC1 Rock Creek at Colwell Hill Lane (near mouth)		

pH Rating Code			
Rating	**Color**	**Upper pH Criteria**	**Lower pH Criteria**
No Concern		None above 8.25	None below 6.75
Low Concern		1 ≥ 8.25	1 ≤ 6.75
Moderate Concern		2 or more ≥ 8.25 or 1 ≥ 8.5	2 ≤ 6.75 or 1 ≤ 6.5
Extreme Concern		2 or more ≥ 8.5	2 or more ≤ 6.5

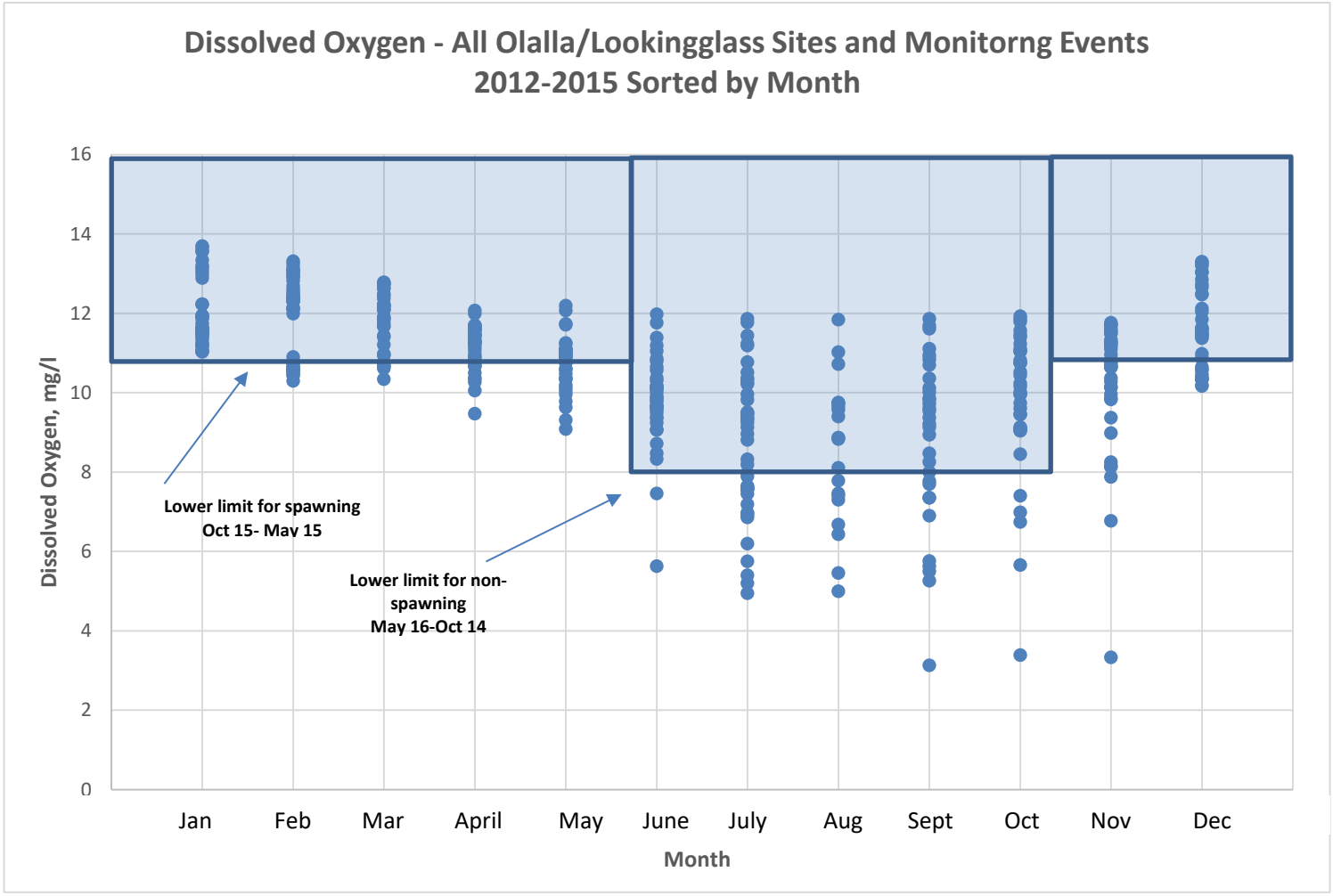
Table 8. Olalla/Lookingglass Watershed sites rated for pH levels with Color Key.

RESULTS – Olalla/Lookingglass Watershed

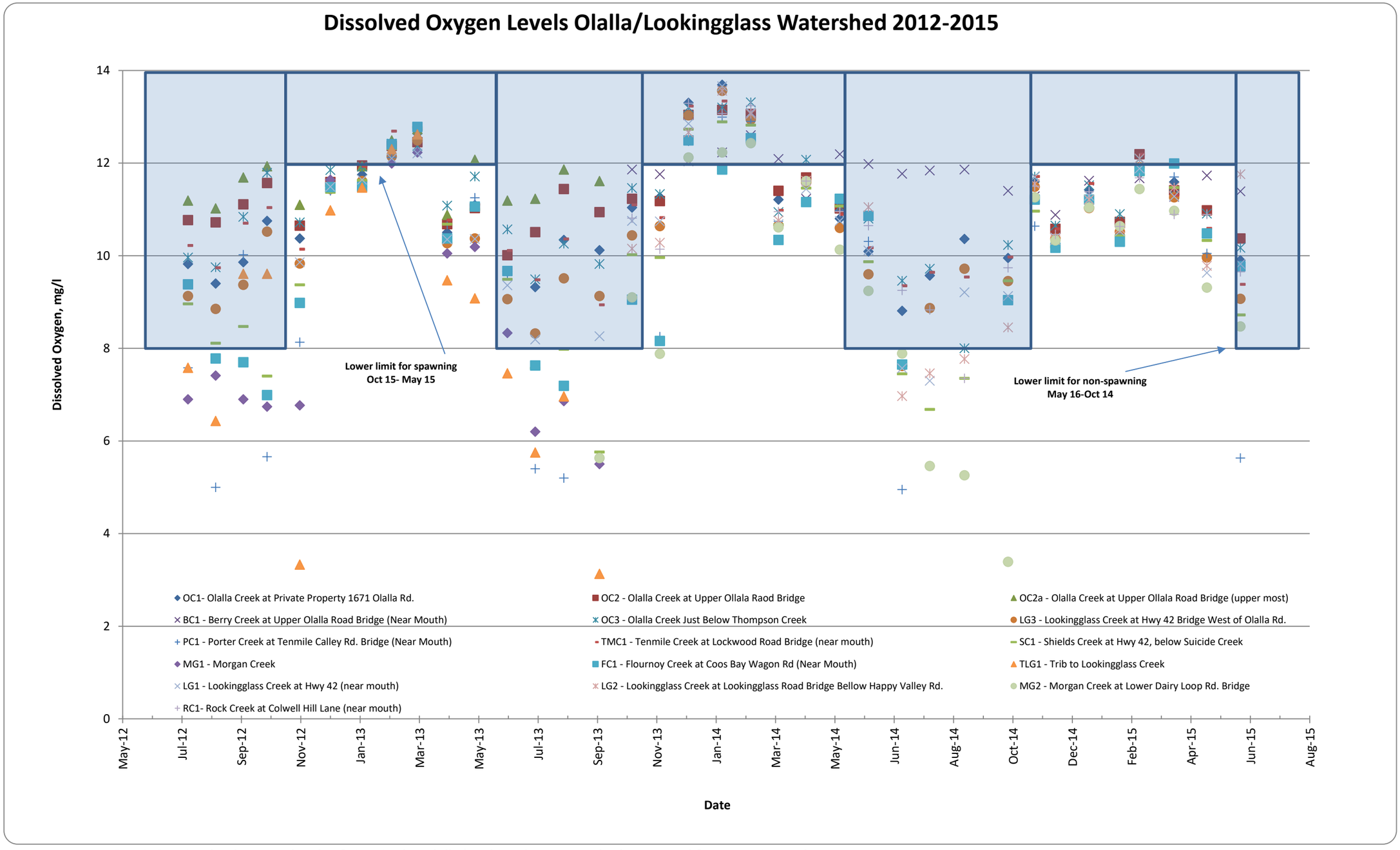
Dissolved Oxygen

During the summer months all exceedances of minimum dissolved oxygen criteria are in streams that go dry except mainstem Lookingglass Creek. Lookingglass Creek is a low flow, low gradient stream during the summer with Berry Creek providing the main flow from Ben Irving Reservoir.

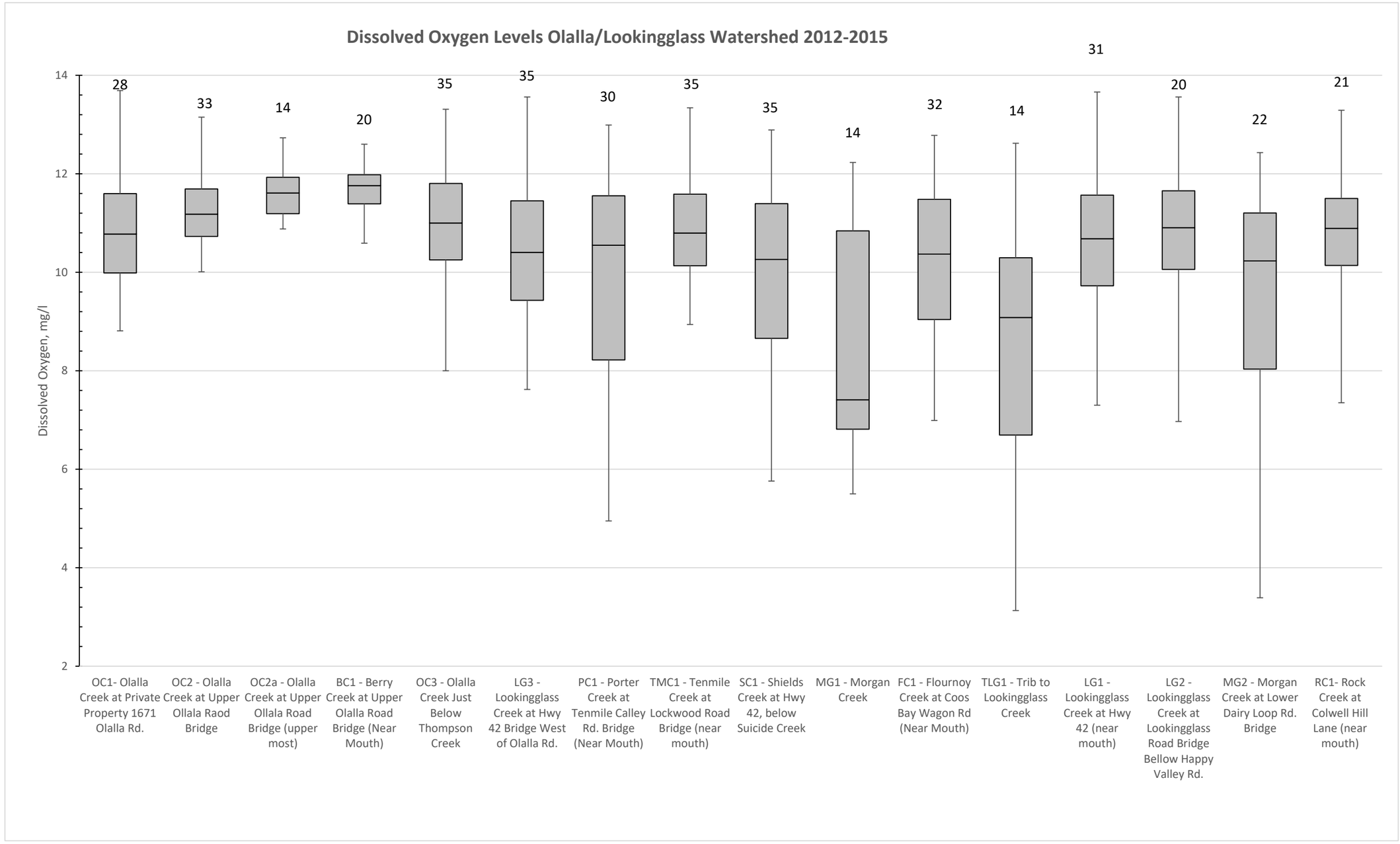
Berry Creek and Olalla just below Berry Creek were the only sites with no to low concern all of the rest were high concern. Looking at **Graph 8** you can see that these exceedances mostly occurred either early or late in the designated spawning timeframe.



Graph 7. Dissolved Oxygen levels Olalla/Lookingglass Watershed 2012-2015 all sites all data sorted by month.



Graph 8. Dissolved oxygen levels of sites in the Olalla/Lookingglass Watershed compared for spawning and non-spawning DEQ criteria.



Graph 9. Box Plot of Dissolved oxygen levels of sites in Olalla/Lookingglass Watershed 2012-2015. The number of above each represents the number of monitoring events for that site.

	Non-spawning Season May 16-October 14				Spawning Season October 13-May 15			
	Total # Samples	# Below Minimum D.O. Criteria of 8 mg/l	% Below Minimum D.O. Criteria of 8 mg/l	Rating	Total # Samples	# Below Minimum D.O. Criteria of 11 mg/l	% Below Minimum D.O. Criteria of 11 mg/l	Rating
OC1 - Olalla Creek at Private Property 1671 Olalla Rd.	14	0	0%		20	4	20%	
OC2 - Olalla Creek at Upper Olalla Road Bridge	10	0	0%		19	4	21%	
OC2a - Olalla Creek at Upper Olalla Road Bridge (upper most)	6	0	0%		15	0	0%	
BC1 - Berry Creek at Upper Olalla Road Bridge (near mouth)	6	0	0%		15	2	13%	
OC3 - Olalla Creek just below Thompson Creek	14	0	0%		22	6	27%	
LG3 - Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.	14	1	7%		22	10	45%	
PC1 - Porter Creek at Tenmile Valley Road Bridge (near mouth)	11	7	64%		21	9	41%	
TMC1 - Tenmile Creek at Lockwood Road Bridge (near mouth)	12	0	0%		22	9	41%	
SC1 - Shields Creek at Hwy 42, below Suicide Creek	14	7	50%		22	9	41%	
MG1 - Morgan Creek	8	7	88%		7	3	43%	
FC1 - Flournoy Creek at Coos Bay Wagon Rd (near mouth)	11	6	55%		22	8	36%	
TLG1 - Tributary to Lookingglass Creek	8	6	75%		7	4	57%	
LG1 - Lookingglass Creek at Hwy 42 (near mouth)	9	2	22%		22	10	45%	
LG2 - Lookingglass Creek at LG Bridge below Happy Valley Rd	6	3	50%		14	6	43%	
MG2 - Morgan Creek at Lower Dairy Loop Rd. Bridge	7	4	57%		15	8	53%	
RC1 - Rock Creek at Colwell Hill Lane (near mouth)	4	1	25%		17	10	59%	

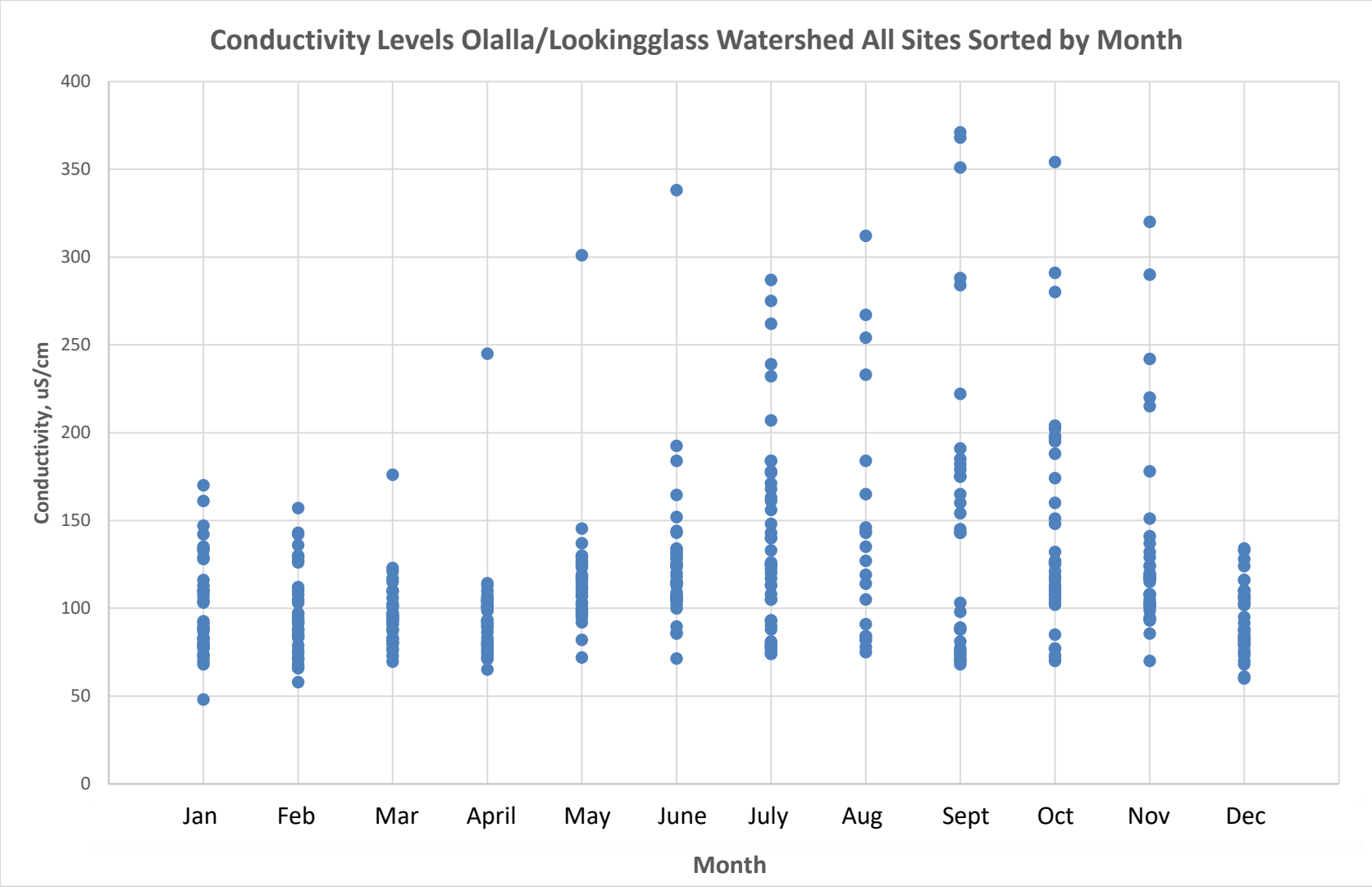
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	0% (No Exceedances)
	Low Concern	≥1% ≤9% Exceedances
	High Concern	≥10% ≤19% Exceedances
	Extreme Concern	≥20% Exceedances

Table 9. Rating of Olalla/Lookingglass Watershed Sites for stream dissolved oxygen levels compared to Spawning Season and Non-Spawning Season DEQ Criteria with Color Key.

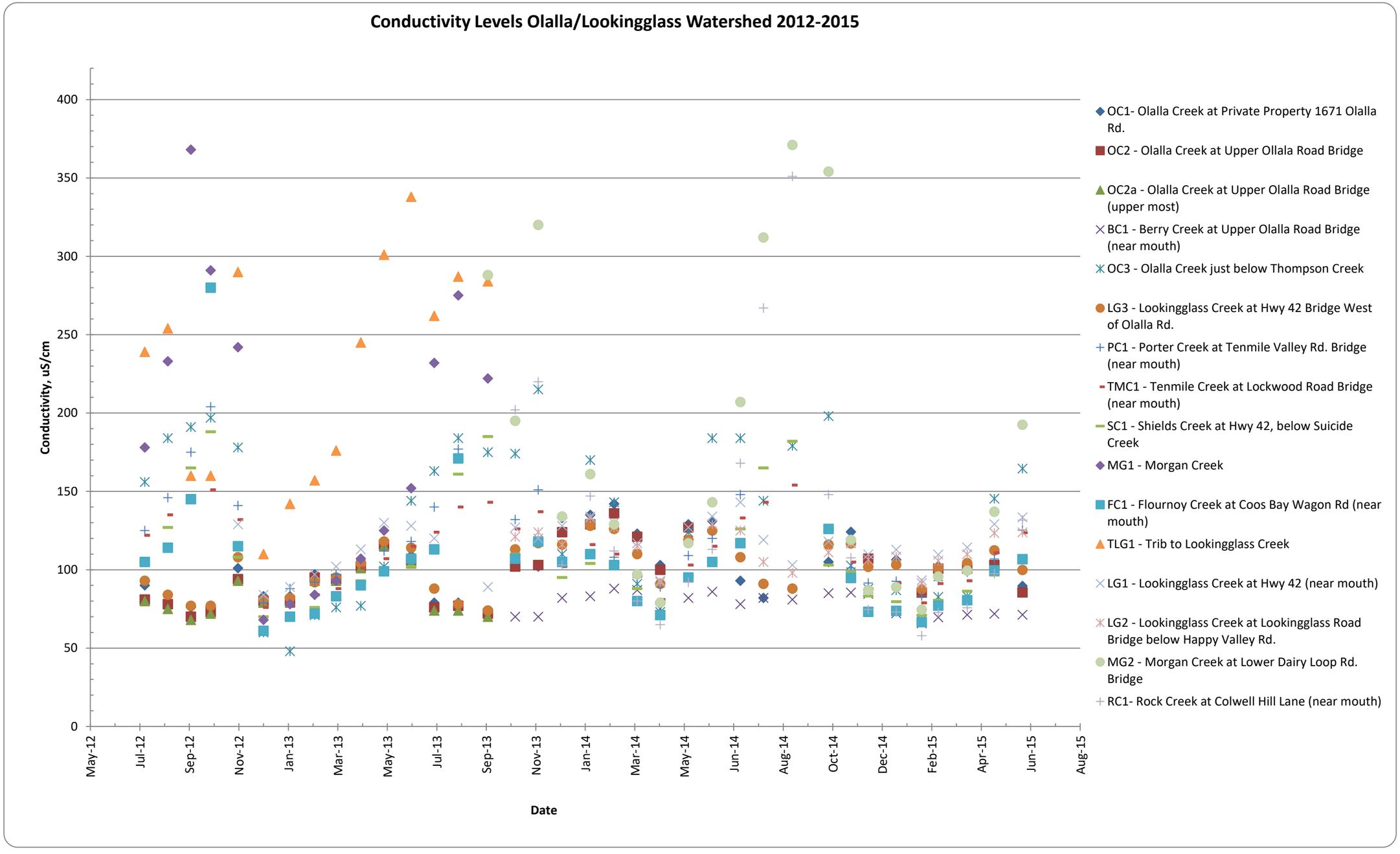
RESULTS – Olalla/Lookingglass Watershed

Conductivity

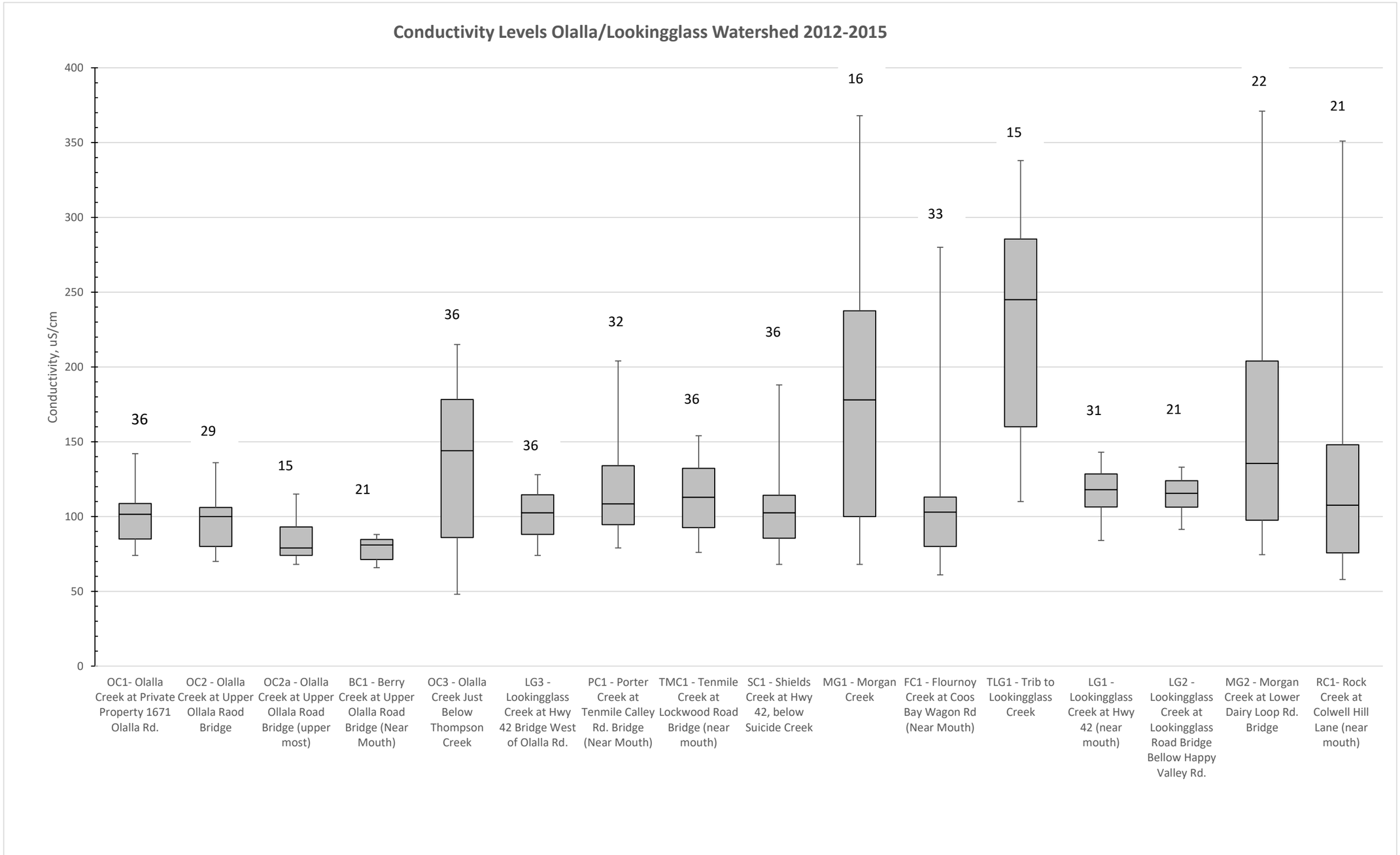
All conductivity levels in the Olalla/Lookingglass monitoring area were within normal ranges for the Umpqua Basin, and none exceeded 500 us/cm. The sites with higher outliers are all steams that go dry in the summer. In general, as a stream dries up the saltiness (conductivity) of the remaining water increases.



Graph 10. Conductivity levels all Olalla/Lookingglass sites and events from 2012-2015 displayed by month.



Graph 11. Conductivity Olalla/Lookingglass Sites 2012-2015.



Graph 12. Box Plots of conductivity levels at Olalla/Lookingglass sites. Number above each represents the number of monitoring events for that site.

Conductivity Level Rating Olalla/Lookingglass Watershed Monitoring Sites 2012-2015

SITE	Rating
OC1 Olalla Creek at Private Property 1671 Olalla Rd.	
OC2 Olalla Creek at Upper Olalla Road Bridge	
OC2a Olalla Creek at Upper Olalla Road Bridge (upper most)	
BC1 Berry Creek at Upper Olalla Road Bridge (near mouth)	
OC3 Olalla Creek just below Thompson Creek	
LG3 Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.	
PC1 Porter Creek at Tenmile Valley Rd. Bridge (near mouth)	
TMC1 Tenmile Creek at Lockwood Road Bridge (near mouth)	
SC1 Shields Creek at Hwy 42, below Suicide Creek	
MG1 Morgan Creek	
FC1 Flournoy Creek at Coos Bay Wagon Rd (near mouth)	
TLG1 Tributary to Lookingglass Creek	
LG1 Lookingglass Creek at Hwy 42 (near mouth)	
LG2 Lookingglass Creek at Lookingglass Road Bridge below Happy Valley Rd.	
MG2 Morgan Creek at Lower Dairy Loop Rd. Bridge	
RC1 Rock Creek at Colwell Hill Lane (near mouth)	

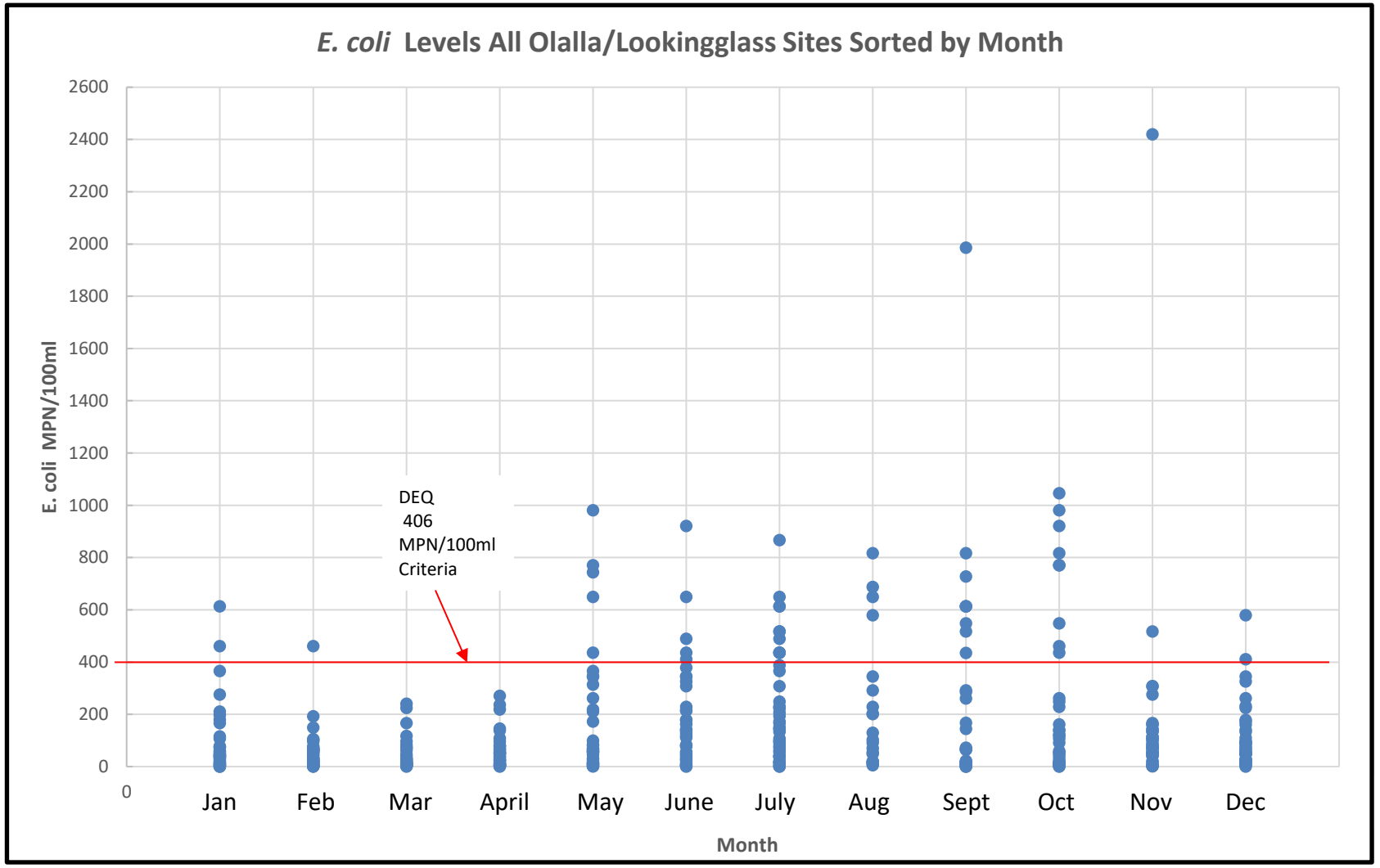
Rating	Color	Conductivity Level
No Concern		<500 uS/cm
Concern		>500 uS/cm

Table 10. Conductivity levels ratings of Olalla/Lookingglass monitoring sites 2012-2015.

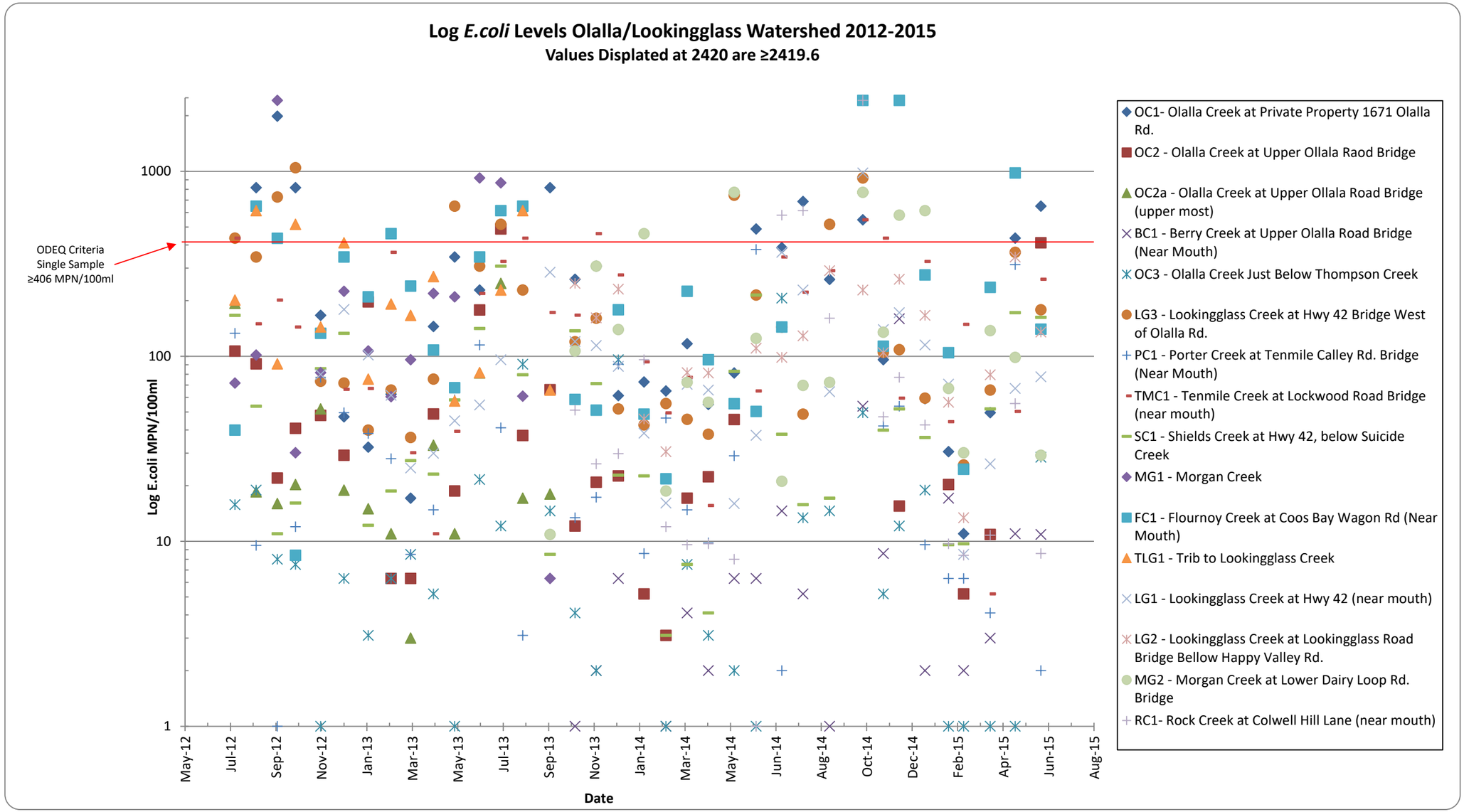
RESULTS - Olalla/Lookingglass Watershed

E. coli Bacteria

E. coli contamination is an issue of concern throughout the Olalla/Lookingglass watershed. There are some sites in particular that stand out with sample levels detected at equal to or greater than the one time 406 MPN/ml criteria. In **Table 11** displays the sites of highest concern, shown by percent of samples exceeding various criteria. At site OC1 – Olalla Creek at Private Property 1671 Olalla Rd. (lowest site on Olalla Creek) 33% of the samples were above the DEQ single sample criteria.

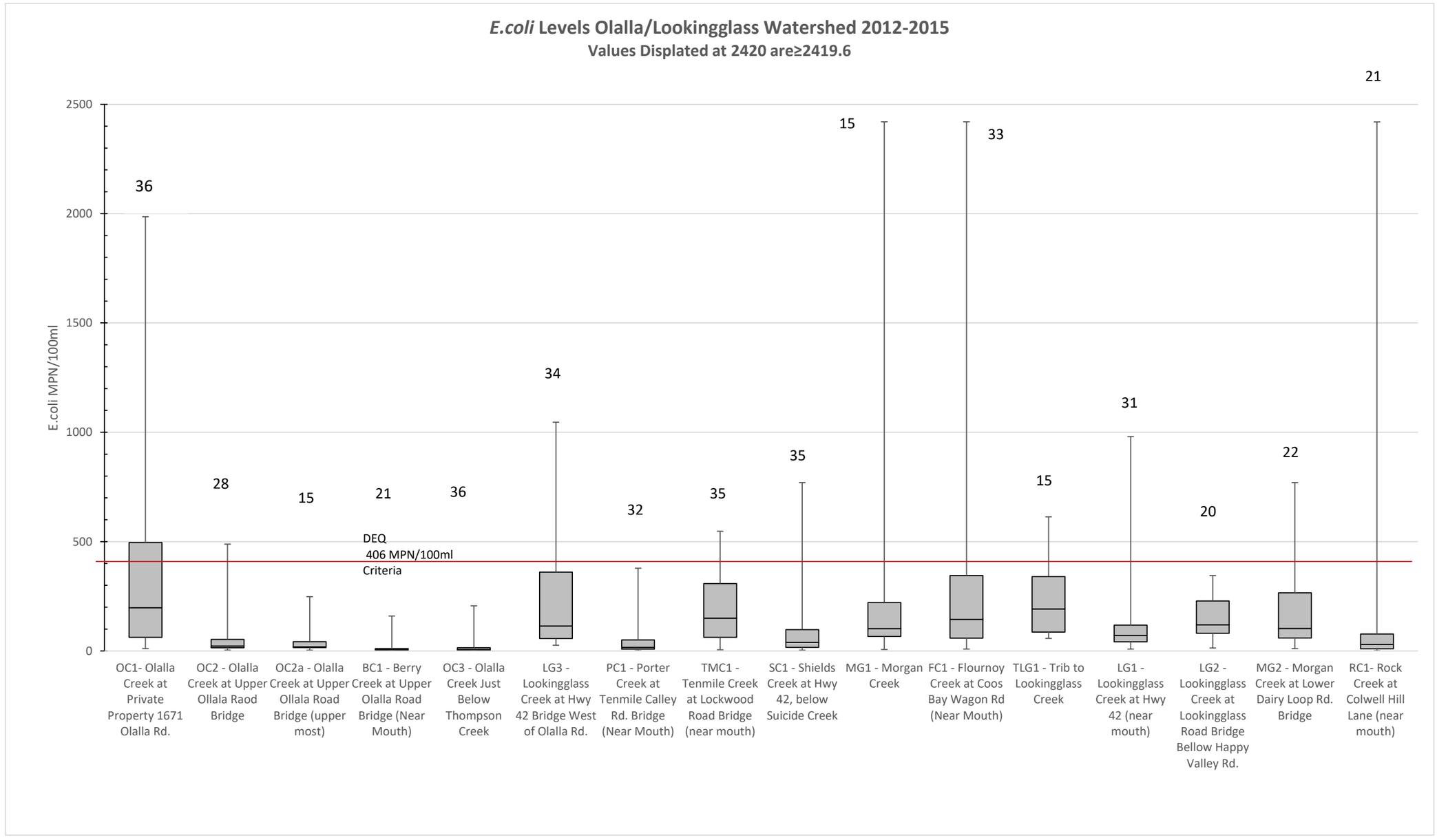


Graph 13. *E. coli* levels all Olalla/Lookingglass sites from 2012-2015 sorted by month.



Log *E.coli* Levels Olalla/Lookingglass Watershed 2012-2015
Values Displated at 2420 are ≥2419.6

Graph 14.Log *E. coli* levels Olalla/Lookingglass Watershed sites 2012-2015.



Graph 15.Box plots of *E. coli* levels of Olalla/Lookingglass Watershed sites 2012-2015. The number above each represents the number of monitoring events for that site.

Rating of Olalla/Lookingglass Watershed Sites for *E. coli*, Summer and Winter

Olalla\Lookingglass Watershed	126 or Greater		235 or Greater		406 or Greater		Total
Station ID - Site Description	Count	% of Samples	Count	% of Samples	Count	% of Samples	# of Samples
OC1- Olalla Creek at Private Property 1671 Olalla Rd.	20	56%	17	47%	12	33%	36
OC2 - Olalla Creek at Upper Olalla Road Bridge	4	14%	2	7%	2	7%	28
OC2a - Olalla Creek at Upper Olalla Road Bridge (upper most)	2	13%	1	7%	0	0%	15
BC1 - Berry Creek at Upper Olalla Road Bridge (near mouth)	1	5%	0	0%	0	0%	21
OC3 - Olalla Creek just below Thompson Creek	1	3%	0	0%	0	0%	36
LG3 - Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.	16	47%	11	32%	8	24%	34
PC1 - Porter Creek at Tenmile Valley Rd. Bridge (near mouth)	3	9%	2	6%	0	0%	32
TMC1 - Tenmile Creek at Lockwood Road Bridge (near mouth)	21	60%	12	34%	5	14%	35
SC1 - Shields Creek at Hwy 42, below Suicide Creek	9	25%	2	6%	1	3%	36
MG1 - Morgan Creek	6	40%	3	20%	3	20%	15
FC1 - Flournoy Creek at Coos Bay Wagon Rd (near mouth)	19	58%	13	39%	8	24%	33
TLG1 - Trib to Lookingglass Creek	10	67%	5	33%	4	27%	15
LG1 - Lookingglass Creek at Hwy 42 (near mouth)	7	23%	3	10%	1	3%	31
LG2 - Lookingglass Creek at Lookingglass Road Bridge below Happy Valley Rd.	10	50%	4	20%	0	0%	20
MG2 - Morgan Creek at Lower Dairy Loop Rd. Bridge	9	41%	6	27%	5	23%	22
RC1- Rock Creek at Colwell Hill Lane (near mouth)	4	19%	3	14%	3	14%	21

Table 11. Rating of all Olalla/Lookingglass Watershed Sites for *E. coli*.

SITE	Summer				Winter			
	Total # Samples	# ABOVE ODEQ Criteria 406 MPN/100ml	% ABOVE ODEQ Criteria 406 MPN/100ml	Rating	Total # Samples	# ABOVE ODEQ Criteria 406 MPN/100ml	% ABOVE ODEQ Criteria 406 MPN/100ml	Rating
OC1 Olalla Creek at Private Property 1671 Olalla Rd.	16	10	63%		20	2	10%	
OC2 Olalla Creek at Upper Olalla Road Bridge	10	2	20%		18	0	0%	
OC2a Olalla Creek at Upper Olalla Road Bridge (upper most)	8	0	0%		7	0	0%	
BC1 Berry Creek at Upper Olalla Road Bridge (near mouth)	7	0	0%		14	0	0%	
OC3 Olalla Creek Just Below Thompson Creek	15	0	0%		21	0	0%	
LG3 Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.	14	6	43%		20	2	10%	
PC1 Porter Creek at Tenmile Valley Rd. Bridge (near mouth)	12	0	0%		20	0	0%	
TMC1 Tenmile Creek at Lockwood Road Bridge (near mouth)	14	2	14%		21	3	21%	
SC1 Shields Creek at Hwy 42, below Suicide Creek	14	0	0%		21	0	0%	
MG1 Morgan Creek	8	3	38%		7	0	0%	
FC1 Flournoy Creek at Coos Bay Wagon Rd (near mouth)	12	5	42		21	3	14%	
TLG1 Tributary to Lookingglass Creek	8	2	25%		7	2	29%	
LG1 Lookingglass Creek at Hwy 42 (near mouth)	11	0	0%		20	1	5%	
LG2 Lookingglass Creek at Lookingglass Road Bridge below Happy Valley Rd.	16	0	0%		4	0	0%	
MG2 Morgan Creek at Lower Dairy Loop Rd. Bridge	8	0	0%		14	3	21%	
RC1 Rock Creek at Colwell Hill Lane (near mouth)	7	2	29%		14	1	7%	

Rating	Color	*5E. coli* MPN/100ml
No Concern (below standard criteria)		< 406
Concern (exceeds standard criteria)		> 406

Table 12. Rating of all Olalla/Lookingglass Watershed Sites for *E. coli*, Summer and Winter.

RESULTS - Olalla/Lookingglass Watershed

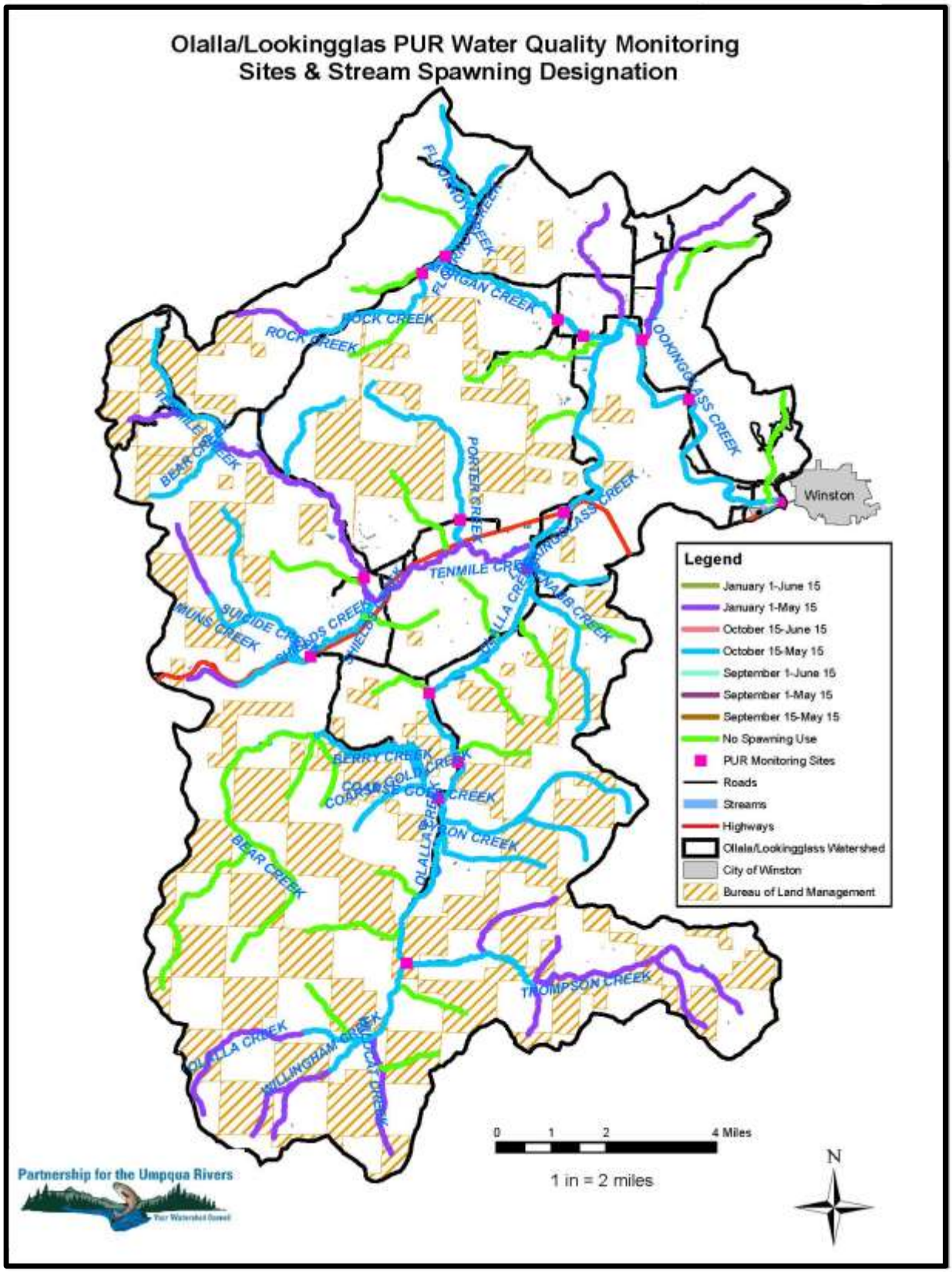
Grab Sample Temperature Monitoring

Temperature was recorded at each of our grab sample monitoring events, and though this does not allow evaluation for DEQ temperature criteria, it is included here for evaluation and stream rating in order to provide additional information for planning restoration sites. There was no continuous temperature collected in this watershed due to low stream flows and streams going dry. The main stem sites were all from bridges that did not have safe access to the stream.

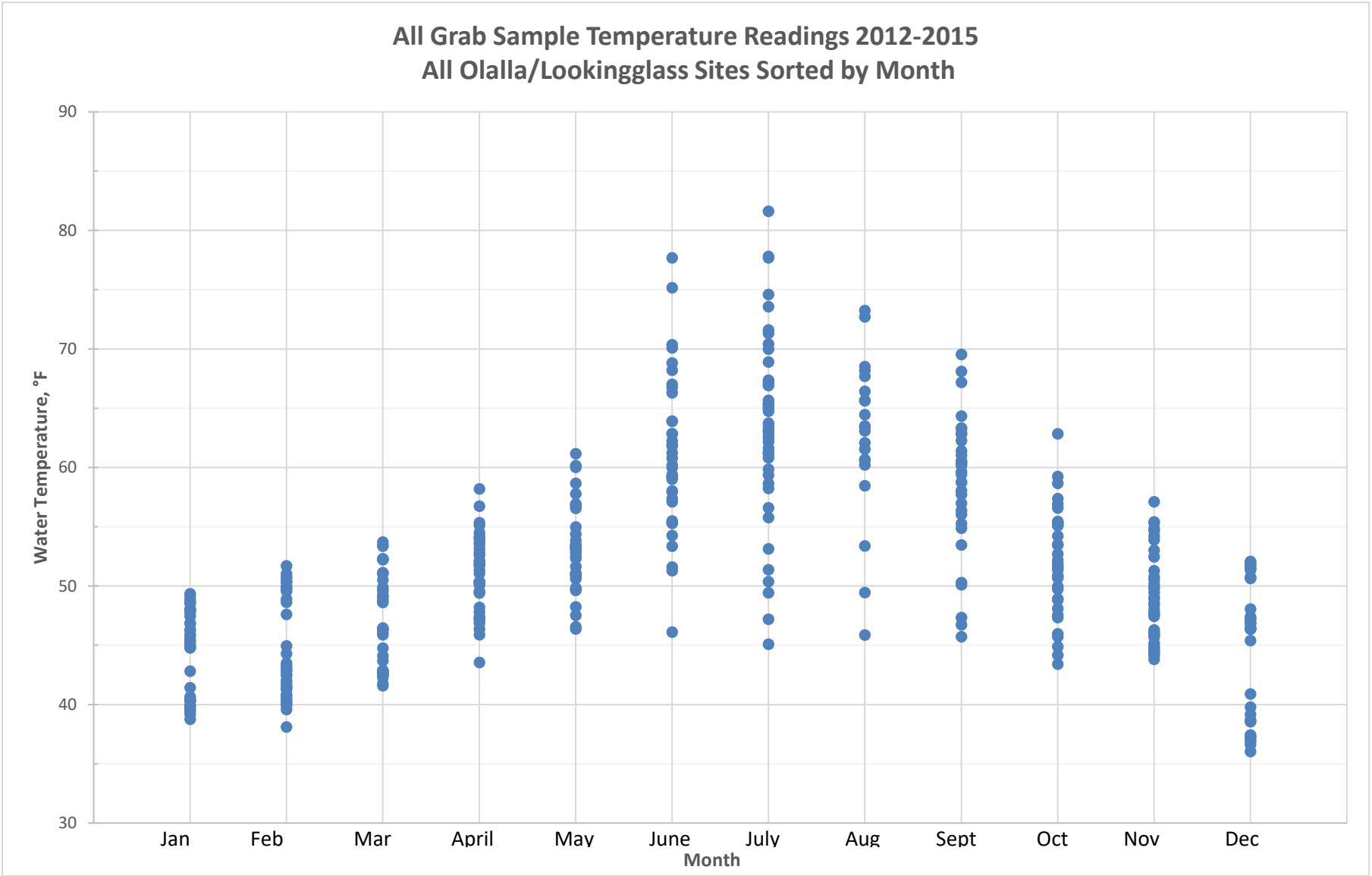
From the grab sampling monitoring data for Olalla/Lookingglass Watershed numerous exceedances in temperature were detected for the "Rearing and Migration" criteria of 64.4°F for Oct 15 – May 15. Our grab sample monitoring indicated that LG3 Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd, MG1 Morgan Creek, FC1 Flournoy Creek at Coos Bay Wagon Rd (near mouth), TLG1 Trib. to Lookingglass Creek, LG2 Lookingglass Creek at Lookingglass Road bridge below Happy Valley Rd, MG2 Morgan Creek at Lower Dairy Loop Rd. bridge sites all had at least two exceedances of the maximum temperature, all the other sites did not exceed ODEQ criteria during our grab sampling events.

Map 4 indicates that our monitoring sites were all on designated "Spawning" streams from October 15 to May 15. A number of sites exceeded the criteria in this period at the edges of the time periods – see **Table 13** for ratings of streams exceeding recommended temperatures.

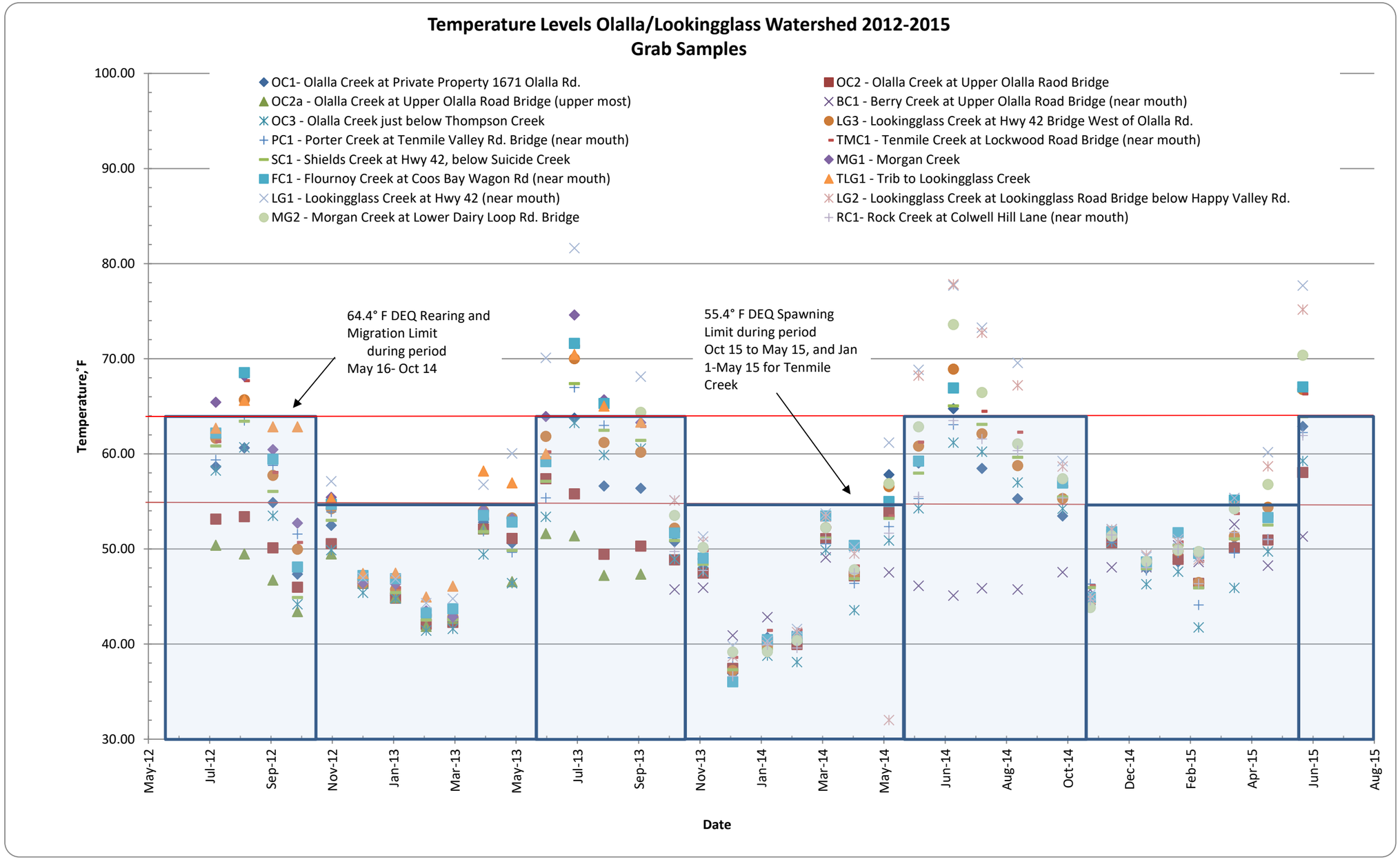
Graph 19 depicts our grab sample data from January 2014 through August 2015. The sites represented are OC3 - Olalla Creek just below Thompson Creek is located about 3.5 miles upstream of the mouth of Berry Creek and OC1 – Olalla Creek at private property 1671 Olalla Rd. is located about six miles downstream of the mouth of Berry Creek. The water in Berry Creek flows out of Ben Irving Reservoir into Olalla Creek. In the Umpqua Basin TMDL, ODEQ performed a heat source simulation for July 12-31, 2002 representing the summer critical period see **Appendix K: ODEQ Heat Source Simulation for Olalla-Lookingglass Creek**. These data show some of the interesting phenomenon of water released from a reservoir in a system that typically has low summer flows. ODEQ's data appears to simulate our data in August 2014 where the release cools the Olalla Creek flows. This could be due to annual weather patterns and/or changes in yearly discharge patterns.



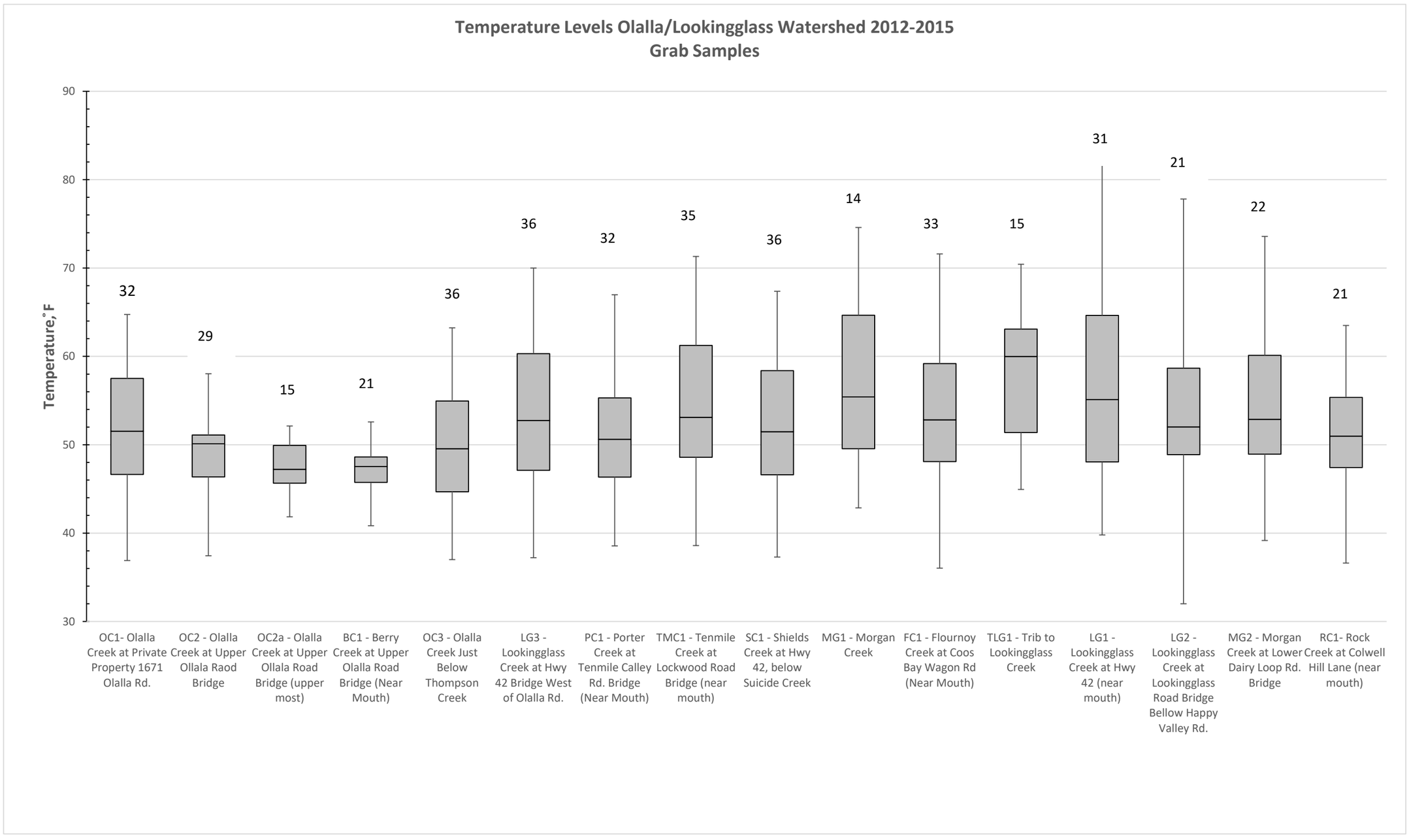
Map 4. Olalla/Lookingglass PUR monitoring sites with ODEQ stream spawning designations.



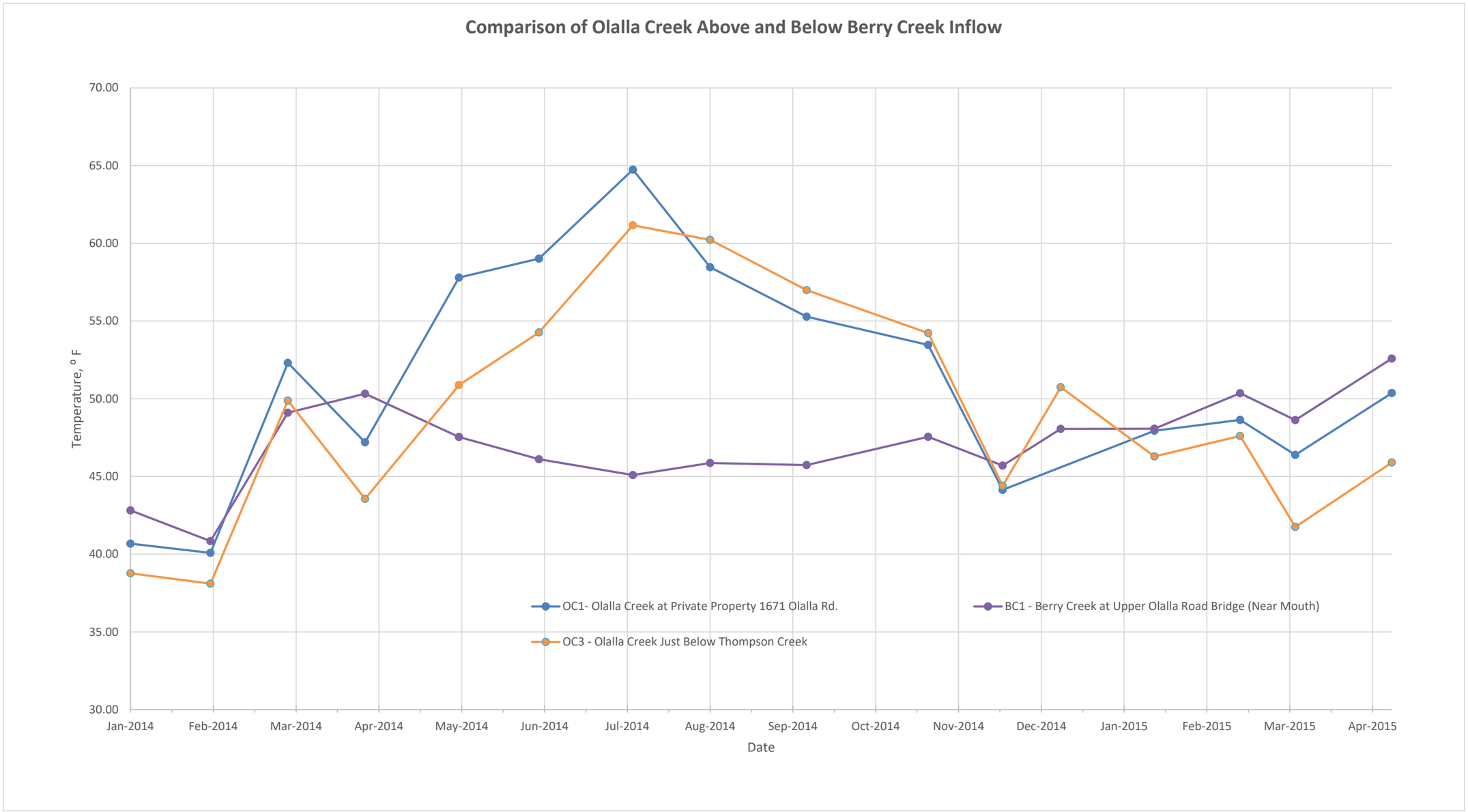
Graph 16. Grab sample temperature data all events and sites sorted by month 2012-2015.



Graph 17. Grab sample temperature results for all Olalla/Lookingglass sites 2012-2015.



Graph 18. Box and whisker plots of grab sample temperatures for each site in Olalla/Lookingglass Watershed. Number above each indicates the number of sampling events.



Graph 19.Comparison of Olalla Creek Above and Below Berry Creek January 2014 to April 2015.

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Monitoring Sites 2012-2015
Temperature Ratings for Olalla/Lookingglass Grab Sample

SITE	Rating based on Rearing and Migration Criteria 64.4° May 16-Oct 14	Rating based on Spawning Criteria 55.4 ° Oct 15-May 15
OC1 Olalla Creek at Private Property 1671 Olalla Rd.		
OC2 Olalla Creek at Upper Olalla Road Bridge		
OC2a Olalla Creek at Upper Olalla Road Bridge (upper most)		
BC1 Berry Creek at Upper Olalla Road Bridge (near mouth)		
OC3 Olalla Creek just below Thompson Creek		
LG3 Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.		
PC1 Porter Creek at Tenmile Valley Rd. Bridge (near mouth)		
TMC1 Tenmile Creek at Lockwood Road Bridge (near mouth)		
SC1 Shields Creek at Hwy 42, below Suicide Creek		
MG1 Morgan Creek		
FC1 Flournoy Creek at Coos Bay Wagon Rd (near mouth)		
TLG1 Tributary to Lookingglass Creek		
LG1 Lookingglass Creek at Hwy 42 (near mouth)		
LG2 Lookingglass Creek at Lookingglass Road Bridge below Happy Valley Rd.		
MG2 Morgan Creek at Lower Dairy Loop Rd. Bridge		
RC1 Rock Creek at Colwell Hill Lane (near mouth)		

Rating	Grab Sample Temperatures Rearing and Migration Oct 15 to May 15	Grab Sample Temperatures Spawning Criteria 55.4 ° Oct 15-May 15	Color
Good	≤64.4° F	≤55.40° F	
Showed Exceedence	>64.4° F	>55.4° F	

Table 13. Temperature ratings for Olalla/Lookingglass monitoring sites.

RESULTS - Olalla/Lookingglass Watershed

Summary

Table 14 presents the summary of ratings of all six water quality parameters monitored in the Olalla/Lookingglass Watershed. It is evident that this area's worst problem is exceedances of turbidity and dissolved oxygen criteria, almost all sites are of "High Concern" for these parameters. Thirteen sites in this watershed showed "Low" to "No Concern" for pH. Three sites indicated "Moderate Concern" and there were none of "Extreme Concern". The levels of conductivity in this region were all in normal ranges. Five of the sites had no exceedance of 406 MPN/ml of *E. coli* (ODEQ criteria), however 11 of the sites had exceedances. Eight of the sites had temperature exceedances and eight did not.

Overall the sites of most concern, considering all parameters, are LG3 - Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd., TMC1 - Tenmile Creek at Lockwood Road Bridge (near mouth), MG1 - Morgan Creek, FC1 - Flournoy Creek at Coos Bay Wagon Rd (near mouth), TLG1 Tributary to Lookingglass Creek, LG1 - Lookingglass Creek at Hwy 42 (near mouth). These each had levels of "High Concern" for turbidity, dissolved oxygen, *E. coli* and temperature.

The sites of least concern, considering all parameters, are OC2a - Olalla Creek at Upper Olalla Road Bridge (upper most), BC1 - Berry Creek at Upper Olalla Road Bridge (near mouth) with only turbidity of "High Concern" and OC3 - Olalla Creek just below Thompson Creek with only dissolved oxygen of "High Concern".

Summary Rating for Olalla/Lookingglass Monitoring Sites – Six Water Quality Parameters

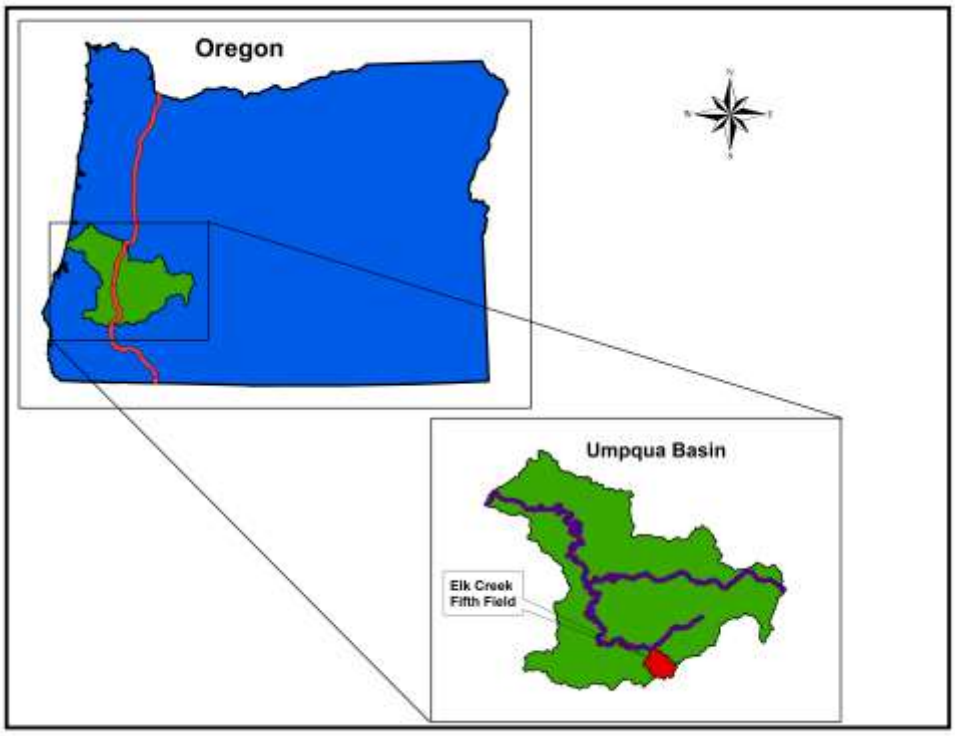
	Turbidity	pH	Dissolved Oxygen	Conductivity	*E. coli* ≥406 MPN/100ml Criteria	Grab Sample Temperatures Rearing and Migration 64.4 ° Oct 15 to May 15	Grab Sample Temperatures Spawning Criteria 55.4 ° Oct 15-May 15
OC1 Olalla Creek at Private Property 1671 Olalla Rd.							
OC2 Olalla Creek at Upper Olalla Road Bridge							
OC2a Olalla Creek at Upper Olalla Road Bridge (upper most)							
BC1 Berry Creek at Upper Olalla Road Bridge (near mouth)							
OC3 Olalla Creek just below Thompson Creek							
LG3 Lookingglass Creek at Hwy 42 Bridge West of Olalla Rd.							
PC1 Porter Creek at Tenmile Valley Rd. Bridge (near mouth)							
TMC1 Tenmile Creek at Lockwood Road Bridge (near mouth)							
SC1 Shields Creek at Hwy 42, below Suicide Creek							
MG1 Morgan Creek							
FC1 Flournoy Creek at Coos Bay Wagon Rd (near mouth)							
TLG1 Tributary to Lookingglass Creek							
LG1 Lookingglass Creek at Hwy 42 (near mouth)							
LG2 Lookingglass Creek at Lookingglass Rd. Bridge below Happy Valley Rd.							
MG2 Morgan Creek at Lower Dairy Loop Rd. Bridge							
RC1 Rock Creek at Colwell Hill Lane (near mouth)							

Table 14. Rating summary of Olalla/Lookingglass monitoring sites. See individual parameter's summary for the criteria used in establishing the color.

Elk Creek/Tiller Area

Area Description, Background & Monitoring Sites

The Elk Creek sixth field watershed consists of private lands and lands managed by the U.S.F.S./ Tiller Ranger District. A majority of the region is within the Umpqua Cascades Ecoregion with a portion of the area around Callahan Creek falling in the Inland Siskiyou Ecoregion. Expect for small plateaus along Tiller Trail Highway, the area consists mainly of deep "V"-shaped valleys and steep slopes. The Tiller Region is 983 feet elevation at the confluence of Elk Creek and the South Umpqua River. Many of the streams in the Tiller Region are dominated by surface water input rather than groundwater due to the lack of permeability of the rock dominated area.



Map 5. Elk Creek/Tiller Watershed area map.

The longest tributary to the South Umpqua in the Tiller area is Elk Creek, which is 14.6 miles long and has a 3.2% gradient. The land use in the area is dominated by forest with around 2% being agriculture, the majority of which is along, or very near Tiller Trail Highway. Instream water rights, or water that is to remain in the stream and not be removed from the stream for other water uses, exceeds the average flow available from September through November in Elk Creek. The summer flow in Elk Creek can drop below one cfs.

Map 7 in the temperature section for Elk Creek indicates the creeks designated as spawning and non-spawning in the watershed. This area is designated a "Core Cold-Water Habitat" as shown in **Figure 320A - Umpqua Basin Fish Use Designations from ODEQ 2003 (Appendix I)**. Spawning designation for salmon and steelhead is from October 15th thru June 15th, a month longer than most of our other watersheds.

The Elk Creek Watershed has been the focus of an ongoing comprehensive collaborative watershed restoration project which has included private landowners, federal agencies (USFS and NRCS), state agencies (ODFW and OWEB), the Cow Creek Band of the Umpqua Band of Indians and non-profits including the Nature Conservancy, the Partnership for the Umpqua Rivers and The South Umpqua Rural Community Partnership (SURCP). Joe Hall Creek, Brownie Creek and Elk Creek have already had large instream restoration projects completed and many more are being planned which are now spearheaded by SURCP. This report updates the 2012 OWEB Final Report with the addition of 2013 data.

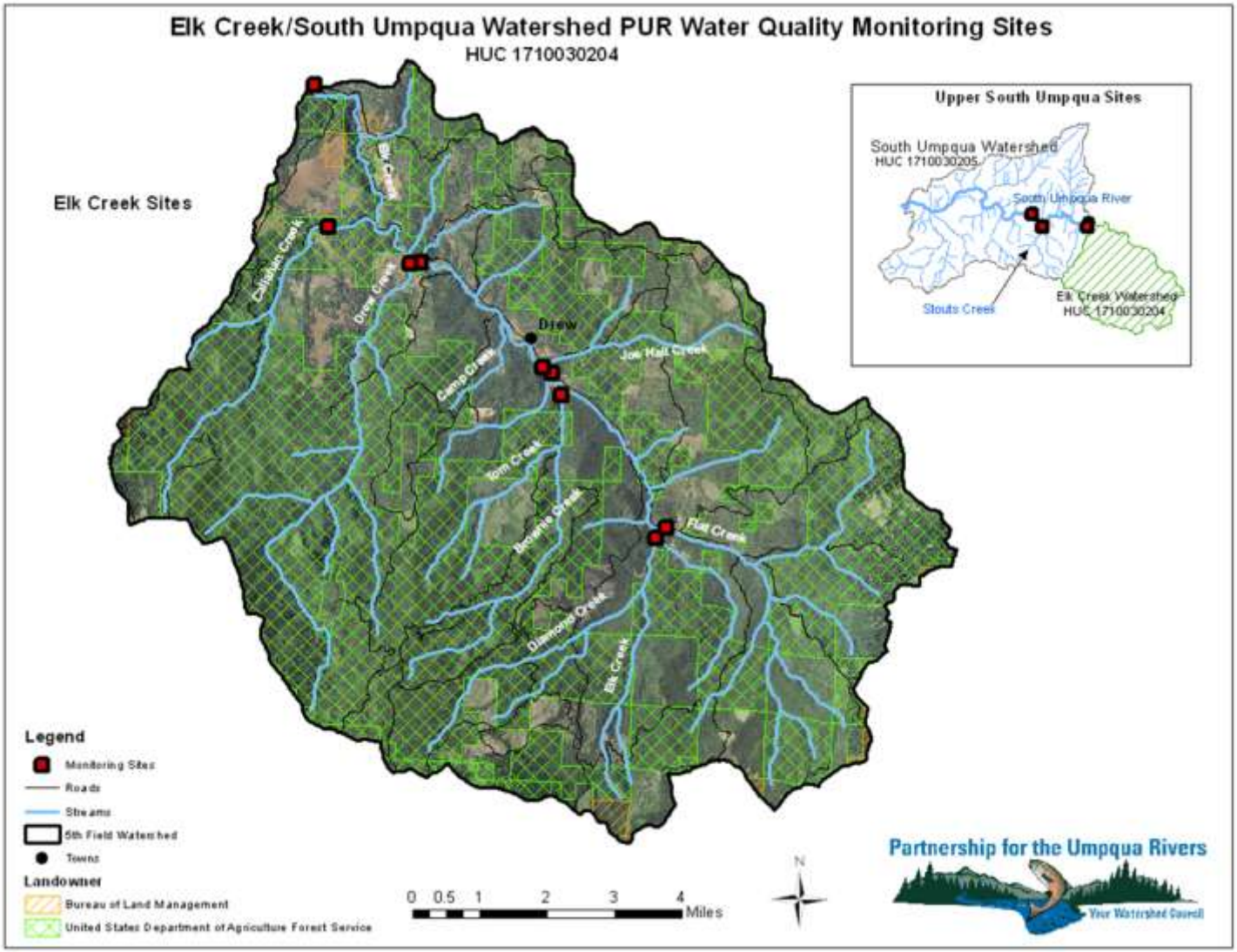
Photo 3. Elk Creek merging with the South Umpqua 1/29/13.

Photo 4. Elk Creek at mouth 7/24/13.

Elk Creek/Tiller Area Monitoring Sites Description and Location

Site ID #	Site Name	Site Location	Latitude	Longitude
E1	Mouth of Elk Creek	Mouth of Elk Creek	42°55.603'N	122°57.087'W
E2	Callahan Creek	Lower Callahan Creek	42°53.792'N	122°56.466'W
E3	Drew Creek	Drew Creek at mouth	42°53.359'N	122°55.301'W
E4	Elk Creek above Drew Creek	Elk Creek above Drew Creek	42°53.383'N	122°55.272'W
E5	Joe Hall Creek	Mouth of Joe Hall Creek	42°52.050'N	122°52.942'W
E6	Elk Creek above Joe Hall	Elk Creek above Joe Hall	42°52.028'N	122°52.936'W
E7	Brownie Creek	Brownie Creek near mouth	42°521.736'N	122°52.549'W
E8	Shed Creek (also known as Flat Creek)	Shed at mouth	42°50.024'N	122°50.929W
E9	Elk Creek above Shed Creek	Elk Creek above Shed Creek	42°50.002'N	122°50.929W
SU1	South Umpqua at Tiller	South Umpqua at Tiller Bridge above Elk Creek	42°55.636'N	122°57.073'W
ST1	Stouts Creek at mouth	Stouts Creek at mouth	42°55.776'N	123°03.121'W
SU2	South Umpqua below Stouts Creek	South Umpqua below Stouts Creek	42°55.778'N	123°03.143'W

Table 15. Sites in the Elk Creek/Tiller monitoring area.

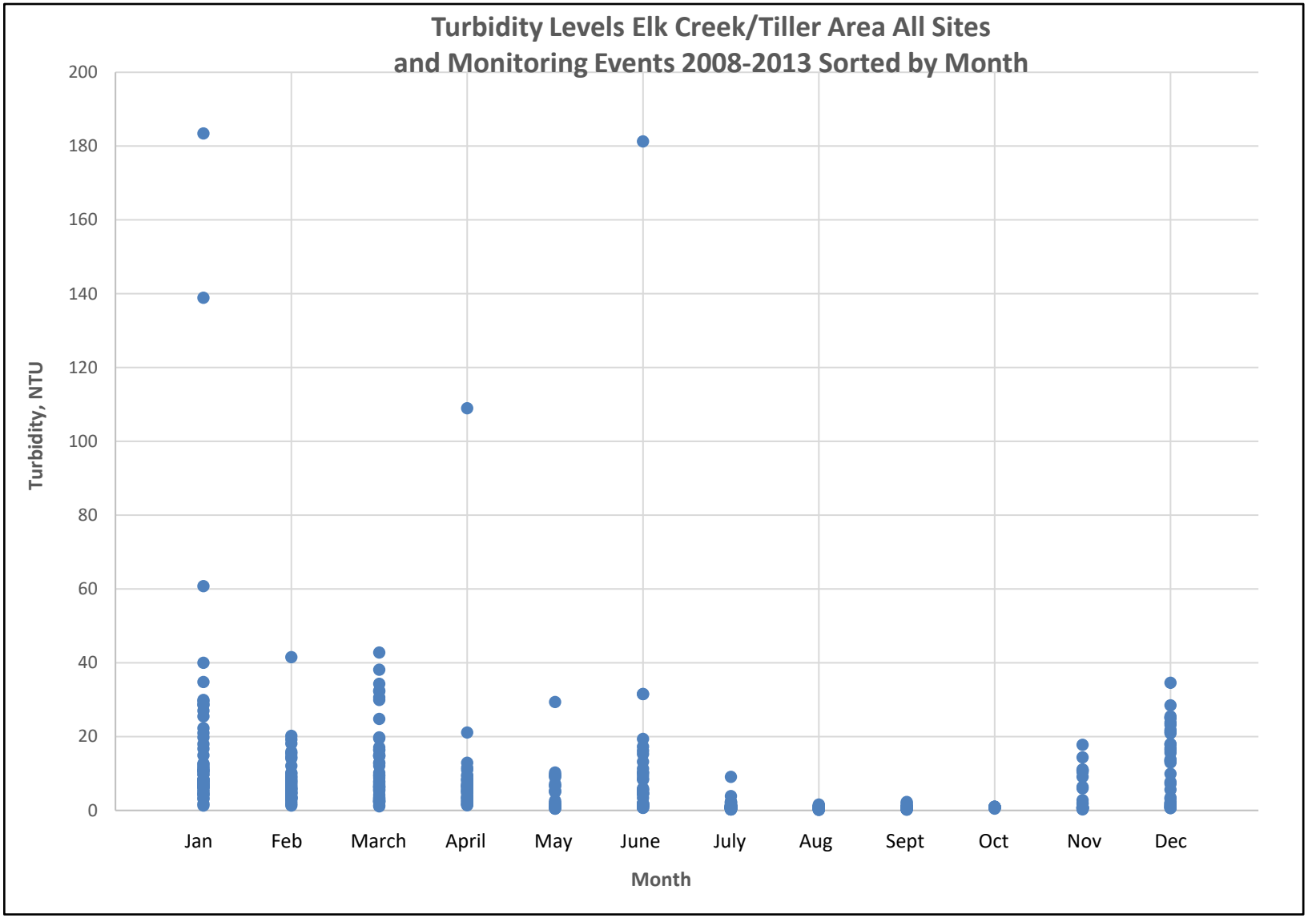


Map 6. Elk Creek/Tiller monitoring sites map.

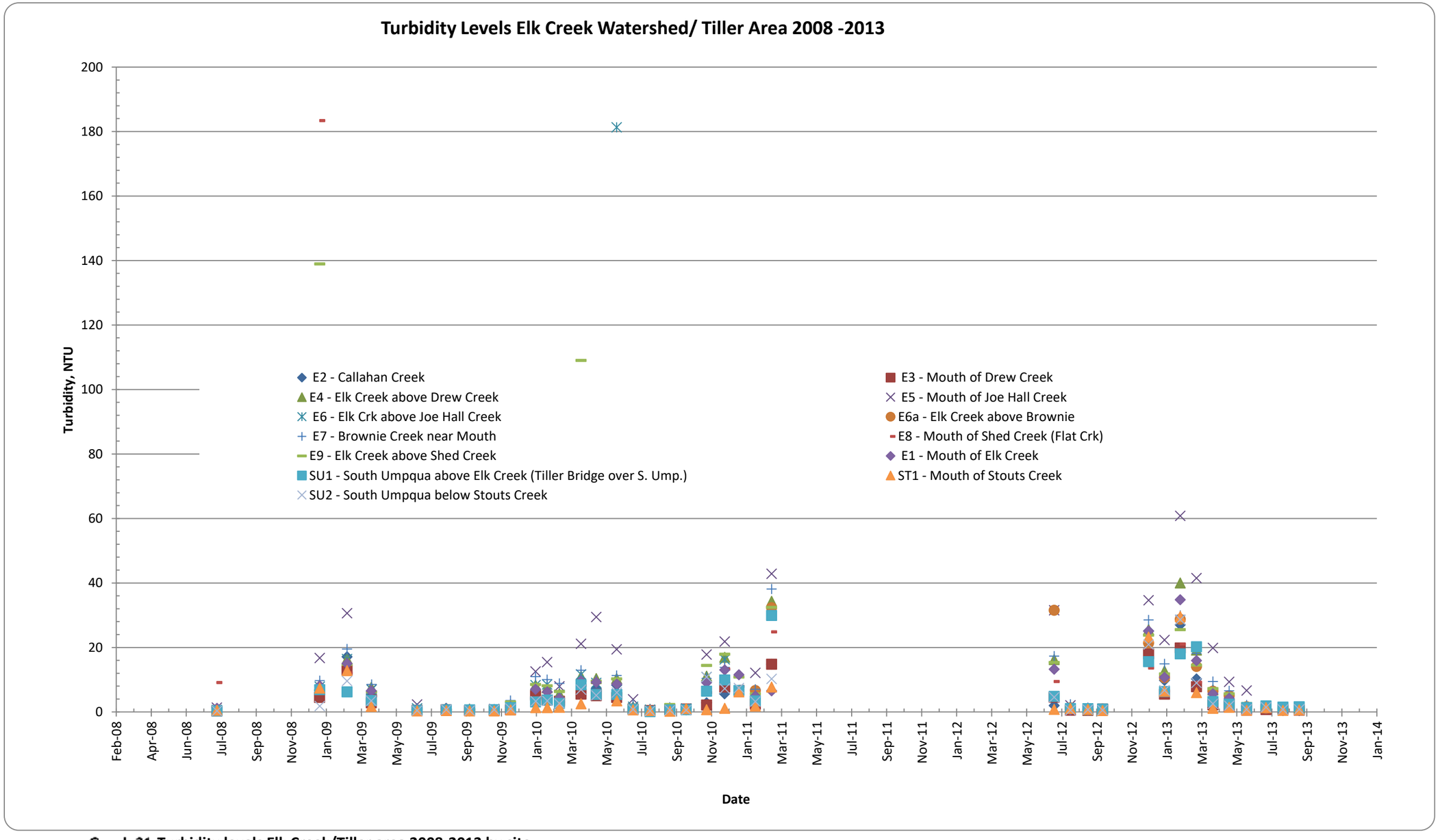
RESULTS – Elk Creek/Tiller Area

Turbidity

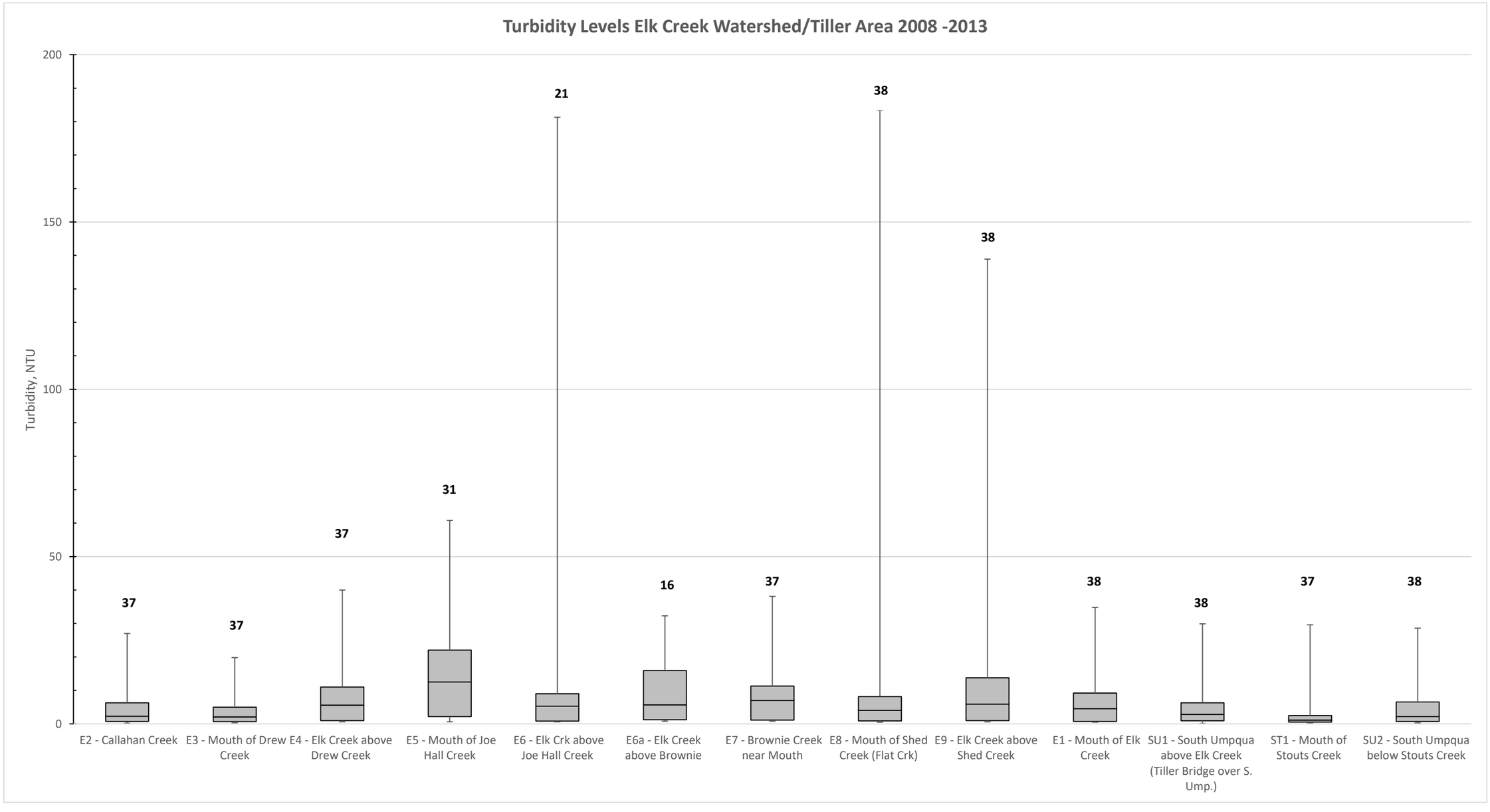
Turbidity is an issue in the Elk Creek Watershed as is evident in **Photo 3**. It is typically due to a rain/storm related occurrence, see **Table 17** for the differences between summer and winter ratings. Note the absence of data for Joe Hall Creek in mid-summer is due to there being no surface flow. **Graph 20** shows the time of year that spikes in turbidity occur. See **Table 16** for the stream ratings summary for turbidity.



Graph 20. Turbidity levels sorted by month for all sites and monitoring events in Elk Creek/Tiller area 2008-2013.



Graph 21.Turbidity levels Elk Creek/Tiller area 2008-2013 by site.



Graph 22.Box and Whisker plots of turbidity levels for Elk Creek/Tiller Area sites 2008-2013. Numbers above each indicates the number of monitoring events.

Turbidity Levels ≥10 NTU, Year Round Monitoring Events by Site Elk Creek/Tiller Area 2008-2013

Elk Creek Watershed/ Tiller Area		10 NTU's or Greater	
Station ID - Stie Description	Total # of Samples	Count	% of Samples
E2 - Callahan Creek	37	5	14%
E3 - Mouth of Drew Creek	37	4	11%
E4 - Elk Creek above Drew Creek	37	12	32%
E5 - Mouth of Joe Hall Creek	31	17	55%
E6 - Elk Crk above Joe Hall Creek	21	5	24%
E7 - Brownie Creek near Mouth	37	12	32%
E6a - Elk Creek above Brownie	16	6	38%
E8 - Mouth of Shed Creek (Flat Crk)	38	6	16%
E9 - Elk Creek above Shed Creek	38	13	34%
E1 - Mouth of Elk Creek	38	8	21%
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump.)	38	4	11%
ST1 - Mouth of Stouts Creek	37	3	8%
SU2 - South Umpqua below Stouts Creek	38	4	11%

Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	< 10 NTU
	Low Concern	Between 1 % and 9% of samples ≥10NTU
	High Concern	Between 10% and 20% ≥10 NTU
	Extreme Concern	20% or more ≥10 NTU

Table 16. Turbidity levels year-round Elk Creek/Tiller Area Sites 2008-2013.

Turbidity Levels, Summer and Winter, Elk Creek/Tiller Area Sites 2008-2013

SITE	Summer (May 1 - Sept.30)			Winter (Oct 1-April 30)		
	Total # Samples	# > 10 NTU	% > 10 NTU	Total # Samples	# > 10 NTU	% > 10 NTU
E2 - Callahan Creek	17	0	**0%**	20	5	**25%**
E3 - Mouth of Drew Creek	17	0	**0%**	20	4	**20%**
E4 - Elk Creek above Drew Creek	17	3	**18%**	20	**9**	**45%**
E5 - Mouth of Joe Hall Creek	11	3	**27%**	20	14	**70%**
E6 - Elk Creek above Joe Hall Creek	9	1	**11%**	12	4	**33%**
E6a - Elk Creek above Brownie	8	1	**13%**	8	5	**63%**
E7 - Brownie Creek near Mouth	15	0	**0%**	22	11	**50%**
E8 - Mouth of Shed Creek (Flat Creek)	17	0	**0%**	21	6	**29%**
E9 - Elk Creek above Shed Creek	16	2	**13%**	22	11	**50%**
E1 - Mouth of Elk Creek	17	1	**8%**	21	7	**33%**
SU1 - South Umpqua above Elk Creek	17	0	**0%**	21	4	**19%**
ST1 - Mouth of Stouts Creek	16	0	**0%**	21	3	**14%**
SU2 - South Umpqua below Stouts Creek	17	0	**0%**	21	4	**19%**

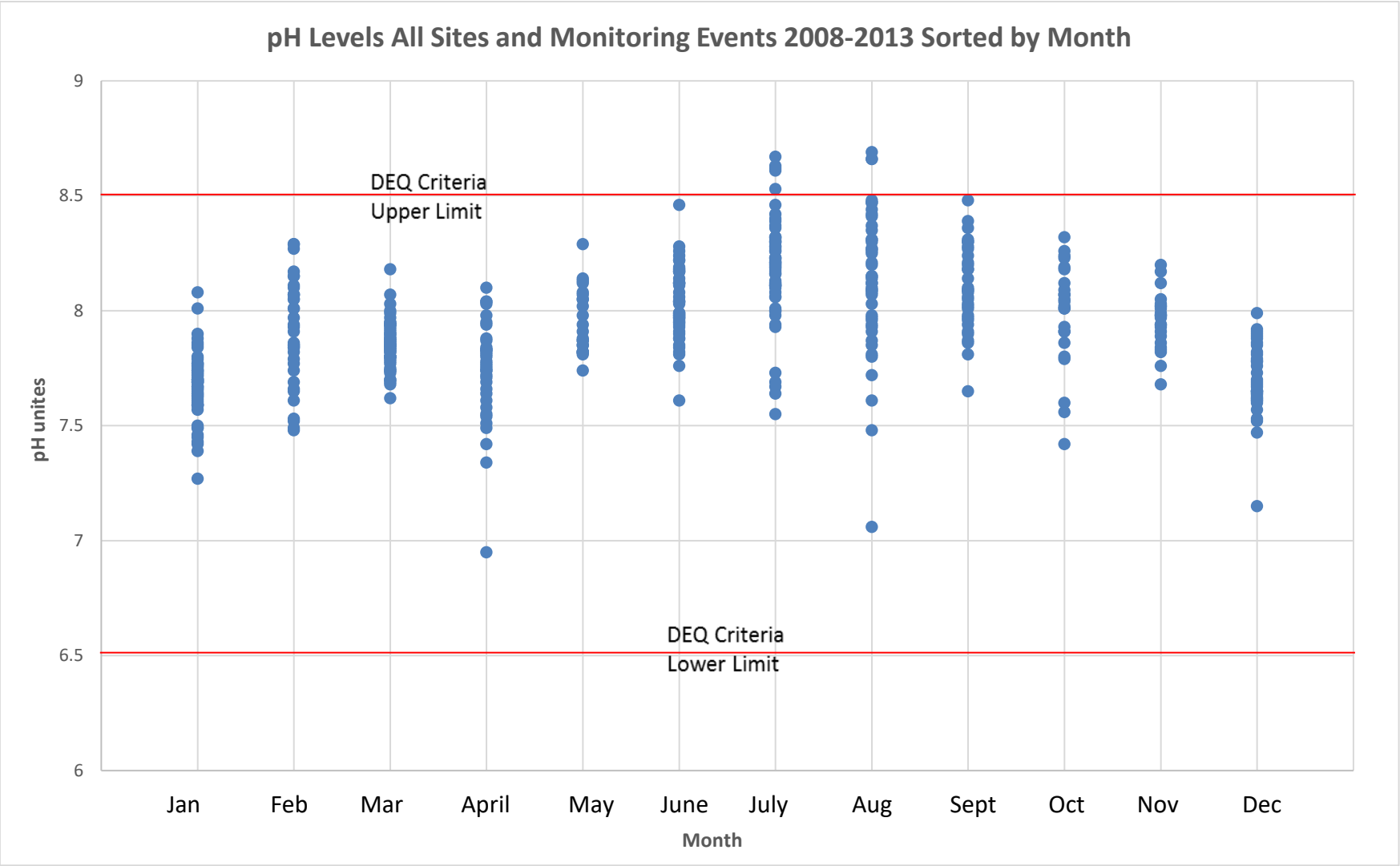
Rating	Color	Turbidity
No Concern		All samples < 10 NTU
Low Concern		Between1 % and 9% of samples 10NTU or greater
High Concern		Between 10% and 20% of samples 10 NTU or greater
Extreme Concern		20% or more of samples 10 NTU or greater

Table 17. Turbidity levels summer and winter Elk Creek/Tiller area sites 2008-2013 with Color Key.

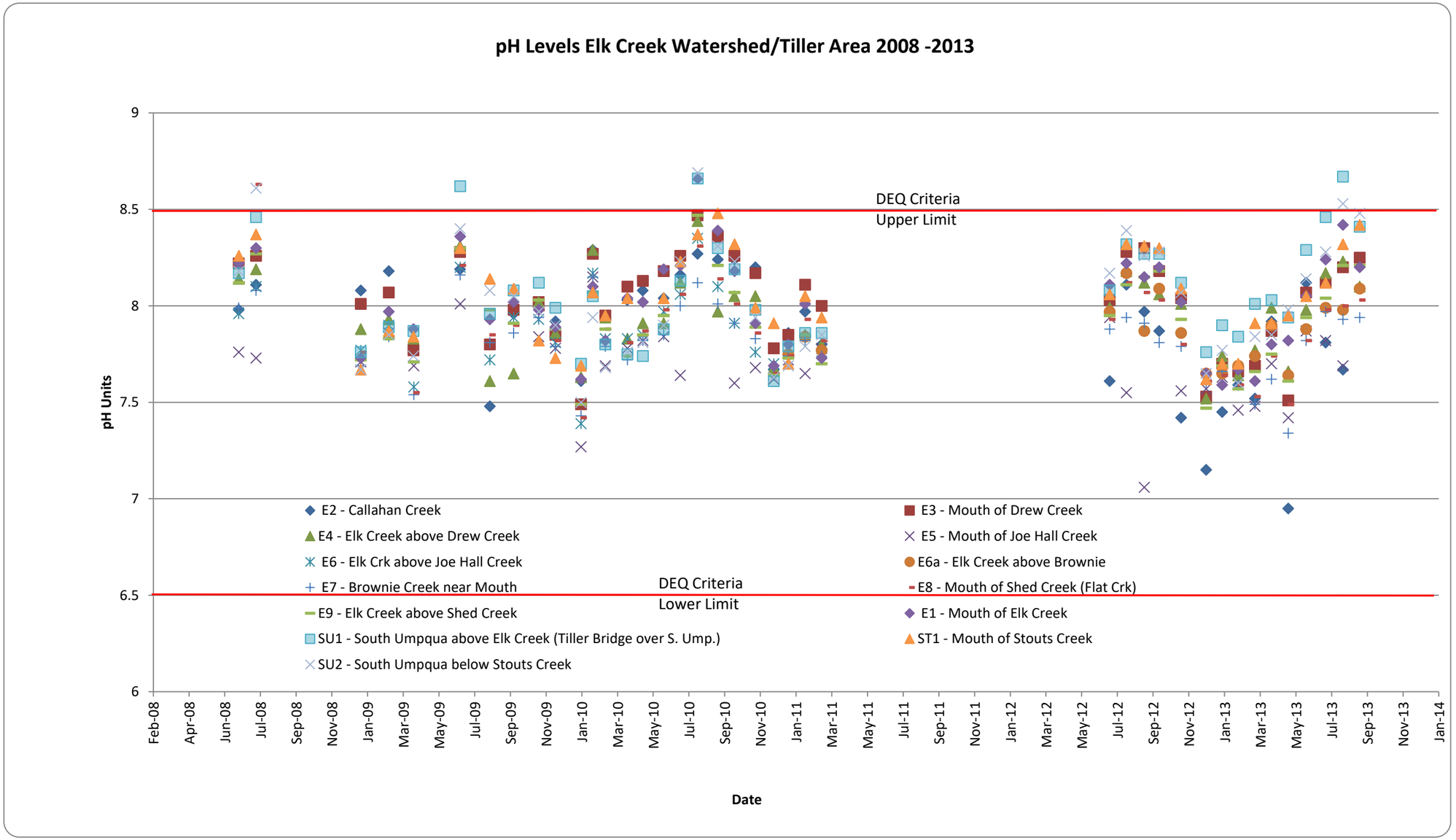
RESULTS – Elk Creek/Tiller Area

pH

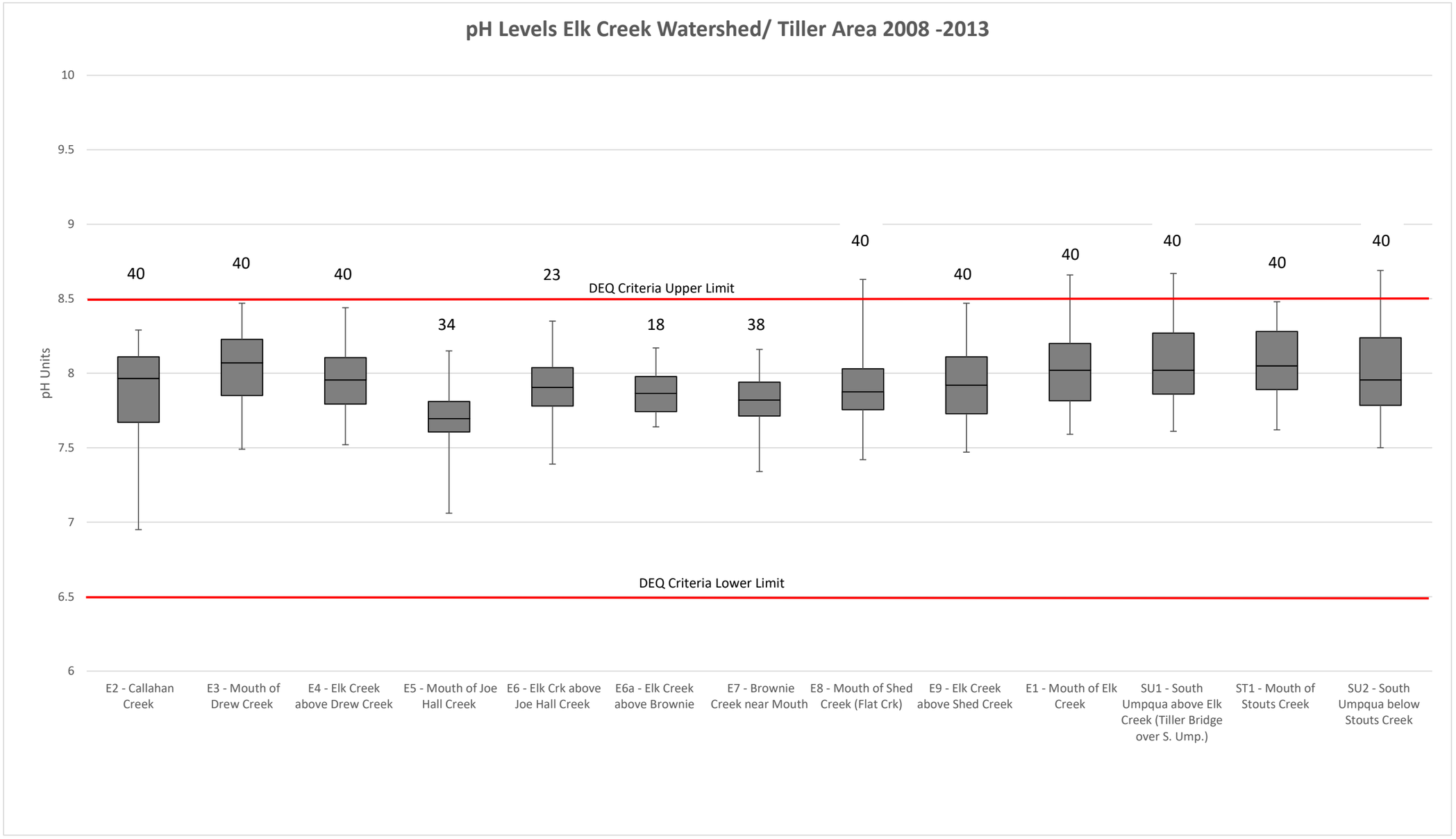
Three monitoring sites exceeded the DEQ maximum pH of 8.5 often enough to be rated of "Extreme Concern." The South Umpqua above Elk Creek, South Umpqua below Stouts Creek and Elk Creek at the mouth. Seven sites had pH values ≥8.25 which we rated as "Moderate Concern" because there is a good chance that they would have surpassed the 8.5 level if sampled later in the day. Three sites, Joe Hall at its mouth, Elk Creek above Brownie and Brownie Creek near its mouth had no pH readings ≥ 8.25. Elevated pH levels at all sites occurred during summer months, as would be expected due to heavy algal growth, see **Table 18** for pH ratings of all streams monitored in the Elk Creek/Tiller area. At no time did the pH level fall below the lower limit of pH 6.5 at any of the Elk Creek/Tiller Area sites.



Graph 23.pH levels sorted by month for all sites and events 2008-2013 for Elk Creek/Tiller Area.



Graph 24. pH levels Elk Creek/Tiller area 2008-2013 by site.



Graph 25.Box plot of pH levels by site 2008-2013 Elk Creek/Tiller area, numbers indicate sample events.

Station ID - Site Description	Upper pH Criteria	Lower pH Criteria
E2 - Callahan Creek		
E3 - Mouth of Drew Creek		
E4 - Elk Creek above Drew Creek		
E5 - Mouth of Joe Hall Creek		
E6 - Elk Creek above Joe Hall Creek		
E7 - Brownie Creek near Mouth		
E6a - Elk Creek above Brownie		
E8 - Mouth of Shed Creek (Flat Creek)		
E9 - Elk Creek above Shed Creek		
E1 - Mouth of Elk Creek		
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump.)		
ST1 - Mouth of Stouts Creek		
SU2 - South Umpqua below Stouts Creek		

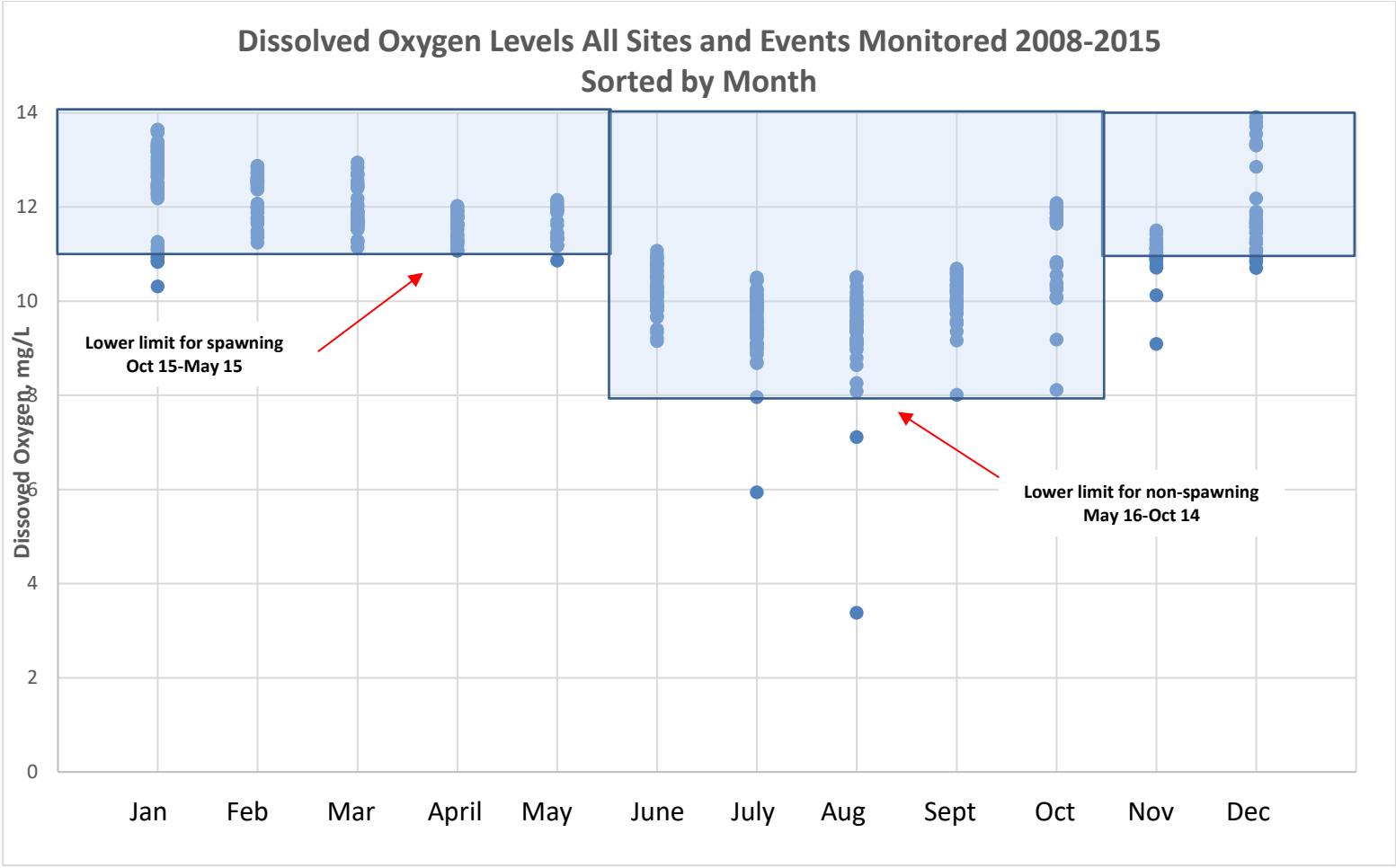
pH Rating Code			
Rating	**Color**	**Upper pH Criteria**	**Lower pH Criteria**
No Concern		None above 8.25	None below 6.75
Low Concern		1 ≥ 8.25	1 ≤ 6.75
Moderate Concern		2 or more ≥ 8.25 or 1 ≥ 8.5	2 ≤ 6.75 or 1 ≤ 6.5
Extreme Concern		2 or more ≥ 8.5	2 or more ≤ 6.5

Table 18. Elk Creek/Tiller area sites pH ratings and color code table.

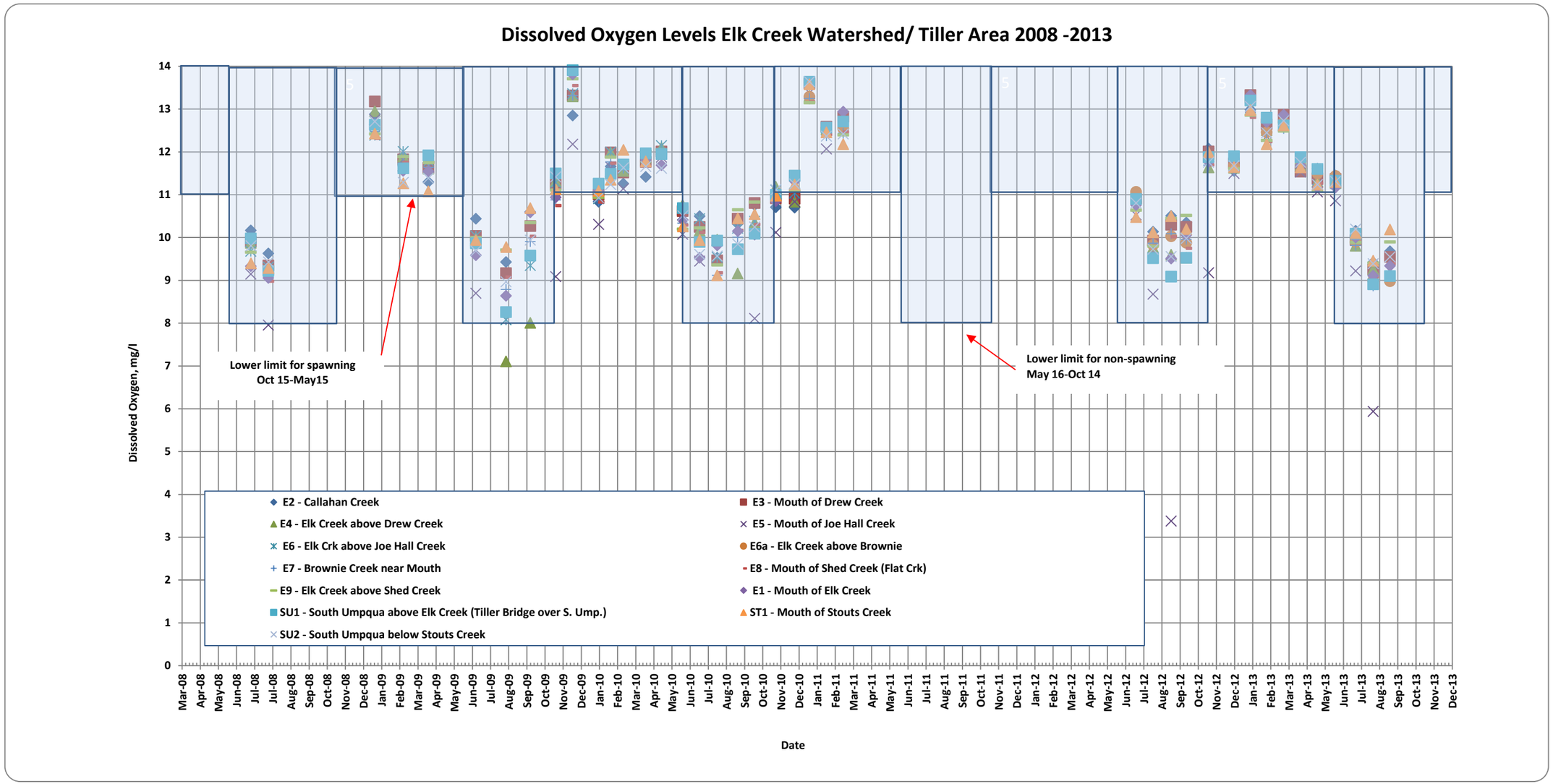
RESULTS – Elk Creek/Tiller Area

Dissolved Oxygen

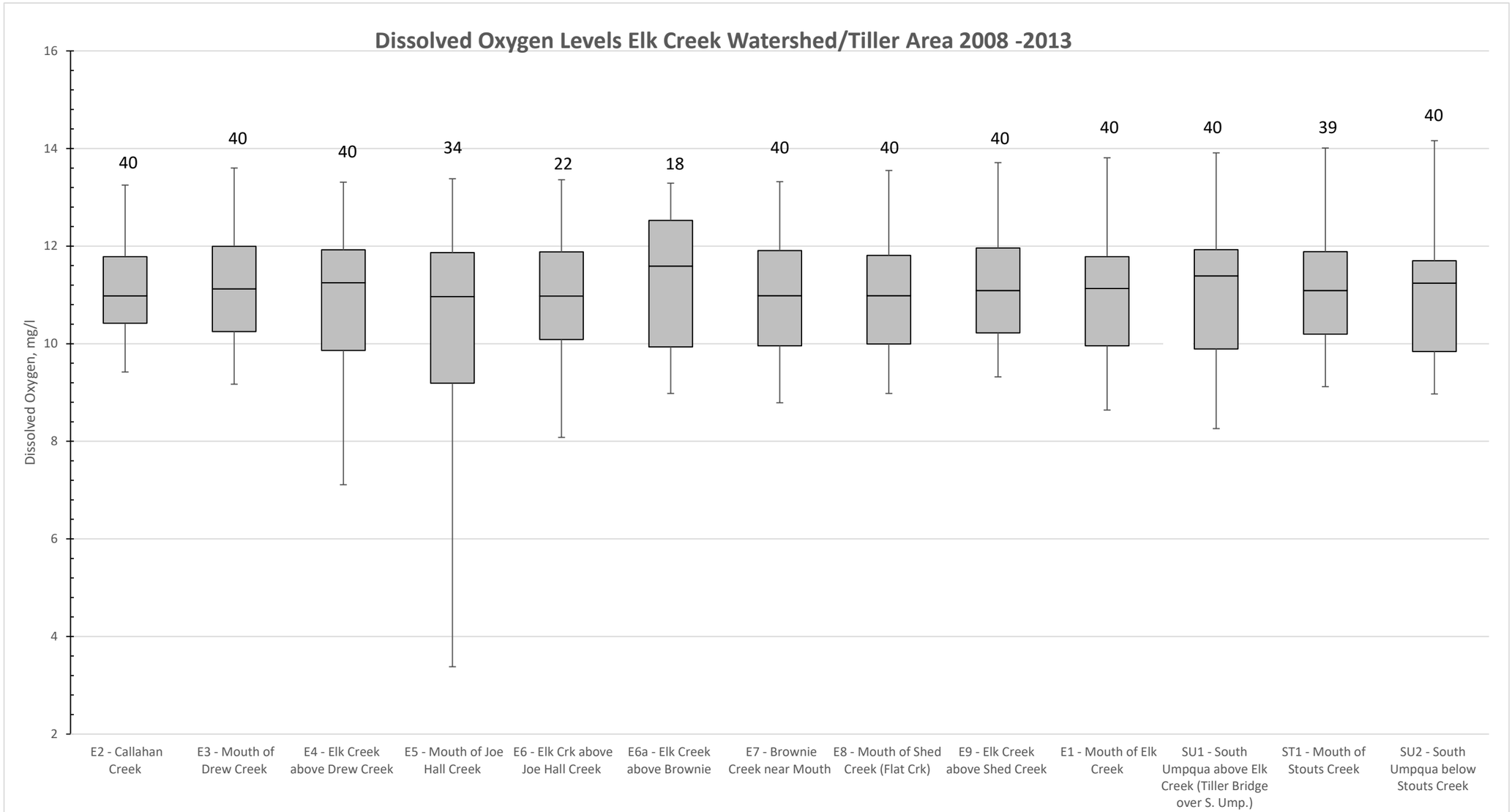
Three sites, E6a - Elk Creek above Brownie, E1 - Mouth of Elk Creek, and ST1 - Mouth of Stouts Creek had no exceedances of the DEQ dissolved oxygen criteria for both spawning and non-spawning ratings, see **Table 19**. Almost all exceedances occurred during the spawning period. E5 - Mouth of Joe Hall Creek and SU1 - South Umpqua above Elk Creek had dissolved oxygen levels of "Extreme Concern." **Graph 28** indicates that when the total data is evaluated in box plots, all of the sites indicated that 25%, the upper quartile, (see **Appendix H: Interpreting a Box Plot**) of their data was above 11 mg/l, and 50 % (the median quartile) was above 10.5 with many being right at 11. It is evident that salmon are reproducing well in this area even if a few times conditions are not optimal.



Graph 26. Dissolved oxygen levels sorted by month for all sites and monitoring evens Elk Creek/Tiller area 2008-2015.



Graph 27. Dissolved oxygen levels by site in Elk Creek/Tiller area 2008-2013, shaded areas depict DEQ spawning and non-spawning criteria.



Graph 28. Box plot of dissolved oxygen levels 2008-2013 Elk Creek/Tiller area by site. The numbers above the box plots are the number of sampling events.

	Non-spawning Season May 16-October 14				Spawning Season October 15-May 15			
	Total # Samples	# Below Minimum D.O. Criteria of 8 mg/l	% Below Minimum D.O. Criteria of 8 mg/l	Rating	Total # Samples	# Below Minimum D.O. Criteria of 11 mg/l	% Below Minimum D.O. Criteria of 11 mg/l	Rating
E2 - Callahan Creek	18	0	0%		22	3	14%	
E3 - Mouth of Drew Creek	18	0	0%		22	2	9%	
E4 - Elk Creek above Drew Creek	18	1	6%		22	1	5%	
E5 - Mouth of Joe Hall Creek	12	3	25%	**	22	5	23%	
E6 - Elk Creek above Joe Hall Creek	10	0	0%		12	1	8%	
E7 - Brownie Creek near Mouth	18	0	0%		22	3	14%	
E6a - Elk Creek above Brownie	8	0	0%		10	0	0%	
E8 - Mouth of Shed Creek (Flat Creek)	18	0	0%		22	1	5%	
E9 - Elk Creek above Shed Creek	18	0	0%		22	1	0%	
E1 - Mouth of Elk Creek	18	0	0%		22	0	0%	
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump.)	18	0	0%		22	6	27%	
ST1 - Mouth of Stouts Creek	18	0	0%		21	0	0%	
SU2 - South Umpqua below Stouts Creek	18	0	0%		22	2	9%	

**Goes dry

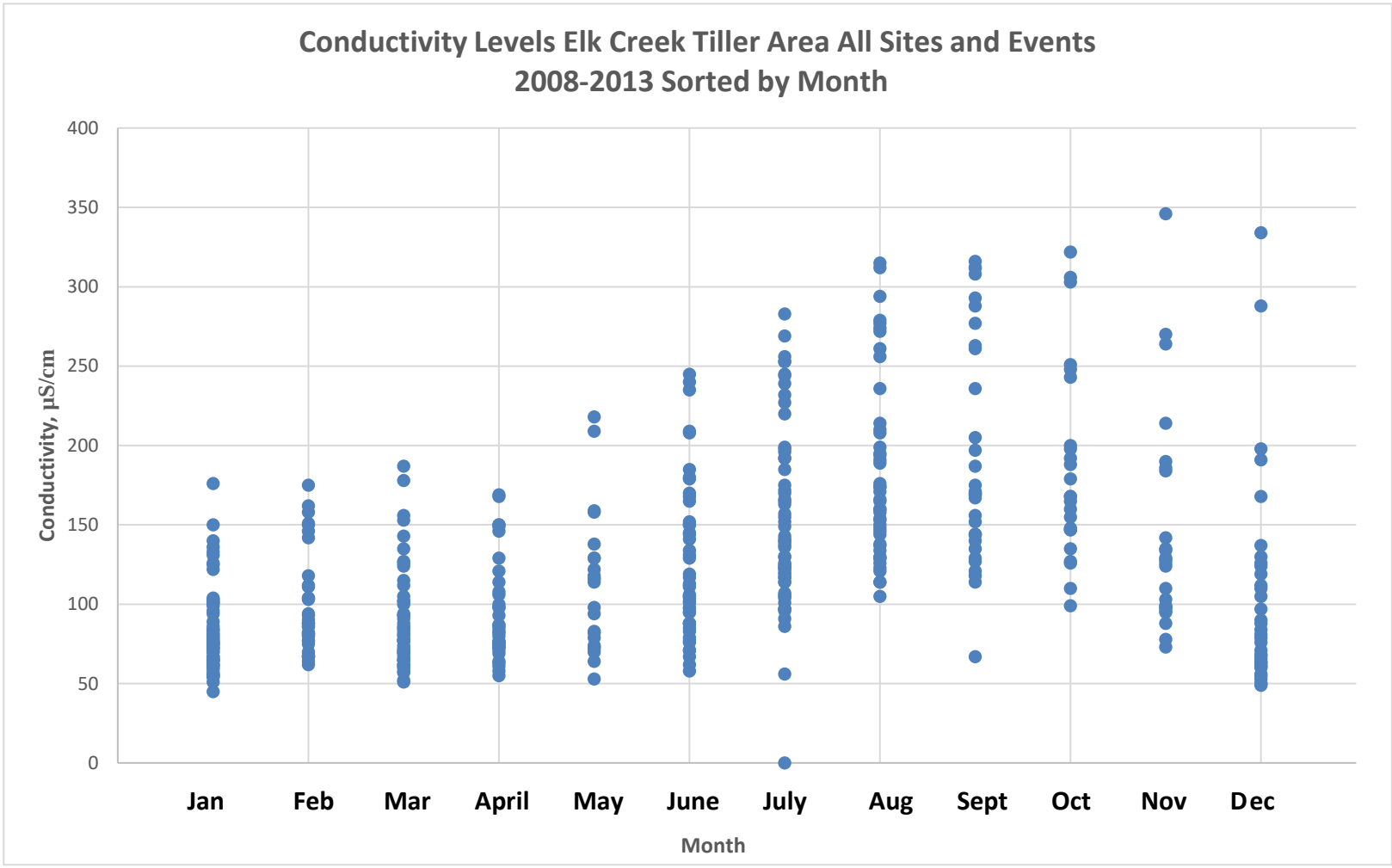
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	0% (No Exceedances)
	Low Concern	≥1% ≤9% Exceedances
	High Concern	≥10% ≤19% Exceedances
	Extreme Concern	≥20% Exceedances

Table 19. Rating of Elk Creek Tiller area sites for stream dissolved oxygen levels compared to Spawning Season and Non-Spawning Season DEQ Criteria with Color Key.

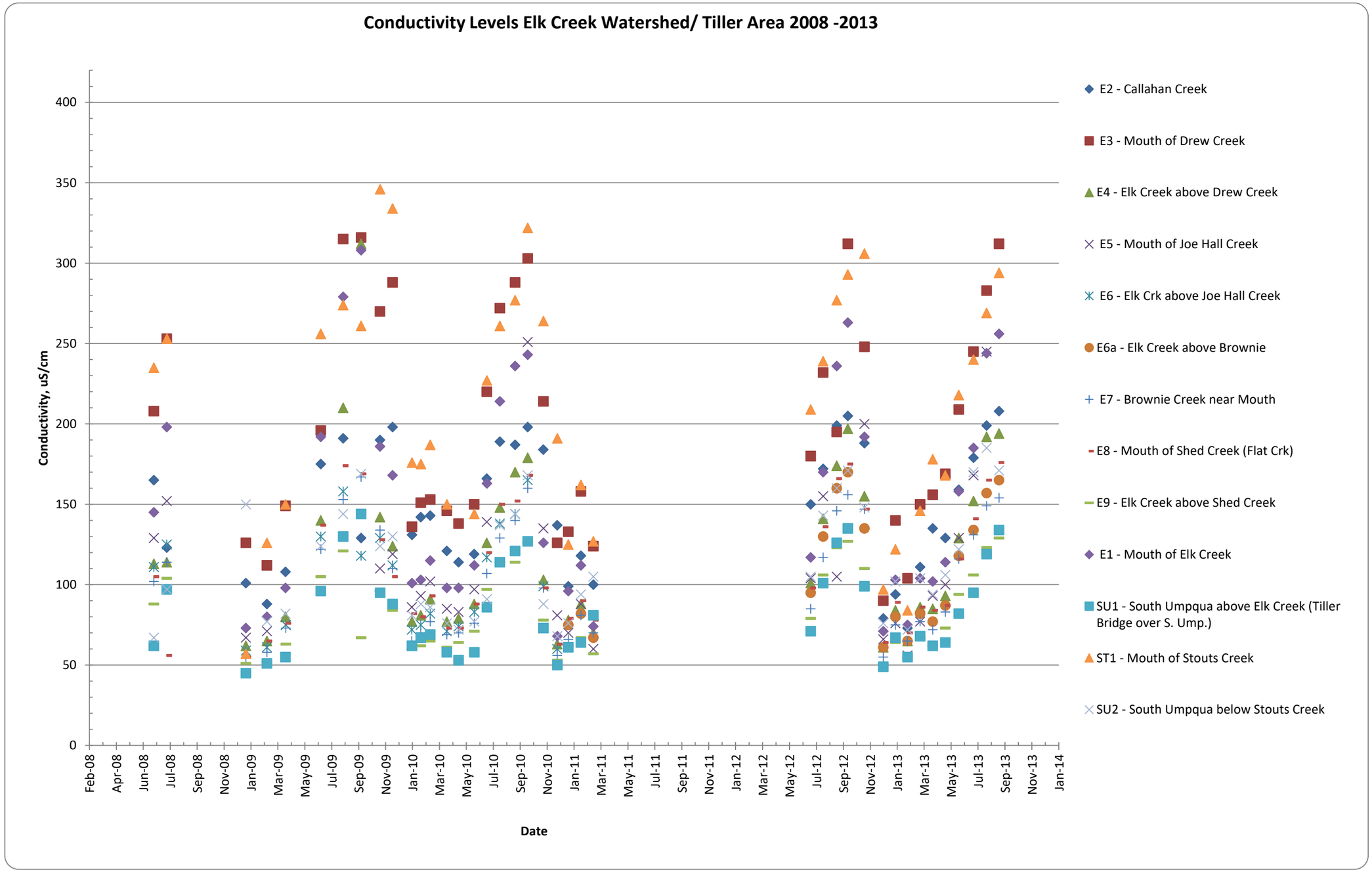
RESULTS – Elk Creek/Tiller Area

Conductivity

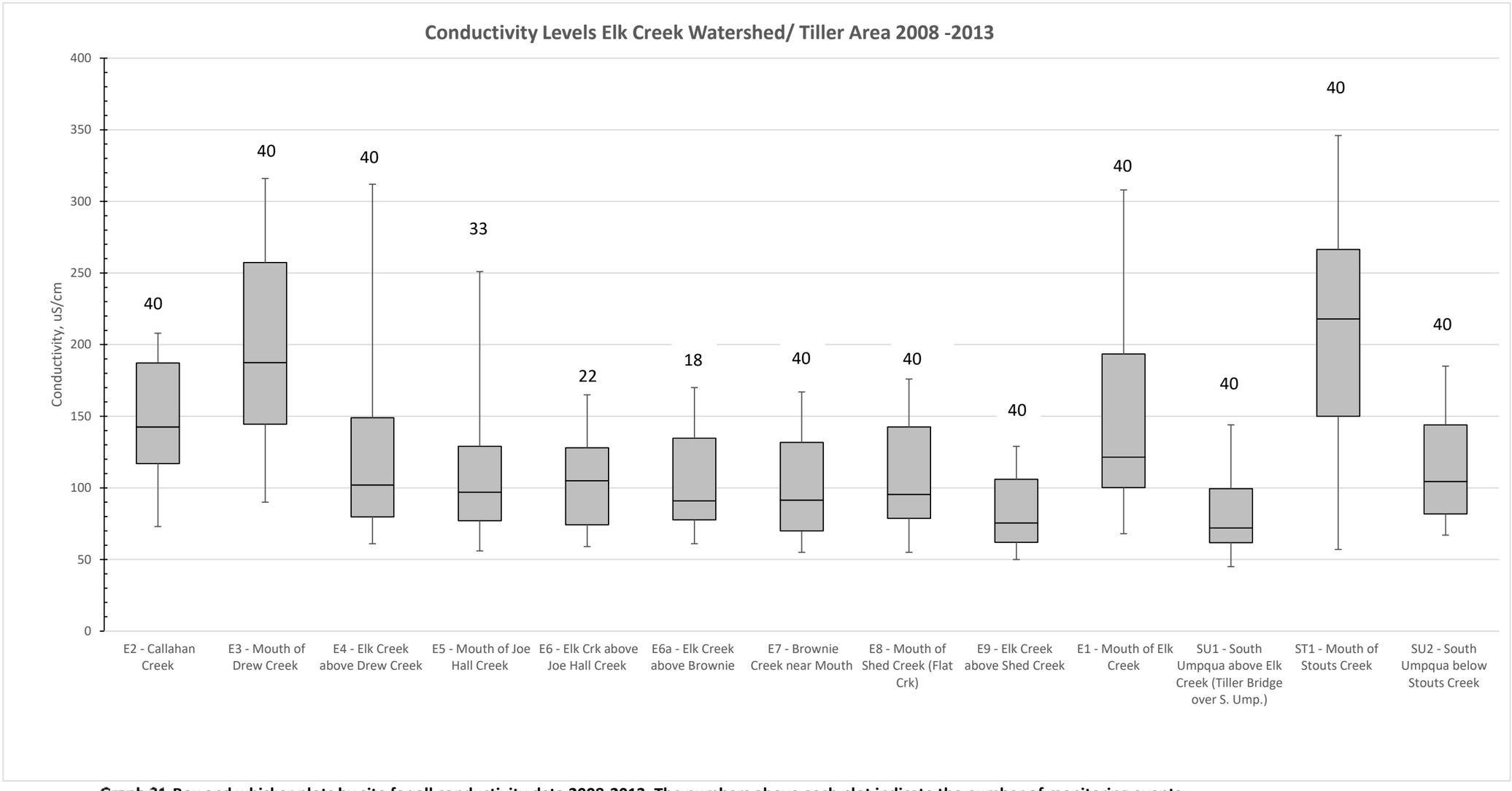
All conductivity levels in the Elk Creek/Tiller monitoring area were within normal ranges for the Umpqua Basin, and none exceeded 500 us/cm. Two tributaries, Drew Creek and Stouts Creek had the highest levels which is most likely indicative of differing geological makeup.



Graph 29.Conductivity levels for all Elk Creek Tiller area sites and monitoring events 2008-2013 sorted by month.



Graph 30.Elk Creek/Tiller Area conductivity levels all monitoring events 2008-2013 sorted by site.



Graph 31.Box and whisker plots by site for all conductivity data 2008-2013. The numbers above each plot indicate the number of monitoring events.

Conductivity Level Rating Elk Creek Tiller Area Monitoring Sites 2008-2013

Station ID - Site Description	Conductivity Rating
E2 - Callahan Creek	
E3 - Mouth of Drew Creek	
E4 - Elk Creek above Drew Creek	
E5 - Mouth of Joe Hall Creek	
E6 - Elk Creek above Joe Hall Creek	
E6a - Elk Creek above Brownie	
E7 - Brownie Creek near Mouth	
E8 - Mouth of Shed Creek (Flat Creek)	
E9 - Elk Creek above Shed Creek	
E1 - Mouth of Elk Creek	
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump.)	
ST1 - Mouth of Stouts Creek	
SU2 - South Umpqua below Stouts Creek	

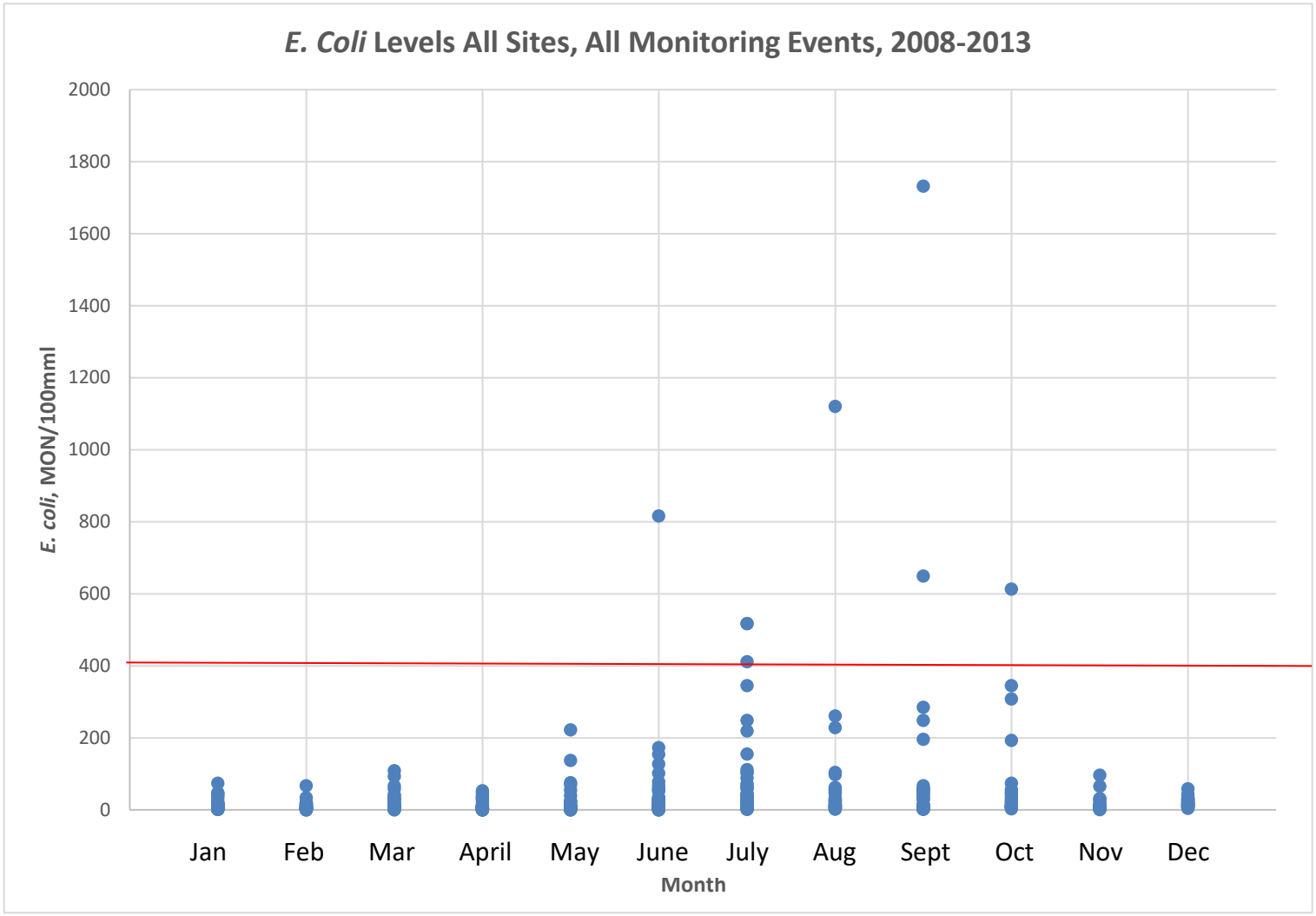
Rating	Color	Conductivity Level
No Concern		<500 uS/cm
Concern		>500 uS/cm

Table 20. Conductivity Level Rating Elk Creek Tiller Area Monitoring sites 2008-2013.

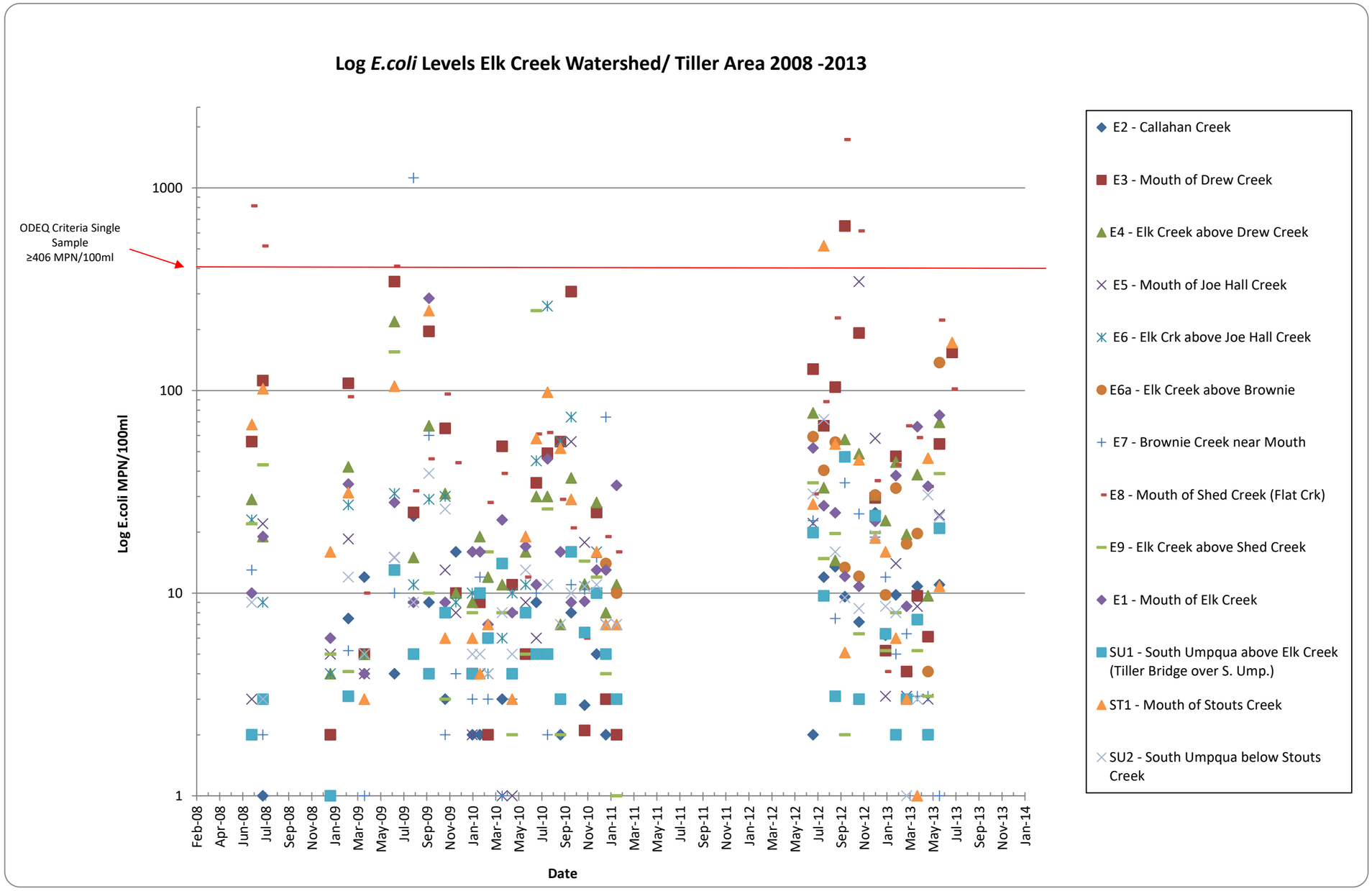
RESULTS – Elk Creek/Tiller Area

E. coli Bacteria

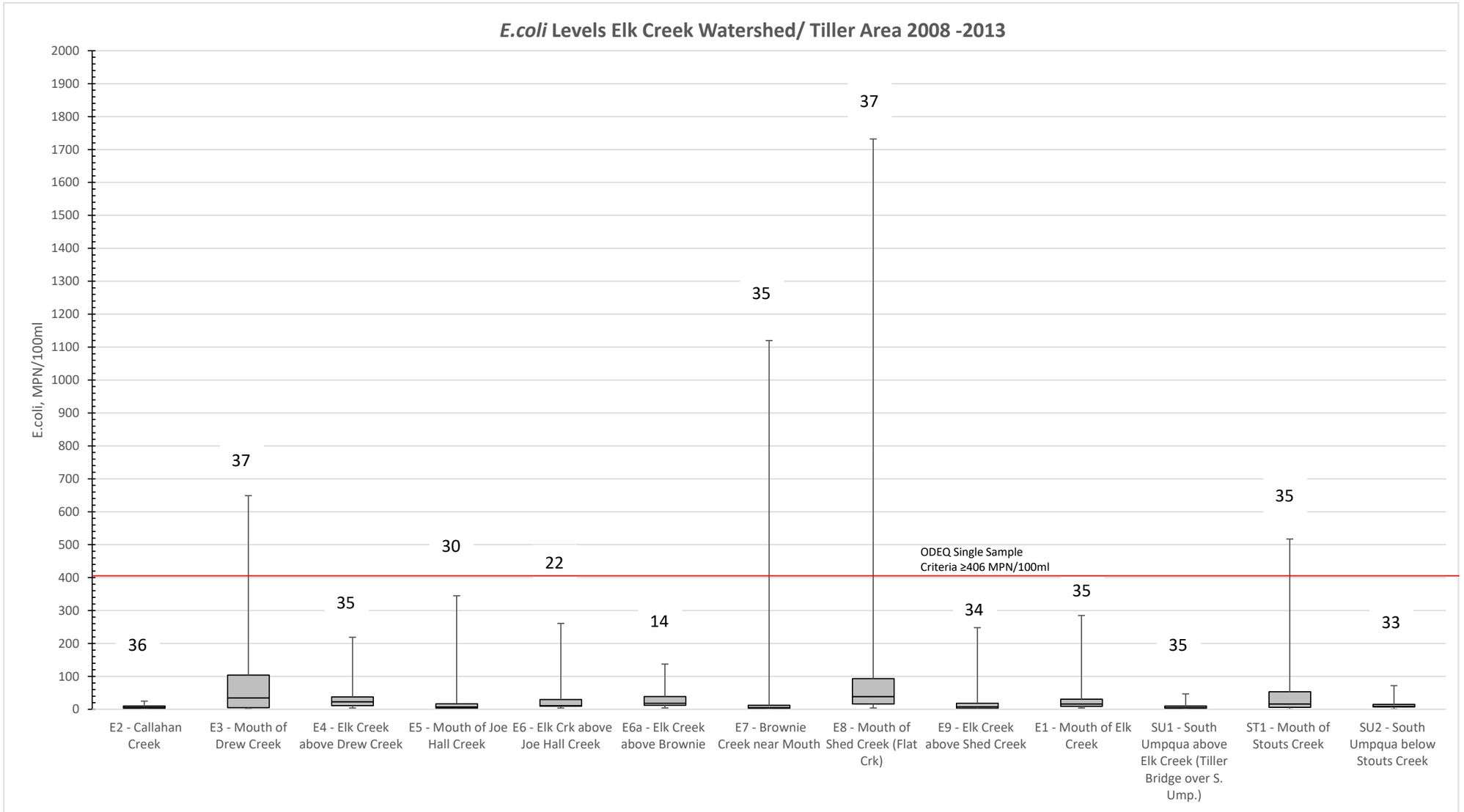
Three monitoring sites in the Elk Creek/Tiller monitoring area showed exceedances of the DEQ *E. coli* criteria (406 MPN/100ml), and those occurred in summer. Those sites were Brownie Creek at its mouth, Drew Creek at the mouth and Shed Creek at its mouth. There was only a single exceedance of DEQ criteria during the winter and that occurred at the mouth of Shed Creek. Shed Creek had the worst overall *E. coli* ratings for this watershed, See **Table 22** for the *E. coli* rating of all creeks in the Elk Creek/Tiller monitoring area. Ratings table. Ten sites never exceeded the ODEQ criteria of 406 MPN/ml for either summer or winter.



Graph 32.*E. coli* Levels all sites and monitoring events 2008-2013 sorted by month.



Graph 33.Log *E. coli* levels Elk Creek/Tiller 2008-2013 by site.



Graph 34. Box and whisker plots of *E. coli* levels for Elk Creek Tiller Area sites 2008-2013. The number above the plots represents the number of monitoring events.

E. coli Levels Elk Creek Tiller Area 2008-2013 Exceeding 126 or 406 MPN/100ml

Station ID - Site Description	126 or Greater		406 or Greater		Total # of Samples
	Count	% of Samples	Count	% of Samples	
E2 - Callahan Creek	0	0%	0	0%	36
E3 - Mouth of Drew Creek	7	19%	1	3%	37
E4 - Elk Creek above Drew Creek	1	3%	0	0%	35
E5 - Mouth of Joe Hall Creek	1	3%	0	0%	30
E6 - Elk Crk above Joe Hall Creek	1	5%	0	0%	22
E6a - Elk Creek above Brownie	1	7%	0	0%	14
E7 - Brownie Creek near Mouth	1	3%	1	3%	35
E8 - Mouth of Shed Creek (Flat Crk)	7	19%	5	14%	37
E9 - Elk Creek above Shed Creek	2	6%	0	0%	34
E1 - Mouth of Elk Creek	1	3%	0	0%	35
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump.)	0	0%	0	0%	35
ST1 - Mouth of Stouts Creek	3	9%	1	3%	35
SU2 - South Umpqua below Stouts Creek	0	0%	0	0%	33

Table 21. Elk Creek Tiller area sites % of monitoring events exceed 126 or 406 MPN/ml 2008-2013.

Rating of Elk Creek Sites for *E. coli*, Summer and Winter

SITE	Summer (May1 – Sept 30)							Winter (Oct 1 – April 30)						
	Total # Summer Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating	Total # Winter Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating
Callahan Creek above mouth	15	0	0%		0	0%		21	0	0%		0	0%	
Mouth Drew Creek	15	3	20%		1	7%		22	0	0%		0	0%	
Elk Creek above Drew Creek	18	0	0%		0	0%		22	0	0%		0	0%	
Mouth Joe Hall Creek	12	0	0%		0	0%		21	1	5%		0	0%	
Elk Creek above Joe Hall Creek	10	1	10%		0	0%		12	0	0%		0	0%	
Brownie Creek near mouth	18	1	6%		1	6%		22	0	0%		0	0%	
Elk Creek above Brownie Creek	8	0	0%		0	0%		10	0	0%		0	0%	
Mouth Shed Creek (Flat Creek)	18	5	28%		4	22%		22	1	5%		1	5%	
Elk Creek above Shed Creek	18	1	6%		0	0%		22	0	0%		0	0%	
Mouth Elk Creek	18	1	6%		0	0%		22	0	0%		0	0%	
South Umpqua above Elk Creek (Tiller, Bridge over S Ump)	18	0	0%		0	0%		22	0	0%		0	0%	
Stouts Creek at mouth	17	2	12%		0	0%		22	0	0%		0	0%	
South Umpqua below Stouts Creek	18	0	0%		0	0%		22	0	0%		0	0%	

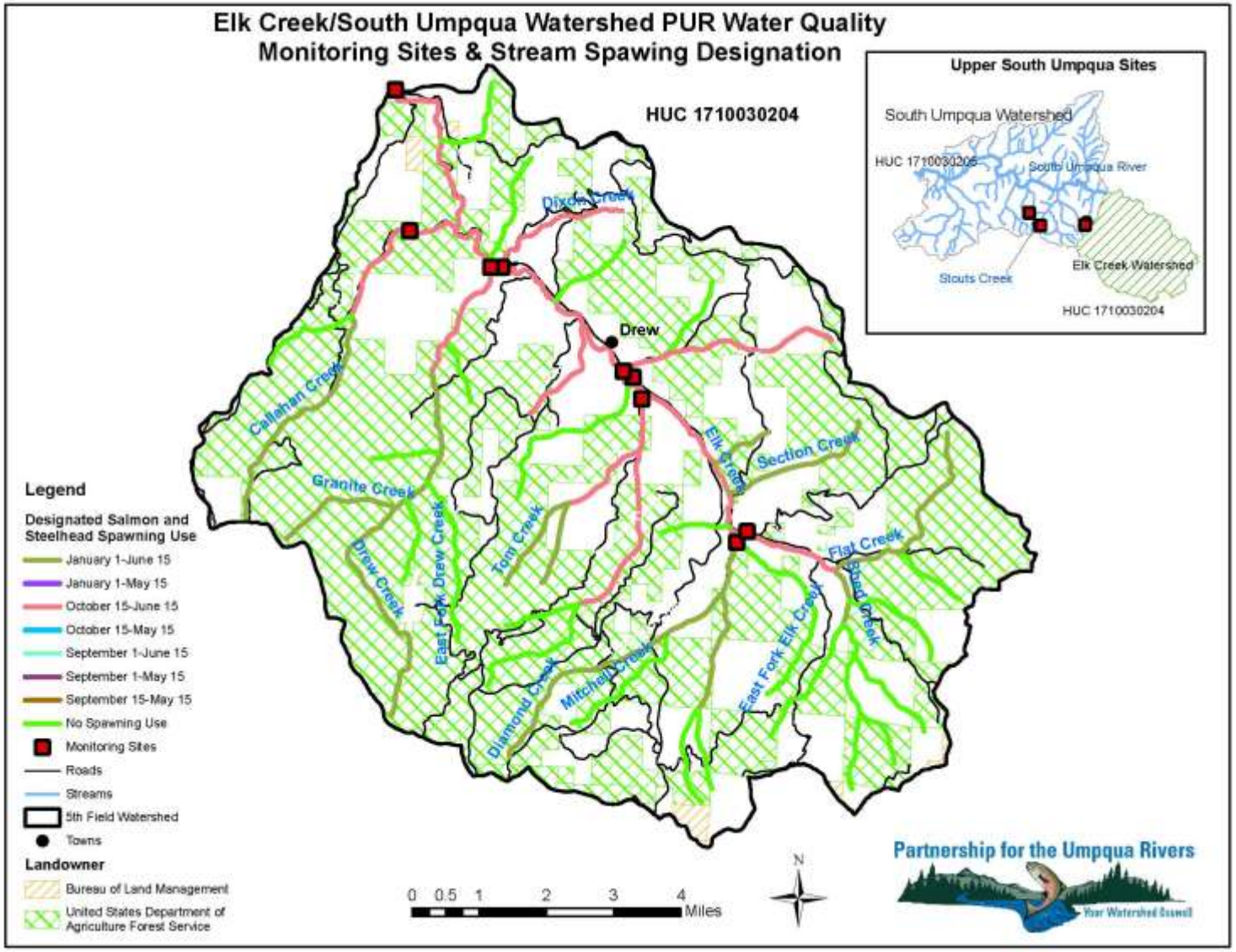
Table 22. ***E. coli*** **ratings for summer and winter Elk Creek Tiller area sites 2008-2013.**

Rating	Color	EPA Criteria	ODEQ Criteria
No Concern (below standard)		< 235	< 406
Concern (exceeds standard)		≥ 235	≥ 406

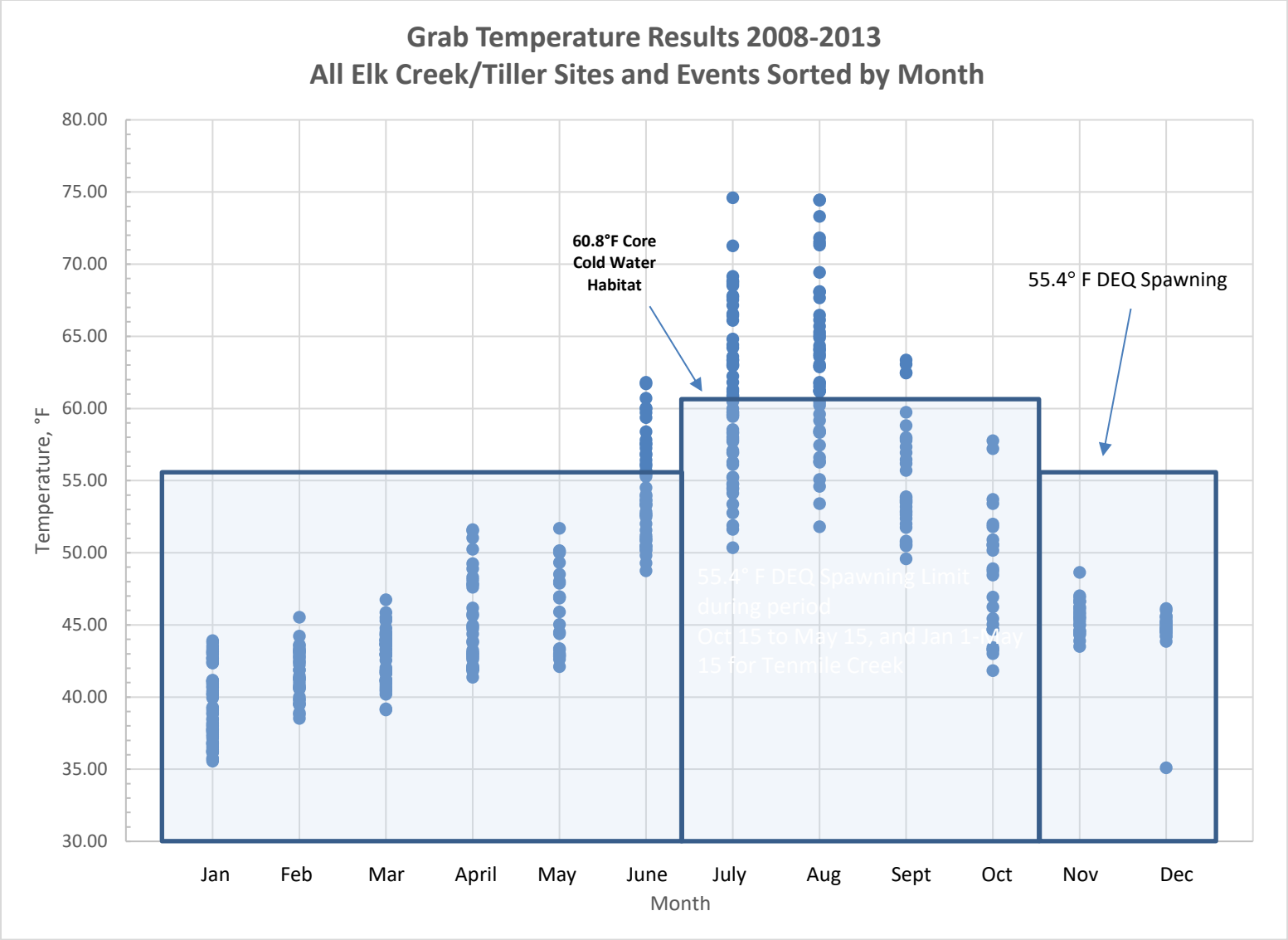
RESULTS – Elk Creek/Tiller Area

Grab Sample Temperature Monitoring

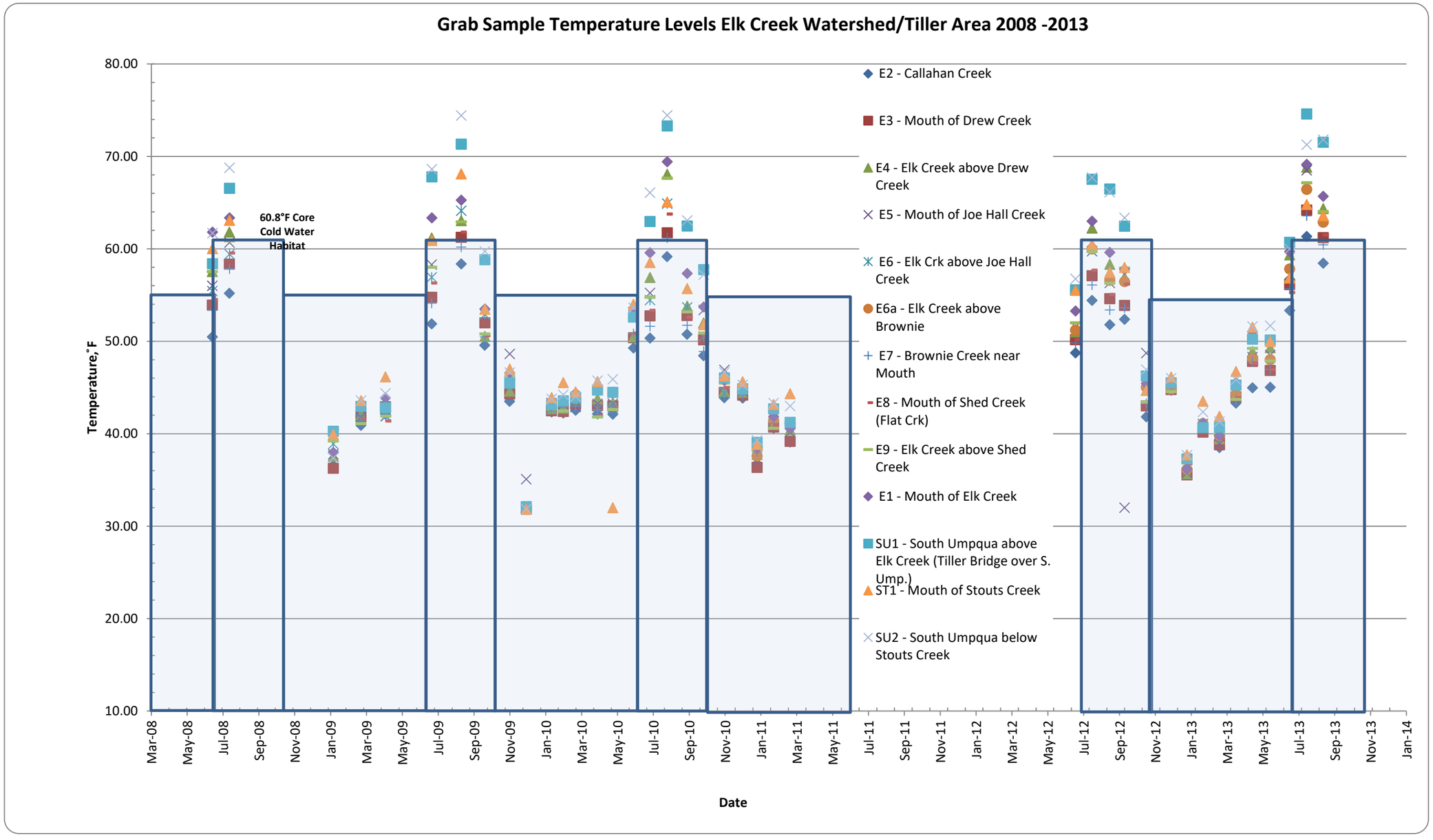
Of the 13 monitoring sites in the Elk Creek/Tiller area, the USFA only recorded continuous temperature readings at six sites, except 2015 when only two sites are reported under continuous temperature. Temperature was recorded at each of our grab sample monitoring events, and though this does not allow evaluation for DEQ temperature criteria, it is included here for evaluation and stream rating in order to provide additional information for planning restoration sites. The rating table of all sites in the Elk Creek/Tiller area for temperature is displayed in **Table 23**. Of the sites, South Umpqua below Stouts Creek and Stouts Creek at its mouth, are in the area designated by DEQ as "Migration and Rearing" and need to meet the criteria of <64.4^{o} F. The South Umpqua above Elk Creek is designated "Non-spawning." The other 10 sites fall into designated area for "Core Cold Water" which must meet the criteria of <60.8^{o} F. **Table 23** accounts for these different stream criteria. All sites exceeded their appropriate criteria.



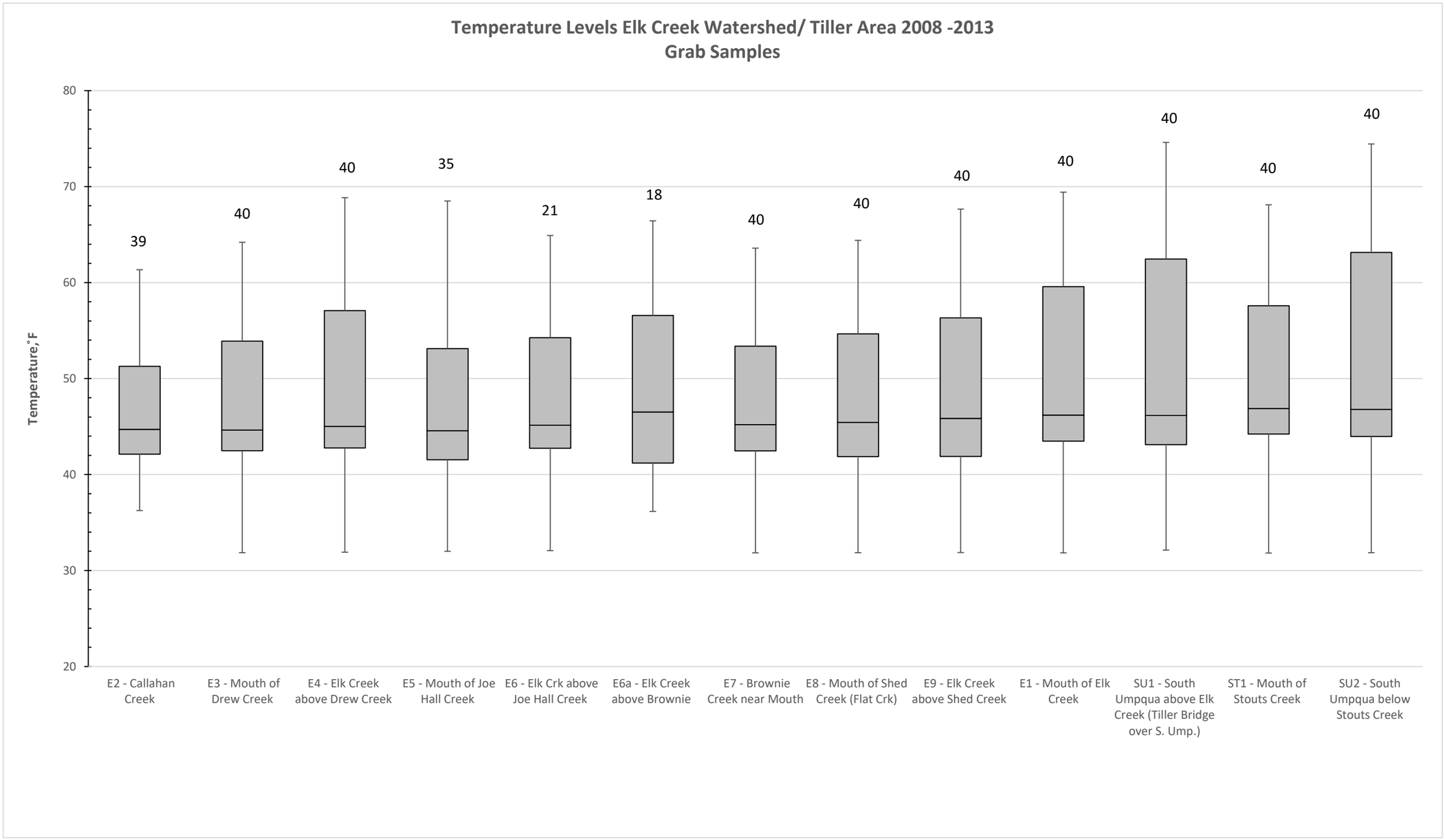
Map 7. Elk Creek/South Umpqua Watershed PUR water quality monitoring sites and streams' spawning designations.



Graph 35. Grab sample temperature monitoring 2008-2013 using all sites and monitoring events, sorted by month.



Graph 36.Grab sample temperature values for all Elk Creek/Tiller Area sites 2008-2013.



Graph 37.Box Plots of Temperature Levels Elk Creek Watershed/ Tiller Area 2008 -2013. The number above each plot represents the number of monitoring events.

Grab Sample Temperature Ratings for Elk Creek/Tiller Area Monitoring Sites 2008-2014

SITE	Grab Sample Temperatures Core Cold Water Habitat* ≤60.8° F	Grab Sample Temperatures Rearing & Migration ≤64.4°F	Grab Sample Temperatures Spawning◊ ≤55.4° Oct 15-June15F
Callahan Creek*		N/A	
Mouth Drew Creek*		N/A	
Elk Creek above Drew Creek*		N/A	
Mouth Joe Hall Creek*		N/A	
Elk Creek above Joe Hall Creek*		N/A	
Brownie Creek near mouth *		N/A	
Elk Creek above Brownie*		N/A	
Mouth Shed Creek (Flat Creek)*		N/A	
Elk Creek above Shed Creek*		N/A	
Mouth Elk Creek*		N/A	
South Umpqua above Elk Creek (Tiller, Bridge over S Ump)*	N/A		N/A
Mouth Stouts Creek ◊	N/A		
South Umpqua below Stouts Creek◊	N/A		

Note the first 10 sites should meet the core cold water criteria of < 60.8° F while the last two should meet the rearing and migration temperature of <64.4° F. Both should meet the spawning criteria of 55.4°F. The South Umpqua above Elk Creek need only meet the "Rearing & Migration" criteria of ≤64.4°F.

Rating	Color	Grab Sample Temperatures Core Cold Water Habitat*	Grab Sample Temperatures Rearing & Migration	Grab Sample Temperatures Spawning
Good		All samples < 60.8° F	All samples ≤64.4° F	All samples ≤55° F
Concern		Any samples >60.8° F	Any samples >64.4° F	Any samples >55.4° F

Table 23. Temperature ratings for Elk Creek/Tiller monitoring area sites.

RESULTS – Elk Creek/Tiller Area

Continuous Temperature

PUR partnered with the USFS Tiller Ranger District in the monitoring of the Elk Creek/Tiller area with PUR collecting the grab sample water quality parameters and the Forest Service providing the data from their continuous summer temperature monitoring sites. For this study, we analyzed the USFS data for 2008-2015 for sites that are the same as, or in proximity to, PUR's water quality monitoring sites for those same years.

Table 28displays the ratings for the continuous temperature data collected from 2008-2015 in the Elk Creek/Tiller Watershed where data was collected. **Table 29** provides the summary rating table for both continuous 7-ADM Stream Temperature values and grab sample levels for the Watershed. This table indicates that all of the Elk Creek/Tiller area sites rank as needing improvement for reducing temperature levels to meet the criteria. Of the sites, South Umpqua below Stouts Creek and Stouts Creek at its mouth, are in the area designated by DEQ as Migration and Rearing and need to meet the criteria of <64.4^{o} F. The other ten sites fall into designated area for Core Cold Water which must meet the criteria of <60.8^{o} F.

Looking at the Seasonal Maximum temperature a few of the sites in the Elk Creek/Tiller area exceeded the potentially lethal temperatures Bell (1990, p. 11.4) found for steelhead and cutthroat trout (75.0°F and 73.0°F respectively). These sites were Drew Creek at Mouth in 2008, Elk Creek at Tiller in 2008,2009,2010, and 2015; Shed (Flat) Creek at Mouth in 2009, and the South Umpqua at Tiller above Elk Creek in 2015. No sites except the South Umpqua exceeded the lethal stream temperatures Brett (1952, pg. 282-3) found for young coho and Chinook salmon, acclimated to 70°F, of ≥78.8°F. Though the temperatures of these sites exceed the lethal limit for steelhead and/or cutthroat trout, due to the diurnal fluctuation of stream temperatures associated with night cooling, the streams are not above these temperatures for very long.

Graph 38 and **Graph 39** display the temperature readouts from the 2015 loggers at the South Umpqua at Tiller above Elk Creek and the Mouth of Elk Creek. It is interesting to compare the fluctuations in temperatures throughout the summer due to weather patterns as well as the difference between South Umpqua and Elk Creek.

Graph 40 displays the 7-DAM Stream Temperature from 2008 to 2015 of each of the sites. This shows that the tributaries are clearly cooler than Elk Creek itself but vary from year to year between the creeks for highest 7-DAM Stream Temperature.

Site Name	Start Date	Stop date	Seasonal Maximum Stream Temperature		Seasonal Minimum Stream Temperature		Seasonal Maximum ΔT		7-Day Averages			
			Date	(°F)	Date	(°F)	Date	(Δ °F)	Date	Maximum Temp (°F)	Minimum Temp (°F)	ΔT (Δ °F)
Elk Creek/Tiller												
Brownie Creek at Mouth - 2008	07/02/08	09/17/08	08/16/08	68.4	09/03/08	49.9	07/08/08	8.4	08/17/08	66.2	62.3	3.9
Brownie Creek at Mouth - 2009	06/24/09	10/08/09	08/02/09	70.0	10/07/09	42.8	06/27/09	9.1	08/01/09	69.1	65.6	3.5
Brownie Creek at Mouth - 2010	06/16/10	09/26/10	08/16/10	67.8	06/16/10	47.8	07/06/10	11.0	07/27/10	66.5	59.1	7.5
Callahan Creek at Mouth - 2008	06/10/08	09/17/08	08/16/08	67.5	06/12/08	47.4	06/13/08	6.8	08/17/08	65.5	62.4	3.1
Callahan Creek at Mouth - 2009	06/24/09	10/08/09	08/02/09	69.8	10/07/09	43.7	06/27/09	5.9	08/01/09	69.1	66.0	3.1
Callahan Creek at Mouth - 2010	06/16/10	09/26/10	07/27/10	65.2	06/16/10	48.9	07/06/10	6.4	07/27/10	64.5	60.6	3.9
Drew Creek at Mouth - 2008	06/10/08	09/17/08	08/16/08	70.1	06/12/08	47.9	06/13/08	8.1	08/17/08	67.7	63.7	4.0
Drew Creek at Mouth - 2009	06/24/09	10/08/09	07/30/09	73.9	10/07/09	43.4	06/27/09	8.1	07/31/09	72.9	66.9	6.0
Drew Creek at Mouth - 2010	06/16/10	09/26/10	07/27/10	67.6	06/16/10	49.6	07/06/10	7.7	07/27/10	66.7	61.2	5.5
Elk Creek at Tiller - 2008	06/11/08	09/22/08	07/09/08	74.0	06/11/08	49.8	06/27/08	9.3	07/07/08	72.8	66.1	6.7
Elk Creek at Tiller - 2009	06/17/09	09/30/09	08/04/09	74.4	09/30/09	52.9	06/24/09	7.5	08/02/09	73.3	70.4	2.9
Elk Creek at Tiller - 2010	06/23/10	09/22/10	07/28/10	73.9	09/12/10	54.7	07/07/10	9.0	07/27/10	73.0	66.3	6.6
Flat Creek at Mouth - 2008	06/10/08	09/25/08	08/16/08	68.3	06/12/08	44.9	06/27/08	8.2	08/15/08	65.9	61.3	4.6
Flat Creek at Mouth - 2009	06/16/09	10/13/09	07/30/09	75.6	10/12/09	42.2	07/27/09	11.2	07/31/09	74.3	65.4	9.0
Flat Creek at Mouth - 2010	06/18/10	10/23/10	08/16/10	68.8	10/20/10	43.7	08/24/10	10.1	08/16/10	67.0	59.2	7.8
Joe Hall Creek at Mouth - 2008	06/10/08	08/04/08	07/09/08	69.4	06/12/08	46.6	07/11/08	9.6	07/11/08	68.6	59.5	9.1
Joe Hall Creek at Mouth - 2009	06/16/09	07/27/09	07/27/09	72.1	06/23/09	54.2	07/27/09	12.0	07/24/09	69.1	59.7	9.4

Table 24. Continuous temperature results Elk Creek/Tiller 2008-2010.

Site Name	Total Monitored Days Exceeding ODEQ Criteria			% of Days from 6/24-9/17 Exceeding Criteria - Elk Sites			Warmest Day of 7-Day Maximum Stream Temperature			Monitoring Organization or Agency
	Days > 60.8 °F	Days > 64.4 °F	Days > 68 °F	% Days > 60.8 °F	% Days > 64.4 °F	% Days > 68 °F	Date	Maximum Temp (°F)	Minimum Temp (°F)	
Elk Creek/Tiller										
Brownie Creek at Mouth - 2008	*54	*19	*2	*63	*22	*2	08/16/08	68.4	62.7	USFS
Brownie Creek at Mouth - 2009	59	22	6	69	26	7	08/02/09	70.0	67.2	USFS
Brownie Creek at Mouth - 2010	55	23	0	64	27	0	07/27/10	67.3	60.1	USFS
Callahan Creek at Mouth - 2008	57	15	0	66	17	0	08/16/08	67.5	63.2	USFS
Callahan Creek at Mouth - 2009	49	14	8	57	16	9	08/02/09	69.8	67.3	USFS
Callahan Creek at Mouth - 2010	49	7	0	57	8	0	07/27/10	65.2	61.5	USFS
Drew Creek at Mouth - 2008	65	38	4	76	44	5	08/16/08	70.1	64.4	USFS
Drew Creek at Mouth - 2009	83	41	13	94	48	15	07/30/09	73.9	67.6	USFS
Drew Creek at Mouth - 2010	57	28	0	66	33	0	07/27/10	67.6	62.2	USFS
Elk Creek at Tiller - 2008	82	66	38	81	74	44	07/09/08	74.0	66.0	USFS
Elk Creek at Tiller - 2009	90	62	33	93	66	35	08/04/09	74.4	70.4	USFS
Elk Creek at Tiller - 2010	76	61	46	86	71	53	07/27/10	73.9	67.4	USFS
Flat Creek at Mouth - 2008	53	10	1	62	12	1	08/16/08	68.3	63.1	USFS
Flat Creek at Mouth - 2009	90	52	22	95	60	26	07/30/09	75.6	66.3	USFS
Flat Creek at Mouth - 2010	56	29	2	63	34	2	08/16/10	68.8	60.1	USFS
Joe Hall Creek at Mouth - 2008	*44	*34	*12	*100	*81	*29	07/09/08	69.4	60.3	USFS
Joe Hall Creek at Mouth - 2009	*40	*21	*5	*100	*59	*15	07/27/09	72.1	60.1	USFS

Table 25. Cont. Continuous temperature results Elk Creek/Tiller 2008-2010.

Site Name	Start Date	Stop date	Seasonal Maximum		Seasonal Minimum		Seasonal Max ΔT		7-Day averages			
			Date	Value	Date	Value	Date	Value	Date	Maximum	Minimum	Δ T
Brownie Creek at the Mouth 2011	06/27/11	09/21/11	08/26/11	65.9	07/01/11	50.2	07/05/11	9.1	08/25/11	64.3	59.2	5.2
Brownie Creek at the Mouth 2012	06/27/12	09/21/12	08/17/12	66.9	06/27/12	48.3	07/07/12	8.4	08/16/12	66.0	60.3	5.7
Brownie Creek at the Mouth 2013	06/27/13	09/21/13	07/02/13	70.1	09/19/13	51.7	06/28/13	8.2	07/01/13	68.1	61.3	6.8
Brownie Creek at the Mouth 2014	06/27/14	09/21/14	07/16/14	69.7	09/11/14	53.4	07/01/14	8.3	07/15/14	68.1	62.4	5.8
Callahan Creek at the Mouth 2011	06/27/11	09/21/11	08/26/11	64.2	09/18/11	51.7	07/05/11	5.9	08/26/11	63.0	59.9	3.2
Callahan Creek at the Mouth 2012	06/27/12	09/21/12	08/17/12	65.6	06/27/12	50.1	06/27/12	5.8	08/16/12	64.7	60.9	3.8
Callahan Creek at the Mouth 2013	06/27/13	09/21/13	07/03/13	68.0	09/20/13	53.0	06/28/13	5.3	07/01/13	66.1	61.9	4.2
Callahan Creek at the Mouth 2014	06/27/14	09/21/14	07/16/14	67.8	09/06/14	53.9	07/01/14	5.5	07/15/14	66.5	63.0	3.5
Drew Creek at the Mouth 2011	06/27/11	09/21/11	08/26/11	66.9	09/18/11	51.3	07/05/11	6.7	08/25/11	65.4	60.3	5.1
Drew Creek at the Mouth 2012	06/27/12	09/21/12	08/17/12	65.6	06/27/12	50.1	06/27/12	5.8	08/16/12	64.7	60.9	3.8
Drew Creek at the Mouth 2013	07/24/13	09/21/13	07/25/13	69.3	09/20/13	53.2	07/25/13	6.4	08/19/13	66.5	61.5	5.0
Elk Creek at Tiller 2012	06/29/12	09/21/12	08/16/12	72.0	09/12/12	54.1	07/07/12	7.6	08/16/12	71.1	65.8	5.3

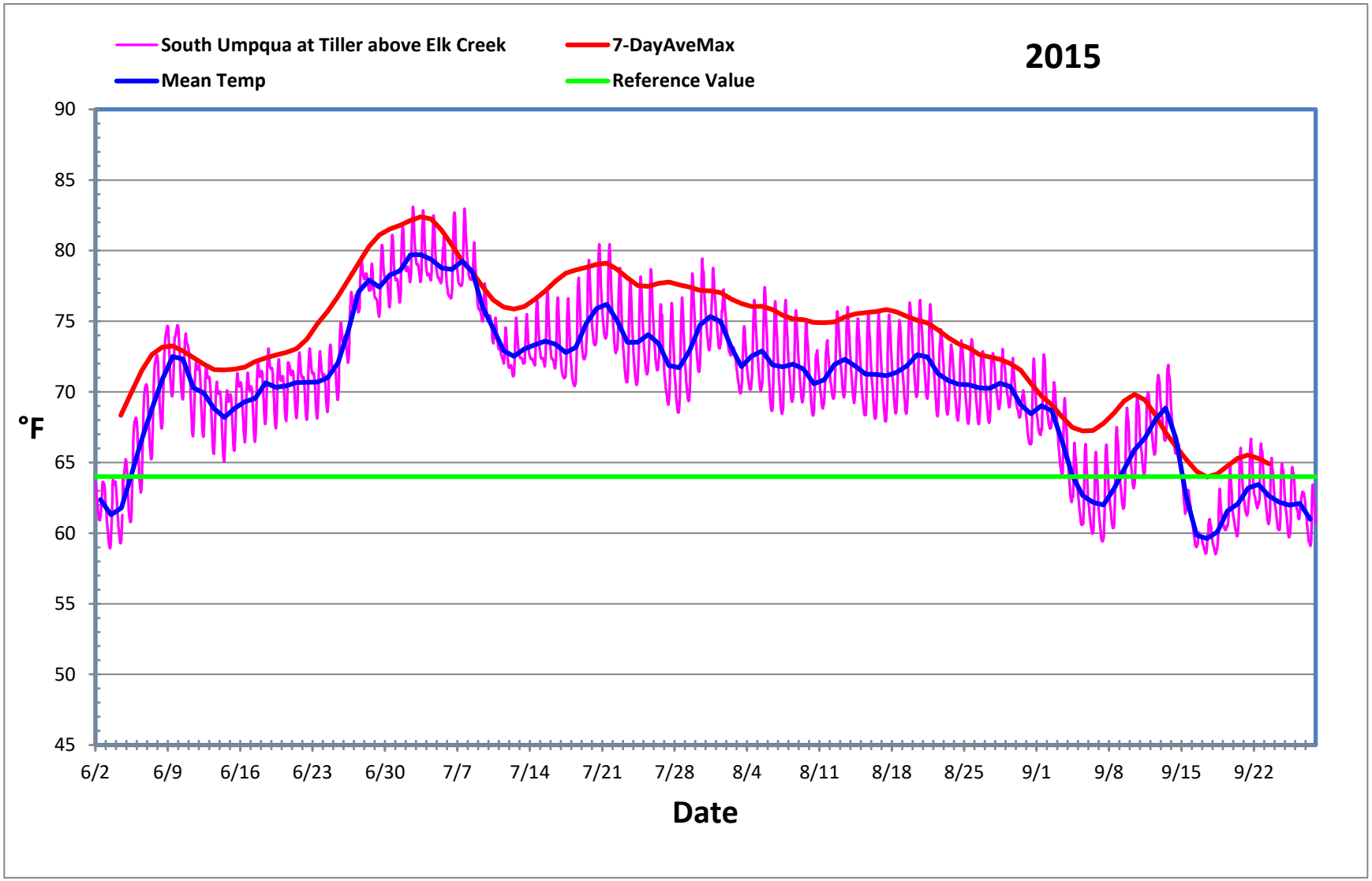
Site Name	Days >	Days >	Days >	Hours >	Hours >	Hours >	Warmest day of 7-day max			Agency
	55 F	64 F	70 F	55 F	64 F	70 F	Date	Maximum	Minimum	
Brownie Creek at the Mouth 2011	87	7	0	1718.0	33.5	0.0	08/26/11	65.9	60.8	UNF-TLRD
Brownie Creek at the Mouth 2012	86	14	0	1658.0	107.5	0.0	08/16/12	66.9	61.2	UNF-TLRD
Brownie Creek at the Mouth 2013	87	48	1	2049.5	411.5	2.0	07/02/13	70.1	63.8	UNF-TLRD
Brownie Creek at the Mouth 2014	87	43	0	2014.0	478.5	0.0	07/16/14	69.7	63.6	UNF-TLRD
Callahan Creek at the Mouth 2011	87	1	0	1857.5	4.0	0.0	08/26/11	64.2	61.2	UNF-TLRD
Callahan Creek at the Mouth 2012	85	10	0	1814.0	51.0	0.0	08/17/12	65.6	62.0	UNF-TLRD
Callahan Creek at the Mouth 2013	87	21	0	2043.5	206.0	0.0	07/03/13	68.0	65.0	UNF-TLRD
Callahan Creek at the Mouth 2014	87	37	0	2055.0	469.0	0.0	07/16/14	67.8	64.2	UNF-TLRD
Drew Creek at the Mouth 2011	87	10	0	1941.5	79.5	0.0	08/26/11	66.9	61.9	UNF-TLRD
Drew Creek at the Mouth 2012	85	10	0	1814.0	51.0	0.0	08/17/12	65.6	62.0	UNF-TLRD
Drew Creek at the Mouth 2013	60	37	0	1415.5	339.0	0.0	08/16/13	67.8	62.9	UNF-TLRD
Elk Creek at Tiller 2012	85	54	19	2031.0	904.0	74.5	08/16/12	72.0	66.1	UNF-TLRD

Table 26. Continuous temperature results Elk Creek/Tiller 2011-2014.

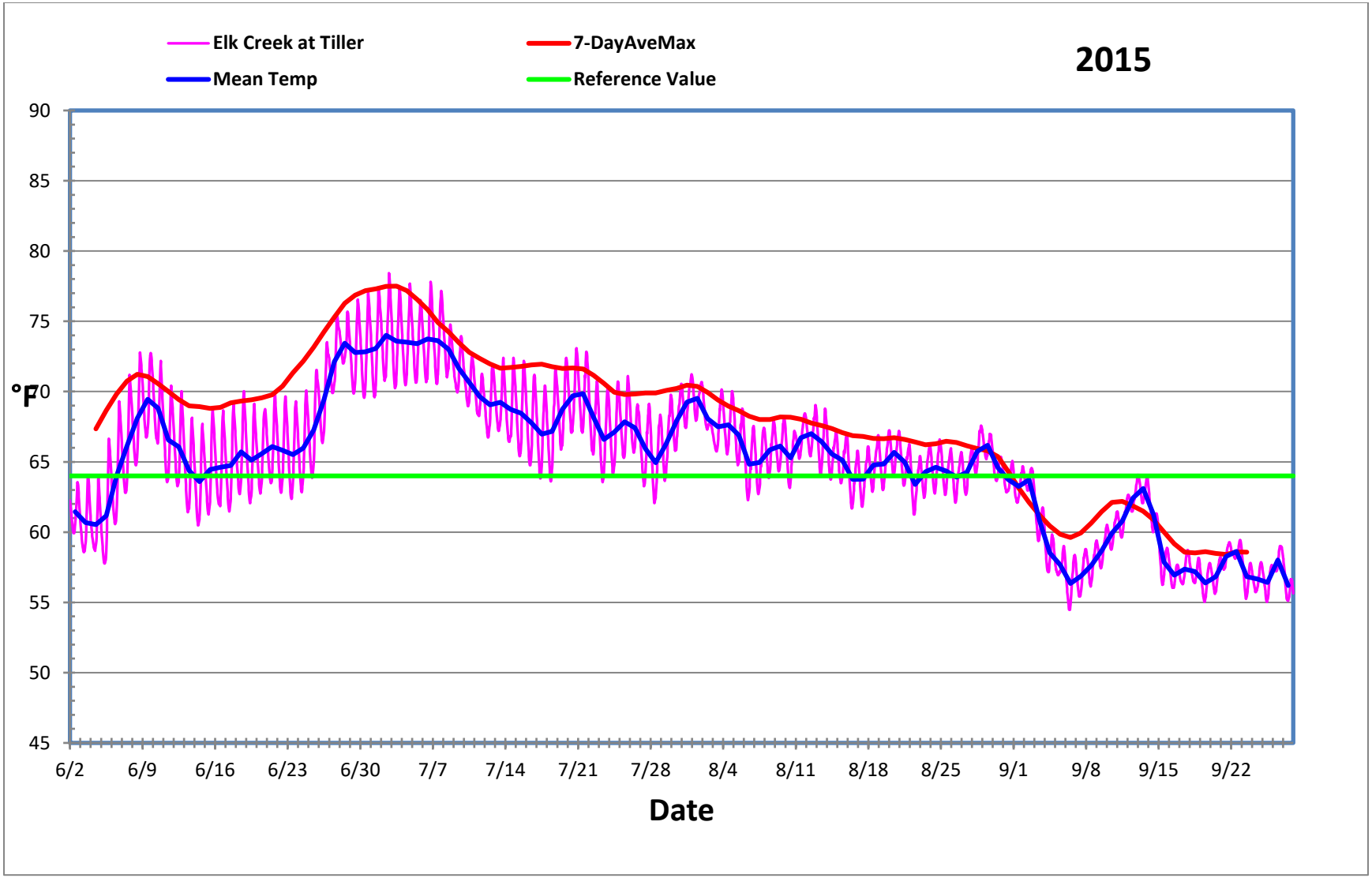
Site Name	Start Date	Stop date	Seasonal Maximum Date	Value	Seasonal Minimum Date	Value	Seasonal Max ΔT Date	Value	7-Day averages Date	Maximum	Minimum	Δ T
Elk Creek at Tiller 2015	06/02/15	09/27/15	07/02/15	78.4	09/06/15	54.5	06/05/15	8.9	07/04/15	77.5	70.4	7.1
South Umpqua at Tiller above Elk Creek 2015	06/02/15	09/27/15	07/02/15	83.1	09/18/15	58.5	07/29/15	9.0	07/04/15	82.4	77.4	5.0

Site Name	Days > 55 F	Days > 64 F	Days > 70 F	Hours > 55 F	Hours > 64 F	Hours > 70 F	Warmest day of 7-day max Date	Maximum	Minimum	Agency
Elk Creek at Tiller 2015	118	92	45	2826.0	1767.0	486.5	07/02/15	78.4	70.8	UNF-TLRD
South Umpqua at Tiller above Elk Creek 2015	118	111	91	2831.5	2379.0	1645.0	07/02/15	83.1	77.8	UNF-TLRD

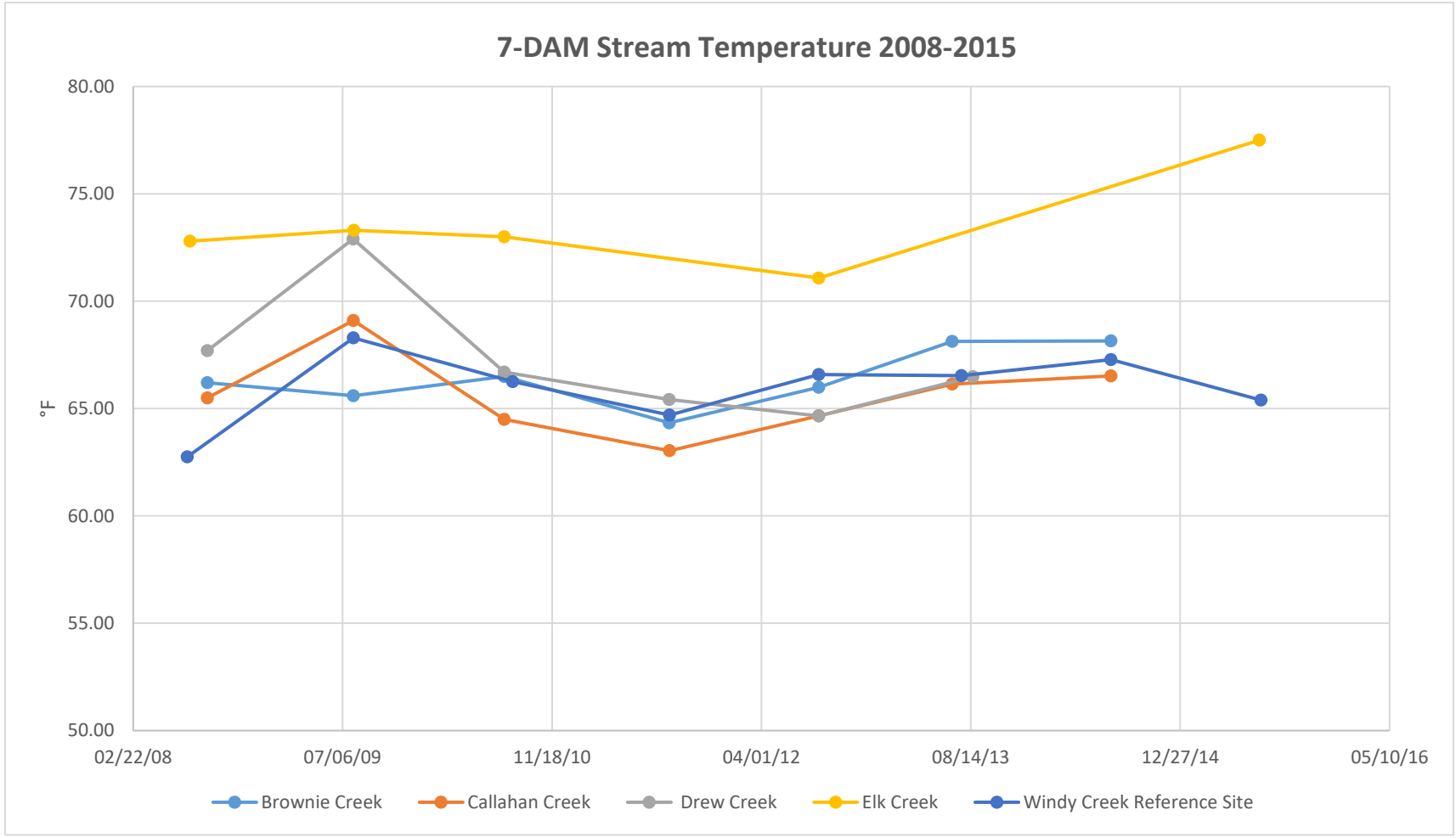
Table 27. Continuous temperature results Elk Creek/Tiller 2015.



Graph 38.2015 Temperature data logger readout South Umpqua above Elk Creek at Tiller.



Graph 39.Temperature data logger readout Elk Creek at mouth 2015.



Graph 40.2008-2014 Annual 7-Day average maximum stream temperatures for Elk Creek Area provided by Amy Rusk, USFS, and Windy Creek which is the most similar stream in the PUR's Umpqua Basin Stream Temperature Characterization, (Dammann D. , 2015).

Continuous Temperature Ratings for Elk Creek/Tiller Area Monitoring Sites 2008-2015

SITE	Rating
Callahan Creek*	USFS Loggers
Mouth Drew Creek*	USFS Loggers
Elk Creek above Joe Hall Creek*	USFS Loggers
Mouth Shed Creek (Flat Creek)*	USFS Loggers
Elk Creek above Shed Creek*	USFS Loggers
South Umpqua above Elk Creek (Tiller, Bridge over S Ump)*	USFS Loggesr

Rating	Color	Temperatures Core Cold Water Habitat*	Temperatures Rearing and Migration◊
Good		< 60.8° F	<64.4° F
Needs Improvement		>60.8° F	>64.4° F

Table 28. Temperature ratings for Elk Creek/Tiller continuous monitoring sites 2008-2015.

Temperature Ratings for All Elk Creek/Tiller Area Monitoring Sites 2008-2015

SITE	Rating
Callahan Creek*	USFS Loggers
Mouth Drew Creek*	USFS Loggers
Elk Creek above Drew Creek*	PUR Grab Sample
Mouth Joe Hall Creek*	USFS Loggers
Elk Creek above Joe Hall Creek*	PUR Grab Sample
Brownie Creek near mouth *	USFS Loggers
Elk Creek above Brownie Creek	PUR Grab Sample
Mouth Shed Creek (Flat Creek)*	USFS Loggers
Elk Creek above Shed Creek*	PUR Grab Sample
Mouth Elk Creek*	USFS Loggesr
South Umpqua above Elk Creek (Tiller, Bridge over S Ump)*	PUR Grab Sample
South Umpqua below Stouts Creek◊	PUR Grab Sample
Mouth Stouts Creek ◊	PUR Grab Sample

Rating	Color	Temperatures Core Cold Water Habitat*	Temperatures Rearing and Migration◊
Good		< 60.8° F	<64.4° F
Needs Improvement		>60.8° F	>64.4° F

Table 29. Temperature summary ratings for all Elk Creek/Tiller monitoring sites 2008-2015.

RESULTS - Elk Creek/Tiller Area

Summary

Table 30 presents the summary of ratings of all six water quality parameters monitored in the Elk Creek/Tiller area from 2008 – 2015. It is evident that this area's worst problem is exceedances of the temperature criteria with every site failing to meet DEQ criteria. Conductivity, on the other hand, is of no concern at any of the sites. Turbidity in winter is a significant concern. Dissolved oxygen, pH, and *E. coli* have concerns at certain sites. Three sites, Mouth Joe Hall Creek, Brownie Creek near mouth and the South Umpqua above Elk Creek all had three parameters in the red ratings.

Summary Rating for Elk Creek/Tiller Area Monitoring Sites – Six Water Quality Parameters

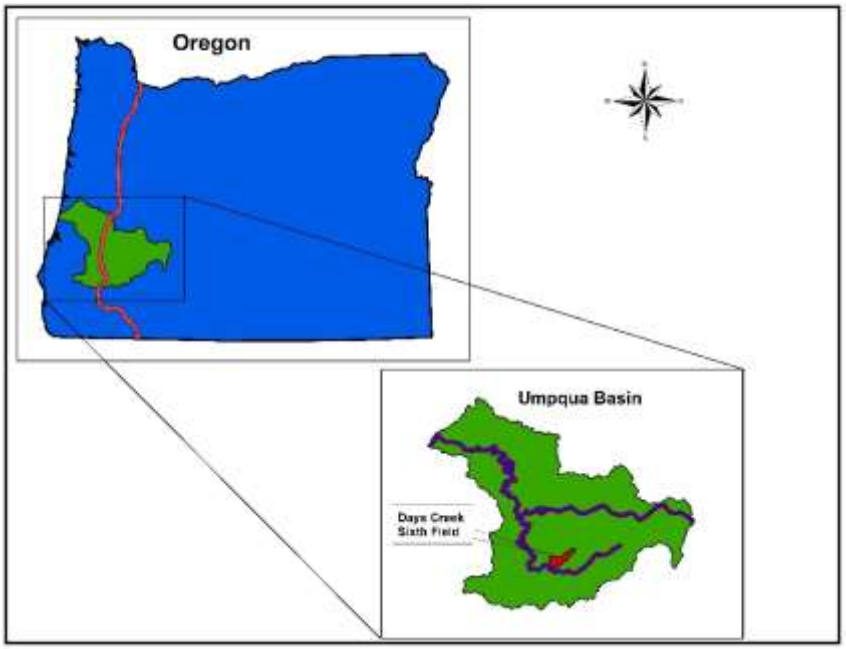
Site	Turbidity	pH	Dissolved Oxygen	Conductivity	*E. coli*	Temperature
Callahan Creek						USFS Data Logger
Mouth Drew Creek						USFS Data Logger
Elk Creek above Drew Creek						PUR Grab Sample
Mouth Joe Hall Creek						PUR Grab Sample
Elk Creek above Joe Hall Creek						PUR Grab Sample
Brownie Creek near mouth						USFS Data Logger
Elk Creek above Brownie						PUR Grab Sample
Mouth Shed Creek (Flat Creek)						PUR Grab Sample
Elk Creek above Shed Creek						PUR Grab Sample
Mouth Elk Creek						USFS Data Logger
South Umpqua above Elk Creek (Tiller, Bridge over S Ump)						USFS Data Logger
Mouth Stouts Creek						PUR Grab Sample
South Umpqua below Stouts Creek						PUR Grab Sample

Table 30. Summary ratings for 2008-2015 Elk Creek/Tiller area monitoring sites – six water quality parameters. See tables for each parameter for color coding.

Days Creek Watershed

Area Description, Background & Monitoring Sites

Days Creek is a 22,000-acre 6th field watershed. It is the longest tributary in the South Umpqua River 5th field watershed; it is 13.9 stream miles. The South Umpqua River's average stream gradient within the watershed is 0.8%. The average stream gradient for Days Creek is 5.0%, while other tributaries have an average gradient of 7.5%. Days Creek's buffers are predominantly two or more trees wide (48.1%, 14.0 riparian miles) and one tree wide (44.2%, 12.9 riparian miles). In the Days Creek system, "domestic" and "livestock" are the two largest water uses after "irrigation."



Map 8. Days Creek Watershed Area Map.

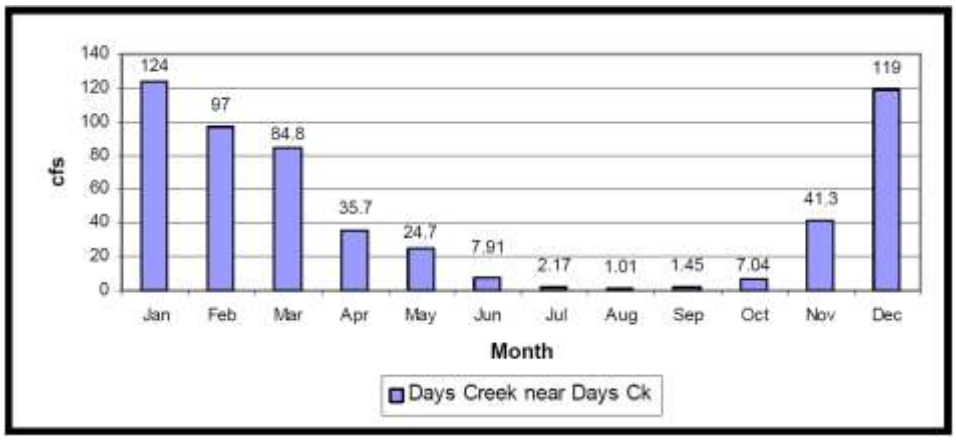


Table 31. Average monthly streamflow for Days Creek at Days Creek (gauge #14308700).

The Days Creek at Days Creek gauge (#14308700) was active from 1955 through 1972. In August, average monthly streamflow for Days Creek at Days Creek is 1.01 cfs. (Geyer, South Umpqua Watershed Assessment and Action Plan, 2003)

Map 10 displays the streams in the Days Creek Watershed that are designated as "Spawning" and "Non-Spawning" use. **Figure 320A - Umpqua Basin Fish Use Designations from ODEQ** 2003 (Appendix I) indicates that Days Creek is in the "Salmon & Trout Rearing & Migration" designation

Photo 5. Days Creek on upper BLM lands 2/26/14.

Photo 6. Days Creek on upper BLM lands 7/17/2013.

Photo 7. Days Creek near 3880 Days Creek Rd. 2/26/14.

Photo 8. Days Creek same site as Photo 7 9/15/14.

Days Creek Water Quality Monitoring Sites

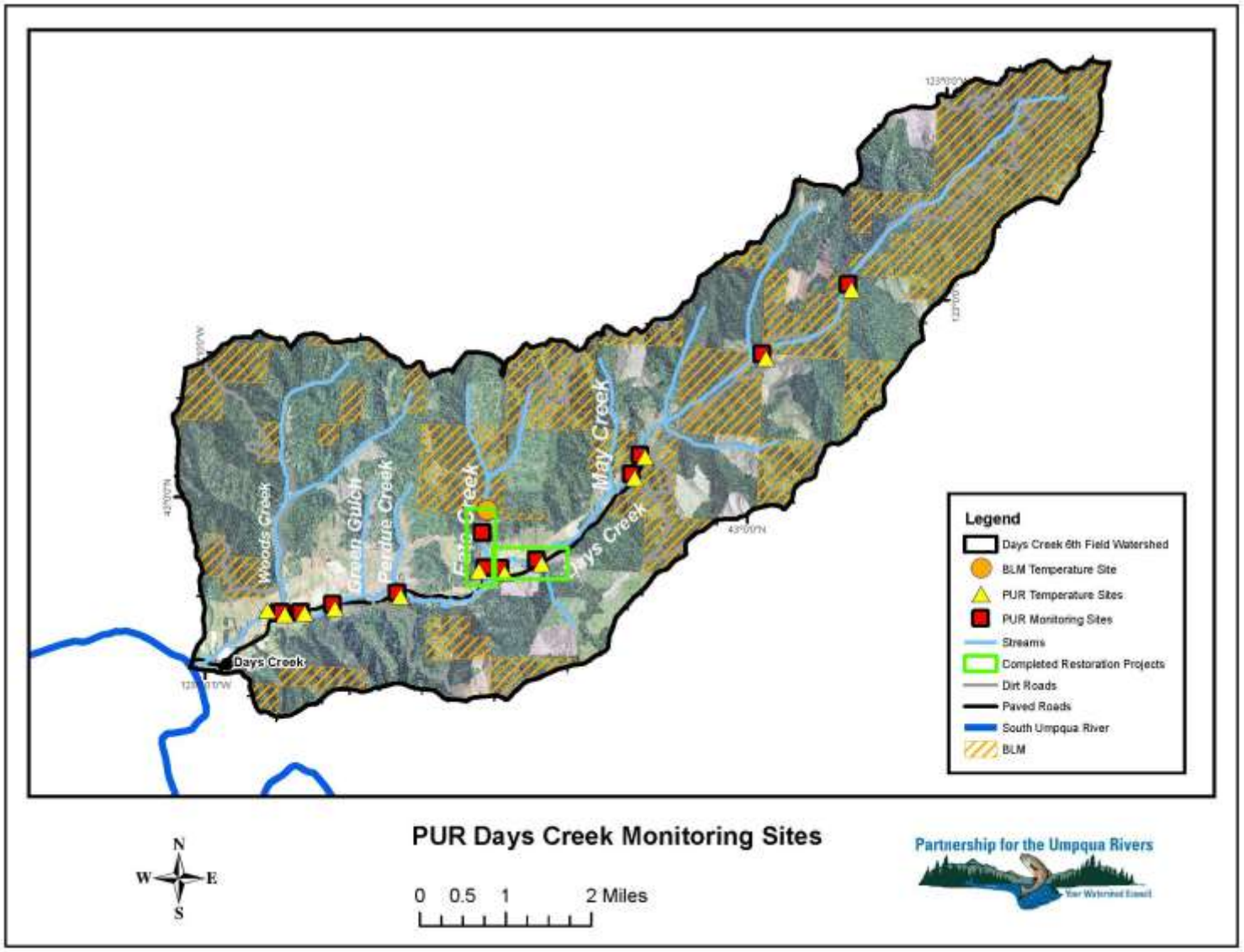
	Site ID	River/Stream	Location	LASAR ID	Latitude	Longitude	Township, Range, Section
1	DC-BLM1	Days Creek	Uppermost BLM Site		43.0396	-123.021	T29S R3W S23
2	DC-BLM2	Days Creek	Between upper BLM Sections		43.0273	-123.041	T29S R3W S27
3	DC-BLM4	Days Creek	Above lower BLM project area		43.0096	-123.068	T29S R3W S33
4	DC-BLM5	Days Creek	Below lower BLM project area		43.0064	-123.07	T29S R3W S33
5	DC-L1	Days Creek	Upper end of Private Land 3880 Days Creek Road		42.9913	-123.091	T30S R3W S5
6	DC-L2	Days Creek	Lower end of Private Land 3880 Days Creek Road		42.9897	-123.1	T30S R3W S5
7	DC-F1	Fate Creek	Below project area	27847	42.9897	-123.103	T30S R3W S6
8	DC-F2	Fate Creek	Above project area		42.9957	-123.104	T30S R3W S6
9	DC1	Days Creek	Bridge at Half Circle Lane		42.985	-123.123	T30S R4W S1
10	DC3	Days Creek	At first singing bridge		42.9812	-123.145	T30S R4W S11
11	DC3b	Days Creek	At second singing bridge		42.9827	-123.138	T30S R4W S11
12	DC3a	Days Creek	At Woods Creek Rd.	34127	42.9811	-123.15	T30S R4W S11
13	DC3b	Woods Creek	Near mouth	34128	42.981	-123.15	T30S R4W S11

Table 32. Days Creek water quality monitoring sites.

Days Creek Water Temperature Recorder Monitoring Sites

	Site ID	River/Stream	Location	LASAR ID	Latitude	Longitude	Township, Range, Section
1	DC-BLM1	Days Creek	Uppermost BLM Site		43.0396	-123.021	T29S R3W S23
2	DC-BLM2	Days Creek	Between upper BLM Sections		43.0273	-123.041	T29S R3W S27
3	DC- BLM3	Days Creek	Lower End of Middle BLM Section		43.017665	-123.0578	T29S R3W S27
4	DC-BLM4	Days Creek	Above lower BLM project area		43.0096	-123.068	T29S R3W S33
5	DC-BLM5	Days Creek	Below lower BLM project area		43.0064	-123.07	T29S R3W S33
6	DC-L1	Days Creek	Upper end of Private Property 3880 Days Creek Road		42.9913	-123.091	T30S R3W S5
7	DC-L2	Days Creek	Lower end of Private Property 3880 Days Creek Rd.		42.9897	-123.1	T30S R3W S5
8	DC-F1	Fate Creek	Below project area	27847	42.9897	-123.103	T30S R3W S6
9	DC1	Days Creek	Bridge at Half Circle Lane		42.985	-123.123	T30S R4W S1
10	DC3	Days Creek	At first singing bridge		42.9812	-123.145	T30S R4W S11
11	DC3b	Days Creek	At second singing bridge		42.9827	-123.138	T30S R4W S11
12	DC3a	Days Creek	At Woods Creek Rd. bridge	34127	42.9811	-123.15	T30S R4W S11
13	DC3b	Woods Creek	Near mouth	34128	42.981	-123.15	T30S R4W S11

Table 33. Days Creek continuous data logger sites.

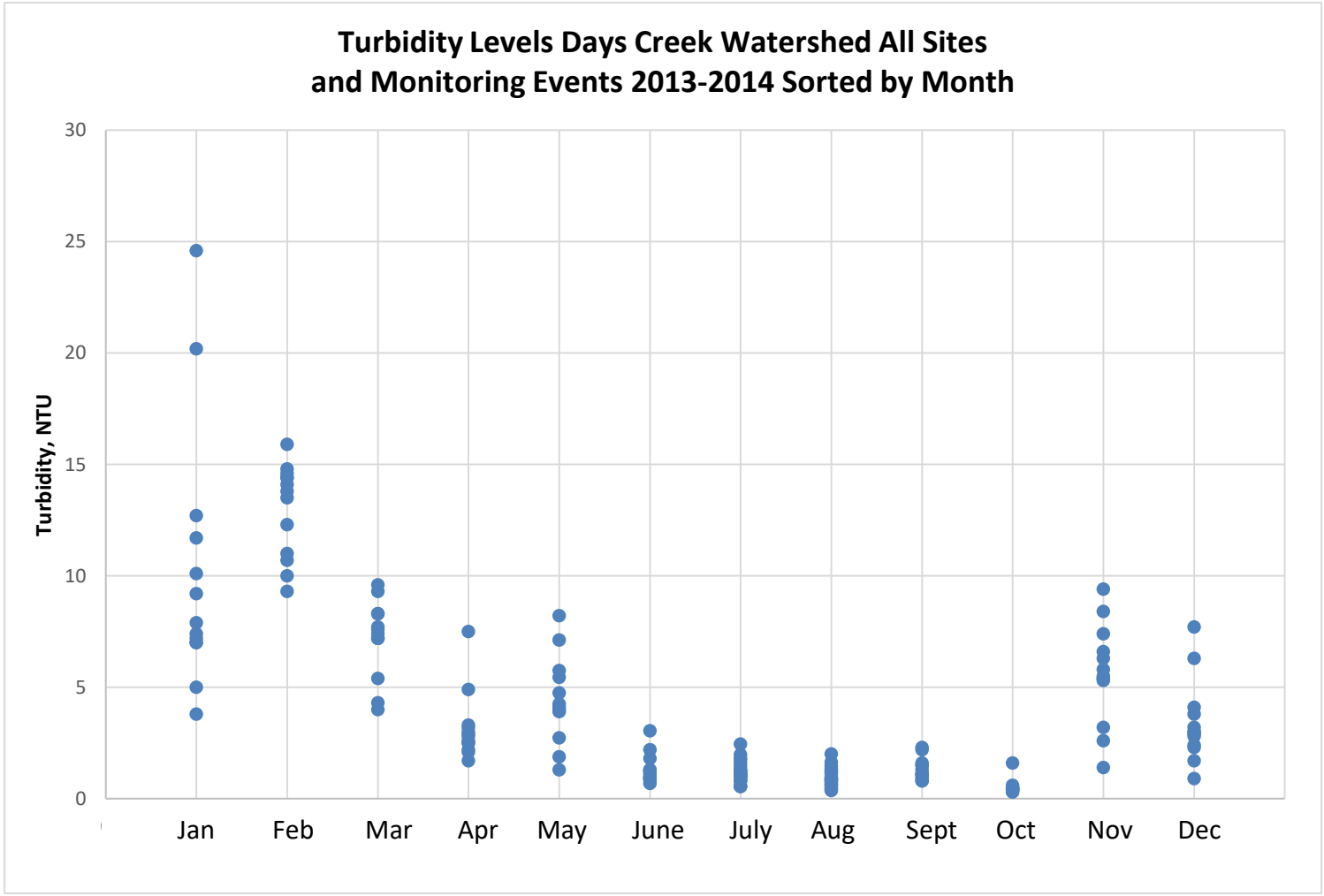


Map 9. Days Creek sixth-field monitoring sites map.

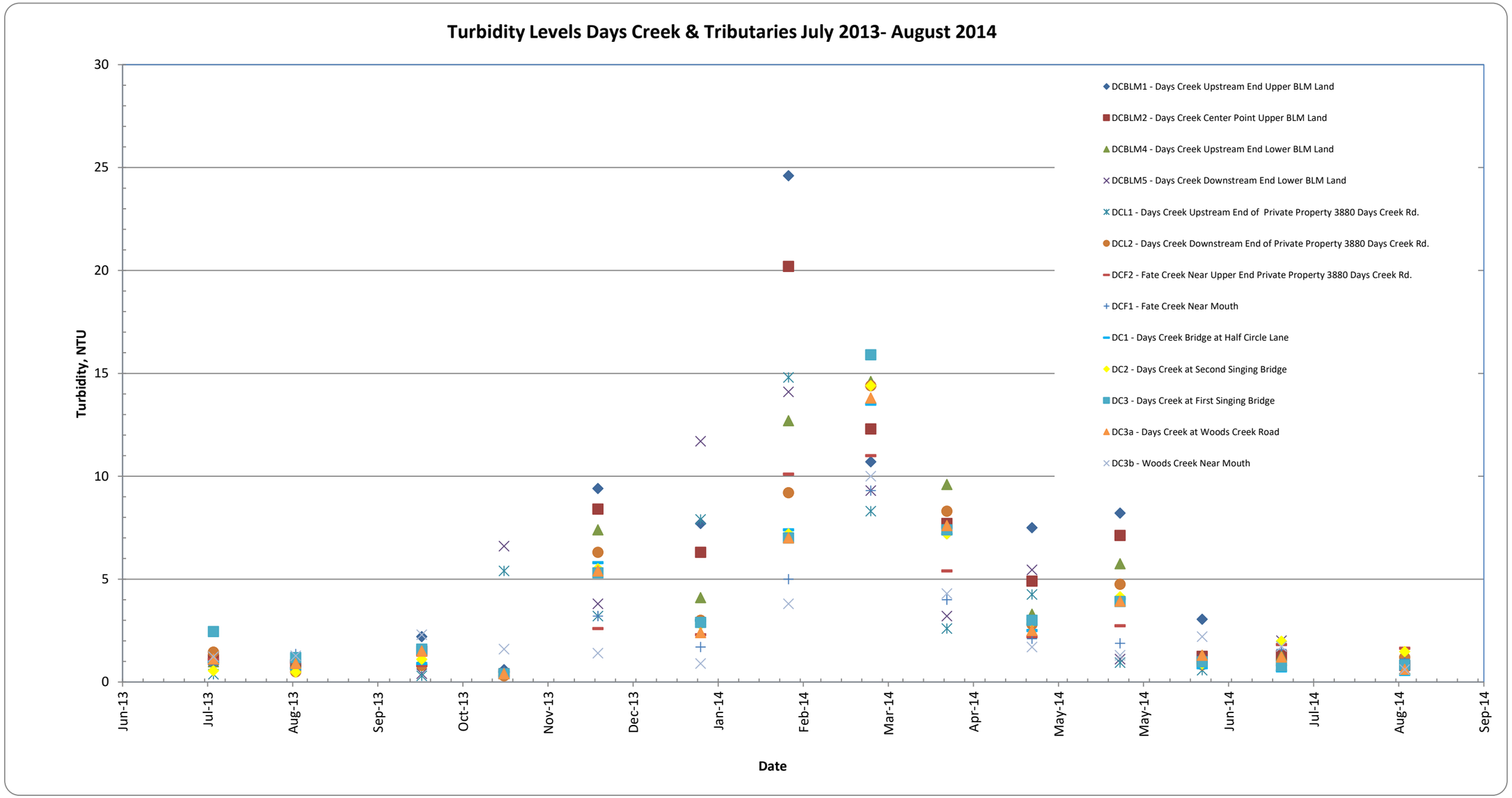
RESULTS- Days Creek Watershed

Turbidity

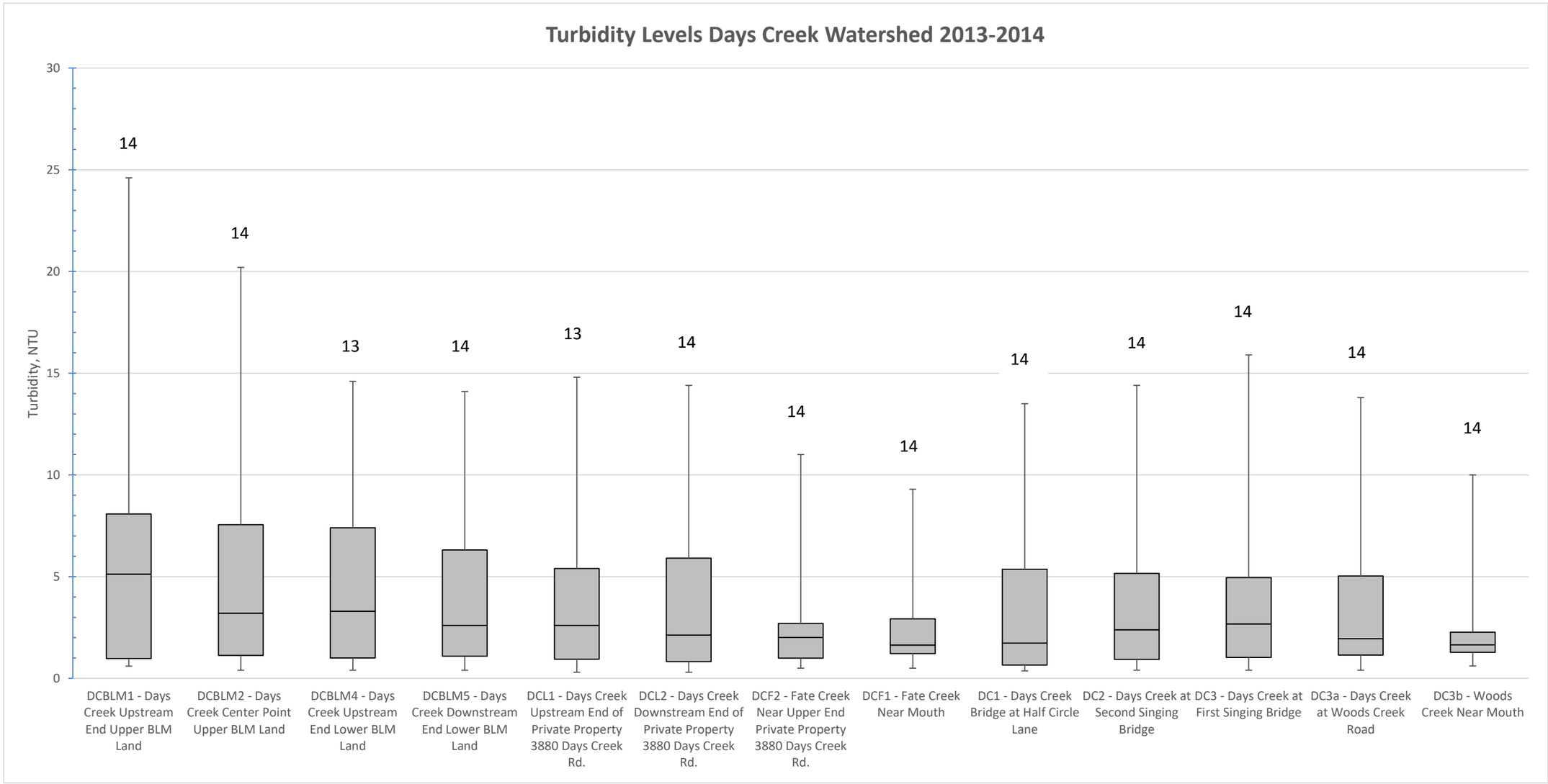
Turbidity can be an issue during winter months and not an issue during summer. **Table 34** rates the streams based on exceedances above 10 NTU. No sampling events or sites reached the "Extreme Concern" level. Five sites had levels of "High Concern" and six had "Low Concern" and two had "No Concern".



Graph 41. Turbidity levels sorted by month for all sites and monitoring events in the Days Creek Watershed 2013-2014.



Graph 42. Turbidity levels Days Creek Watershed by site July 2013-August 2014.



Graph 43. Box Plots of Turbidity Levels Days Creek Watershed July 2013-August 2014. The number above each site's plot indicates the number of sampling events.

Days Creek Watershed		10 NTU's or Greater	
Station ID - Site Description	Total # of Samples	Count	% of Samples
DCBLM1 - Days Creek Upstream End Upper BLM Land	14	2	14%
DCBLM2 - Days Creek Center Point Upper BLM Land	14	2	14%
DCBLM4 - Days Creek Upstream End Lower BLM Land	13	2	15%
DCBLM5 - Days Creek Downstream End Lower BLM Land	14	2	14%
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.	13	1	8%
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.	14	1	7%
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.	14	2	14%
DCF1 - Fate Creek Near Mouth	14	0	0%
DC1 - Days Creek Bridge at Half Circle Lane	14	1	7%
DC2 - Days Creek at Second Singing Bridge	14	1	7%
DC3 - Days Creek at First Singing Bridge	14	1	7%
DC3a - Days Creek at Woods Creek Road	14	1	7%
DC3b - Woods Creek Near Mouth	14	0	0%

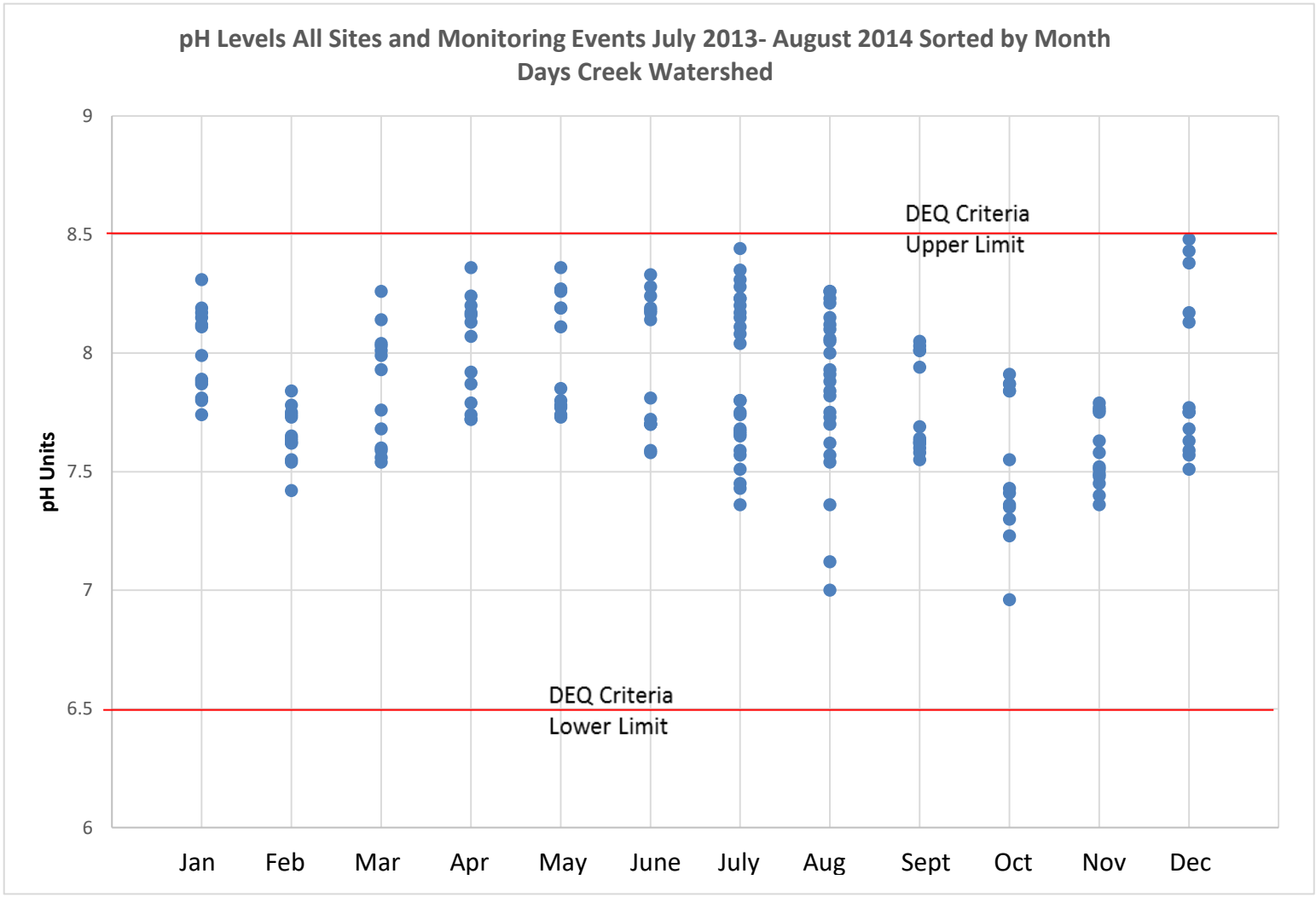
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	< 10 NTU
	Low Concern	Between 1 % and 9% of samples ≥10NTU
	High Concern	Between 10% and 20% ≥10 NTU
	Extreme Concern	20% or more ≥10 NTU

Table 34. Turbidity levels year-round Days Creek Watershed July 2013-August 2014.

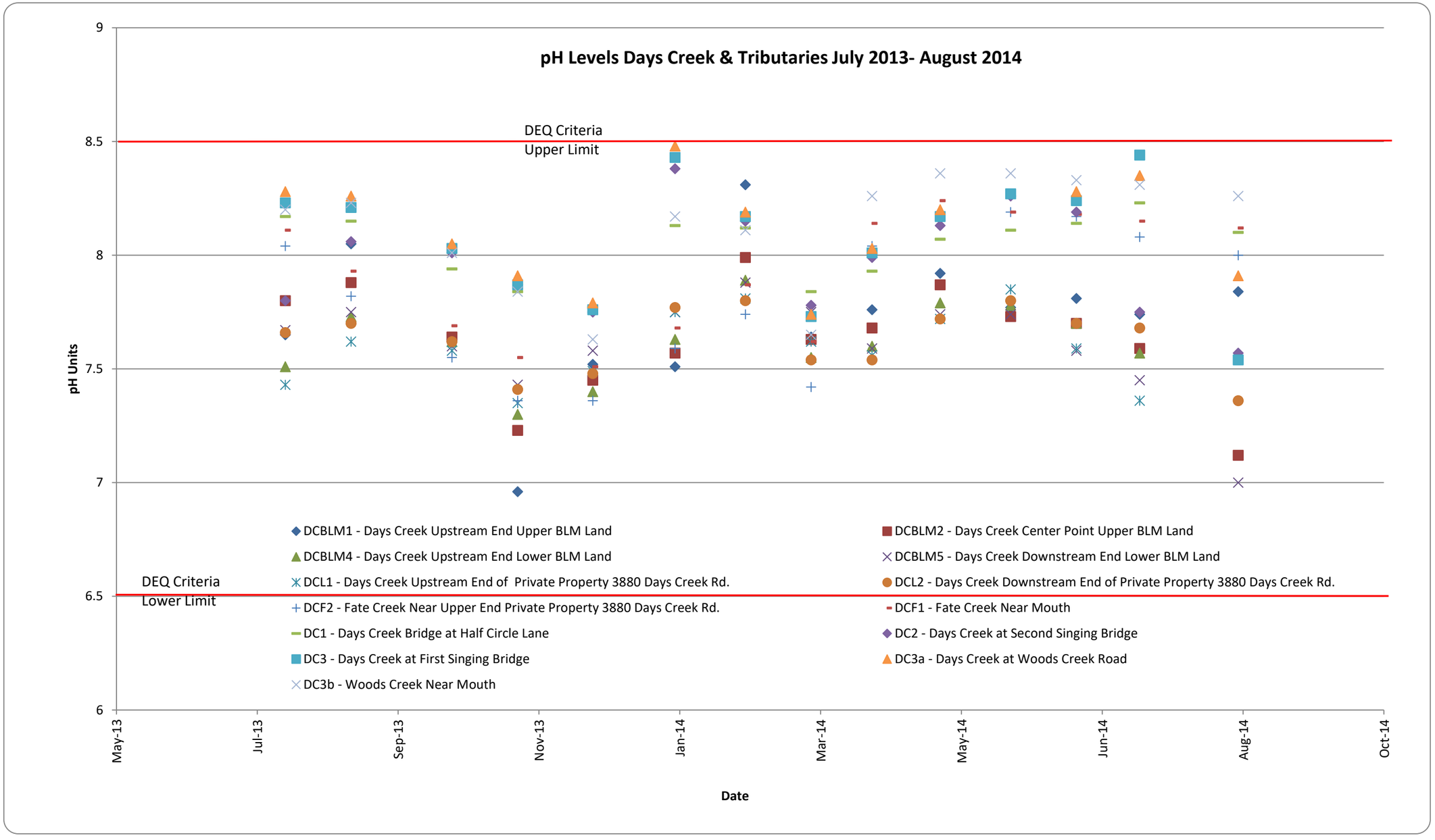
RESULTS - Days Creek Watershed

pH

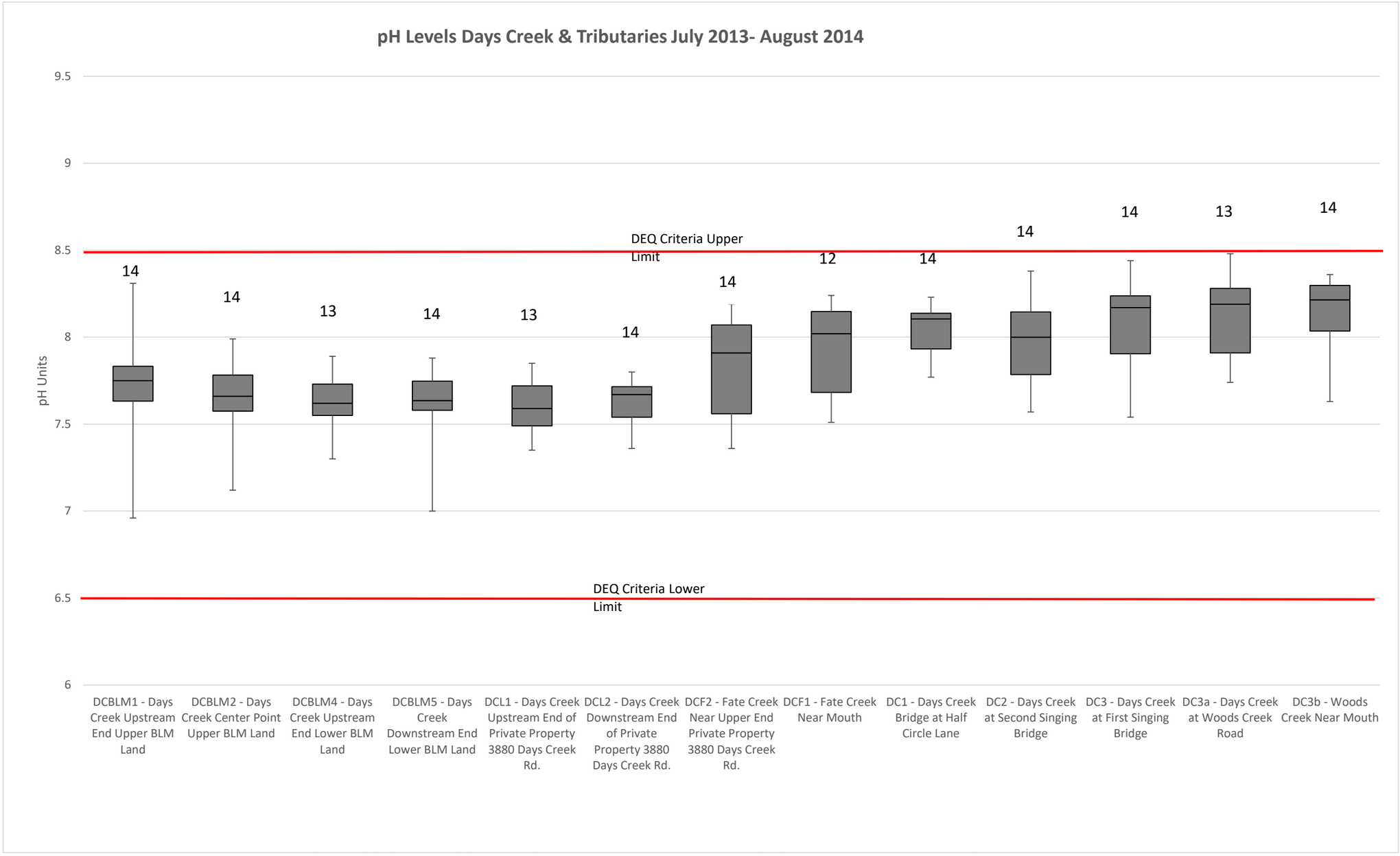
No sites fell outside the DEQ criteria for pH. Four monitoring sites exceeded our "Moderate Concern" level for pH on the high side. Two of these were on lower Days Creek and the other two were tributaries to lower Days Creek. One on upper Days Creek fell in the "Low Concern" rating. No sites were of concern for low pH.
All are summarized in **Table 35**. This rating table flags those sites approaching the criteria because the levels could possibly have gone higher later in the day or on other days. These rating are for planning purposes only.



Graph 44.pH Levels all sites and monitoring events Days Creek Watershed July 2013- August 2014 sorted by month.



Graph 45. pH levels Days Creek Watershed July 2013-August 2014 by site.



Graph 46. Box plot of pH levels by site July 2013-August 2014 Days Creek Watershed, number above indicates the number of sampling events.

Station ID - Site Description	Upper pH Criteria	Lower pH Criteria
DCBLM1 - Days Creek Upstream End Upper BLM Land		
DCBLM2 - Days Creek Center Point Upper BLM Land		
DCBLM4 - Days Creek Upstream End Lower BLM Land		
DCBLM5 - Days Creek Downstream End Lower BLM Land		
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.		
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.		
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.		
DCF1 - Fate Creek Near Mouth		
DC1 - Days Creek Bridge at Half Circle Lane		
DC2 - Days Creek at Second Singing Bridge		
DC3 - Days Creek at First Singing Bridge		
DC3a - Days Creek at Woods Creek Road		
DC3b - Woods Creek Near Mouth		

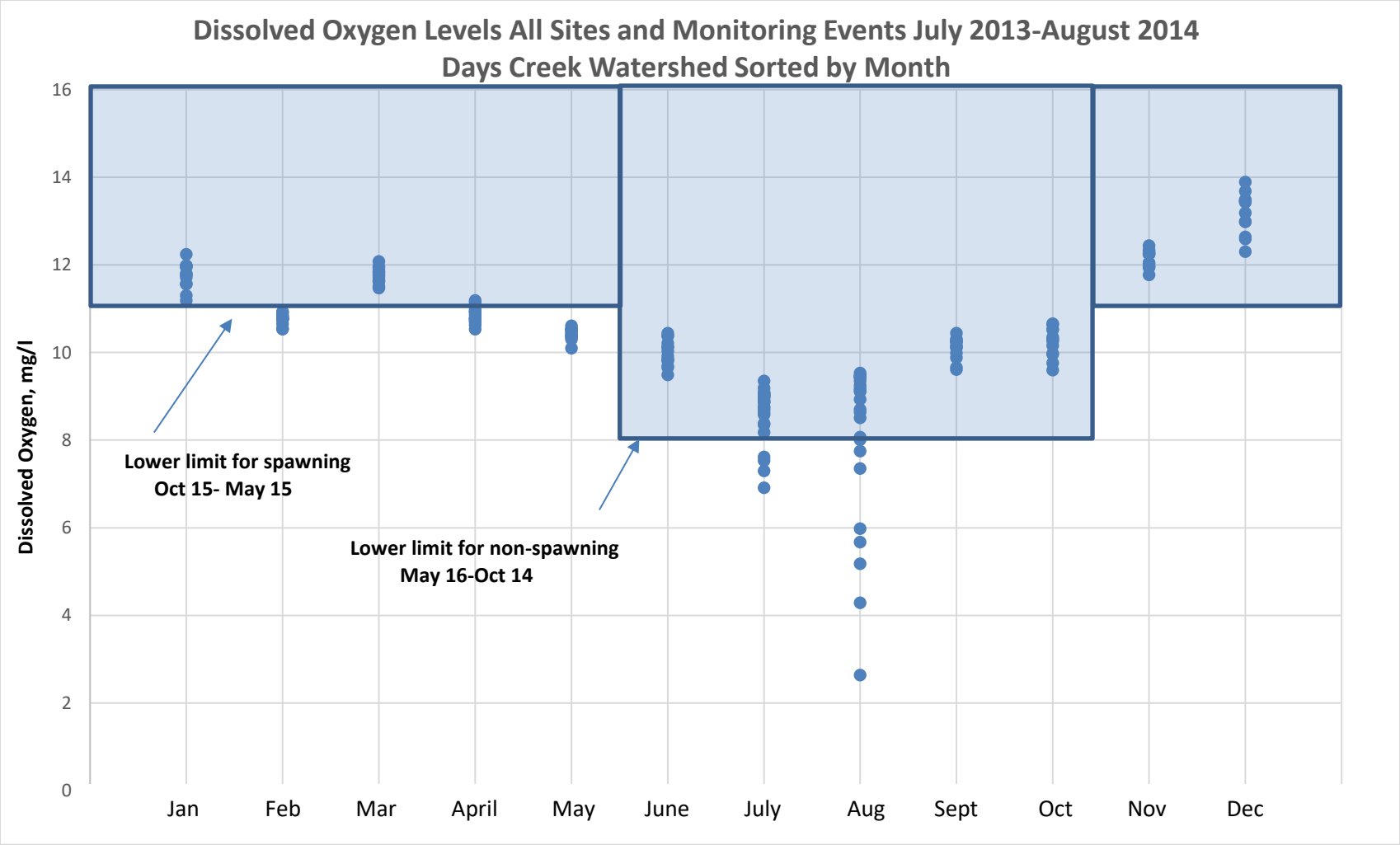
pH Rating Code			
Rating	**Color**	**Upper pH Criteria**	**Lower pH Criteria**
No Concern		None above 8.25	None below 6.75
Low Concern		1 ≥ 8.25	1 ≤ 6.75
Moderate Concern		2 or more ≥ 8.25 or 1 ≥ 8.5	2 ≤ 6.75 or 1 ≤ 6.5
Extreme Concern		2 or more ≥ 8.5	2 or more ≤ 6.5

Table 35. Days Creek Watershed Sites pH ratings by site with color code table.

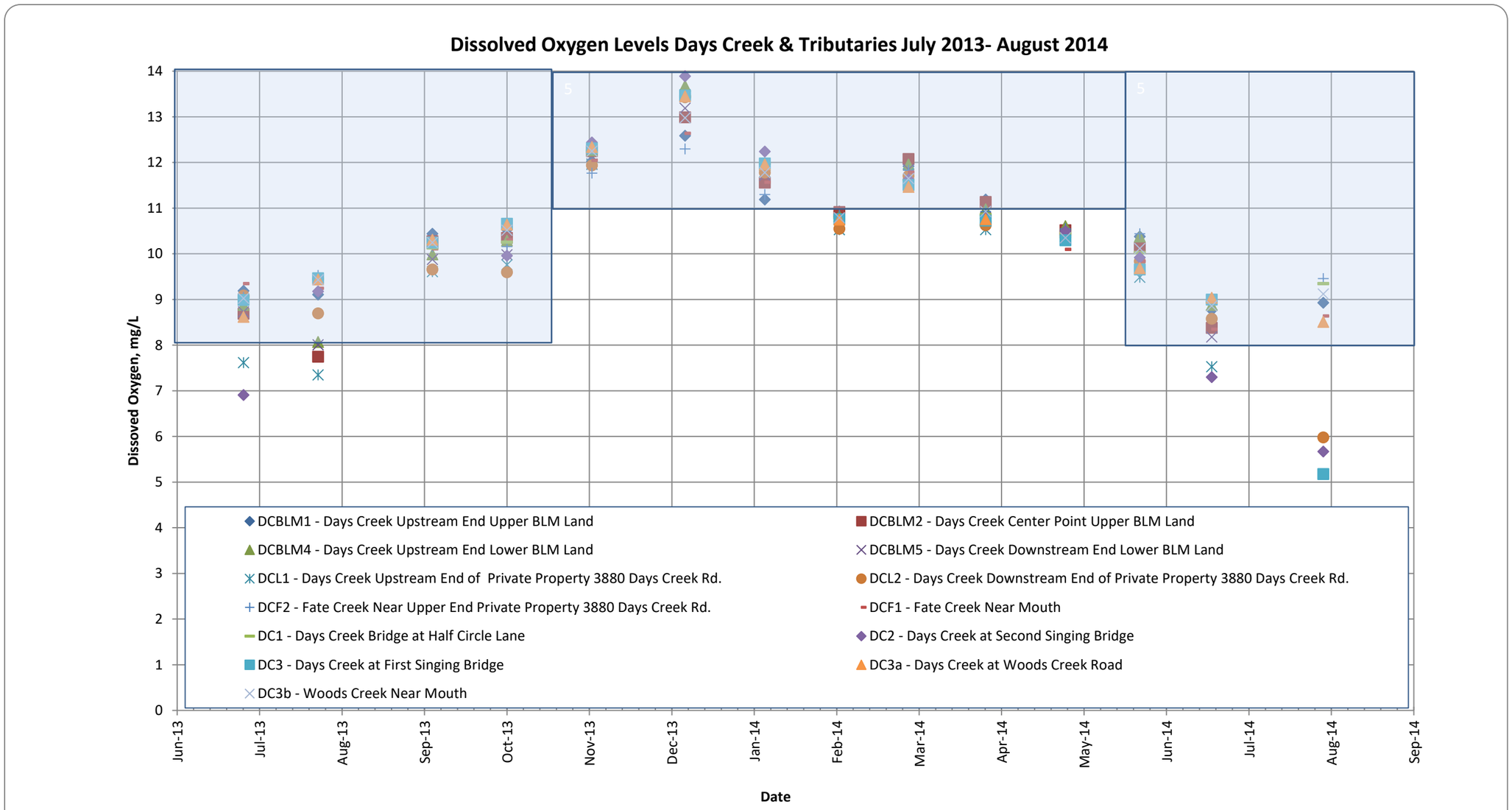
RESULTS – Days Creek Watershed

Dissolved Oxygen

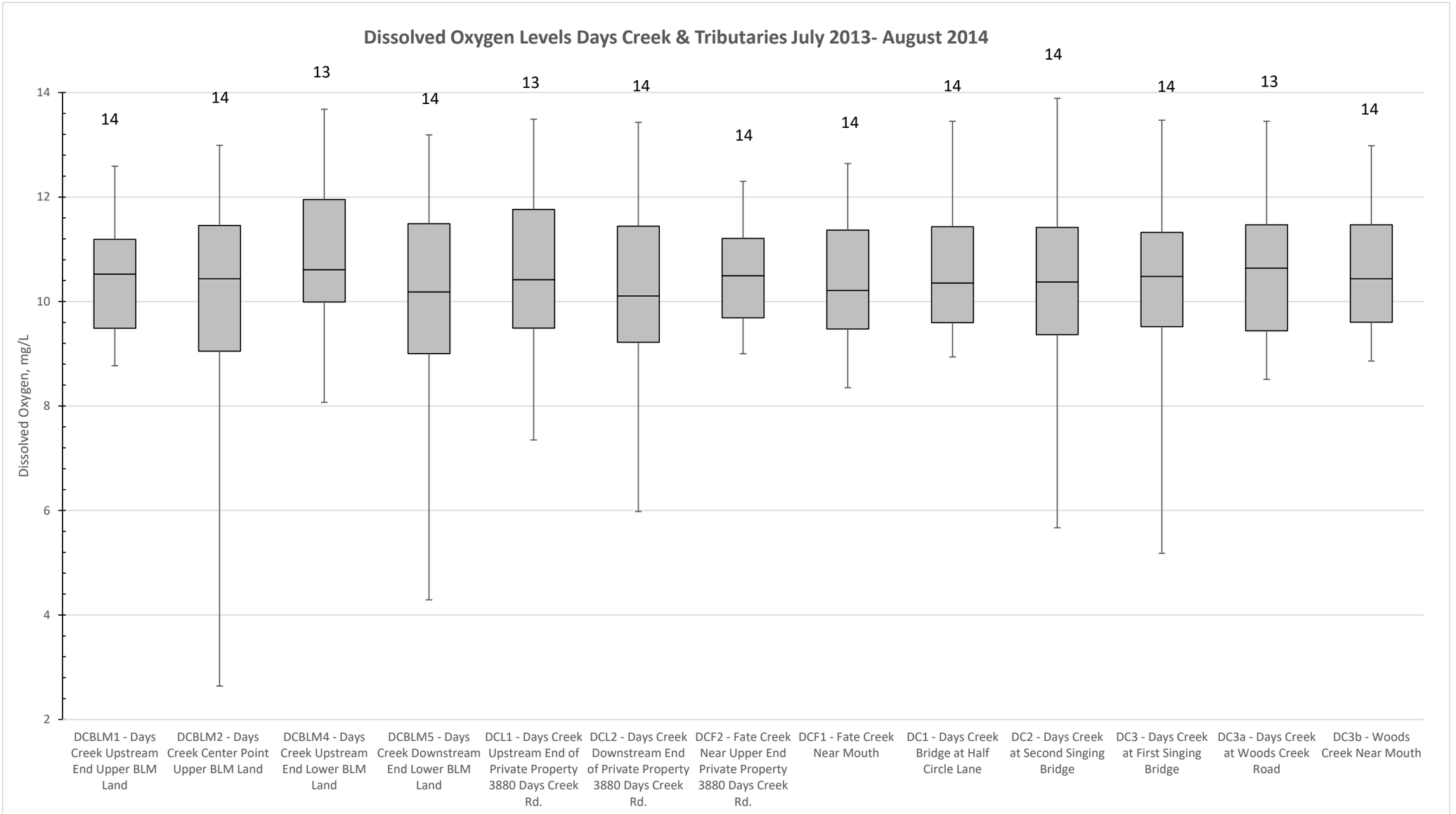
Table 36 depicts dissolved oxygen ratings by site for the Days Creek Watershed July 2013-August 2014 spawning and non-spawning seasons. During Spawning Season (October 15th – May 15th) all sites in the Days Creek sixth-field were rated for "Extreme Concern" for failing to meet the 11 mg/l dissolved oxygen criteria at least twice. During Non-Spawning Season (May 16-October 14) three sites were rated for "Extreme Concern" for failing to meet the 8 mg/l dissolved oxygen criteria at least twice. During August due to extremely low flows and in some instances the stream pooling, dissolved oxygen levels are very low. This is noted in **Table 31** were the average monthly stream flow is 1.01 cfs.



Graph 47. Dissolved Oxygen levels sorted by month for Days Creek Watershed sites all sites and monitoring events.



Graph 48. Dissolved Oxygen levels by site Days Creek Watershed July 2013-August 2014.



Graph 49.Box plots of Days Creek Watershed sites July 2013- August 2014, numbers represent number of monitoring events.

	Non-spawning Season May 16-October 14				Spawning Season October 15-May 15			
	Total # Samples	# Below Minimum D.O. Criteria of 8 mg/l	% Below Minimum D.O. Criteria of 8 mg/l	Rating	Total # Samples	# Below Minimum D.O. Criteria of 11 mg/l	% Below Minimum D.O. Criteria of 11 mg/l	Rating
DCBLM1 - Days Creek Upstream End Upper BLM Land	7	0	0%		7	2	29%	
DCBLM2 - Days Creek Center Point Upper BLM Land	7	2	29%		7	2	29%	
DCBLM4 - Days Creek Upstream End Lower BLM Land	6	0	0%		7	3	43%	
DCBLM5 - Days Creek Downstream End Lower BLM Land	7	1	14%		7	3	43%	
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.	6	3	50%		7	3	43%	
DCL2 - Days Creek Downstream End of Private Property	7	1	14%		7	3	43%	
DCF2 - Fate Creek Near Upper End Private Days Creek Rd.	7	0	0%		7	3	43%	
DCF1 - Fate Creek Near Mouth	7	0	0%		7	3	43%	
DC1 - Days Creek Bridge at Half Circle Lane	7	0	0%		7	3	43%	
DC2 - Days Creek at Second Singing Bridge	7	3	43%		7	4	57%	
DC3 - Days Creek at First Singing Bridge	7	1	14%		7	3	43%	
DC3a - Days Creek at Woods Creek Road	6	0	0%		7	3	43%	
DC3b - Woods Creek Near Mouth	7	0	0%		7	3	43%	

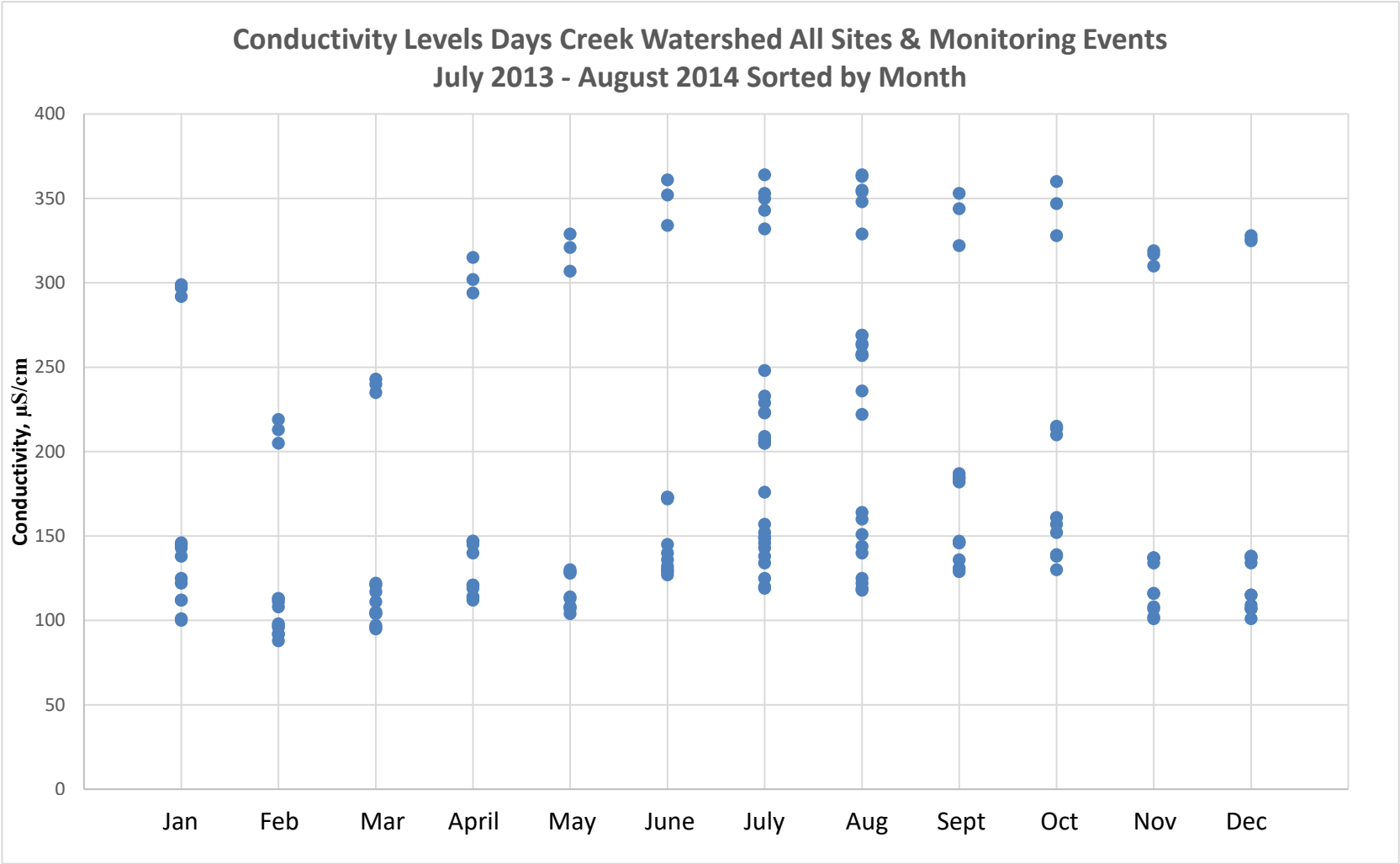
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	0% (No Exceedances)
	Low Concern	≥1% ≤9% Exceedances
	High Concern	≥10% ≤19% Exceedances
	Extreme Concern	≥20% Exceedances

Table 36. Dissolved Oxygen ratings by site for the Days Creek Watershed July 2013-August 2014 spawning and non-spawning seasons.

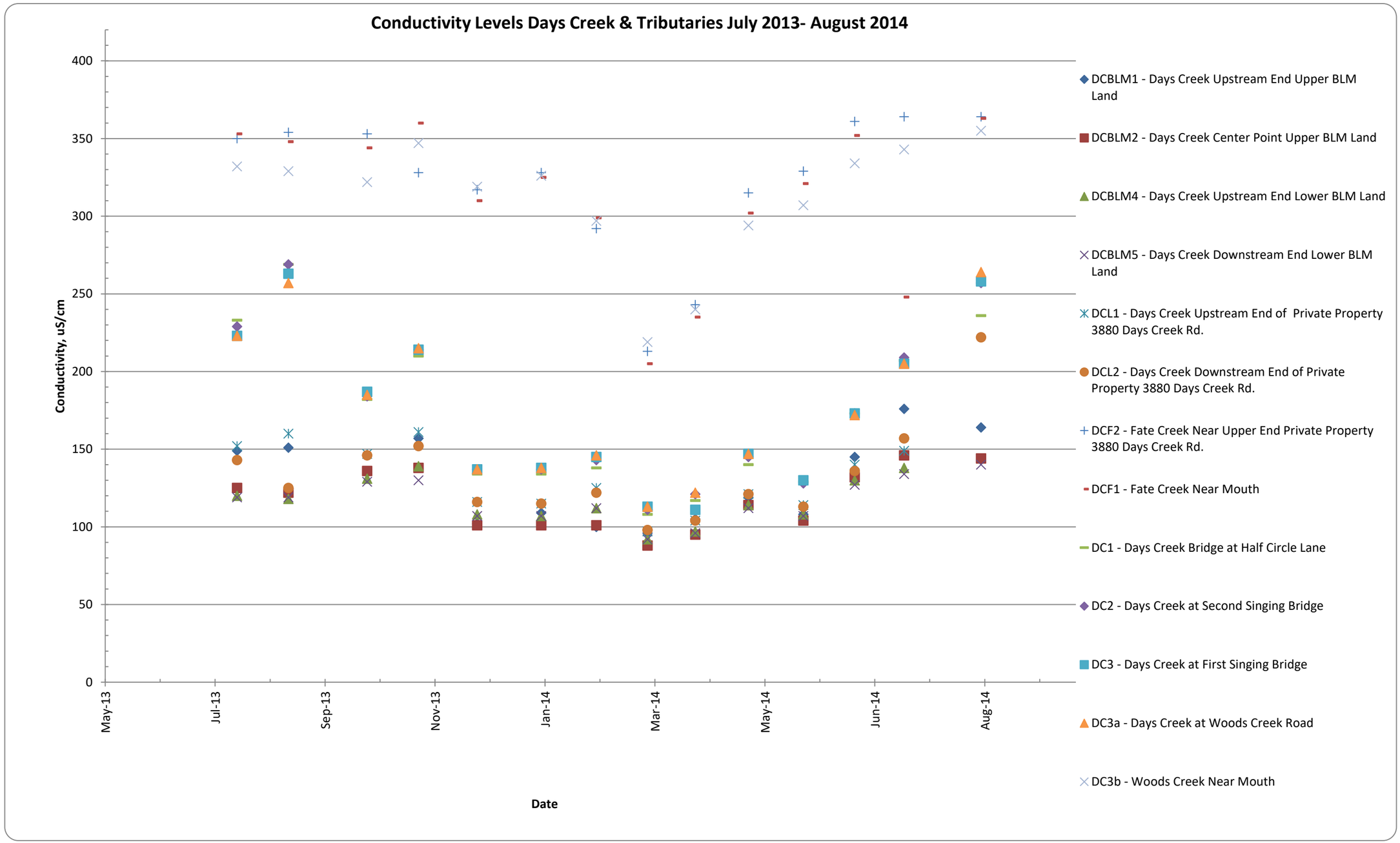
RESULTS – Days Creek Watershed

Conductivity

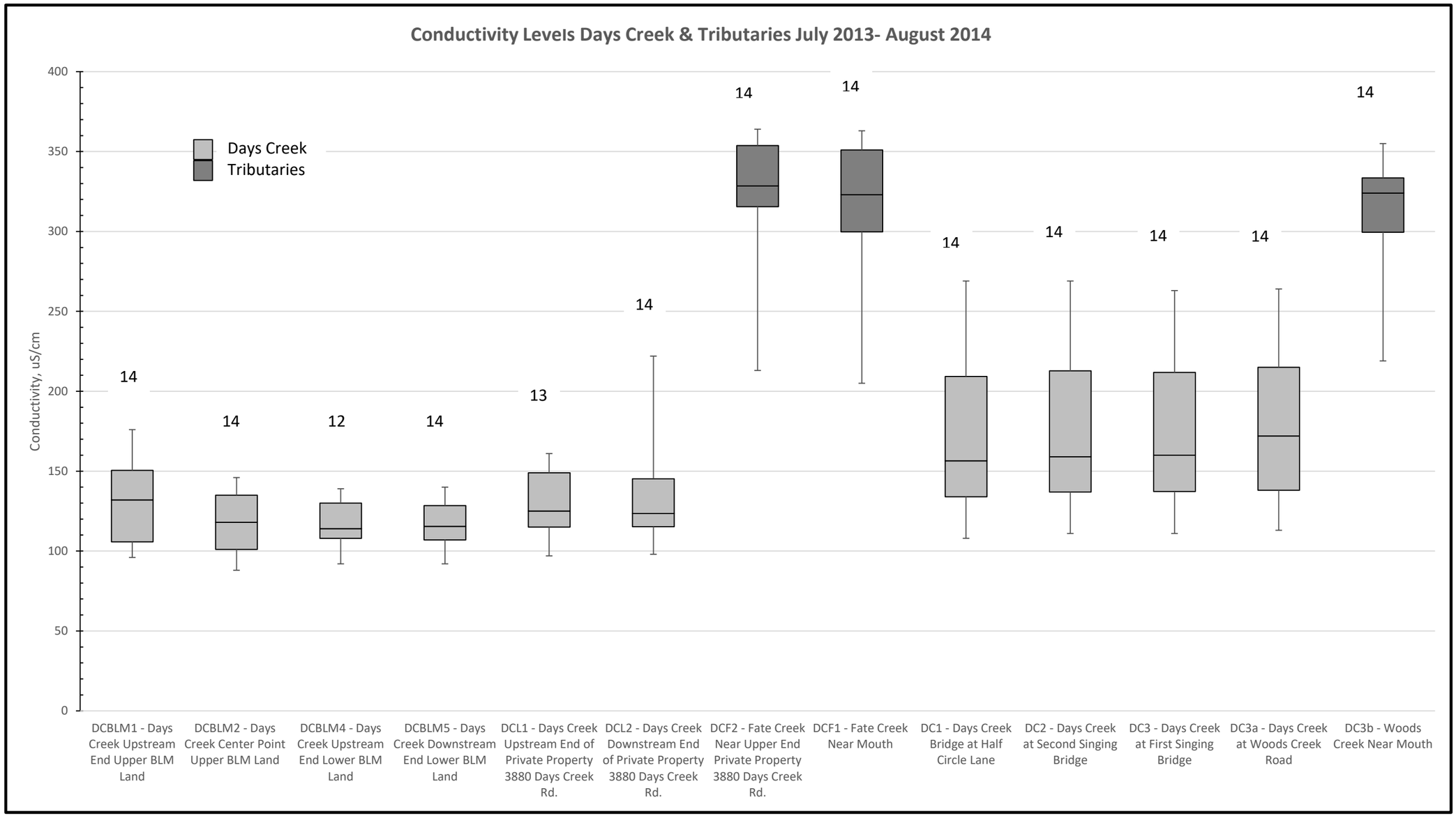
Conductivity levels in the Days Creek monitoring area were within normal ranges for the Umpqua Basin, and none exceeded 400 us/cm. The two tributaries, Fate Creek and Woods Creek showed distinctly higher levels than Days Creek itself. Table 37 is a summary of conductivity ratings for this area. **Graph 51** and **Graph 52** show the clear separation in conductivity levels of the tributaries from Days Creek which is about 100 us/cm lower.



Graph 50. Conductivity levels all Days Creek Watershed sites and monitoring events July 2013 – August 2014 sorted by month.



Graph 51.Conductivity levels Days Creek Watershed sites between July 2013 – August 2014.



Graph 52. Box and whisker plots of Days Creek Watershed sites from July 2013 – August 2014. The number above each plot represents the number of monitoring events.

Conductivity Level Rating Days Creek Watershed Monitoring Sites
July 2013 – August 2014

Station ID - Site Description	Conductivity Rating
DCBLM1 - Days Creek Upstream End Upper BLM Land	
DCBLM2 - Days Creek Center Point Upper BLM Land	
DCBLM4 - Days Creek Upstream End Lower BLM Land	
DCBLM5 - Days Creek Downstream End Lower BLM Land	
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.	
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.	
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.	
DCF1 - Fate Creek Near Mouth	
DC1 - Days Creek Bridge at Half Circle Lane	
DC2 - Days Creek at Second Singing Bridge	
DC3 - Days Creek at First Singing Bridge	
DC3a - Days Creek at Woods Creek Road	
DC3b - Woods Creek Near Mouth	

Rating	Color	Conductivity Level
No Concern		<500 uS/cm
Concern		>500 uS/cm

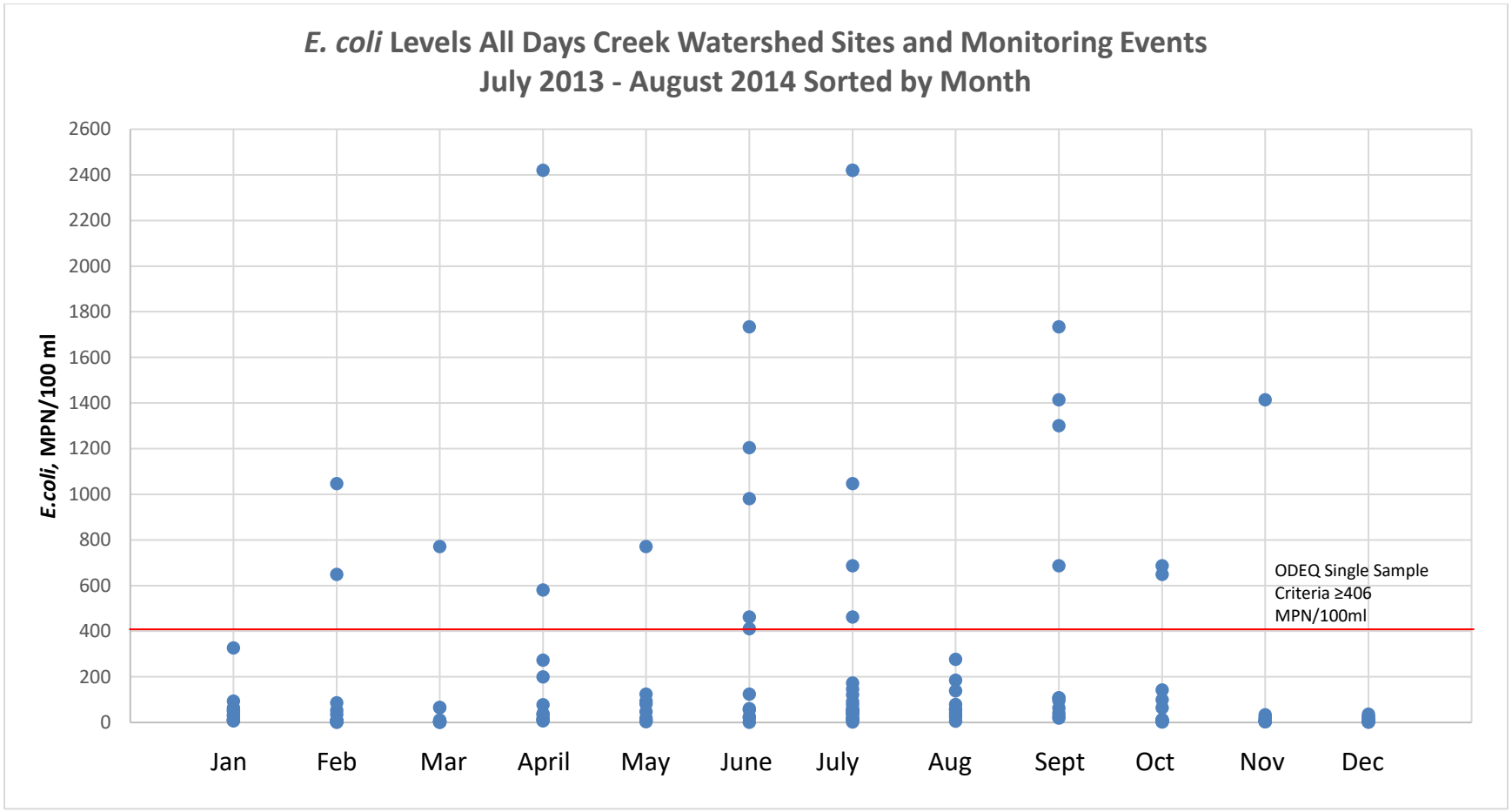
Table 37. Conductivity ratings for Days Creek Watershed sites July 2013 – August 2014.

RESULTS – Days Creek Watershed

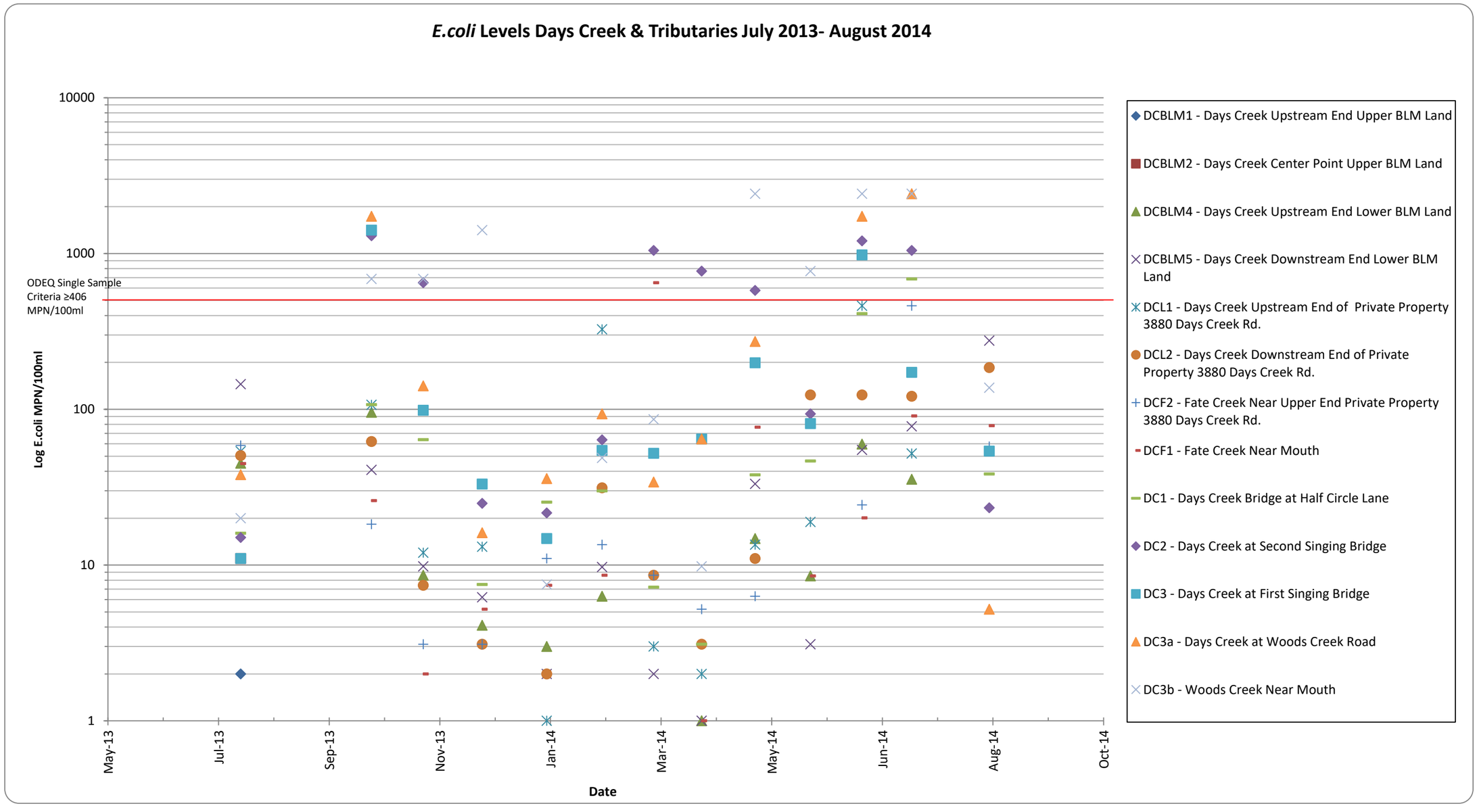
E. coli

Graph 53 clearly indicates that *E. coli* levels exceeded the DEQ one time sampling criteria of ≥406 MPN/100ml with no exceedances in December and January. The Box Plot **Graph 55** shows that Days Creek at the Second Singing Bridge, Days Creek above Woods Creek and Woods Creek near the mouth are by far the greatest offenders. The summary rating **Table 38** shows that three other sites showed a one-time exceedance.

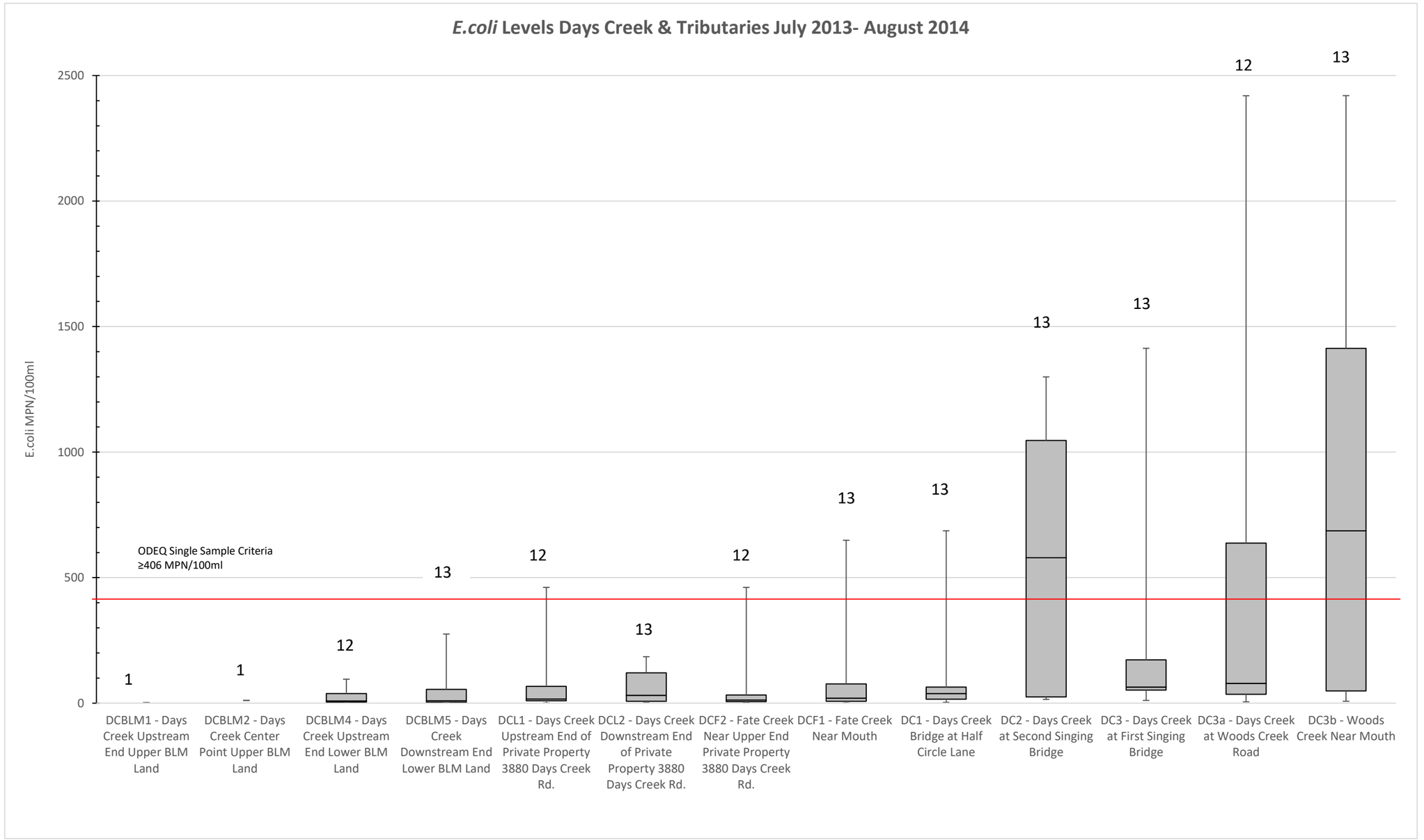
In the case of Fate Creek, because livestock are excluded from all of the private ranch lands and no cattle are run in the forest lands upstream, an investigation was carried out upstream of the collection site to determine possible sources. A dead deer was discovered decomposing in the creek which was the likely source for the *E. coli.*



Graph 53. *E. coli* levels for all Days Creek Watershed sites and monitoring events from July 2013 – August 2014 sorted by month.



Graph 54.*E. coli* levels by Days Creek Watershed monitoring sites July 2013 – August 2014.



Graph 55.Box and whisker plots of each Days Creek Watershed site from July 2013 – August 2014.

Days Creek & Tributaries July 2013- August 2014	126 or Greater		235 or Greater		406 or Greater		
Station ID - Site Description	Count	% of Samples	Count	% of Samples	Count	% of Samples	# of Samples
DCBLM1 - Days Creek Upstream End Upper BLM Land	0	0%	0	0%	0	0%	1
DCBLM2 - Days Creek Center Point Upper BLM Land	0	0%	0	0%	0	0%	1
DCBLM4 - Days Creek Upstream End Lower BLM Land	0	0%	0	0%	0	0%	12
DCBLM5 - Days Creek Downstream End Lower BLM Land	2	15%	1	8%	0	0%	13
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.	2	17%	2	17%	1	8%	12
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.	1	8%	0	0%	0	0%	13
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.	1	8%	1	8%	1	8%	12
DCF1 - Fate Creek Near Mouth	1	8%	1	8%	1	8%	13
DC1 - Days Creek Bridge at Half Circle Lane	2	15%	2	15%	2	15%	13
DC2 - Days Creek at Second Singing Bridge	7	54%	7	54%	7	54%	13
DC3 - Days Creek at First Singing Bridge	4	31%	2	15%	2	15%	13
DC3a - Days Creek at Woods Creek Road	5	42%	4	33%	3	25%	12
DC3b - Woods Creek Near Mouth	8	62%	7	54%	7	54%	13

Table 38. Days Creek Watershed sites July 2013-August 2014 *E. coli* levels occurrence by DEQ and EPA warning levels.

SITE	Summer (May1 – Sept 30)							Winter (Oct 1 – April 30)						
	Total # Sumer Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating	Total # Winter Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating
DCBLM1 - Days Creek Upstream End Upper BLM Land	1	0	0%		0	0%		0	0	0%		0	0%	
DCBLM2 - Days Creek Center Point Upper BLM Land	1	0	0%		0	0%		0	0	0%		0	0%	
DCBLM4 - Days Creek Upstream End Lower BLM Land	5	0	0%		0	0%		7	0	0%		0	0%	
DCBLM5 - Days Creek Downstream End Lower BLM Land	7	1	14%		0	0%		6	0	0%		0	0%	
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.	6	1	17%		1	17%		6	1	17%		0	0%	
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.	7	0	0%		0	0%		7	0	0%		0	0%	
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.	7	1	14%		1	14%		7	0	0%		0	0%	
DCF1 - Fate Creek Near Mouth	6	0	0%		0	0%		7	1	14%		1	14%	
DC1 - Days Creek Bridge at Half Circle Lane	7	0	0%		0	0%		7	0	0%		0	0%	
DC2 - Days Creek at Second Singing Bridge	7	3	43%		3	43%		7	4	57%		4	57%	
DC3 - Days Creek at First Singing Bridge	6	2	33%		2	33%		7	0	0%		0	0%	
DC3a - Days Creek at Woods Creek Road	5	3	60%		3	60%		7	1	14%		0	0%	
DC3b - Woods Creek Near Mouth	6	4	67%		4	67%		7	3	43%		3	43%	

Rating	Color	EPA Criteria	ODEQ Criteria
No Concern (below standard)		< 235	< 406
Concern (exceeds standard)		≥ 235	≥ 406

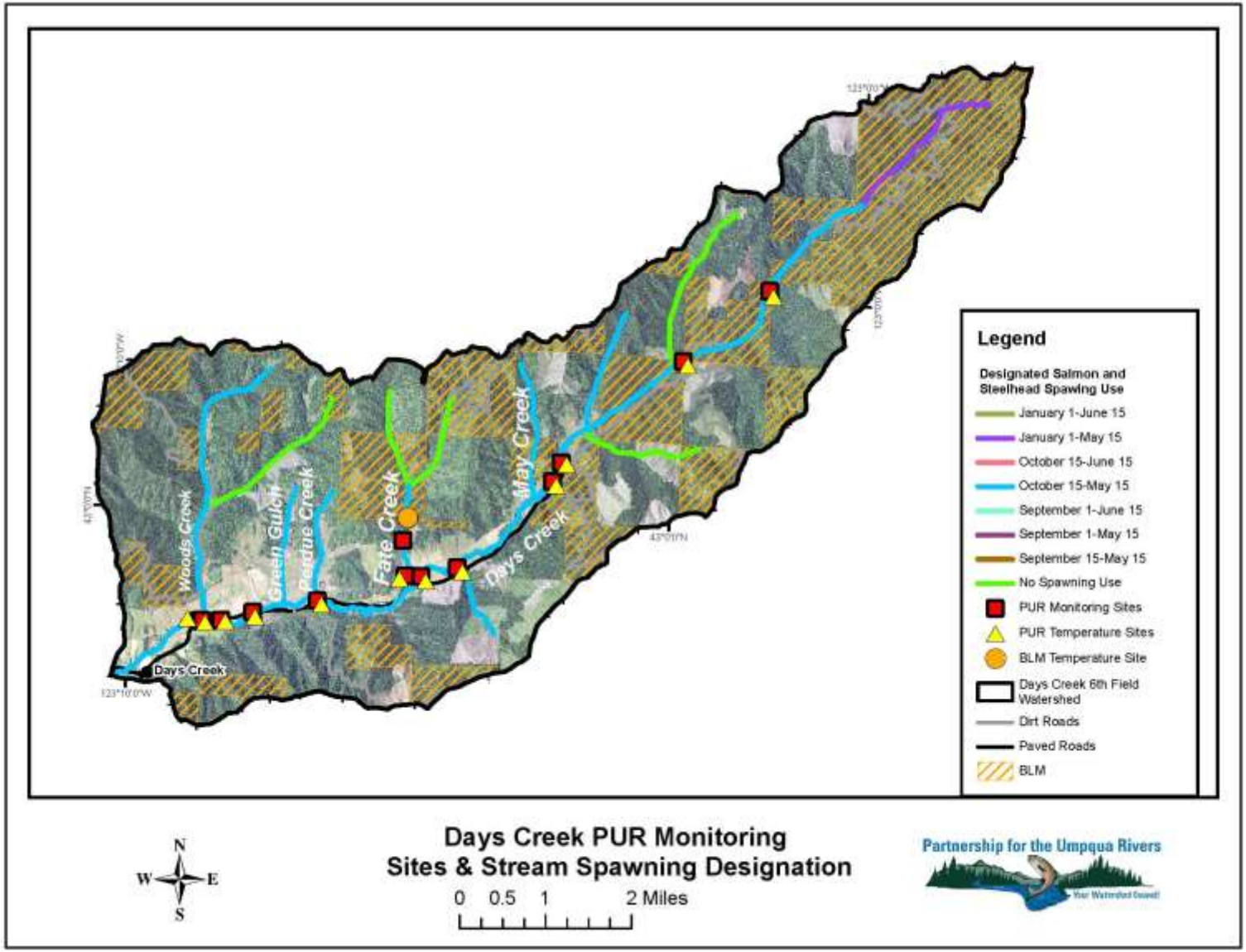
Table 39. Days Creek Watershed sites ratings for *E. coli* levels by summer and winter July 2013-August 2014.

RESULTS – Days Creek Watershed

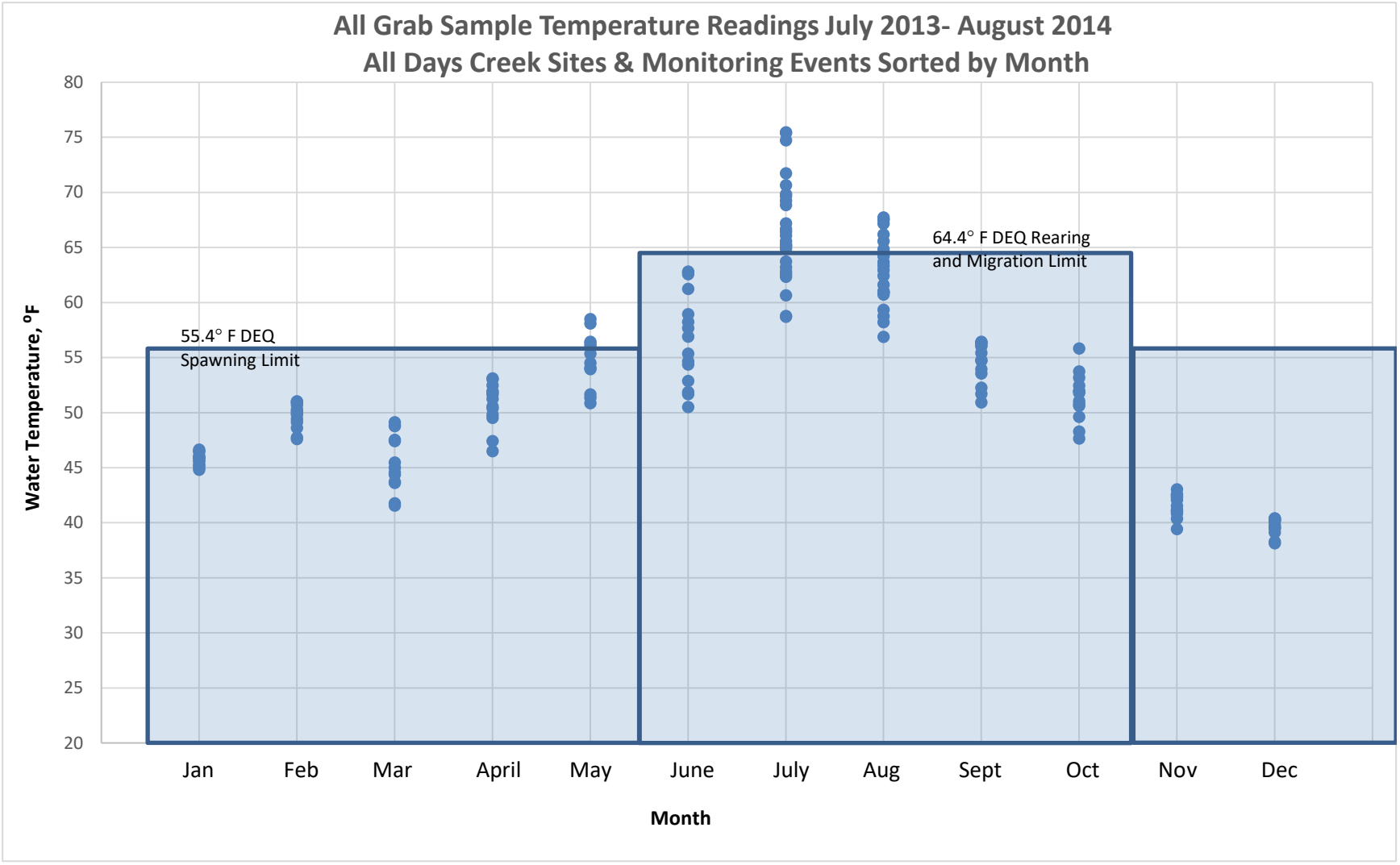
Grab Sample Temperature

Graph 56 displays all of the data collected sorted by month. This shows that from November through April all of the Days Creek sites and monitoring events met the winter ODEQ Spawning Criteria of 55.4° F as established in **Map 10**. Only some sites, at the edge of the spawning period in late May of 2014, rose over the criteria level but still remained below the "Rearing and Migration" temperature limit. July and August however show that a great number of monitoring events displayed temperatures well above the temperature criteria of 64.4°F for that period. **Table 40** displays the summary rating for each site for each of the two time periods. Only the two uppermost sites on Days Creek rated as good for both spawning and rearing/migration times of the year.

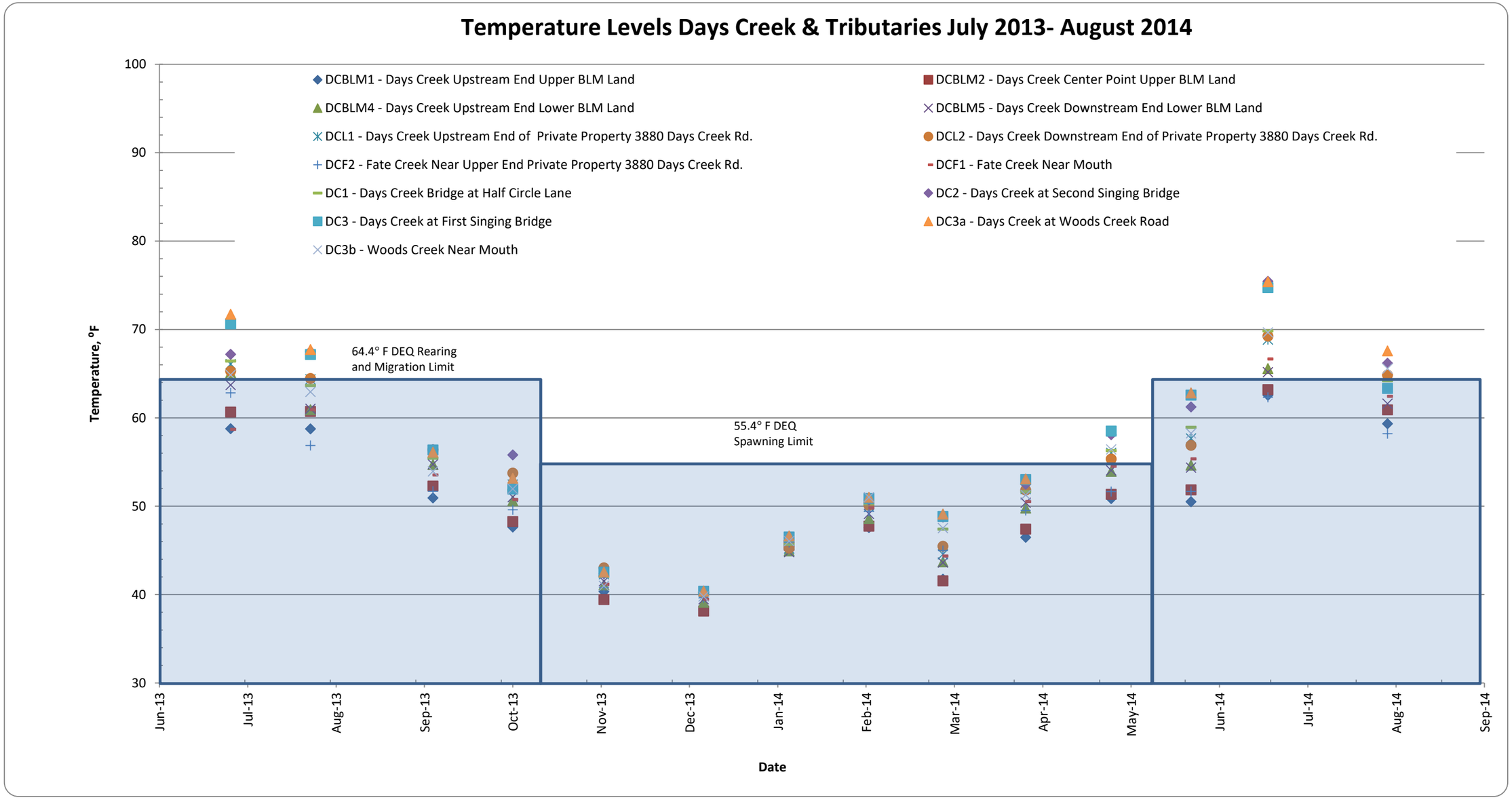
The official criteria for these periods are based on a Seven-Day-Average Maximum (7DAM) temperature. This set of data is only grab sample and therefore not based on a 7DAM. It is presented here as an indicator for restoration purposes only. The next section will include the continuously monitored temperatures which can produce 7DAMs.



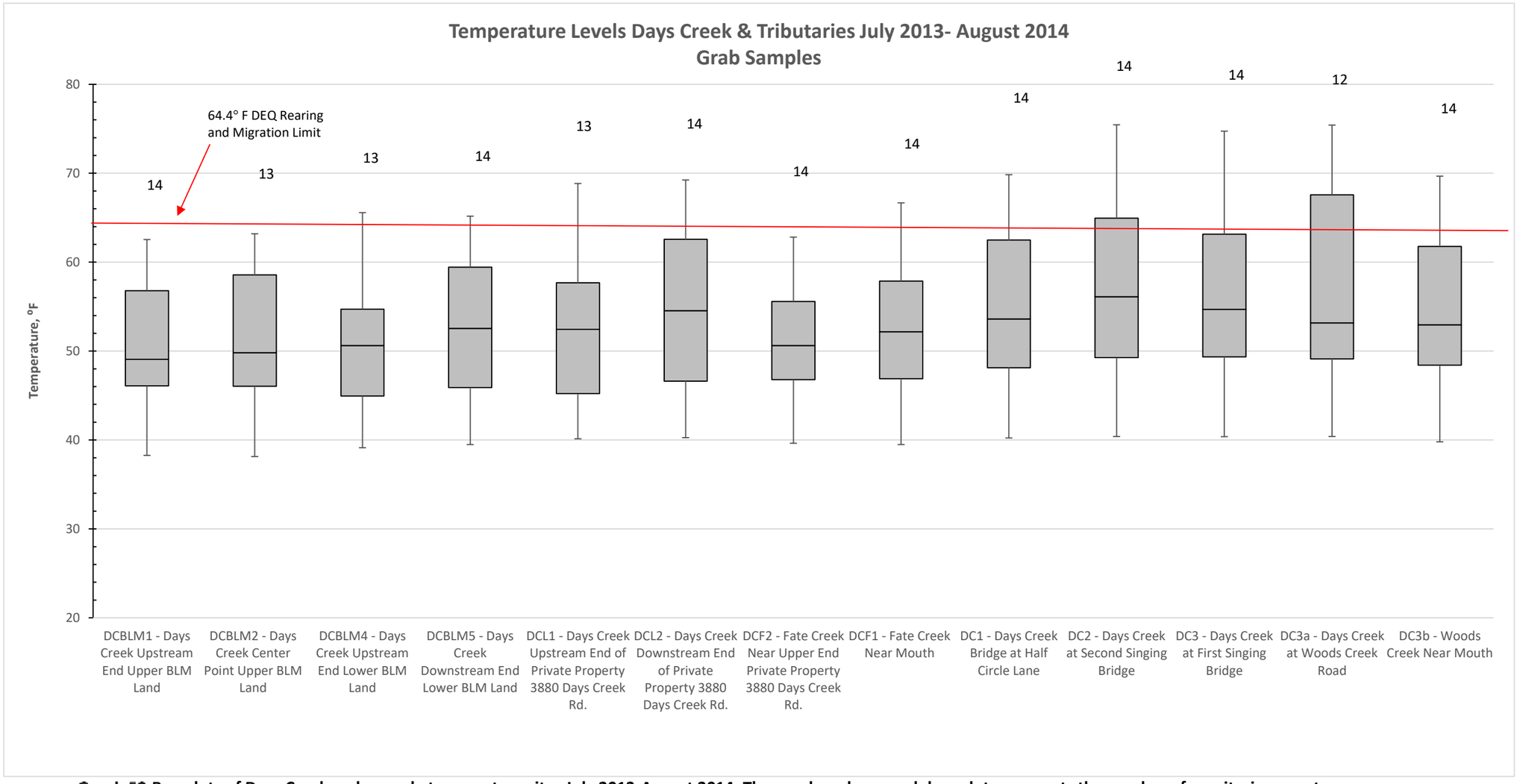
Map 10. Days Creek PUR monitoring sites and ODEQ streams spawning designation.



Graph 56.Days Creek grab sample temperature all sites and monitoring events sorted by month.



Graph 57.Days Creek grab sample temperature values by site July 2013-August 2014.



Graph 58. Box plots of Days Creek grab sample temperature sites July 2013-August 2014. The number above each box plot represents the number of monitoring events.

Temperature Ratings Using Grab Sample Monitoring
Days Creek & Tributaries July 2013- August 2014

SITE	Rating based on Spawning Criteria 55.4° Oct 15-May 15	Rating based on Rearing and Migration Criteria 64.4° May 16-Oct 14
DCBLM1 - Days Creek Upstream End Upper BLM Land		
DCBLM2 - Days Creek Center Point Upper BLM Land		
DCBLM4 - Days Creek Upstream End Lower BLM Land		
DCBLM5 - Days Creek Downstream End Lower BLM Land		
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.		
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.		
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.		
DCF1 - Fate Creek Near Mouth		
DC1 - Days Creek Bridge at Half Circle Lane		
DC2 - Days Creek at Second Singing Bridge		
DC3 - Days Creek at First Singing Bridge		
DC3a - Days Creek at Woods Creek Road		
DC3b - Woods Creek Near Mouth		

Rating	Grab Sample Temperatures Spawning Oct 15 to May 15	Grab Sample Temperatures Rearing and Migration May 16- Oct 14	Color
Good	<55.4° F	<64.4° F	
Needs Improvement	>55.4° F	>64.4° F	

Table 40. Rating chart of Days Creek grab sample water temperatures July 2013- August 2014.

RESULTS – Days Creek Watershed

Continuous Temperature

Table 41 and **Table 42** give the summary outputs from the temperature data loggers for the summer 2013 and 2014 respectively. This is the "Rearing & Migration" designated time of the year and should have been ≤64.4° for Days Creek and its tributaries. The results of this data and the grab sample data which is used to represent the "Spawning" time of winter, since no dataloggers were deployed over the winter, are presented as ratings in **Table 43**. None of the streams monitored in the Days Creek area met criteria for the "Rearing & Migration" summer season.

Summary Data 2013

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Site Name	Lat	Long	Start Date	Stop date	Seasonal Maximum		Seasonal Minimum		Seasonal Max ΔT		7-Day averages			
					Date	Value	Date	Value	Date	Value	Date	Maximum	Minimum	Δ T
Days Creek Uppermost BLM Site	43.0396	-123.021	06/28/13	09/27/13	07/03/13	65.8	09/27/13	49.3	07/14/13	4.7	07/02/13	64.0	60.5	3.5
Days Creek Between upper BLM Sections	43.0273	-123.041	06/28/13	09/27/13	08/22/13	67.8	09/27/13	50.8	08/21/13	9.4	08/20/13	65.6	57.8	7.8
Days Creek Lower part middle BLM section	43.01986	-123.055	06/28/13	09/27/13	07/03/13	67.5	09/27/13	51.5	07/14/13	5.7	07/02/13	65.8	61.5	4.3
Days Creek Above lower BLM project area	43.0096	-123.068	06/28/13	07/24/13	07/23/13	70.4	07/13/13	57.6	07/23/13	9.9	07/21/13	69.8	60.9	8.9
Days Creek below lower BLM project area	43.0064	-123.07	06/28/13	09/27/13	07/26/13	69.2	09/27/13	52.9	07/14/13	7.9	07/25/13	67.7	61.8	5.9
Days Creek upper Lyon property	42.9913	-123.091	06/28/13	07/24/13	07/24/13	72.3	07/13/13	59.8	07/24/13	9.3	07/02/13	70.6	63.0	7.6
Days Creek lower end of Lyon property	42.9897	-123.1	06/28/13	09/27/13	07/02/13	70.0	09/27/13	54.3	06/30/13	6.8	07/01/13	68.3	62.6	5.6
Fate Creek below project area	42.9897	-123.103	06/28/13	09/27/13	07/02/13	67.8	09/27/13	51.2	08/04/13	7.4	07/01/13	66.1	60.9	5.2
Days Creek at bridge at Half Circle Lane	42.985	-123.123	06/28/13	09/27/13	07/02/13	72.7	09/27/13	52.9	07/14/13	9.6	07/01/13	70.6	63.4	7.2
Days Creek at second singing bridge	42.9827	-123138	06/28/13	09/27/13	07/02/13	76.0	09/27/13	52.6	07/09/13	11.5	07/01/13	73.7	64.4	9.3
Days Creek at first singing bridge	42.9812	-123.145	06/28/13	09/27/13	07/02/13	77.6	09/27/13	52.8	07/14/13	11.5	07/01/13	75.2	65.5	9.7
Days Creek at Woods Creek Bridge	42.9811	-123.15	06/28/13	09/27/13	07/02/13	78.1	09/27/13	52.8	06/30/13	11.5	07/01/13	75.6	65.8	9.8
Wood Creek at mouth	42.981	-123.15	06/28/13	09/27/13	07/02/13	70.5	09/27/13	52.1	07/14/13	7.3	07/01/13	68.7	63.0	5.7

Site Name	Days > 55 F	Days > 64 F	Days > 70 F	Hours > 55 F	Hours > 64 F	Hours > 70 F	Warmest day of 7-day max Date	Maximum	Minimum	Agency
Days Creek Uppermost BLM Site	89	7	0	2064.0	55.0	0.0	07/03/13	65.8	63.1	PUR
Days Creek Between upper BLM Sections	89	28	0	2133.0	132.0	0.0	08/22/13	67.8	60.5	PUR
Days Creek Lower part middle BLM section	90	24	0	2136.5	246.5	0.0	07/03/13	67.5	63.8	PUR
Days Creek Above lower BLM project area	27	27	3	647.5	367.0	7.0	07/23/13	70.4	60.5	PUR
Days Creek below lower BLM project area	92	72	0	2169.5	678.5	0.0	07/26/13	69.2	63.1	PUR
Days Creek upper Lyon property	27	27	10	647.5	421.0	34.0	07/03/13	72.3	65.1	PUR
Days Creek lower end of Lyon property	92	68	0	2200.0	711.5	0.0	07/02/13	70.0	64.2	PUR
Fate Creek below project area	89	39	0	2098.0	238.0	0.0	07/02/13	67.8	62.6	PUR
Days Creek at bridge at Half Circle Lane	92	77	7	2166.5	999.5	44.0	07/02/13	72.7	65.5	PUR
Days Creek at second singing bridge	92	81	16	2167.5	1419.5	112.0	07/02/13	76.0	66.9	PUR
Days Creek at first singing bridge	92	81	45	2174.0	1463.0	336.5	07/02/13	77.6	68.1	PUR
Days Creek at Woods Creek Bridge	92	82	62	2174.5	1609.0	466.5	07/02/13	78.1	68.5	PUR
Wood Creek at mouth	90	66	2	2133.0	795.5	7.5	07/02/13	70.5	65.1	PUR

Table 41. Days Creek continuous temperature data summary 2013.

Summary Data 2014

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Site Name	Lat	Long	Start Date	Stop date	Seasonal Maximum		Seasonal Minimum		Seasonal Max ΔT		7-Day averages			
					Date	Value	Date	Value	Date	Value	Date	Maximum	Minimum	Δ T
Days Creek top of uppermost BLM site	43.0396	-123.021	06/20/14	09/13/14	07/16/14	66.0	06/21/14	51.8	07/01/14	5.2	07/15/14	64.6	61.1	3.5
Days Creek between upper BLM sections	43.0273	-123.041	06/20/14	08/10/14	07/16/14	66.1	06/21/14	52.9	07/19/14	6.0	07/17/14	65.6	60.7	4.9
Lower end of middle BLM section	43.01986	-123.055	06/20/14	08/23/14	07/16/14	67.7	06/22/14	53.5	07/01/14	6.0	07/16/14	66.5	62.0	4.4
Days Creek top of lowest BLM project	43.0096	-123.068	06/20/14	08/02/14	07/16/14	71.6	06/22/14	53.5	07/19/14	9.6	07/17/14	70.0	62.0	8.0
Botton of lower BLM project section	43.0064	-123.07	06/20/14	09/14/14	07/16/14	69.2	06/22/14	53.9	07/01/14	7.8	07/16/14	68.0	61.6	6.4
Days Creek upper end of property 3880	42.99208	-123.091	06/20/14	08/03/14	07/16/14	70.9	06/21/14	55.4	07/01/14	9.1	07/16/14	70.4	63.7	6.8
Fate Creek above project area	42.9957	-123.104	06/20/14	09/13/14	07/16/14	64.9	09/04/14	50.1	07/19/14	7.1	08/01/14	63.6	58.6	5.0
Fate Creek below project, old cattle crossing	42.9897	-123.103	06/20/14	09/13/14	07/16/14	67.9	06/22/14	53.0	06/22/14	6.2	08/01/14	66.6	62.4	4.2
Days Creek at Half Circle Lane	42.985	-123.123	06/20/14	09/13/14	07/16/14	72.6	09/10/14	53.4	07/12/14	9.3	07/15/14	70.7	63.8	6.9
Days Creek at second singing bridge	42.98282	-123.138	06/20/14	09/14/14	07/16/14	77.9	06/22/14	55.5	07/12/14	12.3	07/17/14	75.5	66.3	9.2
Days Creek at first singing bridge	42.9812	-123.145	06/20/14	09/13/14	07/16/14	76.1	09/04/14	51.4	09/04/14	16.4	07/15/14	73.9	65.9	7.9
Days Creek at Woods Creek Rd. Bridge	42.9811	-123.15	06/20/14	09/14/14	07/16/14	77.8	09/04/14	50.0	09/12/14	19.7	07/15/14	75.5	66.4	9.1
Woods Creek near mouth	42.981	-123.15	06/20/14	09/13/14	07/16/14	70.7	06/22/14	54.1	07/01/14	7.2	08/01/14	69.0	64.1	4.8

Site Name	Days > 55 F	Days > 64 F	Days > 70 F	Hours > 55 F	Hours > 64 F	Hours > 70 F	Warmest day of 7-day max Date	Maximum	Minimum	Agency
Days Creek top of uppermost BLM site	86	15	0	1955.0	110.0	0.0	07/16/14	66.0	62.6	PUR
Days Creek between upper BLM sections	52	19	0	1208.0	89.0	0.0	07/16/14	66.1	61.8	PUR
Lower end of middle BLM section	65	37	0	1542.5	378.5	0.0	07/16/14	67.7	63.3	PUR
Days Creek top of lowest BLM project	44	32	8	1042.5	400.5	28.0	07/16/14	71.6	63.6	PUR
Botton of lower BLM project section	87	57	0	2072.5	517.5	0.0	07/16/14	69.2	62.6	PUR
Days Creek upper end of property 3880	45	42	8	1079.5	562.5	18.5	07/16/14	70.9	64.8	PUR
Fate Creek above project area	86	5	0	1786.0	15.5	0.0	07/30/14	64.2	58.7	PUR
Fate Creek below project, old cattle crossing	86	42	0	2018.0	451.5	0.0	08/01/14	67.2	62.5	PUR
Days Creek at Half Circle Lane	86	65	14	2024.5	989.5	83.0	07/16/14	72.6	65.5	PUR
Days Creek at second singing bridge	87	83	43	2087.5	1478.5	435.5	07/16/14	77.9	67.8	PUR
Days Creek at first singing bridge	86	75	22	2021.5	1188.5	194.5	07/16/14	76.1	68.0	PUR
Days Creek at Woods Creek Rd. Bridge	87	86	55	2018.5	1462.5	482.0	07/16/14	77.8	68.5	PUR
Woods Creek near mouth	86	62	1	2055.0	927.5	9.0	07/30/14	69.6	64.3	PUR

Table 42. Days Creek continuous temperature data summary 2014.

Temperature Ratings Days Creek & Tributaries July 2013- August 2014

SITE	Rating based on Spawning Criteria 55.4° Oct 15-May 15	Rating based on Rearing-Migration Criteria 64.4° May 16-Oct 14
DCBLM1 - Days Creek Upstream End Upper BLM Land	Grab Sample	Temp Logger
DCBLM2 - Days Creek Center Point Upper BLM Land	Grab Sample	Temp Logger
DCBLM3 - Days Creek Lower part middle BLM Section	Grab Sample	Temp Logger
DCBLM4 - Days Creek Upstream Upper Lower BLM Land	Grab Sample	Temp Logger
DCBLM5 - Days Creek Downstream End Lower BLM Land	Grab Sample	Temp Logger
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.	Grab Sample	Temp Logger
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.	Grab Sample	Temp Logger
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.	Grab Sample	Temp Logger
DCF1 - Fate Creek Near Mouth	Grab Sample	Temp Logger
DC1 - Days Creek Bridge at Half Circle Lane	Grab Sample	Temp Logger
DC2 - Days Creek at Second Singing Bridge	Grab Sample	Temp Logger
DC3 - Days Creek at First Singing Bridge	Grab Sample	Temp Logger
DC3a - Days Creek at Woods Creek Road	Grab Sample	Temp Logger
DC3b - Woods Creek Near Mouth	Grab Sample	Temp Logger

Rating	Color	Grab Sample Temperatures Spawning	7 DAM Migration-Rearing Criteria
Good		<55.4° F	<64.4° F
Needs Improvement		>55.4° F	>64.4° F

Table 43. Summary rating for July 2013 to August 2014 of Days Creek temperature for grab sample and continuous logger data.

RESULTS – Days Creek Watershed

Summary

Table 44 presents the summary of ratings of all six water quality parameters monitored in the Days Creek Watershed area from July 2013- August 2014. It is evident that this area's worst problem is exceedances of the temperature and dissolved oxygen criteria with every site failing to meet DEQ criteria. Conductivity, on the other hand, is of no concern at any of the sites. *E. coli* is of concern on the lower farmland dominated sites. Of note in this regard, DCL2 actually shows a reduction in *E. coli* levels in Days Creek from an upstream site DCL1. These sites are upstream and downstream of a private property on which the landowner has participated in numerous stream restoration projects including livestock exclusion, off stream stock-water provision, instream structure placements, and riparian willow and tree planting. DC1 - Days Creek Bridge at Half Circle Lane was the worst site with 5 scoring categories exceeding criteria.

Summary Rating for Days Creek Watershed Monitoring Sites – Six Water Quality Parameters

	Turbidity	pH	Dissolved Oxygen Non-Spawning Season May 15-October 15	Dissolved Oxygen Spawning Season October 15-May 15	Conductivity	*E. coli* ≥406 MPN/100ml Criteria	Temperature Grab Sample Spawning Criteria 55.4° Oct 15-May 15	Temp Logger 7ADM Temperature Rearing and Migration-Criteria 64.4°
DCBLM1 - Days Creek Upstream End Upper BLM Land								
DCBLM2 - Days Creek Center Point Upper BLM Land								
DCBLM4 - Days Creek Upstream Upper Lower BLM Land								
DCBLM5 - Days Creek Downstream End Lower BLM Land								
DCL1 - Days Creek Upstream End of Private Property 3880 Days Creek Rd.								
DCL2 - Days Creek Downstream End of Private Property 3880 Days Creek Rd.								
DCF2 - Fate Creek Near Upper End Private Property 3880 Days Creek Rd.								
DCF1 - Fate Creek Near Mouth								
DC1 - Days Creek Bridge at Half Circle Lane								
DC2 - Days Creek at Second Singing Bridge								
DC3 - Days Creek at First Singing Bridge								
DC3a - Days Creek at Woods Creek Road								
DC3b - Woods Creek Near Mouth								

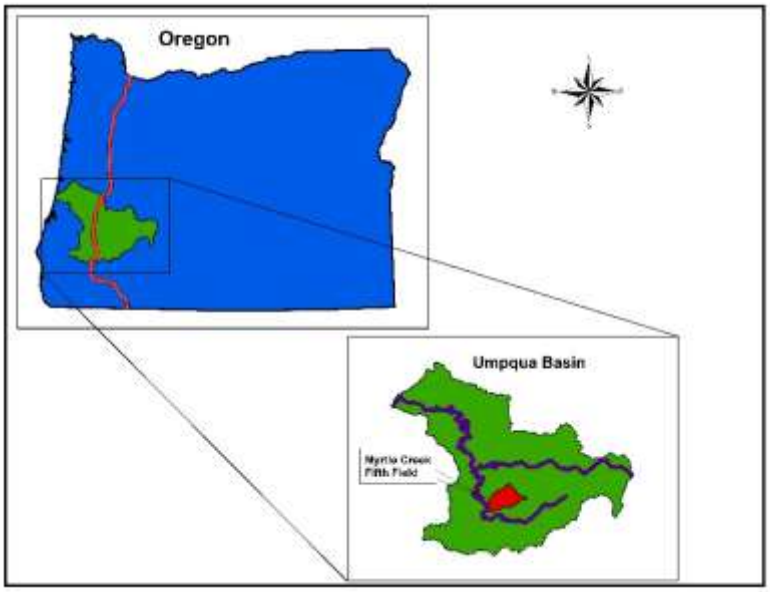
Table 44. Summary ratings for Days Creek monitoring sites – six water quality parameters. See tables for each parameter for color coding.

Myrtle Creek Watershed

Area Description, Background & Monitoring Sites

The Myrtle Creek fifth-field watershed is located in Douglas County, Oregon, and is 76,322.2 acres. The watershed stretches a maximum of 10.8 miles north to south and 17.2 miles east to west. Myrtle Creek is a tributary of the South Umpqua River. Myrtle Creek flows 0.7 miles from the confluence of its two main tributaries to the mouth of the South Umpqua River. North Myrtle Creek is 17.7 miles from the headwater to its confluence with South Myrtle Creek. South Myrtle Creek is 22.2 miles long. Land use in this watershed is typical of land use countywide. The most common land use in the Myrtle Creek drainage is forestry (79%) followed by agriculture (18%). Land ownership is primarily private (57%), with public ownership (43%) administered mostly by the Bureau of Land Management. The city of Myrtle Creek sits at the bottom of this watershed, with the two major streams, North Myrtle and South Myrtle meeting within city limits. Myrtle Creek is the only city within the watershed. According to the US Census Bureau, the city's total population in 2000 was 3,419. (Lyon, Quality Assurance Project Plan For the Umpqua Basin Watershed Council Volunteer Monitoring Program, 2004) (Geyer, Myrtle Creek Assessment and Action Plan, 2003).

Map 13 in the temperature section for Myrtle Creek indicates the creeks designated as spawning and non-spawning in the watershed. Many of the tributaries are considered as not being used for fish "Spawning" but only for "Rearing & Migration" as shown in **Figure 320A - Umpqua Basin Fish Use Designations from ODEQ** 2003 (**Appendix I:**).



Map 11. Myrtle Creek Watershed Map.

Photo 9. Mouth of Myrtle Creek entering the South Umpqua River.

Myrtle Creek was selected as PUR's first watershed to monitor out of all the possible watersheds in the Umpqua Basin for several reasons. It is centrally located, is of a manageable size, contains several of UBWC's/PUR's completed and proposed project sites, and has water quality limiting issues representative of the problems of the South Umpqua Sub Basin. This sub basin has water quality concerns evident by numerous 303(d) listings. Oregon coastal cutthroat and coho populations are severely depressed in this sub basin. In addition, many of our first volunteers came from the Myrtle Creek area.

The water quality monitoring project in Myrtle Creek consisted of two parts: 1) ambient baseline water quality monitoring at selected sites and 2) continuous summer temperature monitoring at selected sites. Sampling was carried out using the standard protocols described in the OWEB Water Quality Monitoring Guidebook. Samples were obtained from as close to the highest flow area (thalweg) as possible – either from the bank with a long armed grabber or from a bridge with a bucket.

Map 12. Map of Myrtle Creek Watershed showing PUR monitoring sites.

Myrtle Creek Monitoring Sites

Site ID #	Site Name	Site Location	Type Site	Latitude	Longitude
M1	Millsite Park	Myrtle Creek below Main Street bridge	City	43°01.418'N	123°17.314'W
SM1a	South Myrtle Creek near mouth	South Myrtle Creek at NW Riverside Drive (near mouth)	Mouth of South Myrtle Creek	43.022741N	123.284678W
SM1	Neal Lane Bridge	South Myrtle Creek Neil Lane Bridge, below golf course	Golf Course, city wastewater discharge	43°01.033'N	123°16.460'W
SM2	DC Cutoff Rd	Days Creek Cutoff Road at private bridge	Above Golf Course	43°00.912'N	123°15.633'W
SM3.5	Ben Branch Near mouth	Ben Branch at culvert under S. Myrtle Road	Farmlands and Rural Residential	43.03567N	123.15926W
SM3	Steve Taylor's	Steve Taylor's Property 4891 S. Myrtle	Rural Residential	43°01.337'N	123°12.593'W
SM3a	Louis Creek	Louis Creek near mouth at S. Myrtle Road bridge	Farmlands and Rural Residential	43°02.139'N	123°08.900'W
SM4	South Myrtle Bridge	Bridge over South Myrtle at 9,700 S. Myrtle Creek Road	Below irrigation project and farm land	43°01.825'N	123°06.361'W
SM3.5	Long Wiley Creek	Short Wiley Creek from box culvert under	Farmlands and Rural Residential	43.03099N	123.116509W
SM4a	South Myrtle Bridge	Between Long Wiley and Letitia	Farmlands and Rural Residential	43.030441N	123.105894W
SM5a	Letitia Creek	Letitia Creek near mouth at 9 S. Myrtle Creek Road	Tributary -2006 PUR projects us	43°02.190'N	123°05.362'W
SM5	South Myrtle at 12 Mile Ranch	UBWC South Myrtle Dam Removal Site- 12 mile ranch	Farmland	43°02.238N	123°01.829W
SM6	Weaver Creek Culvert	First Culvert Hidden Homestead Road	Tributary Forest & Farm	43°03.148'N	123°04.054W
SM7	South Myrtle at end of yellow line	Across South Myrtle Road from BLM 28-3-35.2	Forest	43°05.058N	123°0.1274W
NM1a	Evergreen Park	End of Cedar Street	Residential	43°01.643'N	123°16.588'W
NM1	North Myrtle Creek at Super Y	North Myrtle Creek Access across from Super Y	Residential	43°01.639N	123°16.624W
NM1.5	Spring Brook	Spring Brook from culvert under N Myrtle Rd	Residential	43.040499N	123.262731W
NM2	Bilger Creek	Bilger at mouth at confluence with North Myrtle Creek	Rural Residential	43°02.536'N	123°15.465'W
NM3	North Myrtle at Bilger	North Myrtle Above Confluence with Bilger Creek	Rural Residential	43°02.531'N	123°15.461'W
NM4	North Myrtle Park	North Myrtle Park From entry bridge	Farmland	43°04.507'N	123°11.735'W
NM5a	Frozen Creek	Frozen Creek near mouth	Tributary Farmland and Rural Residential	43°04.772'N	123°11.652'W
NM6	Lee Creek	Lee Creek at Rice Bridge	Tributary Forest	43°07.588N	123°09.576W
NM 5	Slide Creek	Slide Creek Mid Log Placement 1.9 miles up Slide	Forest	43°05.939N	123°08.155W
NM5.5	North Myrtle above Slide Creek	North Myrtle at bridge above Slide Creek	Farmland	43°05.280N	123°10.044W
NM7a	Mouth Buck Fork	North Myrtle Creek Road on Buck Fork Creek	Tributary Forest	43°07.787N	123°07.262W
NM7	1 mile up Buck Fork from mouth	15391 North Myrtle Creek Road on Buck Fork Creek	Tributary Forest	43°08.229N	123°05.799W
NM8	North Myrtle	North Myrtle above Buck Fork	Forest	43°07.784N	123°07.302W

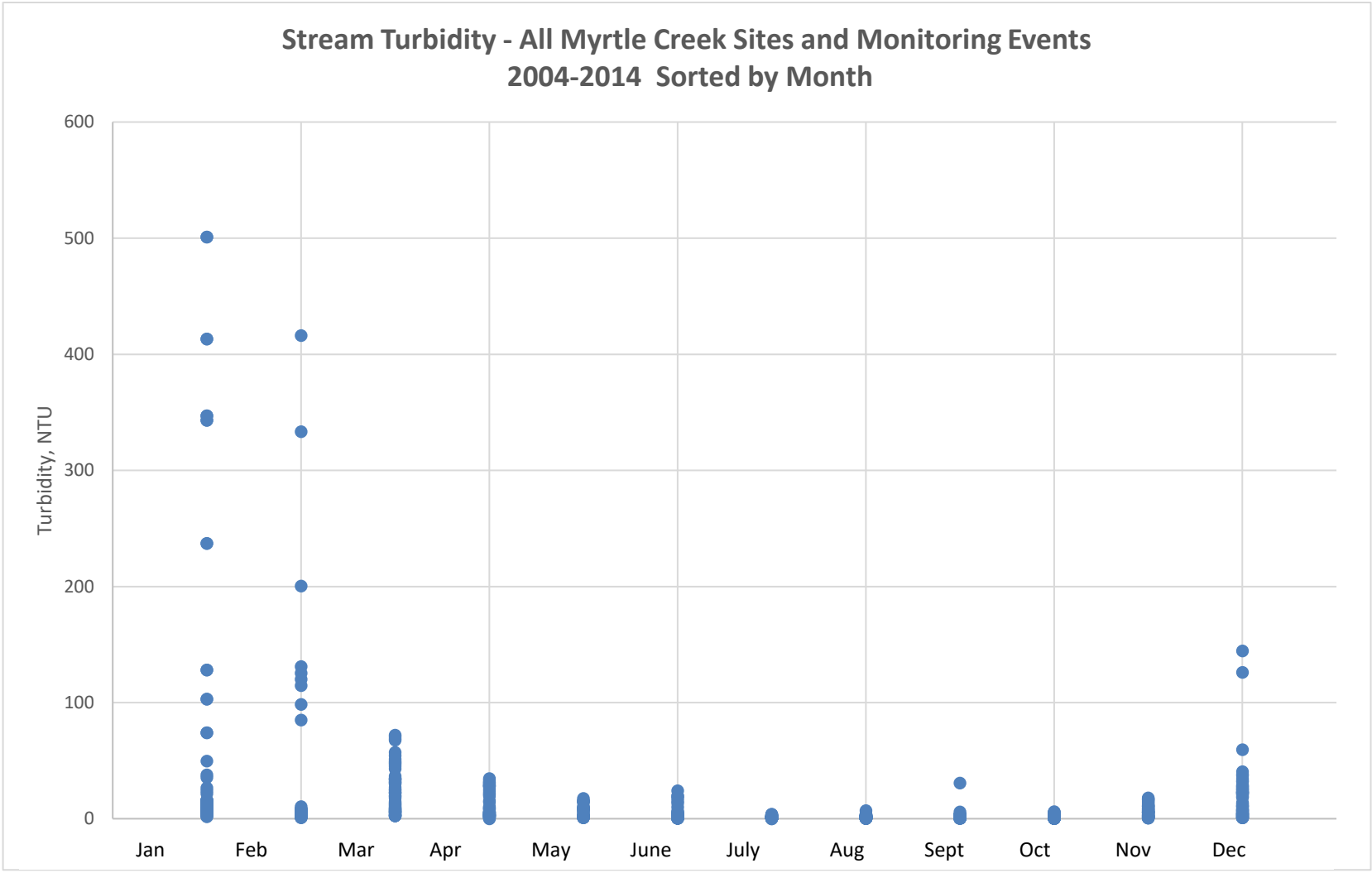
Table 45. Myrtle Creek Watershed Monitoring Sites Description and Location.

RESULTS – Myrtle Creek Watershed

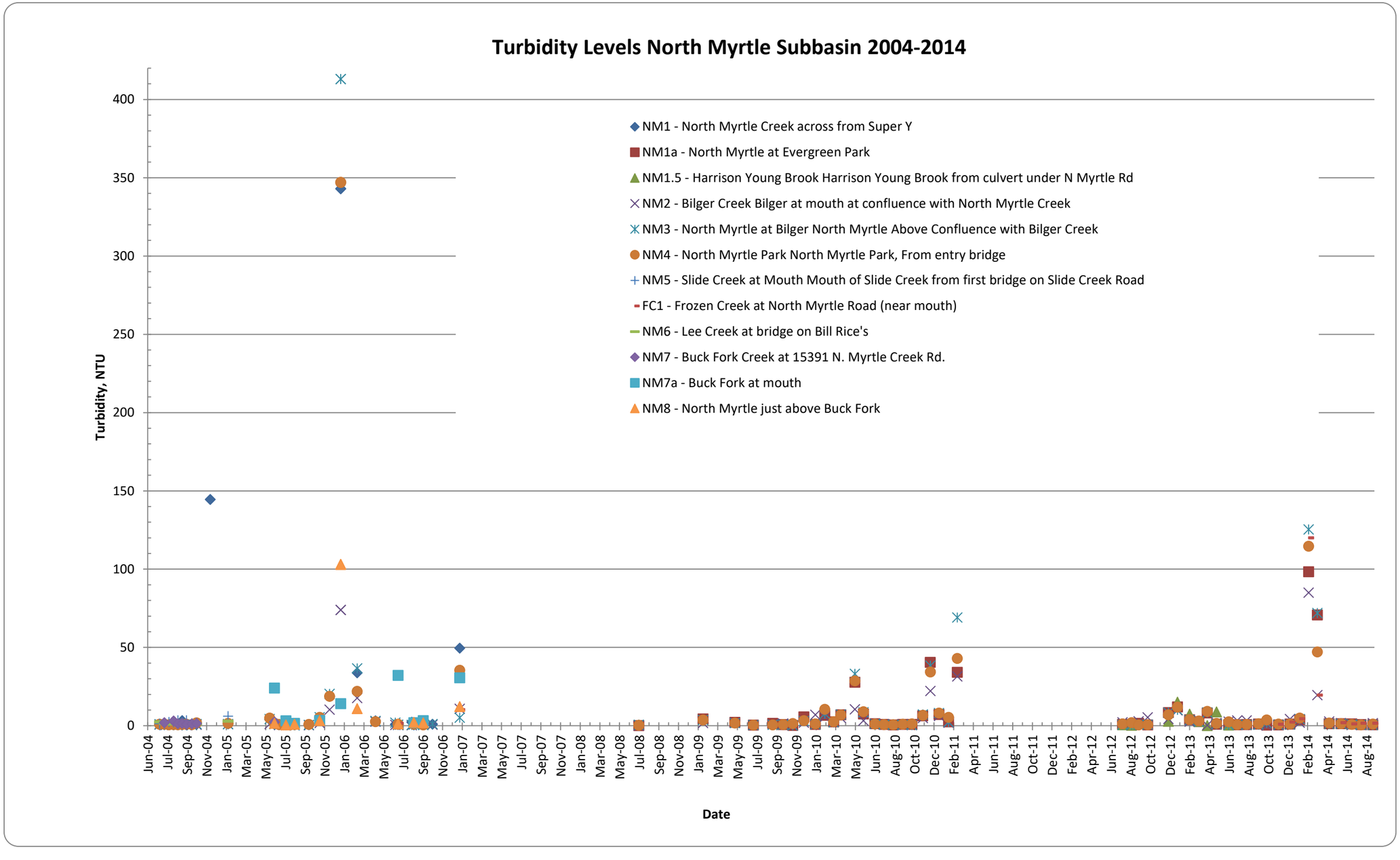
Turbidity

Large increases in turbidity levels in the Myrtle Creek Watershed occurred only during winter months as shown in **Graph 59**. **Graphs 60-67** depict the stream turbidity levels for Myrtle Creek, South Myrtle Creek and North Myrtle Creek as individual values for each monitoring event and as a summation for each site as box and whisker graphs. Outliers were included as these were real events denoting characteristics of the watershed. One of particular note is the high stream turbidity levels in North Myrtle Creek on 1/11/06 that can be tracked from above Buck Fork Creek all the way to the mouth of Myrtle Creek. The turbidity was recorded as high as 501 NTU at Buck Fork that day. Investigation upstream led to the discovery of a substantial debris flow which reconfigured the entire valley of the tributary it followed. In addition, it provided a considerable sediment bed load to North Myrtle Creek which most likely proved beneficial to spawning salmon over time.

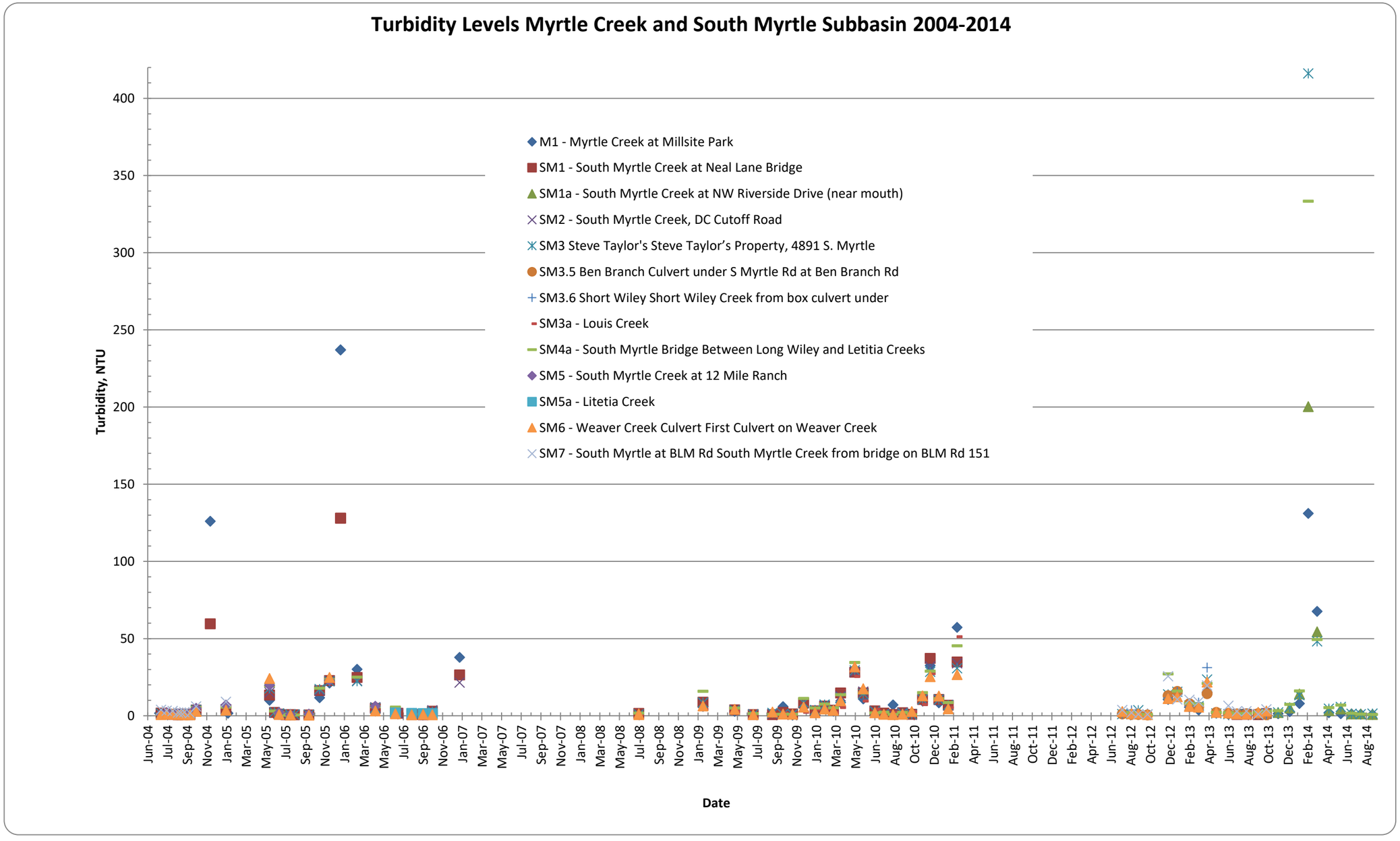
Table 47 summarizes the turbidity results from this study (2004-2014) and rates the streams based on our colored rating table. In addition, **Table 47** compares whether the exceedances occurred during "summer" May 1 – September 30 or "winter" October 1 – April 30. Five sites, SM5a, NM5, NM5.5, NM6, and NM7 rated of "No Concern" during either summer or winter. No sites rated more than "High Concern" for the summer. For the winter however, all of the sites other than SM5a, NM5, NM5.5, NM6 and NM7 were of "High or Extreme Concern" with one rating "High" and 20 rating "Extreme".



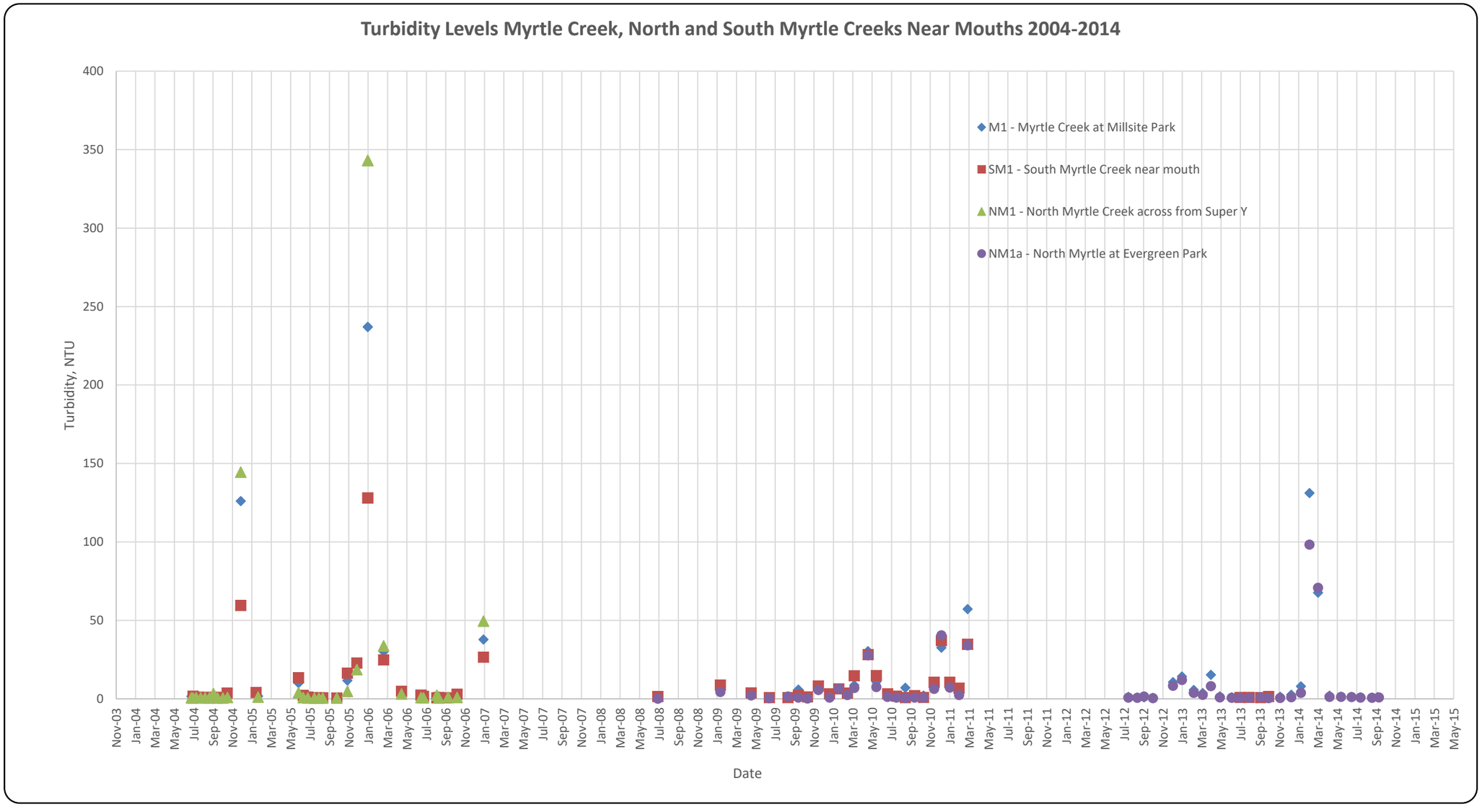
Graph 59.Stream turbidity levels for all Myrtle Creek sites and monitoring events 2004-2014 sorted by month.



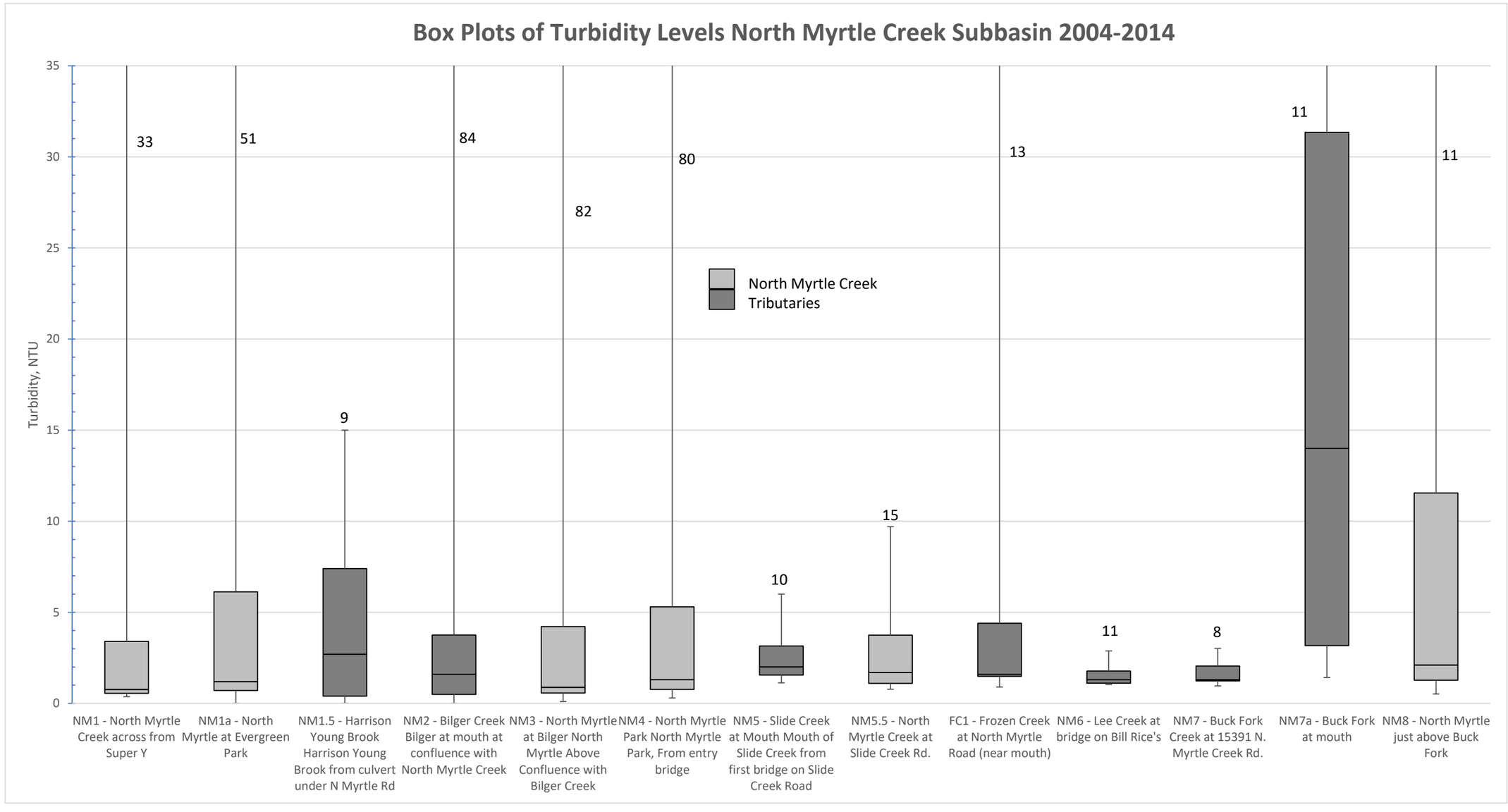
Graph 60.Turbidity levels for North Myrtle Creek Subbasin by site from 2004 – 2014.



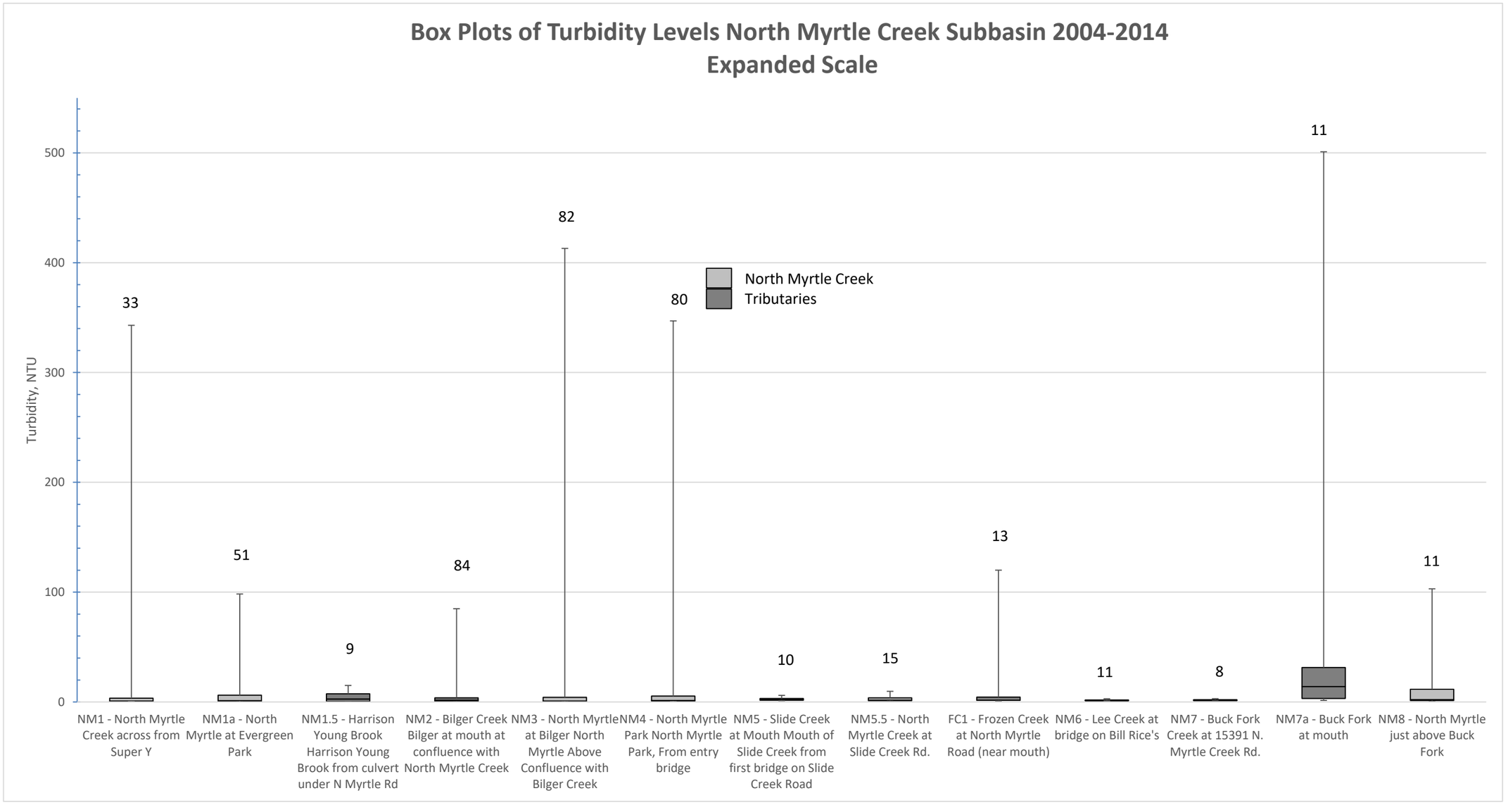
Graph 61.Turbidity levels for South Myrtle Subbasin by site 2004-2014.



Graph 62.Turbidity levels for Myrtle Creek, North Myrtle Creek and South Myrtle Creek 2004-2014.

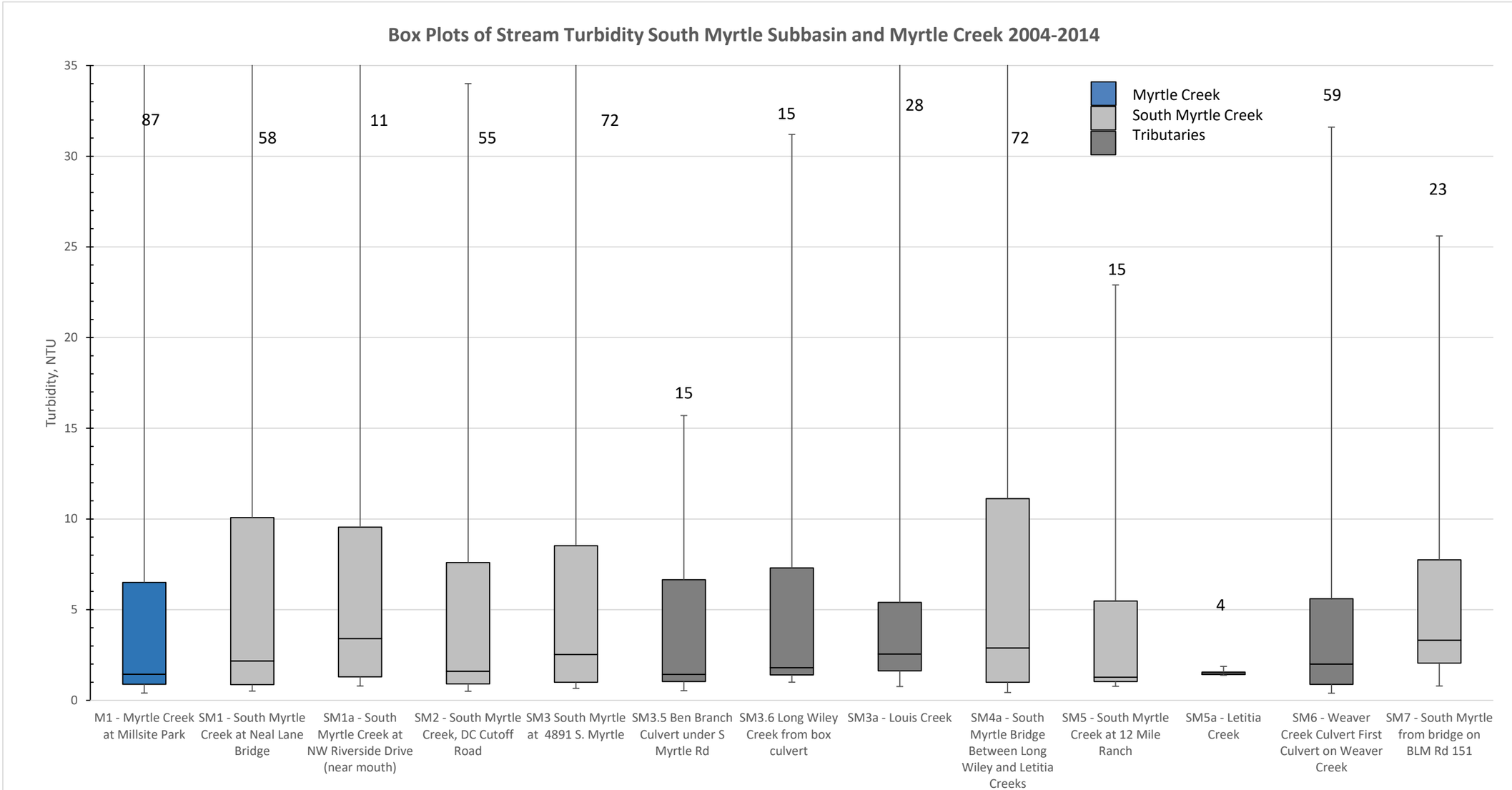


Graph 63. Box plots of turbidity levels for all monitoring events at each site in the North Myrtle Creek Subbasin 2004-2014 scaled to expand box plots for clarity. Numbers above each indicate the number of sampling events.

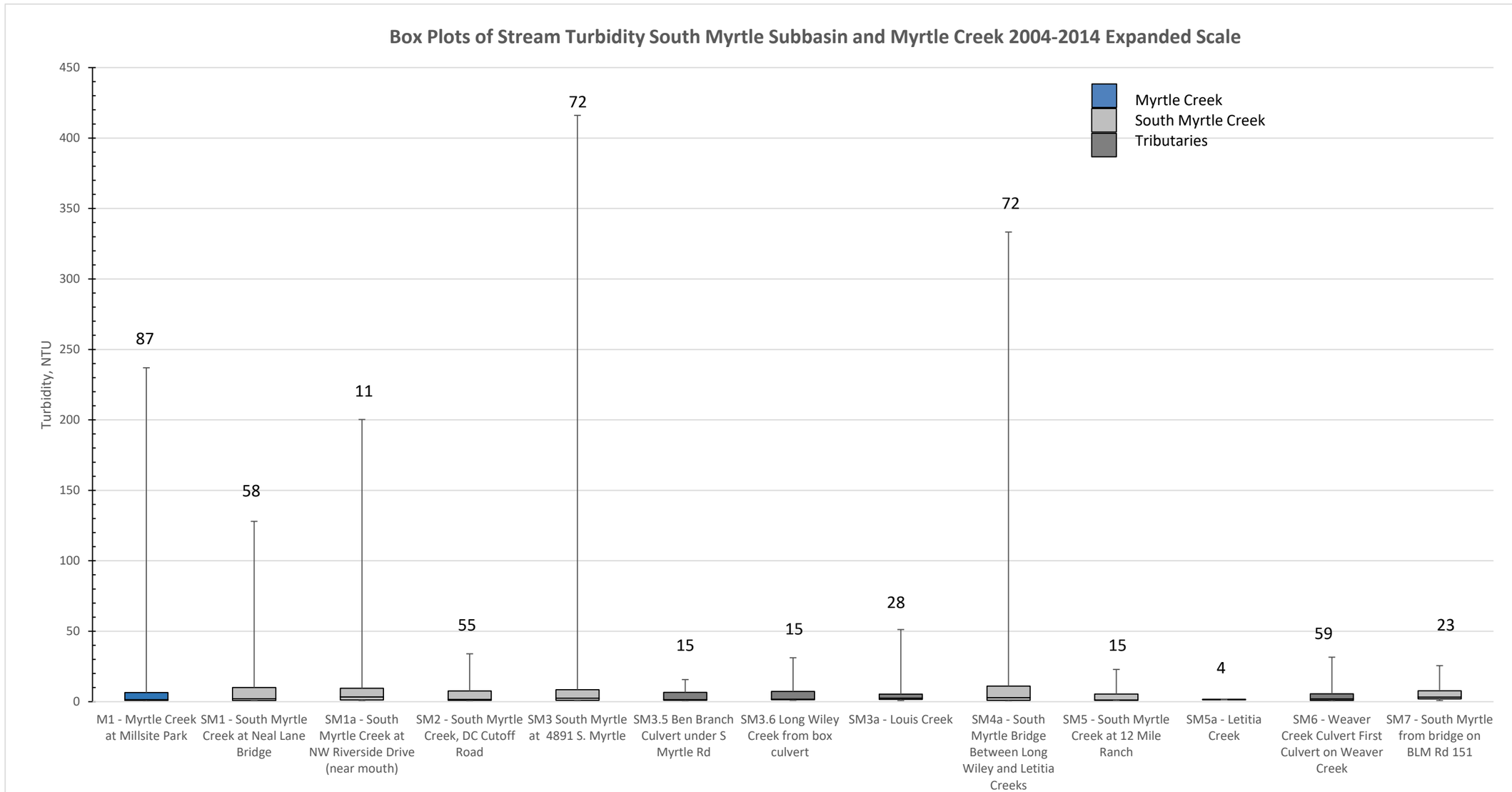


Graph 64. Turbidity box plots of North Myrtle Creek Subbasin and Myrtle Creek monitoring sites including all data from 2004-2014 4 scaled to display out-layers. Numbers above each indicate the number of sampling events.

c



Graph 65. Box plots of stream turbidity for South Myrtle Creek Subbasin and Myrtle Creek monitoring sites from 2004-2014 scaled to expand box plots for clarity. Numbers above each indicate the number of sampling events.



Graph 66.Box plots of turbidity levels South Myrtle Subbasin and Myrtle Creek monitoring sites for 2004-2014 scaled to display outliers. Numbers above each indicate the number of sampling events.

Turbidity Levels Myrtle Creek Watersheds 2004-2014	10 NTU's or Greater		
Station ID - Stie Description	Count	% of Samples	# of Samples
M1 - Myrtle Creek at Millsite Park	16	18%	87
NM1 - North Myrtle Creek across from Super Y	7	16%	43
NM1a - North Myrtle at Evergreen Park	5	13%	39
NM1.5 - Harrison Young Brook from culvert under N Myrtle Rd	1	11%	9
NM2 - Bilger Creek at mouth at confluence with North Myrtle Creek	10	13%	75
NM3 - North Myrtle Above Confluence with Bilger Creek	10	13%	79
NM4 - North Myrtle at Park North Myrtle Park, From entry bridge	12	16%	76
NM5 - Slide Creek 1.9 miles from mouth	0	0%	10
NM5.5 - North Myrtle Creek at Slide Creek Rd.	0	0%	15
FC1 - Frozen Creek at North Myrtle Road (near mouth)	3	23%	13
NM6 - Lee Creek at bridge on Bill Rice's Property	0	0%	10
NM7 - Buck Fork Creek at 15391 N. Myrtle Creek Rd.	0	0%	8
NM7a - Buck Fork at mouth	6	55%	11
NM8 - North Myrtle just above Buck Fork	4	36%	11
SM1 - South Myrtle Creek at Neal Lane Bridge	15	26%	58
SM1a - South Myrtle Creek at NW Riverside Drive (near mouth)	3	27%	11
SM2 - South Myrtle Creek, DC Cutoff Road	12	22%	55
SM3 South Myrtle at Private Property, 4891 S. Myrtle	17	24%	72
SM3.5 Ben Branch Culvert under S Myrtle Rd	3	20%	15
SM3.6 Long Wiley from box culvert	3	20%	15
SM3a - Louis Creek	4	14%	28
SM4a - South Myrtle Bridge Between Long Wiley and Letitia Creeks	19	26%	72
SM5 - South Myrtle Creek at 12 Mile Ranch	2	13%	15
SM5a - Letitia Creek	0	0%	4
SM6 - Weaver Creek Culvert First Culvert on Weaver Creek	11	19%	59
SM7 - South Myrtle from bridge on BLM Rd 151	4	17%	23

Table 46. Summary by site of turbidity levels equal to or exceeding 10 NTUs.

Myrtle Creek Watershed Station ID - Site Description	Summer (May 1 – Sept 30)			Winter (Oct 1 – April 30		
	Total # Samples	# >10 NTU	% >10 NTU	Total # Samples	# >10 NTU	% >10 NTU
SM7 - South Myrtle Creek at Bridge BLM Rd 151	13	0	0%	10	3	30%
SM6 - Weaver Creek at First Culvert on Weaver Creek	30	2	7%	29	9	31%
SM5 - South Myrtle Creek at 12 Mile Ranch	9	1	11%	6	1	17%
SM5a - Letitia Creek near Mouth	3	0	0%	0	0	0%
SM4a - South Myrtle Creek at Bridge Between Long Wiley and Letitia Creek	35	2	6%	37	14	38%
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.	8	0	0%	8	3	38%
SM3a - Louis Creek Near Mouth	12	0	0%	16	4	25%
SM3.5 - Ben Branch Creek at S. Myrtle Rd	8	0	0%	7	3	43%
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.	35	2	6%	37	15	41%
SM2 - South Myrtle Creek above Golf Course	29	2	7%	26	10	38%
SM1 - South Myrtle Creek at Neal Lane Bridge	29	2	7%	29	11	38%
SM1a - South Myrtle Creek at NW Riverside Drive	5	0	0%	6	3	50%
NM8 - North Myrtle Creek above Buck Fork Creek	6	0	0%	4	3	75%
NM7 - Buck Fork Creek at 15391 N. Myrtle Creek Rd.	6	0	0%	2	0	0%
NM7a - Buck Fork Creek near Mouth	6	1	17%	4	4	100%
NM6 - Lee Creek at Bridge on Bill Rice's	7	0	0%	3	0	0%
FC1 - Frozen Creek at N. Myrtle Road near Mouth	7	0	0%	6	3	50%
NM 5.5 North Myrtle above Slide Creek	8	0	0%	7	0	0%
NM 5 Slide Creek	7	0	0%	3	0	0%
NM4 - North Myrtle at N. Myrtle Park	37	0	0%	39	111	28%
NM3 - North Myrtle Creek Above Bilger Creek	39	0	0%	40	9	22%
NM2 - Bilger Creek near Mouth	35	0	0%	39	8	21%
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.	4	0	0%	5	1	20%
NM1 - North Myrtle Creek across from Super Y	19	0	0%	13	5	38%
NM1a - North Myrtle Creek at Evergreen Park	22	0	0%	28	5	18%
M1 - Myrtle Creek at Millsite Park	44	1	2%	42	14	33%

Table 47. Table of Myrtle Creek Watershed sites rated for turbidity levels by summer and winter values.

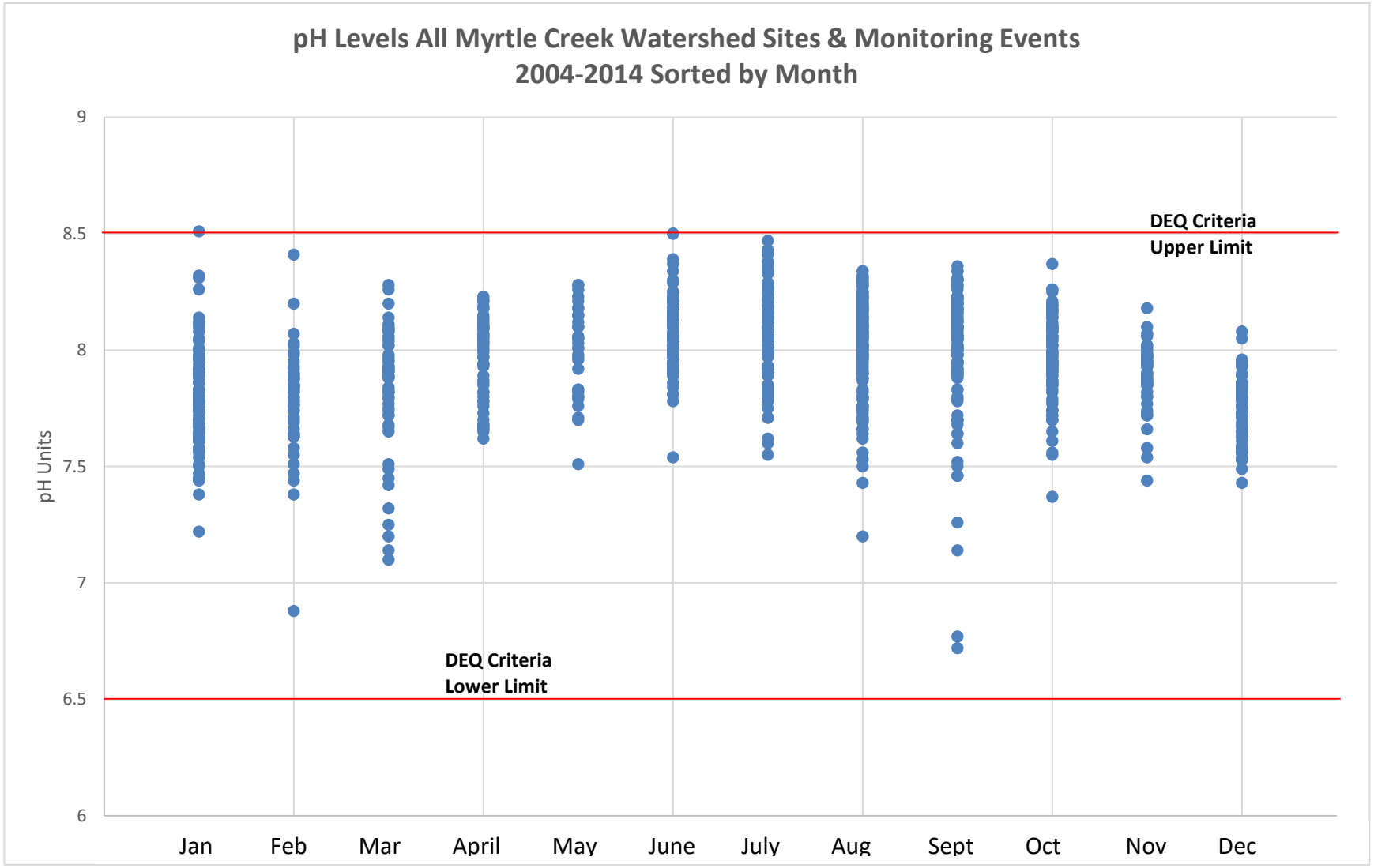
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	< 10 NTU
	Low Concern	Between 1 % and 9% of samples ≥10NTU
	High Concern	Between 10% and 20% ≥10 NTU
	Extreme Concern	20% or more ≥10 NTU

RESULTS – Myrtle Creek Watershed

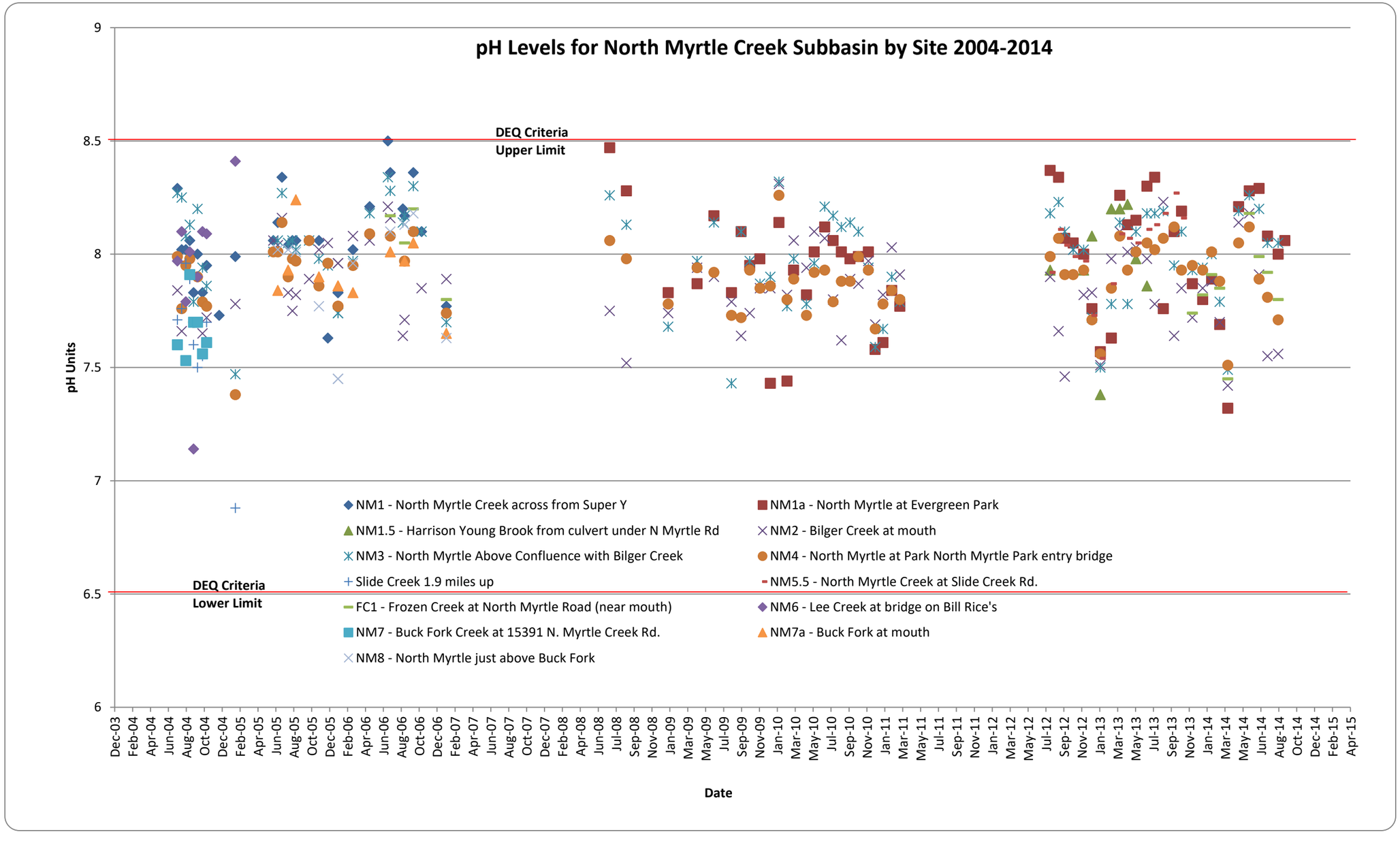
pH

All of the pH grab samples for the Myrtle Creek Watershed from 2004-2014 fell within the DEQ criteria for healthy streams of >6.5 and <8.5 pH (**see Graphs 68-73**) except three occurrences. A few streams neared the upper limit during summer but did not exceed 8.5 during the hours that monitoring occurred. M1-Myrtle Creek at Millsite Park did reach 8.5 on 6/27/06 and on 1/16/14, and it exceeded 8.25 on numerous other dates. NM1-North Myrtle across from Super Y also reached pH 8.5 on 6/27/06. The pH exceeded 8.25 many times at many other sites as well. It is likely that had monitoring occurred later in the afternoon these would have exceeded pH 8.5 frequently in summer as a great deal of algae was present in numerous streams as well as the mainstems. Unfortunately, the logistics of grab sample monitoring and the number of sites monitored during one day make it impractical to create an aggregate summary of changing conditions for a site over 24 hours. To maintain consistent data, sites were monitored in a pre-established order. This allows us to draw more accurate comparisons overtime, for an individual site, as each site is monitored at approximately the same time of day. It is not, however, ideal for comparison between sites where conditions will be different due to the different time of day sampled. **Table 48** indicates a rating of sites for pH based on available data.
By our rating system 10 sites rank of “Moderate Concern” and need watching for elevated pH levels. The rest of the sites are of “Low Concern” (2 sites) to “no Concern” (13 sites).

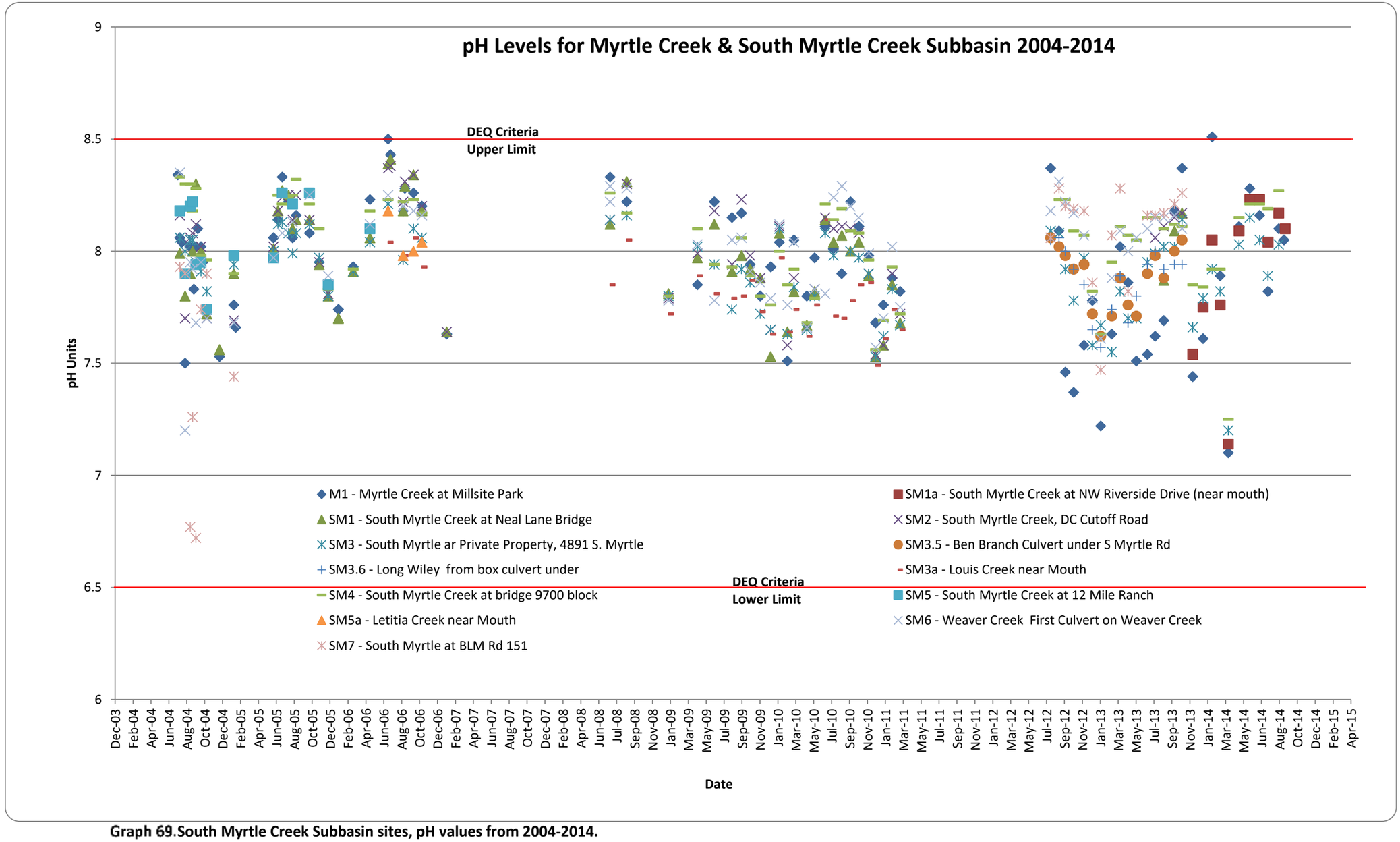
Graph 68 and **Graph 69** indicate no significant change from year to year in watershed pH levels.



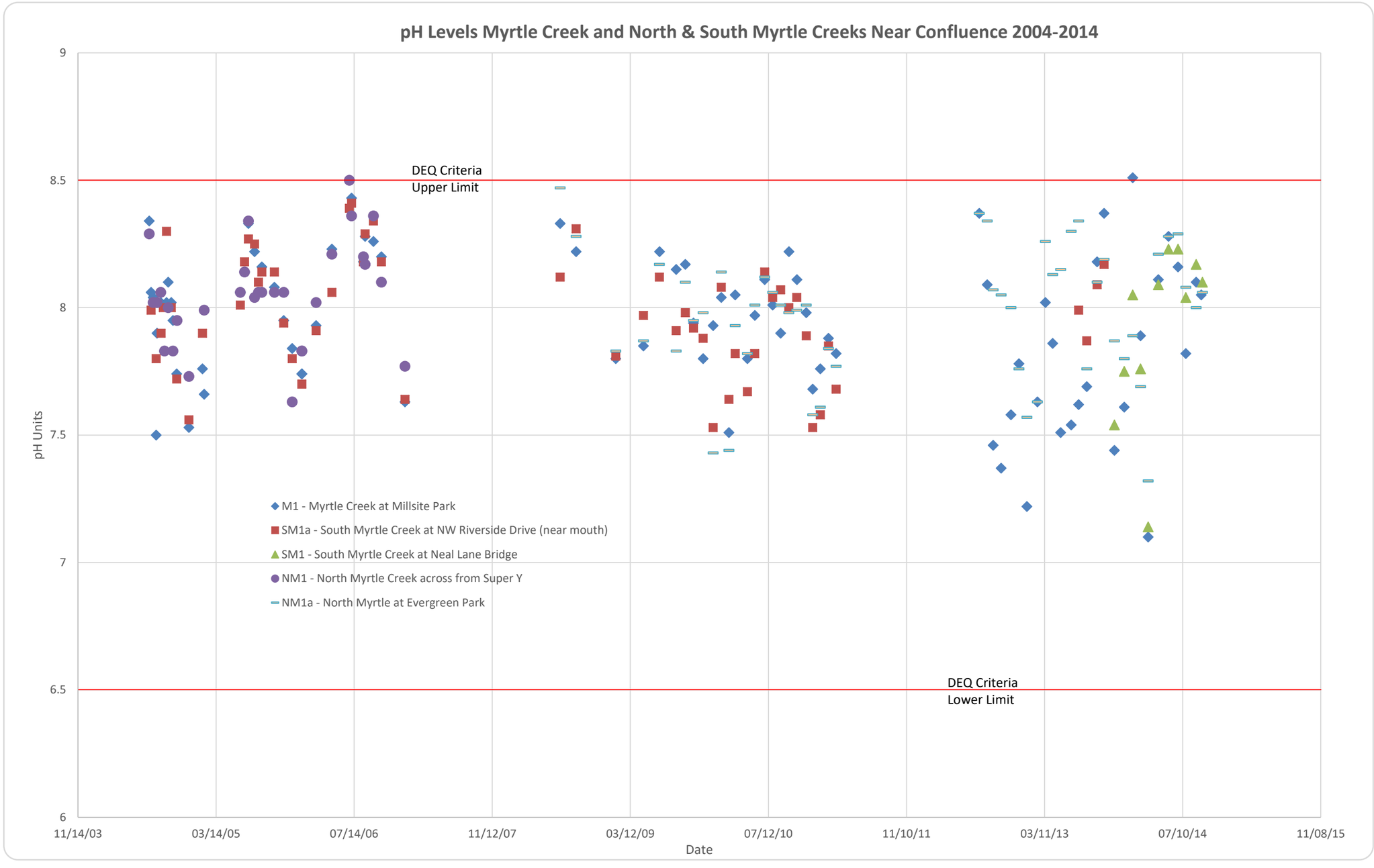
Graph 67. Myrtle Creek Watershed all monitoring events and sites pH levels sorted by month from 2004-2014.



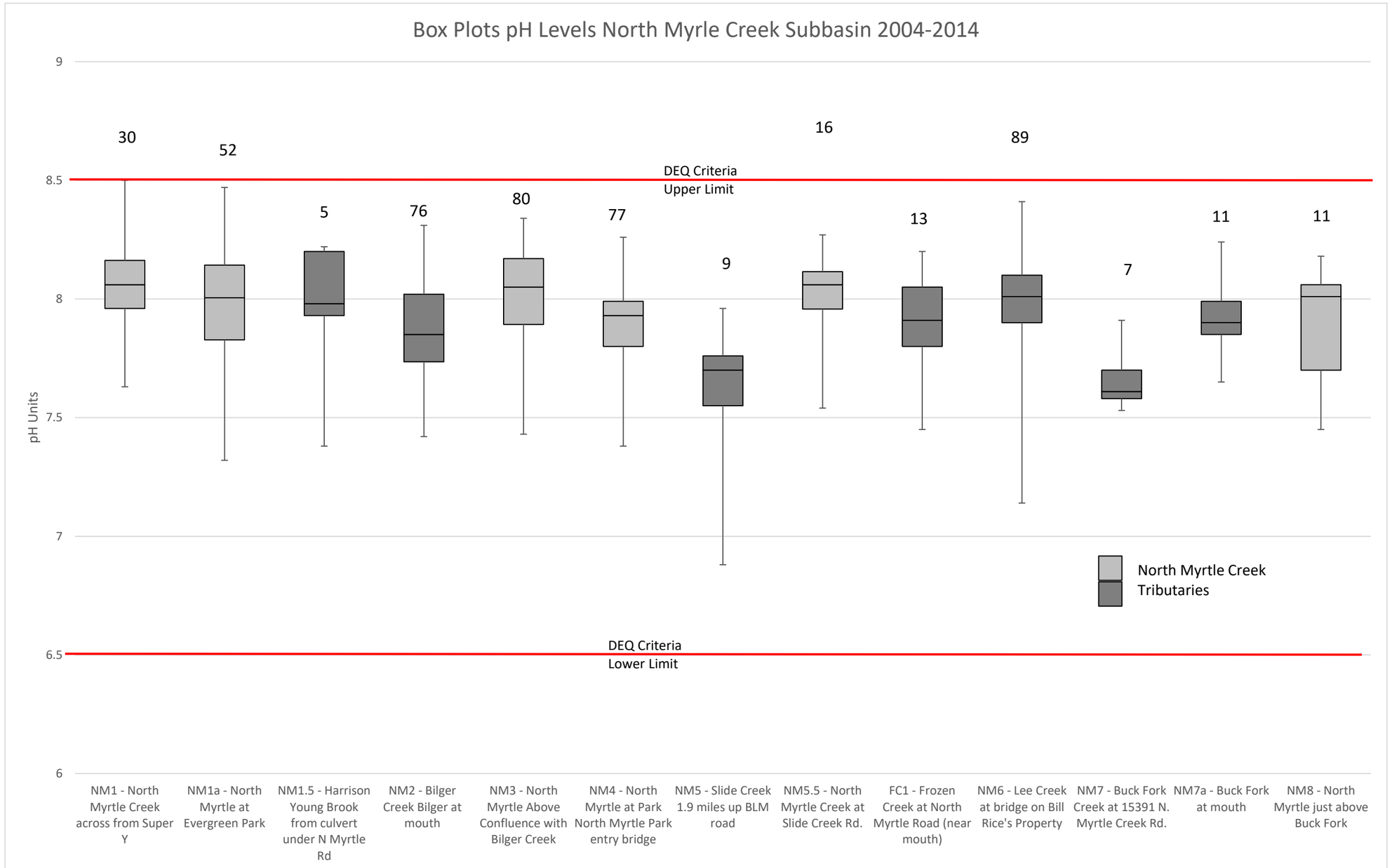
Graph 68.North Myrtle Creek Watershed pH values by site from 2004-2014.



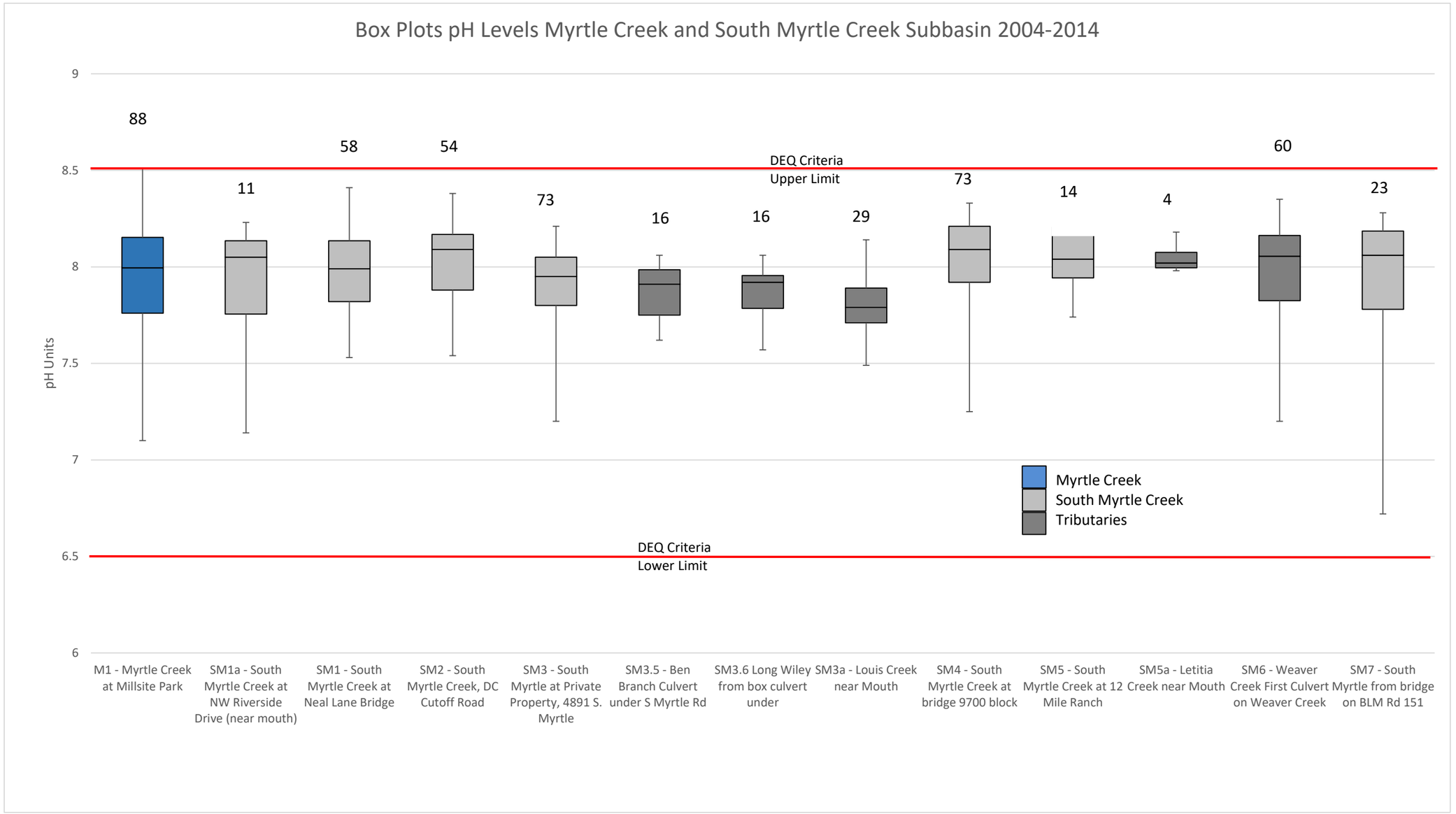
Graph 69.South Myrtle Creek Subbasin sites, pH values from 2004-2014.



Graph 70.pH values for lowest South Myrtle Creek, lowest North Myrtle and Myrtle Creek sites 2004-2014.



Graph 71.Box plots of pH Levels North Myrtle Creek sites 2004-2014. Numbers above each indicate the number of sampling events.



Graph 72.Box plots of pH levels South Myrtle Creek sites 2004-2014. Numbers above each indicate the number of sampling events.

Myrtle Creek Watershed	Upper	Lower
Station ID - Site Description	pH Criteria	pH Criteria
SM7 - South Myrtle Creek at Bridge BLM Rd 151		
SM6 - Weaver Creek at First Culvert on Weaver Creek		
SM5 - South Myrtle Creek at 12 Mile Ranch		
SM5a - Letitia Creek near Mouth		
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek		
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.		
SM3a - Louis Creek Near Mouth		
SM3.5 - Ben Branch Creek at S. Myrtle Rd		
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.		
SM2 - South Myrtle Creek above Golf Course		
SM1 - South Myrtle Creek at Neal Lane Bridge		
SM1a - South Myrtle Creek at NW Riverside Drive		
NM8 - North Myrtle Creek above Buck Fork Creek		
NM7 - Buck Fork Creek near Mouth		
NM5.5 -North Myrtle Creek at bridge on Slide Creek Rd.		
NM 5- Slide Creek 1.9 Miles up Slide Creek Rd.		
NM6 - Lee Creek at Bridge on Bill Rice's		
FC1 - Frozen Creek at N. Myrtle Road near Mouth		
NM4 - North Myrtle at N. Myrtle Park		
NM3 - North Myrtle Creek Above Bilger Creek		
NM2 - Bilger Creek near Mouth		
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.		
NM1 - North Myrtle Creek across from Super Y		
NM1a - North Myrtle Creek at Evergreen Park		
M1 - Myrtle Creek at Millsite Park		

pH Rating Code			
Rating	Color	Upper pH Criteria	Lower pH Criteria
No Concern		None above 8.25	None below 6.75
Low Concern		1 ≥ 8.25	1 ≤ 6.75
Moderate Concern		2 or more ≥ 8.25 or 1 ≥ 8.5	2 ≤ 6.75 or 1 ≤ 6.5
Extreme Concern		2 or more ≥ 8.5	2 or more ≤ 6.5

Table 48. pH rating chart for Myrtle Creek Watershed sites 2004-2015.

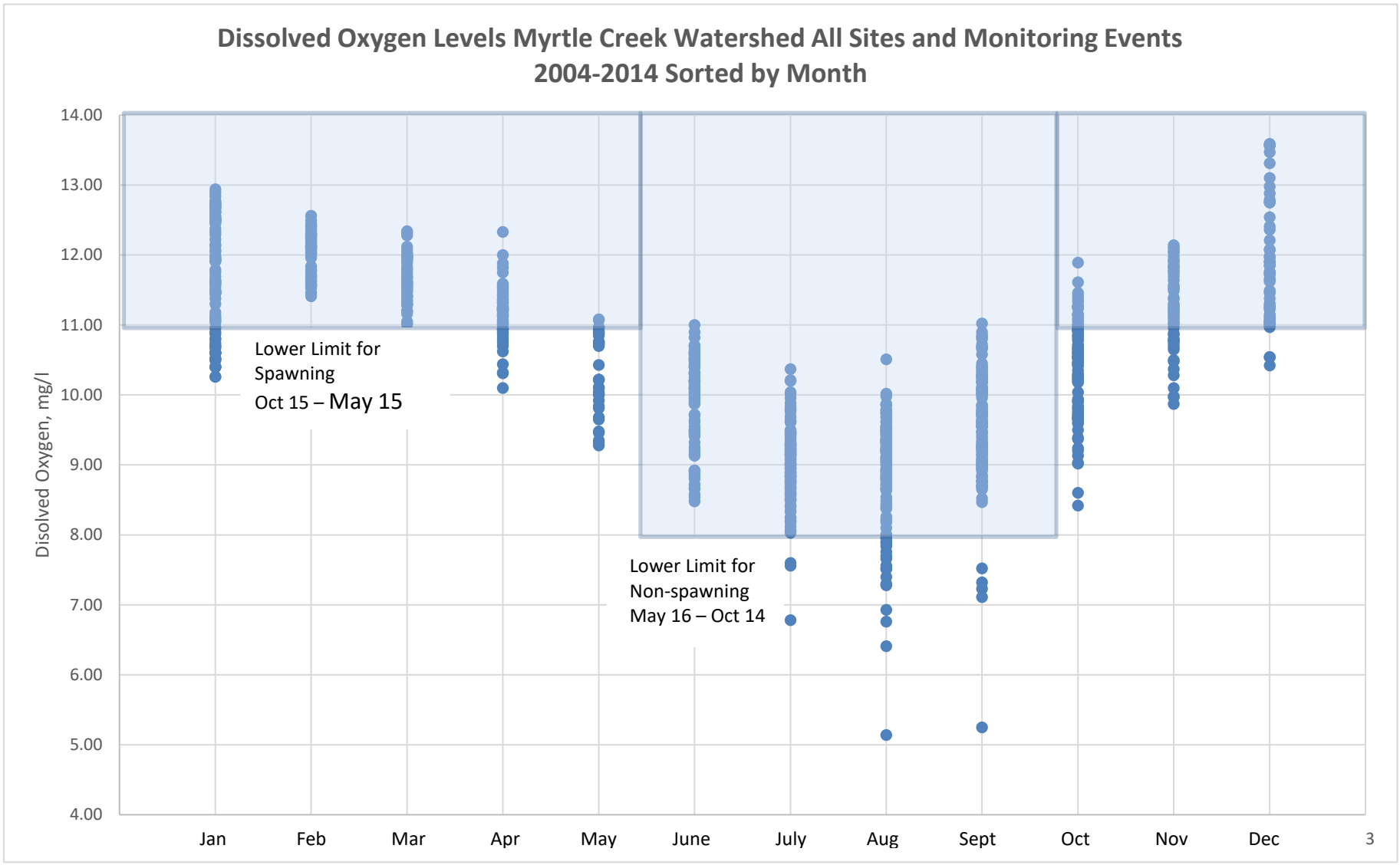
RESULTS – Myrtle Creek Watershed

Dissolved Oxygen

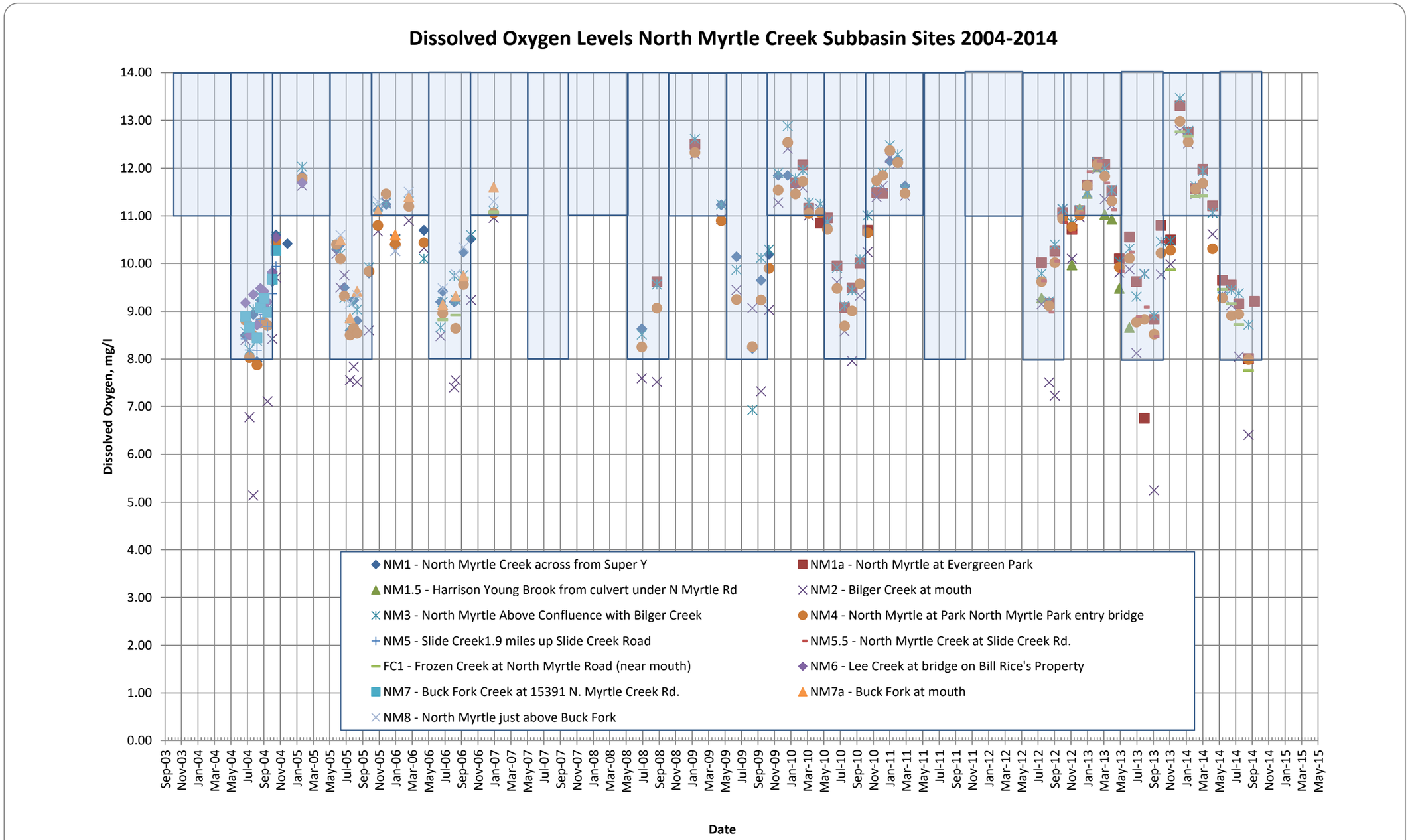
As with pH values, dissolved oxygen levels were sampled at approximately the same time each day of monitoring. Therefore, the results are limited to this time period and are not indicative of 24 hour fluctuations. A great deal of algae was present in this watershed during summers; for this reason, D.O. levels would have fallen during the night while algae were in the respiration phase. **Graph 73** demonstrates the typical annual variation of dissolved oxygen due to seasonal temperature change. The lowest values were in July/August when temperatures were at their highest.

Graph 74 and **Graph 75** respectively display the data for North Myrtle Creek and South Myrtle Creek sites; **Graph 76** shows the two lowest sites on North Myrtle Creek, the two lowest sites on South Myrtle Creek and Myrtle Creek. The blue shaded areas represent the levels and dates that fall within DEQ criteria for healthy salmon for spawning (minimum 11.0 mg/ml) and for rearing and migration (8.0 mg/ml). These data are summarized in **Table 49** where the streams are rated by exceedances of the spawning and non-spawning criteria.

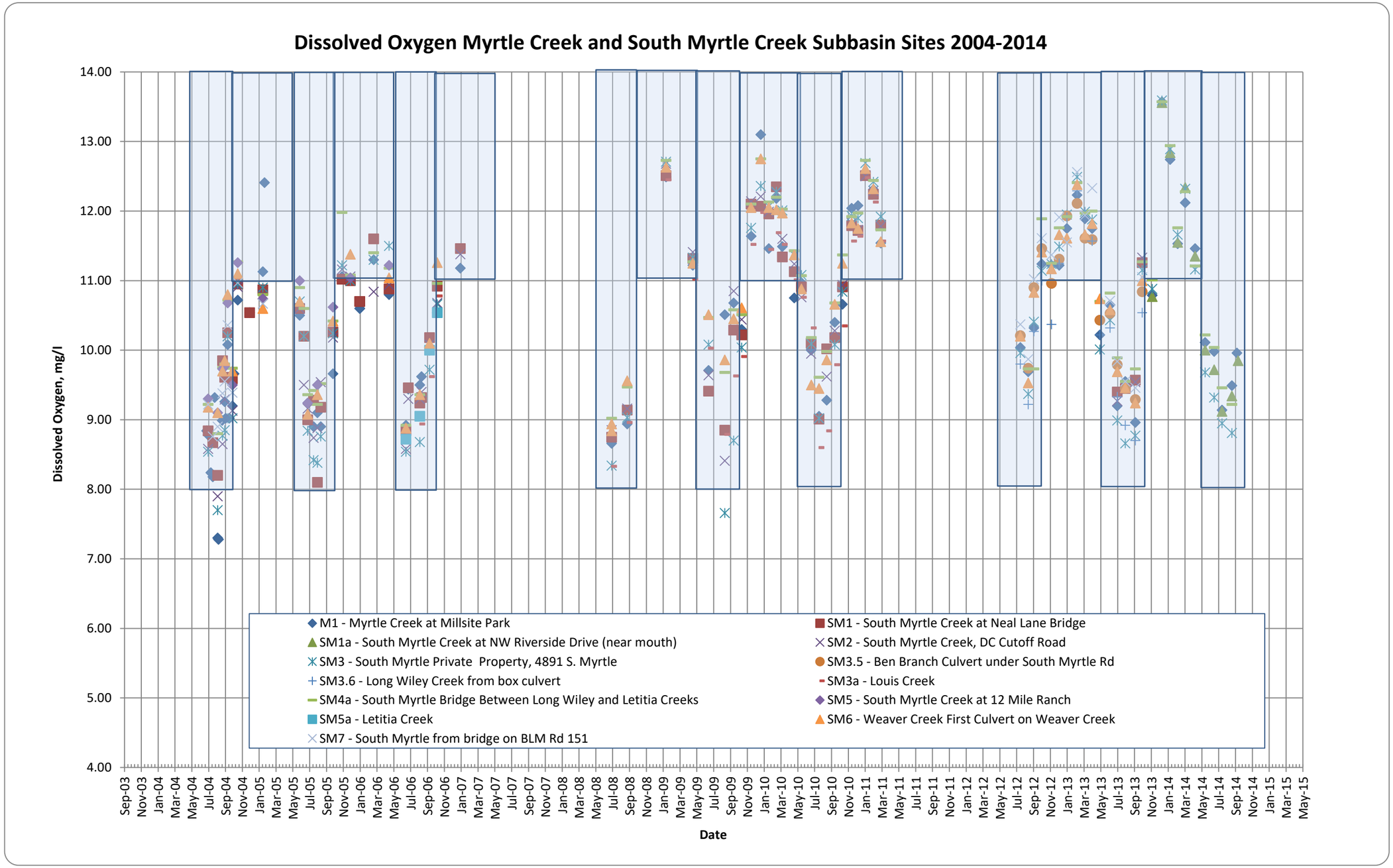
Bilger Creek (other than sites with few samples) has the highest number of exceedances with 32% of the non-spawning, and 35% of the spawning samples falling below acceptable levels of dissolved oxygen. Many other sites on North Myrtle Creek also had significant exceedances of the criteria as did sites on South Myrtle Creek. Myrtle Creek at the mouth had a significant number of exceedances. Creeks higher in the watershed and more likely to have lower temperatures reflect higher dissolved oxygen levels and less exceedances of the criteria – Slide Creek, Frozen Creek, Lee Creek, Buck Fork Creek, North Myrtle above Buck Fork, and Letitia Creek.



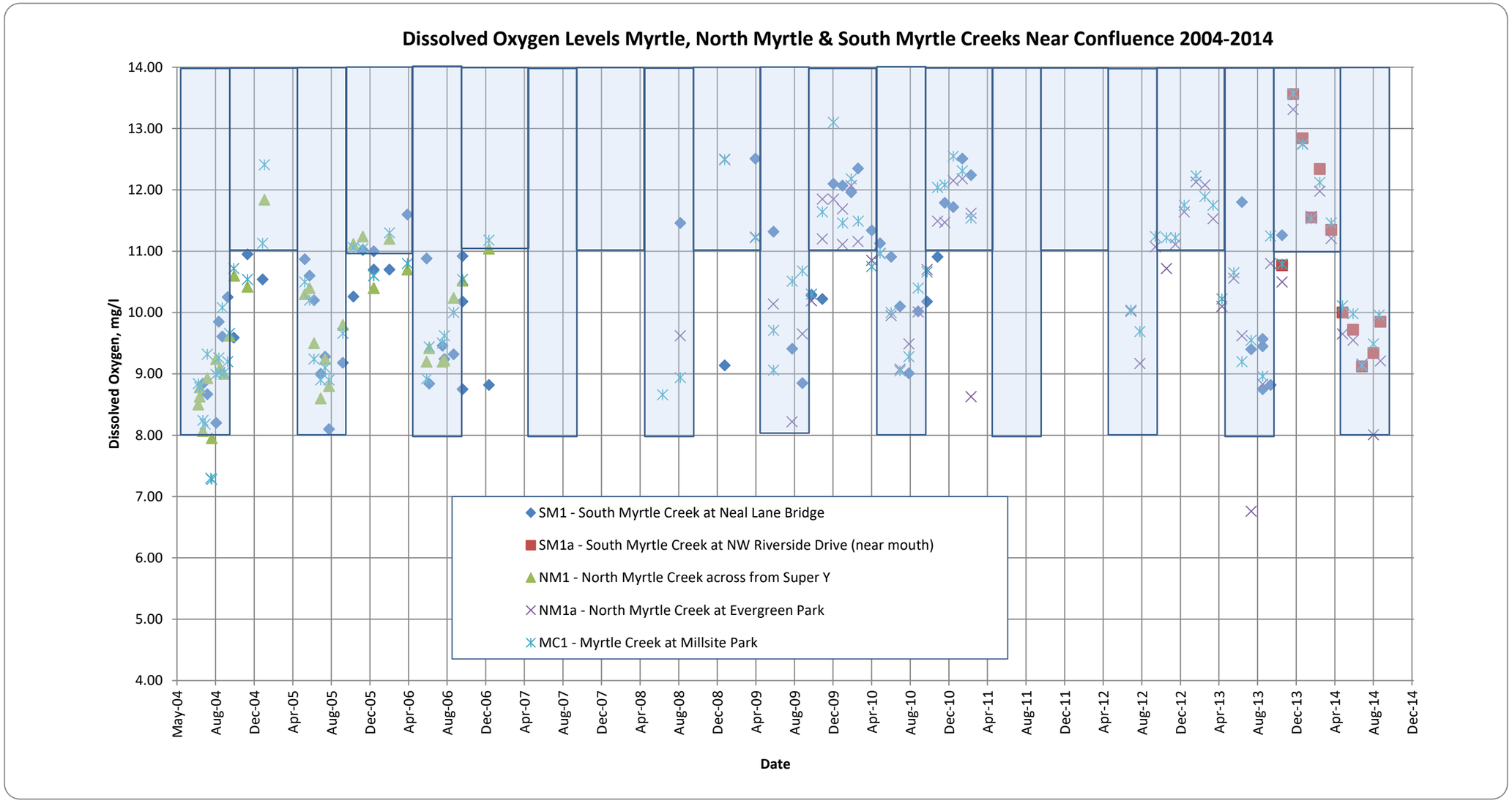
Graph 73.All Myrtle Creek sites and monitoring events 2004-2014 Dissolved Oxygen sorted by month, blue areas indicate appropriate levels for salmonid spawning and non-spawning by time of year.



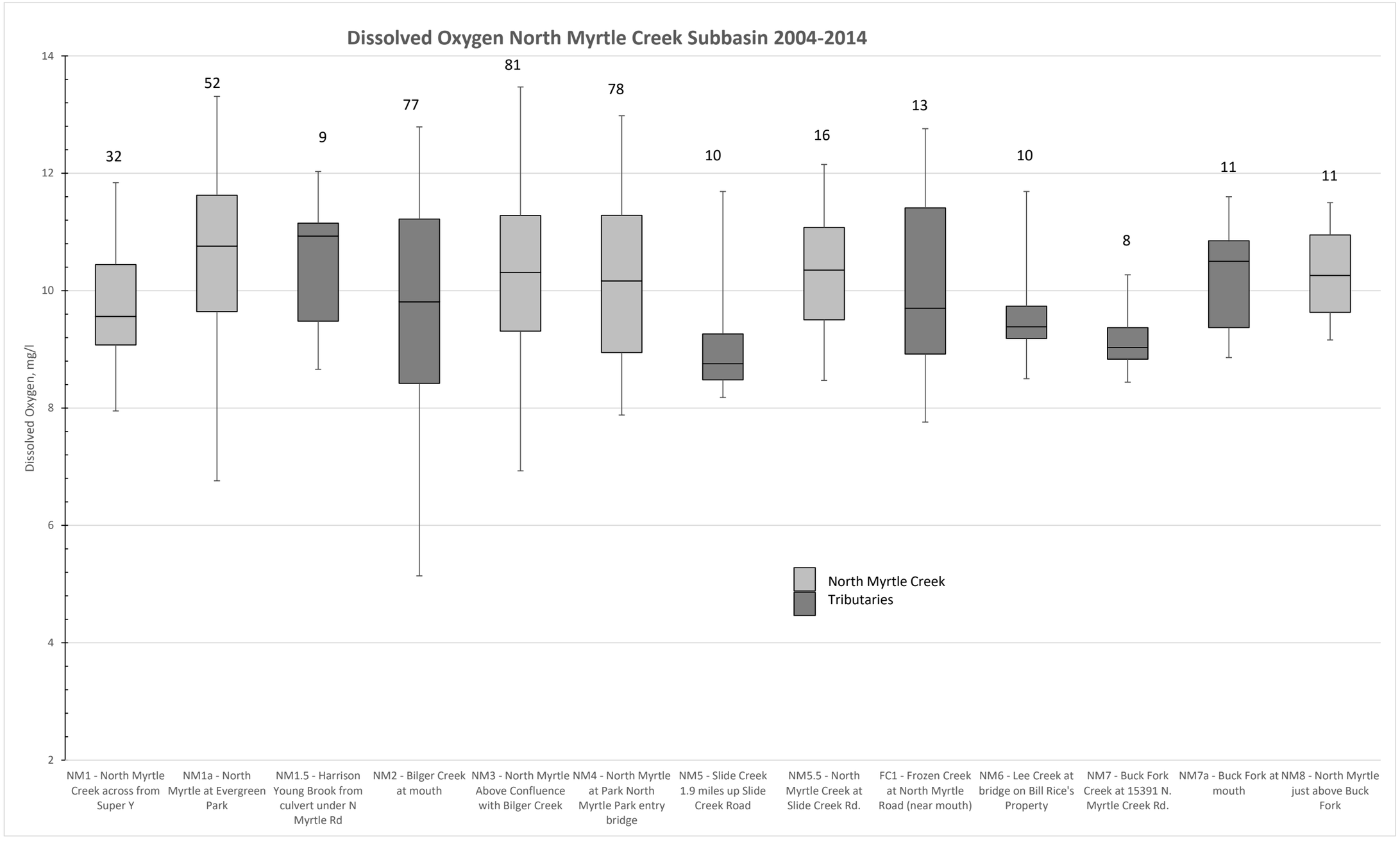
Graph 74. Dissolved oxygen levels for North Myrtle Creek Subbasin by site 2004-2015 blue areas indicate appropriate levels for salmonid spawning and non-spawning by time of year.



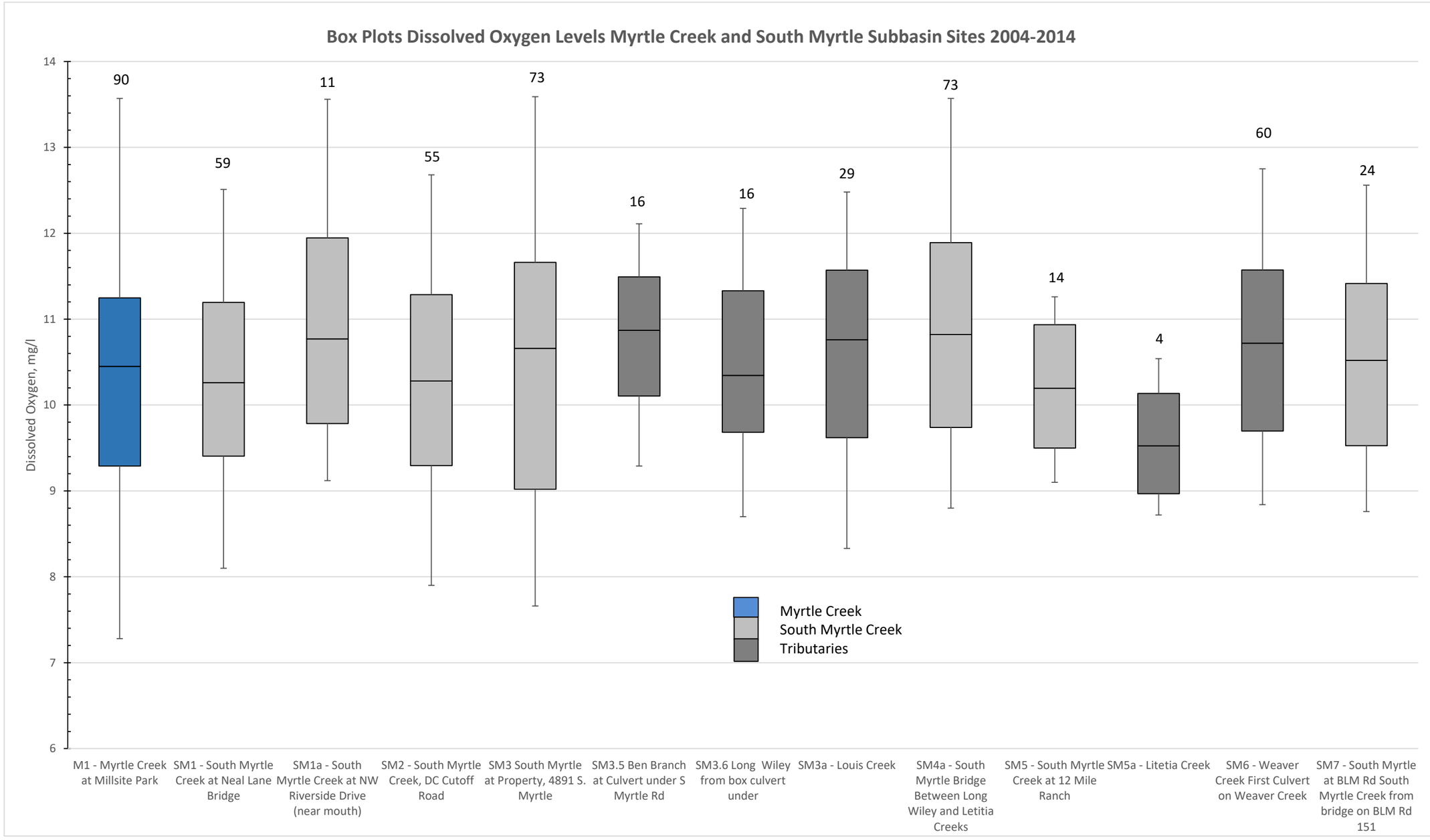
Graph 75.Dissolved oxygen levels for Myrtle Creek and South Myrtle Creek Subbasin sites 2004-2014 blue areas indicate appropriate levels for salmonid spawning and non-spawning by time of year.



Graph 76. Dissolved oxygen levels for lowest North and Lowest South Myrtle sites and Myrtle Creek 2004-2014 blue areas indicate appropriate levels for salmonid spawning and non-spawning by time of year.



Graph 77. Box and whisker plots of dissolved oxygen levels for all sites in North Myrtle Creek. Numbers above each indicate the number of sampling events.



Graph 78. Box and whisker plots of dissolved oxygen levels for South Myrtle Creek sites and Myrtle Creek 2004-2014. Number above each indicate number of sampling events.

	Non-spawning Season May 16-October 14				Spawning Season October 15-May 15			
	Total # Samples	# Below Minimum D.O. Criteria of 8 mg/l	% Below Minimum D.O. Criteria of 8 mg/l	Rating	Total # Samples	# Below Minimum D.O. Criteria of 11 mg/l	% Below Minimum D.O. Criteria of 11 mg/l	Rating
SM7 - South Myrtle Creek at Bridge BLM Rd 151	16	0	0%		8	1	13%	
SM6 - Weaver Creek at First Culvert on Weaver Creek	36	0	0%		13	1	8%	
SM5 - South Myrtle Creek at 12 Mile Ranch	10	0	0%		4	1	25%	
SM5a - Letitia Creek near Mouth	3	0	0%		1	1	100%	
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Ck.	38	0	0%		36	3	8%	
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.	8	0	0%		7	2	29%	
SM3a - Louis Creek Near Mouth	12	0	0%		16	2	13%	
SM3.5 - Ben Branch Creek at S. Myrtle Rd	8	0	0%		7	1	14%	
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.	36	2	5%		36	4	11%	
SM2 - South Myrtle Creek above Golf Course	32	2	6%		25	4	16%	
SM1 - South Myrtle Creek at Neal Lane Bridge	33	0	0%		26	9	35%	
SM1a - South Myrtle Creek at NW Riverside Drive	5	0	0%		6	1	17%	
NM8 - North Myrtle Creek above Buck Fork Creek	6	0	0%		4	1	25%	
NM7 - Buck Fork Creek near Mouth	13	0	0%		5	2	40%	
NM5.5-North Myrtle Creek at Slide Creek Road	5	0	0%		7	2	29%	
NM5 -Slide Creek 1.9 miles up Slide Creek Road	8	0	0%		2	1	50%	
NM6 - Lee Creek at Bridge on Bill Rice's	8	0	0%		2	1	50%	
FC1 - Frozen Creek at N. Myrtle Road near Mouth	7	1	14%		6	1	17%	
NM4 - North Myrtle at N. Myrtle Park	43	1	2%		36	10	28%	
NM3 - North Myrtle Creek Above Bilger Creek	44	0	0%		37	8	22%	
NM2 - Bilger Creek near Mouth	38	12	32%		37	13	35%	
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.	2	0	0%		7	3	43%	
NM1 - North Myrtle Creek across from Super Y	21	0	0%		10	5	50%	
NM1a - North Myrtle Creek at Evergreen Park	24	1	4%		29	6	21%	
M1 - Myrtle Creek at Millsite Park	50	2	4%		38	9	24%	

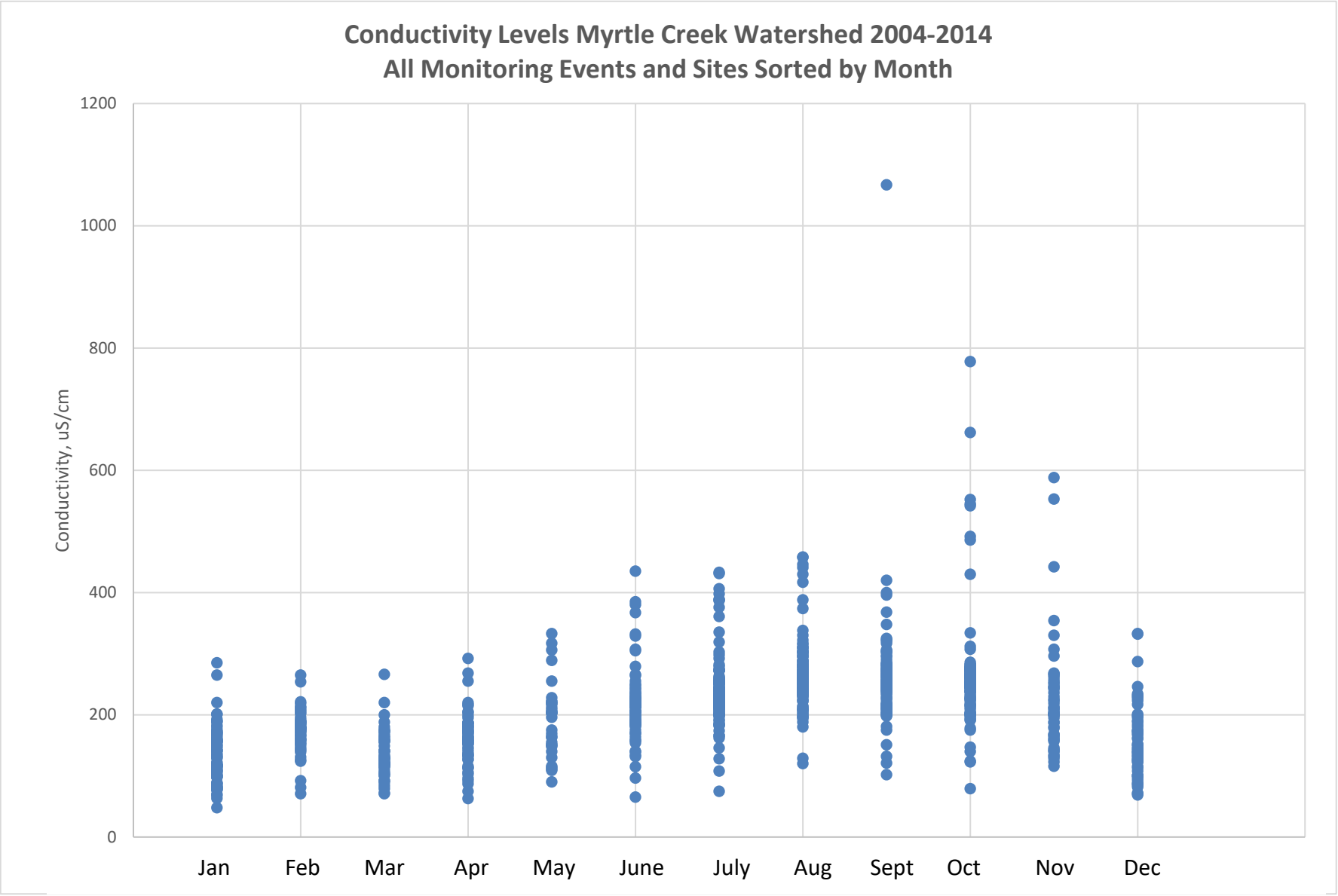
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	0% (No Exceedances)
	Low Concern	≥1% ≤9% Exceedances
	High Concern	≥10% ≤19% Exceedances
	Extreme Concern	≥20% Exceedances

Table 49. Dissolved oxygen levels for Myrtle Creek Watershed sites rated for non-spawning and spawning seasons with rating table.

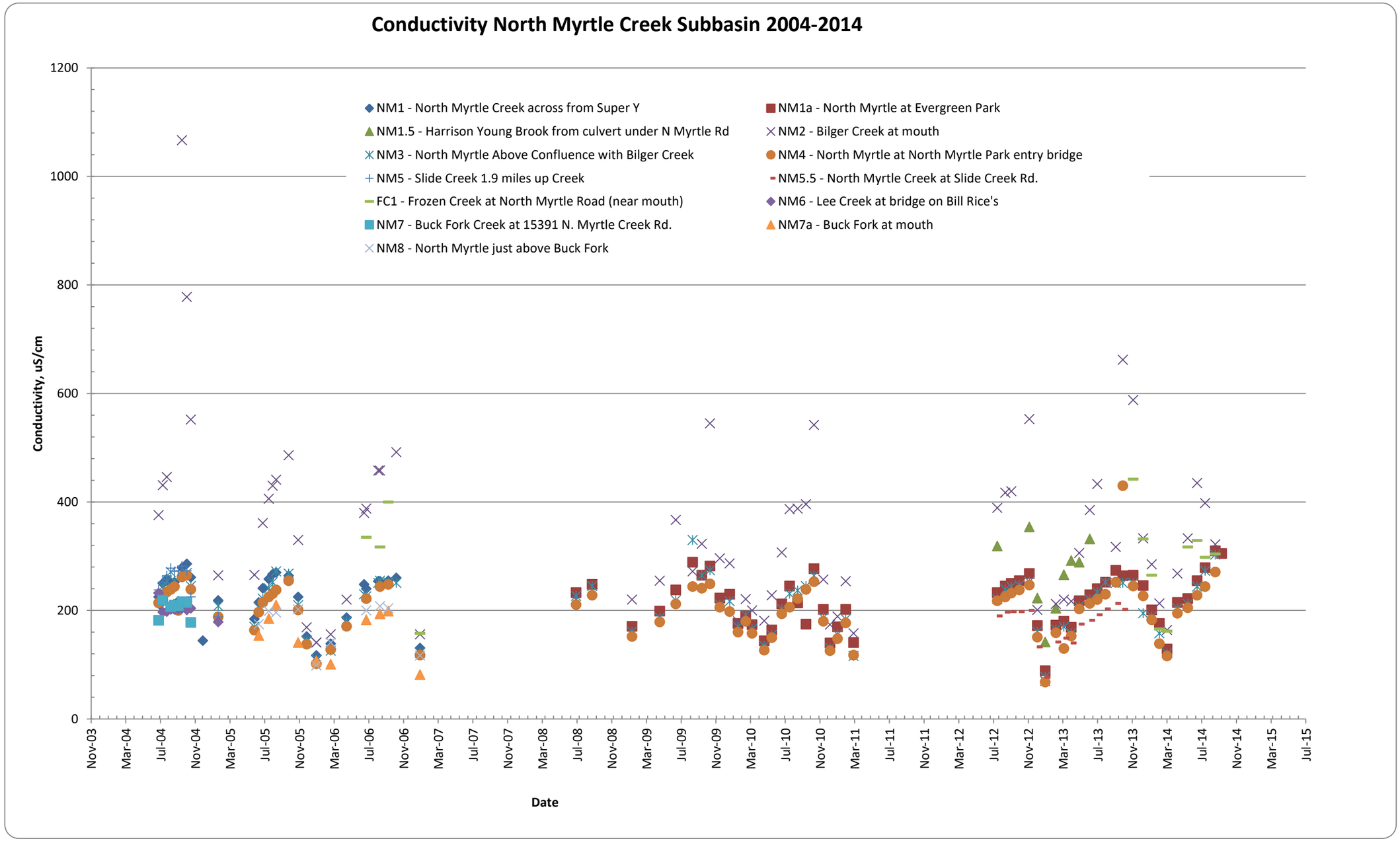
Conductivity

The range of conductivity in the Myrtle Creek Watershed was typically between 50-400 uS/cm with levels decreasing during winter and spring, and increasing during the summer and into fall. This is likely due to dilution and concentration since conductivity levels show an inverse relationship with the rainy season. Rain water has low conductivity and increasing water levels due to rain dilute the mineral content.
Bilger Creek often goes dry at the monitoring site. In 2005, 2006, 2009, 2010, 2012, and 2013 Bilger levels reached the 500 range and the flow was greatly deminished but still flowing. In summer months Bilger demonstratess the opposite effect of dilution, with less water, dissolved solids are more concentrated and therefore conductivity levels are higher.

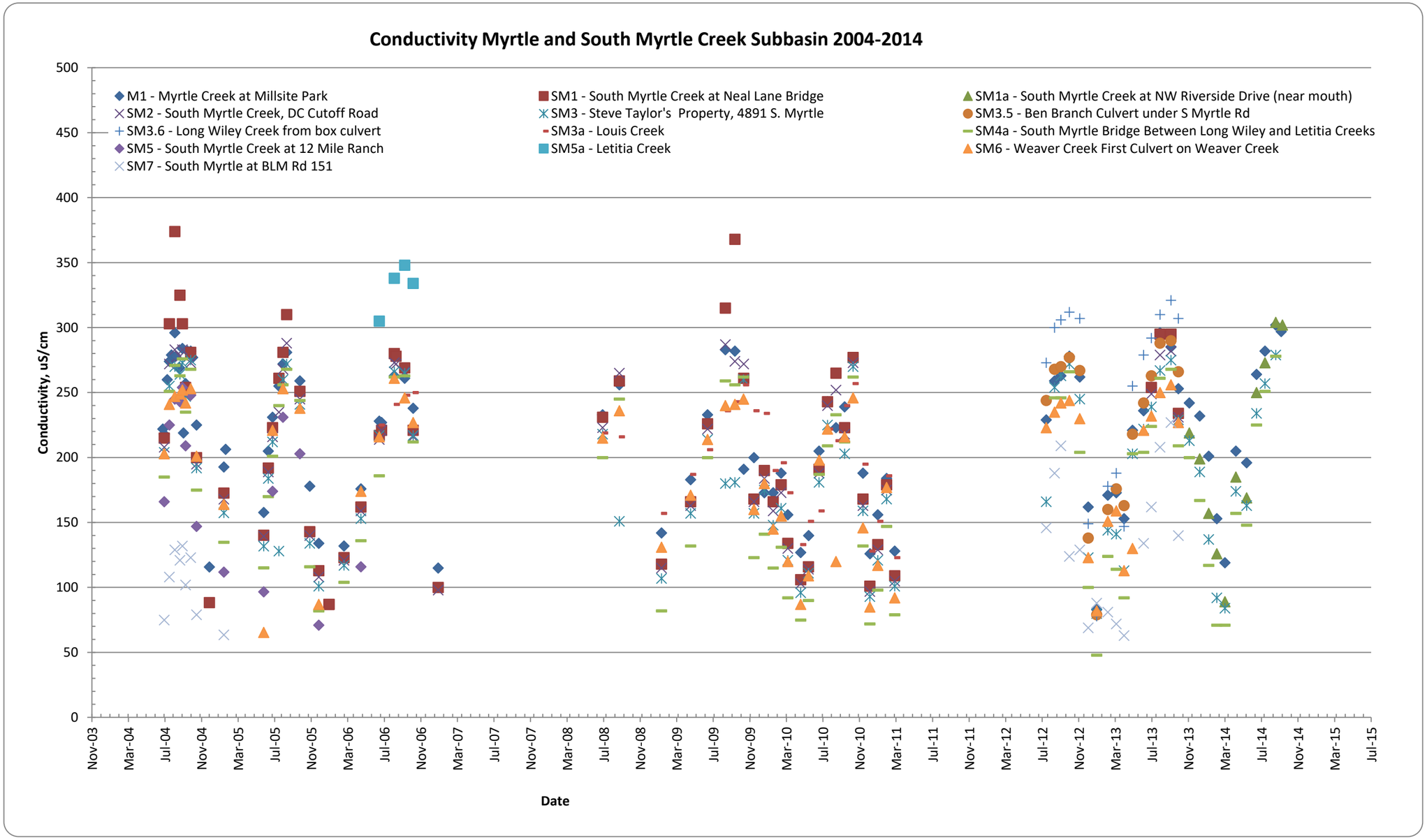
Table 50 summarizes the ratings for the streams in the Mytle Creek Watershed for conductivity.



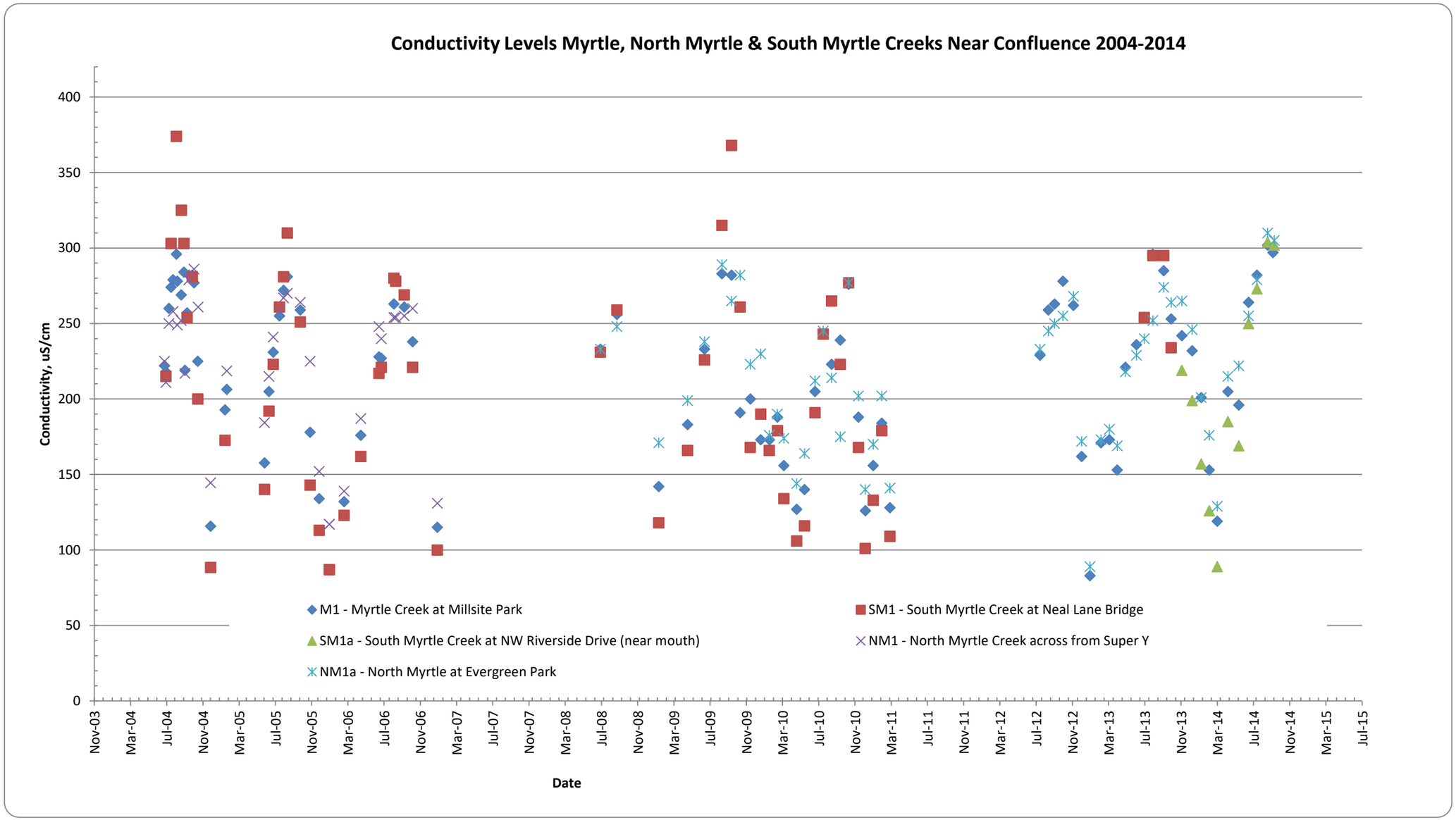
Graph 79. Conductivity levels of all Myrtle Creek Watershed sites and monitoring events sorted by month 2004-2014.



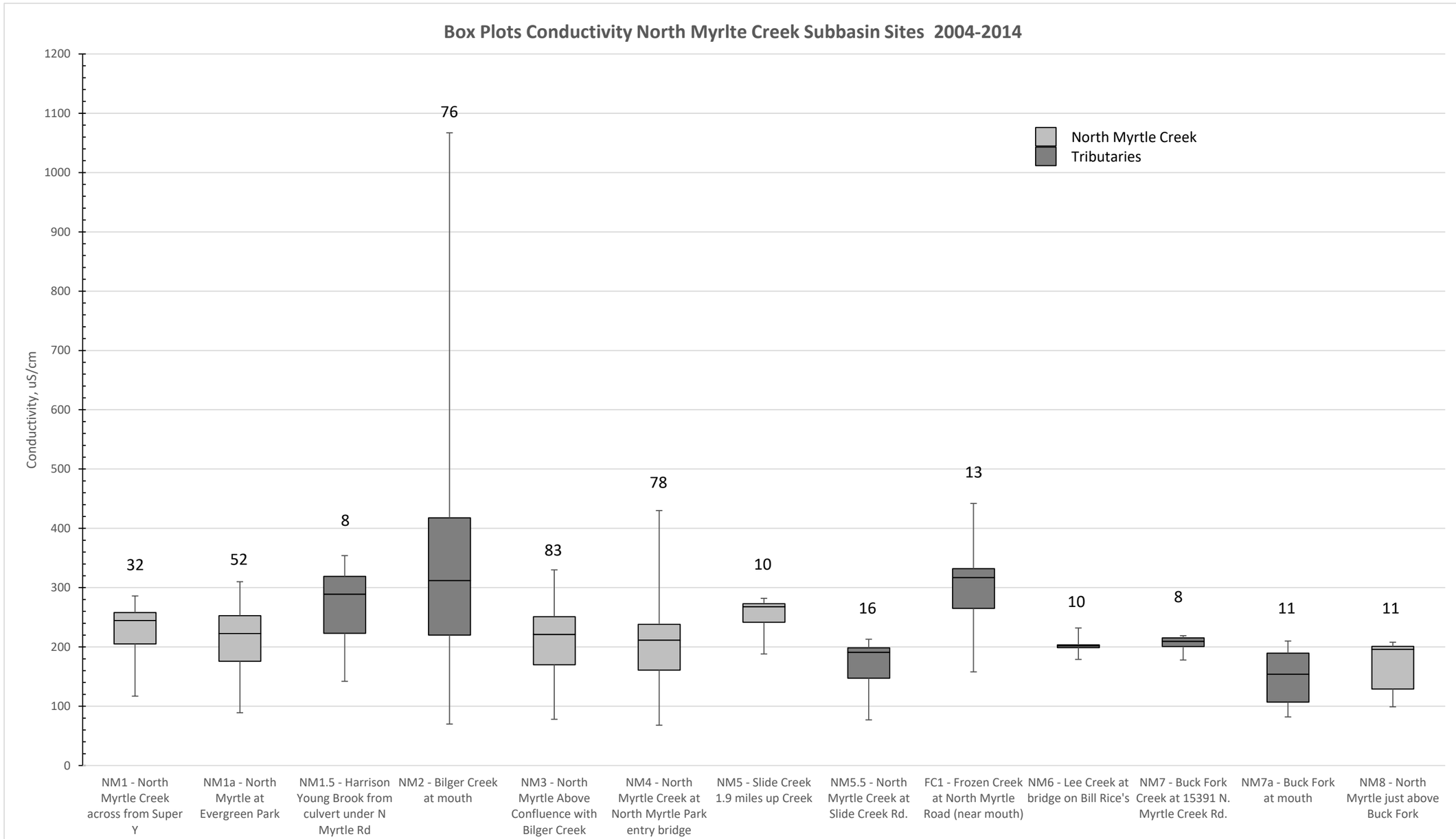
Graph 80.Conductivity levels North Myrtle Creek Subbasin sites 2004-2014.



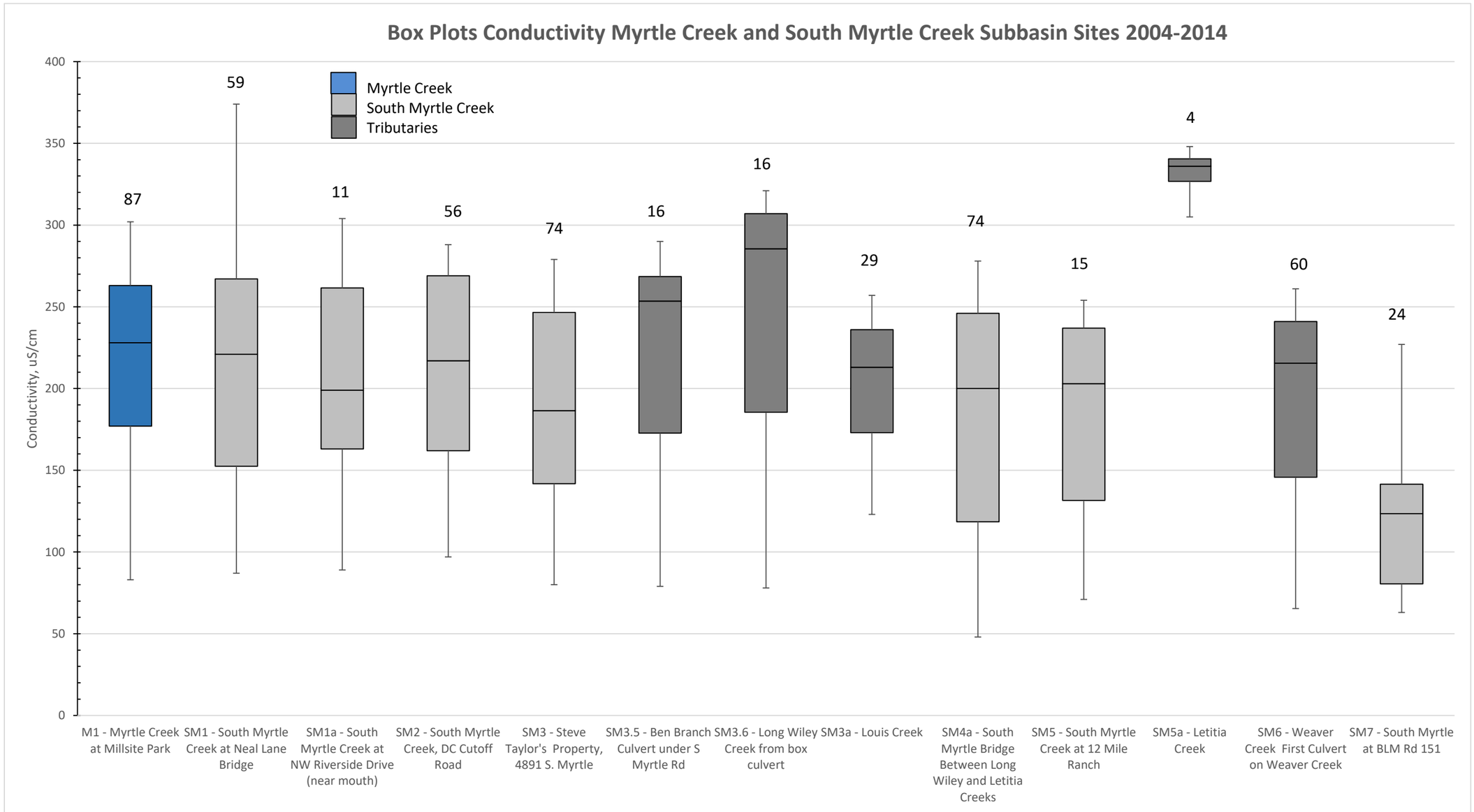
Graph 81.Conductivity levels Myrtle Creek and South Myrtle Creek Subbasin sites 2004-2014.



Graph 82.Conductivity levels near mouths of South Myrtle, North Myrtle and Myrtle Creeks 2004-2014.



Graph 82. Box and whisker plots of conductivity levels for North Myrtle Creek Subbasin sites and Myrtle Creek site. Numbers above each indicate the number of sampling events.



Graph 83.Box and whisker plots of conductivity levels for South Myrtle Creek Subbasin sites and Myrtle Creek site. Numbers above each indicate the number of sampling events.

Myrtle Creek Watershed	
Station ID - Site Description	**Conductivity Rating**
SM7 - South Myrtle Creek at Bridge BLM Rd 151	
SM6 - Weaver Creek at First Culvert on Weaver Creek	
SM5 - South Myrtle Creek at 12 Mile Ranch	
SM5a - Letitia Creek near Mouth	
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek	
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.	
SM3a - Louis Creek Near Mouth	
SM3.5 - Ben Branch Creek at S. Myrtle Rd	
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.	
SM2 - South Myrtle Creek above Golf Course	
SM1 - South Myrtle Creek at Neal Lane Bridge	
SM1a - South Myrtle Creek at NW Riverside Drive	
NM8 - North Myrtle Creek above Buck Fork Creek	
NM7 - Buck Fork Creek near Mouth	
NM6 - Lee Creek at Bridge on Bill Rice's	
FC1 - Frozen Creek at N. Myrtle Road near Mouth	
NM5.5 North Myrtle at Slide Creek Road	
NM5 Slide Creek 1.9 miles up Slide Creek Rd.	
NM4 - North Myrtle at N. Myrtle Park	
NM3 - North Myrtle Creek Above Bilger Creek	
NM2 - Bilger Creek near Mouth	Going Dry
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.	
NM1 - North Myrtle Creek across from Super Y	
NM1a - North Myrtle Creek at Evergreen Park	
M1 - Myrtle Creek at Millsite Park	

Rating	Color	Conductivity Level
No Concern		<500 uS/cm
Concern		>500 uS/cm

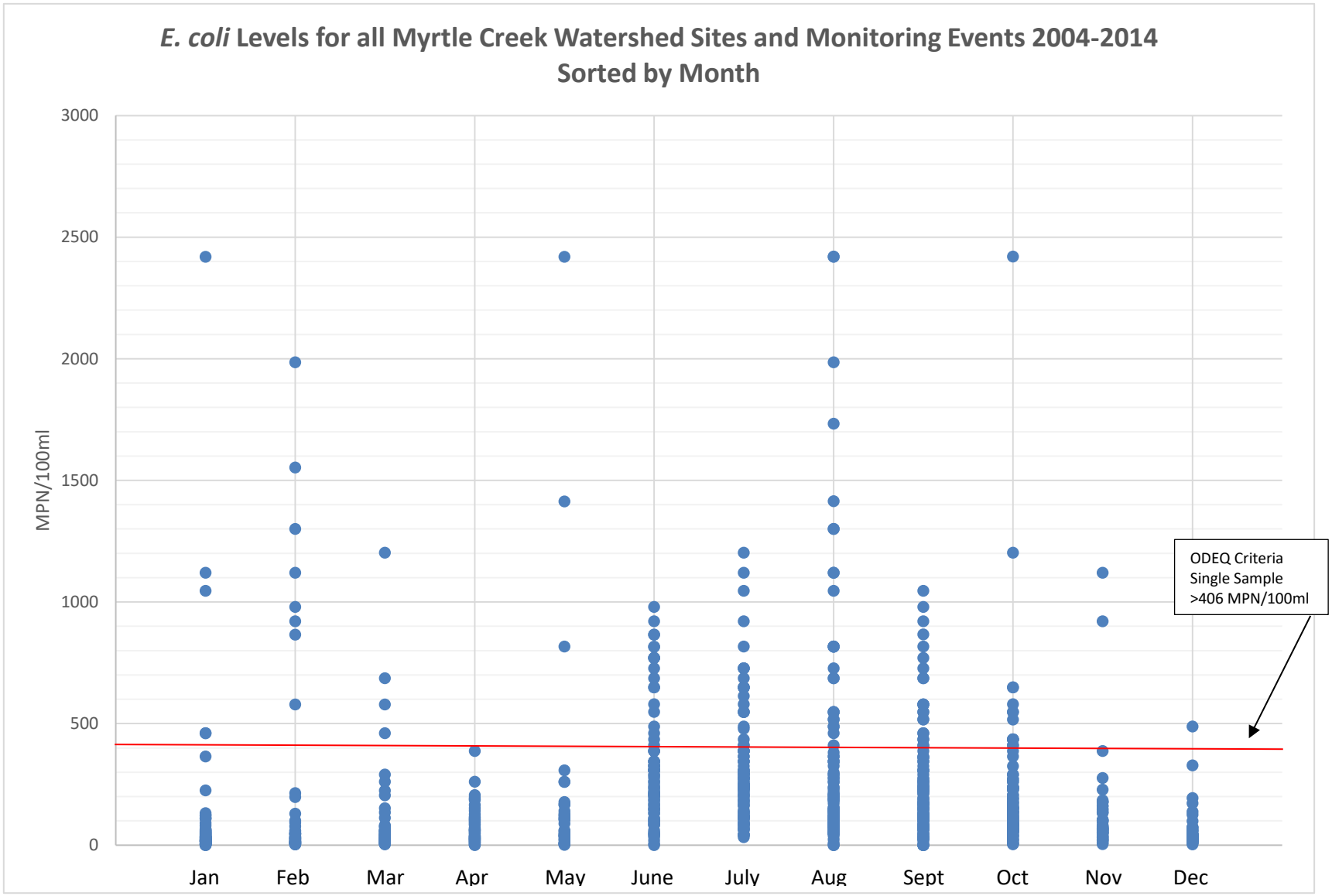
Table 50. Conductivity ratings and key for Myrtle Creek Watershed sites 2004-2014.

RESULTS – Myrtle Creek Watershed

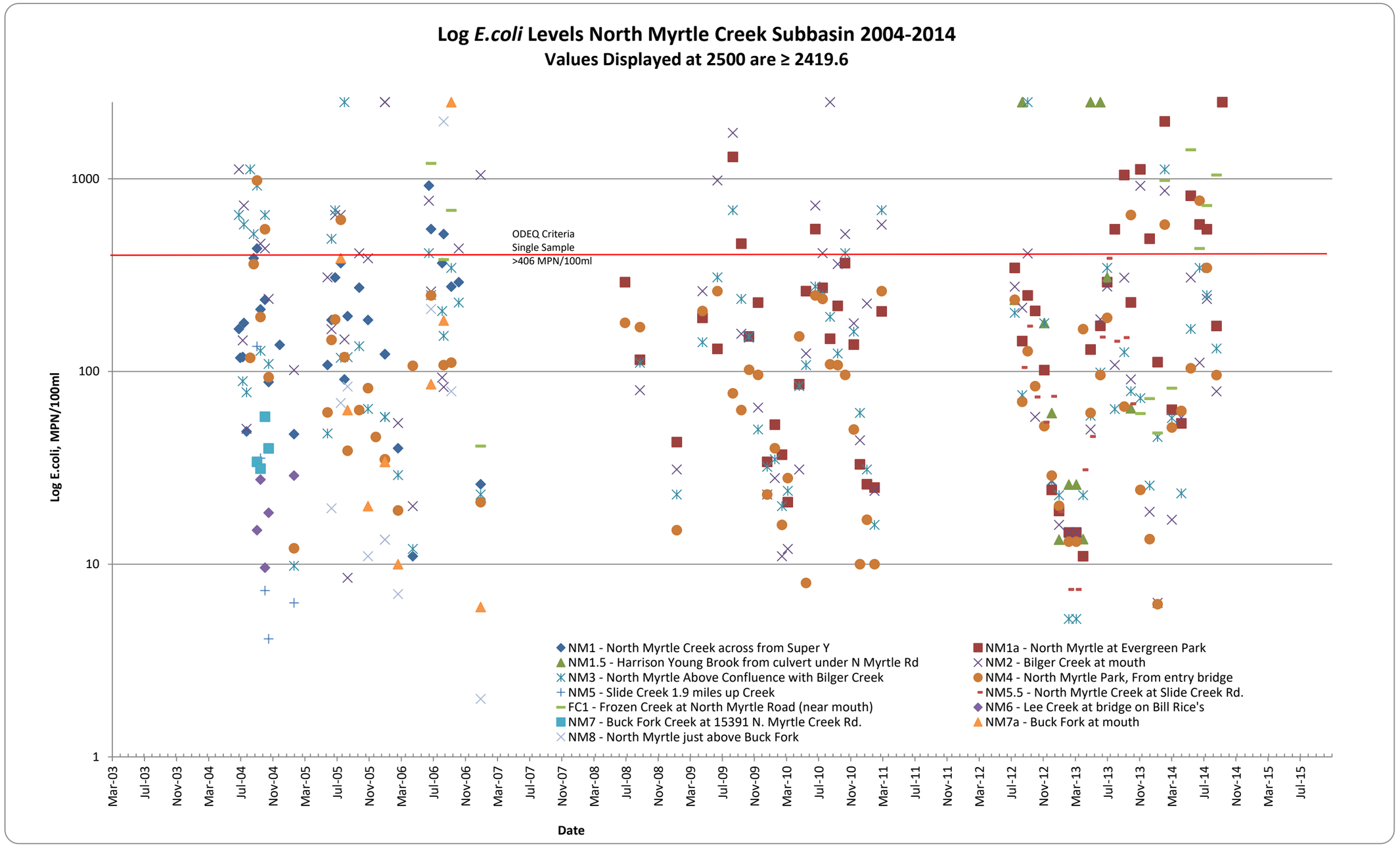
E. coli Bacteria

E. coli levels are a substantial concern in the Myrtle Creek Watershed. **Graph 84**, displays all of the data by month, Exceedances of the ODEQ *E. coli* standard of a single occurrence greater than 406 MPN/ml occurred in every month but the greatest numbers of exceedances happened during the months of June through September.

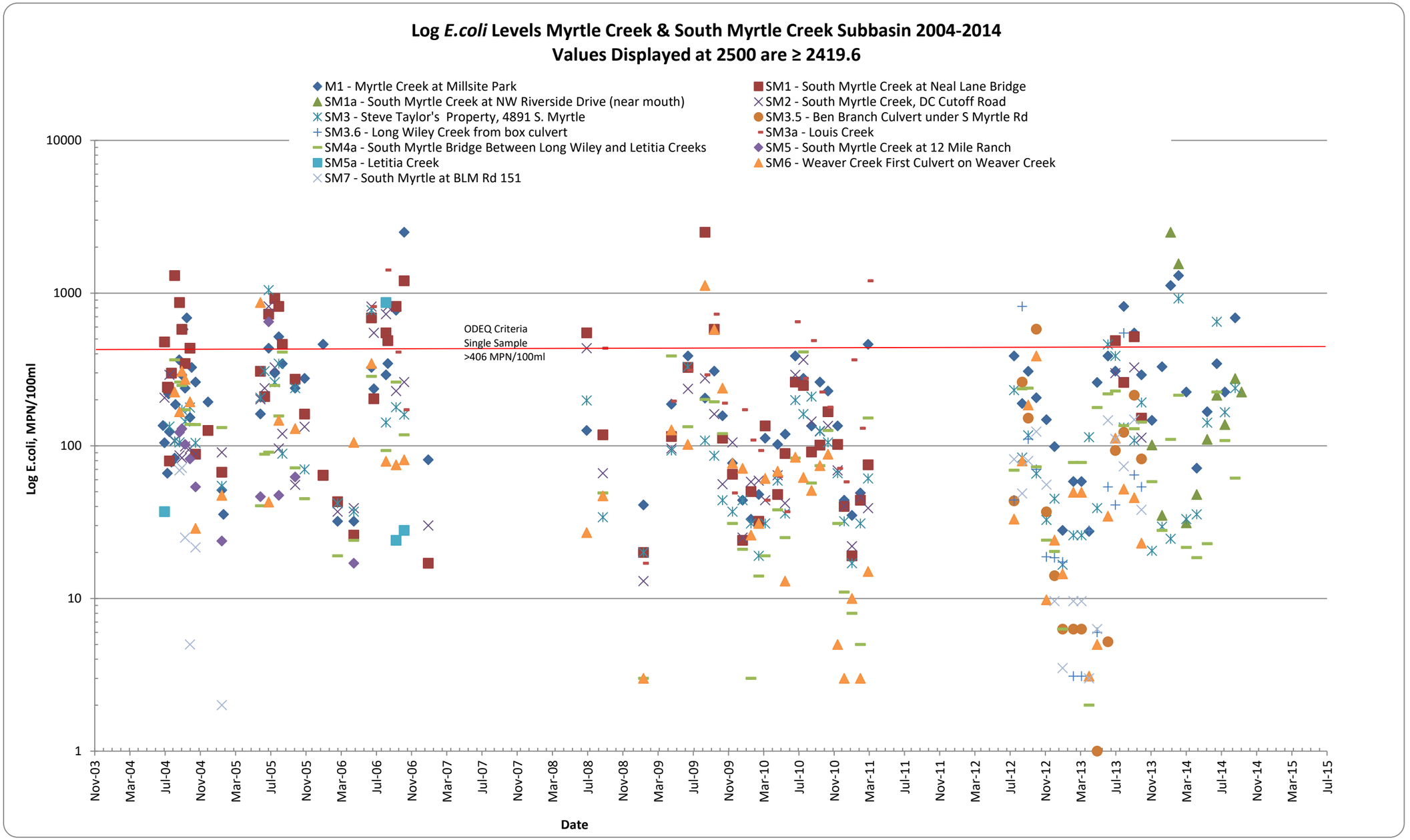
Table 52 summarizes all the monitoring sites and rates them in terms of *E. coli* levels divided by May 1 to September 30 and October 1 to April 30th. Only three sites demonstrated no exceedances of the ≥406 MPN/ml *E. coli* criteria. Those sites were high in the North Myrtle Creek Watershed: on Buck Fork and Lee Creeks; and high in the South Myrtle Creek Watershed at our uppermost site at the end of the paved road on South Myrtle on BLM property.



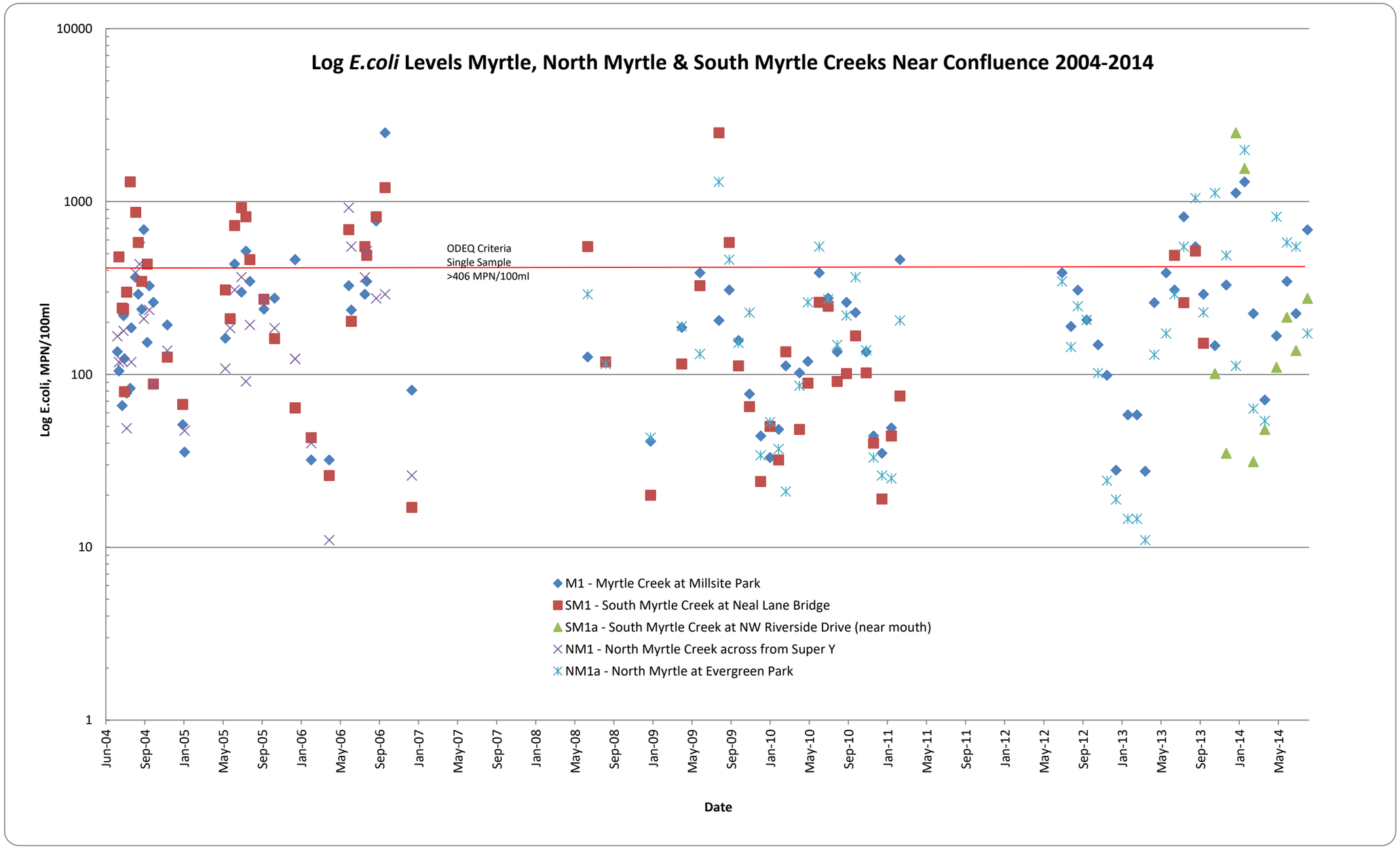
Graph 84.*E. coli* levels, all Myrtle Creek Watershed sites and monitoring events sorted by months 2004-2014.



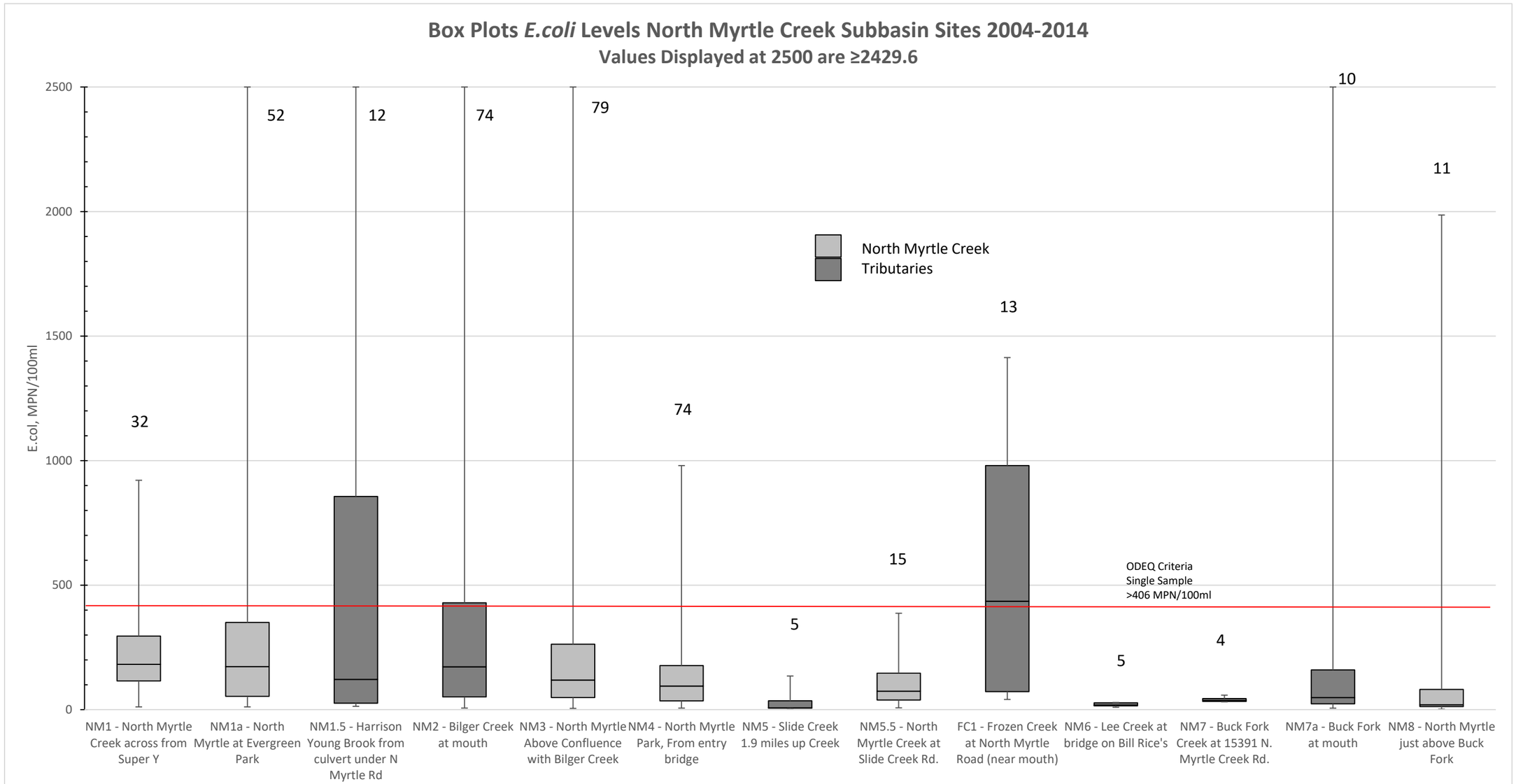
Graph 85.Log *E. coli* levels North Myrtle Creek Subbasin 2004-2014 by site.



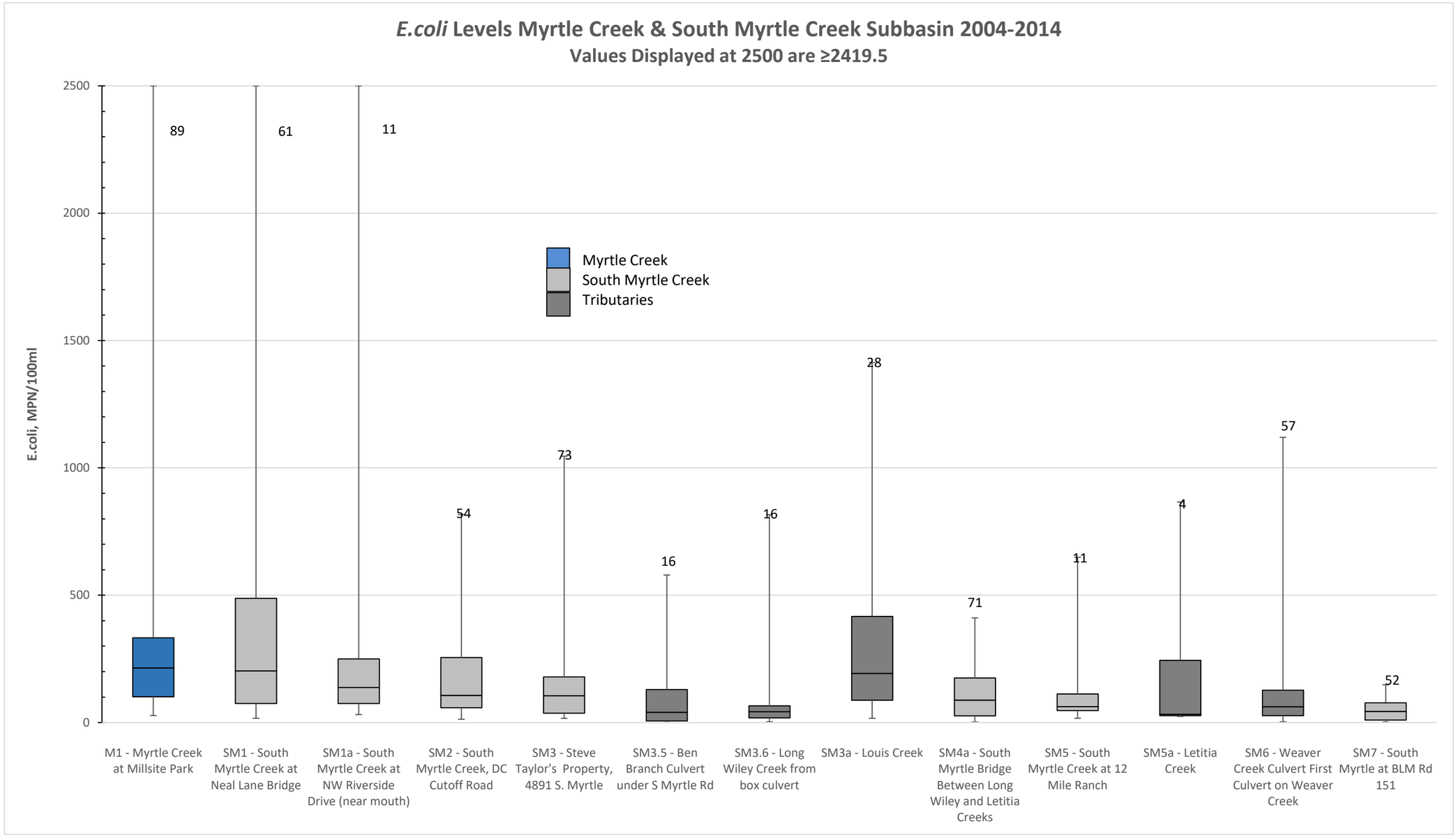
Graph 86.Log *E. coli* levels Myrtle Creek and South Myrtle Creek Subbasin sites 2004-2014.



Graph 87. Log of *E. coli* levels for Myrtle Creek and lowest two sites on North Myrtle Creek and South Myrtle Creek sites 2004-2014.



Graph 88. Box plot of *E. coli* levels North Myrtle Creek Subbasin 2004-2014. Numbers above each indicate the number of sampling events.



Graph 89.Box plots of *E. coli* levels Myrtle Creek & South Myrtle Creek Subbasin sites 2004-2014. The number above the box plot indicates the number of monitoring events included.

Myrtle Creek Watershed	126 or Greater		235 or Greater		406 or Greater		
Station ID - Site Description	Count	% of Samples	Count	% of Samples	Count	% of Samples	# of Samples
M1 - Myrtle Creek at Millsite Park	60	70%	40	47%	14	16%	86
SM1 - South Myrtle Creek at Neal Lane Bridge	35	57%	29	48%	19	31%	61
SM1a - South Myrtle Creek at NW Riverside Drive (near mouth)	6	55%	3	27%	2	18%	11
SM2 - South Myrtle Creek, DC Cutoff Road	23	43%	16	30%	6	11%	54
SM3 - Steve Taylor's Property, 4891 S. Myrtle	29	40%	12	16%	5	7%	73
SM3.5 - Ben Branch Culvert under S Myrtle Rd	4	25%	2	13%	1	6%	16
SM3.6 - Long Wiley Creek from box culvert	2	13%	2	13%	2	13%	16
SM3a - Louis Creek	19	68%	12	43%	8	29%	28
SM4a - South Myrtle Bridge Between Long Wiley and Letitia Creeks	29	41%	11	15%	2	3%	71
SM5 - South Myrtle Creek at 12 Mile Ranch	2	18%	1	9%	1	9%	11
SM5a - Letitia Creek	1	25%	1	25%	1	25%	4
SM6 - Weaver Creek First Culvert on Weaver Creek	15	26%	8	14%	3	5%	57
SM7 - South Myrtle at BLM Rd 151	2	9%	0	0%	0	0%	22
NM1 - North Myrtle Creek across from Super Y	19	59%	12	38%	4	13%	32
NM1a - North Myrtle at Evergreen Park	32	63%	18	35%	11	22%	51
NM1.5 - Harrison Young Brook from culvert under N Myrtle Rd	5	45%	4	36%	2	18%	11
NM2 - Bilger Creek at mouth	39	55%	30	42%	19	27%	71
NM3 - North Myrtle Above Confluence with Bilger Creek	35	45%	22	29%	13	17%	77
NM4 - North Myrtle Park, From entry bridge	24	32%	14	19%	6	8%	74
NM5 - Slide Creek 1.9 miles up Creek	1	20%	0	0%	0	0%	5
NM5.5 - North Myrtle Creek at Slide Creek Rd.	5	33%	1	7%	0	0%	15
FC1 - Frozen Creek at North Myrtle Road (near mouth)	8	62%	8	62%	7	54%	13
NM6 - Lee Creek at bridge on Bill Rice's	0	0%	0	0%	0	0%	5
NM7 - Buck Fork Creek at 15391 N. Myrtle Creek Rd.	0	0%	0	0%	0	0%	4
NM7a - Buck Fork at mouth	2	22%	1	11%	0	0%	9
NM8 - North Myrtle just above Buck Fork	2	18%	1	9%	1	9%	11

Table 51. ***E. coli*** **exceedances by site for Myrtle Creek watershed based on various criteria.**

SITE	Summer (May1 – Sept 30)							Winter (Oct 1 – April 30)						
	Total # Sumer Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating	Total # Winter Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating
SM7 - South Myrtle Creek at Bridge BLM Rd 151	11	0	0%		0	0%		11	0	0%		0	0%	
SM6 - Weaver Creek at First Culvert on Weaver Creek	29	6	21%		3	10%		23	2	9%		0	0%	
SM5 - South Myrtle Creek at 12 Mile Ranch	6	1	17%		1	17%		5	0	0%		0	0%	
SM5a - Letitia Creek near Mouth	3	1	33%		1	33%		1	0	0%		0	0%	
SM4a - South Myrtle Creek at Bridge Between Long Wiley and Letitia Creek	34	10	29%		2	6%		22	1	5%		0	0%	
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.	8	2	25%		2	25%		8	0	0%		0	0%	
SM3a - Louis Creek Near Mouth	12	9	75%		7	32%		16	2	13%		1	6%	
SM3.5 - Ben Branch Creek at S. Myrtle Rd	8	1	13%		0	0%		8	1	13%		1	13%	
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.	34	9	26%		2	6%		38	2	5%		1	3%	
SM2 - South Myrtle Creek above Golf Course	29	15	52%		4	14%		27	2	7%		0	0%	
SM1 - South Myrtle Creek at Neal Lane Bridge	33	26	79%		17	52%		29	4	14%		3	10%	
SM1a - South Myrtle Creek at NW Riverside Drive	5	1	20%		0	0%		6	2	33%		2	33%	
NM8 - North Myrtle Creek above Buck Fork Creek	6	1	17%		1	17%		5	0	0%		0	0%	
NM7 - Buck Fork Creek near Mouth	7	2	29%		1	14%		7	0	0%		0	0%	
NM6 - Lee Creek at Bridge on Bill Rice's	2	0	0%		0	0%		3	0	0%		0	0%	
NM5.5 North Myrtle at Slide Creek Road	8	1	13%		0	0%		7	0	0%		0	0%	
NM5 Slide Creek 1.9 miles up Slide Creek Rd.	2	0	0%		0	0%		0	0	0%		0	0%	
FC1 - Frozen Creek at N. Myrtle Road near Mouth	7	7	100%		6	86%		6	1	17%		1	17%	
NM4 - North Myrtle at N. Myrtle Park	33	10	30%		3	9%		40	3	8%		3	8%	
NM3 - North Myrtle Creek above Bilger Creek	40	19	48%		10	25%		39	3	8%		3	8%	
NM2 - Bilger Creek near Mouth	36	20	56%		12	33%		23	6	26%		5	22%	
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.	5	5	100%		3	60%		7	0	0%		0	0%	
NM1 - North Myrtle Creek across from Super Y	21	9	43%		4	19%		12	3	25%		0	0%	
NM1a - North Myrtle Creek at Evergreen Park	22	14	64%		9	41%		18	2	11%		1	6%	
M1 - Myrtle Creek at Millsite Park	45	28	62%		9	20%		43	12	28%		5	12%	

Rating	Color	EPA Criteria	ODEQ Criteria
No Concern (below standard criteria)		< 235	< 406
Concern (exceeds standard criteria)		≥ 235	≥ 406

Table 52. Rating of Myrtle Creek sites for *E. coli* levels.

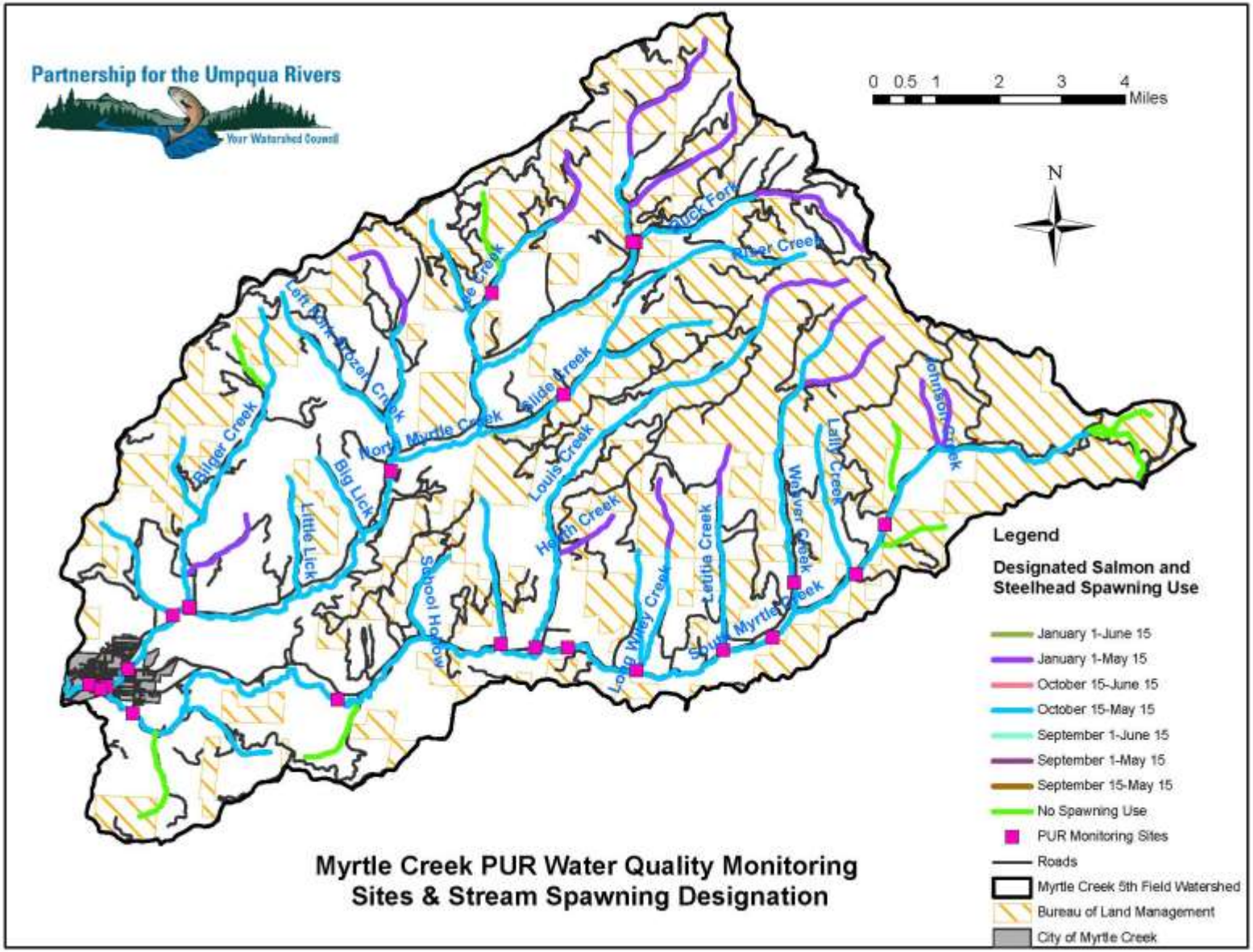
RESULTS – Myrtle Creek Watershed

Grab Sample Temperature

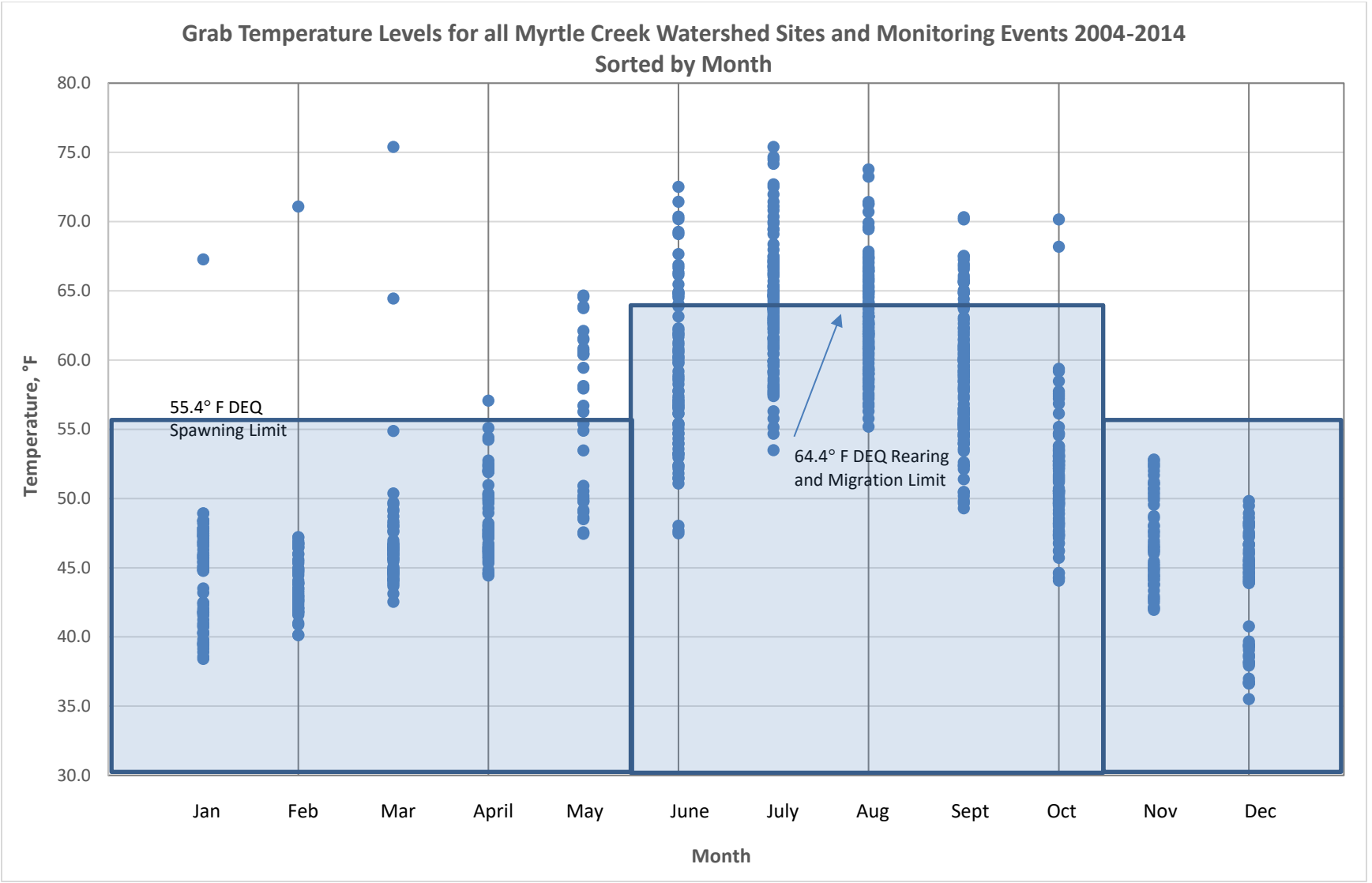
Temperature was recorded at each of our grab sample monitoring events, and though this does not allow evaluation for DEQ temperature criteria, it is included here for evaluation and stream rating in order to provide additional information for planning restoration sites.

Map 13 displays the DEQ streams identified for designated salmon and steelhead spawning use in this watershed as well as the timing of when this occurs. All of our monitoring sites were within the October 12-May 15 spawning use designation.

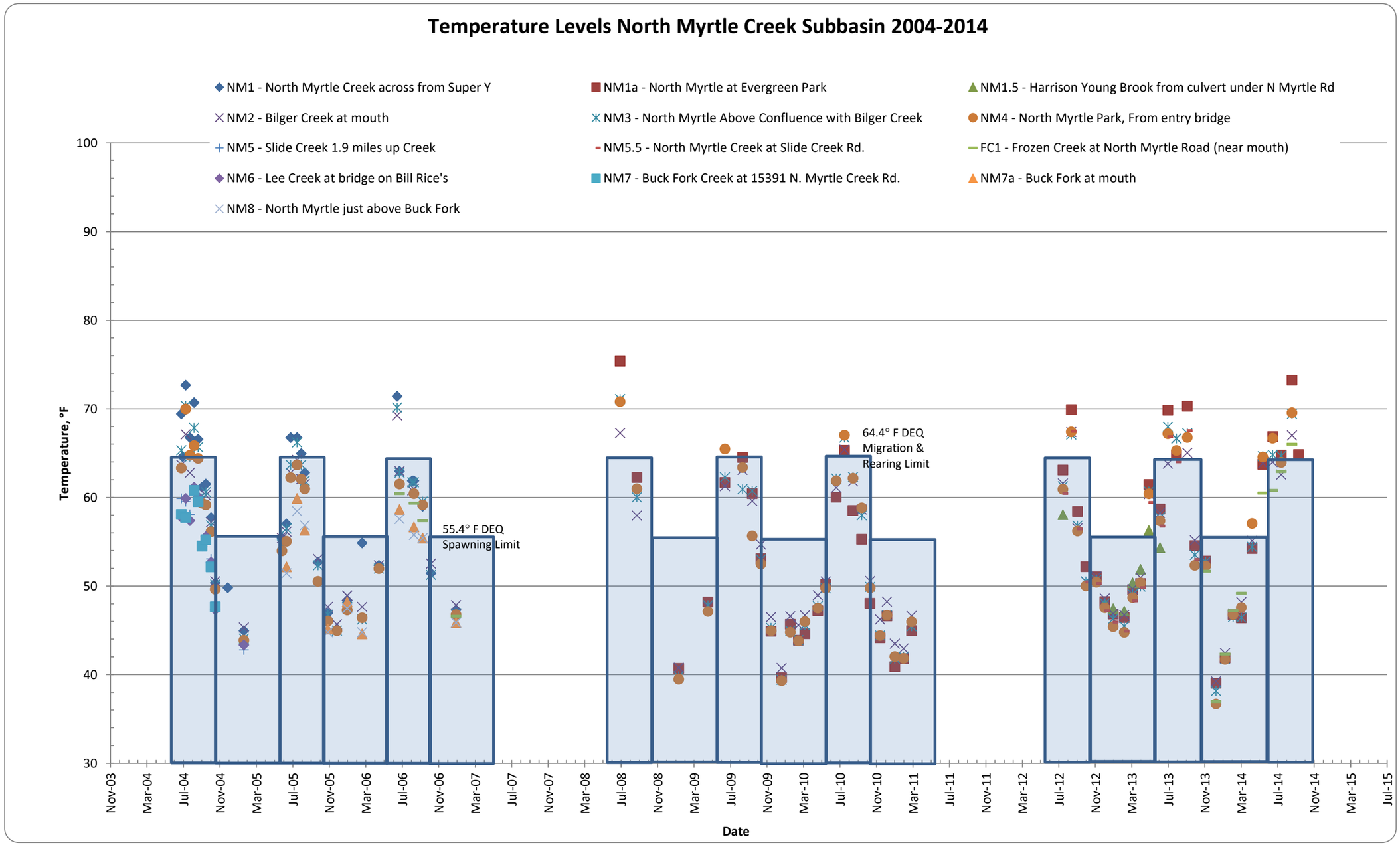
From the grab sampling monitoring data for the Myrtle Creek Watershed numerous exceedances in temperature, 14 of the 25 sites, had exceedances of the biological criteria for "Rearing and Migration" of 64.4°F for May 16 to Oct 14. A fewer number of sites, 7 out of 25, had exceedances of the "Spawning" criteria of 55.4°F from Oct 15 to May 15, six sites, one in the South Myrtle Watershed and 4 in the North Myrtle Watershed and Myrtle Creek had exceedances for both summer and winter criteria. These sites were: SM3 South Myrtle Creek at a Private Property at 4891 S. Myrtle Road, NM4 North Myrtle at North Myrtle Park, NM3 North Myrtle above Bilger Creek, Bilger Creek at its mouth, North Myrtle Creek at Evergreen Park and Myrtle Creek at Millsite Park. **Table 53** displays the temperature rankings of all the sites by summer and winter criteria.



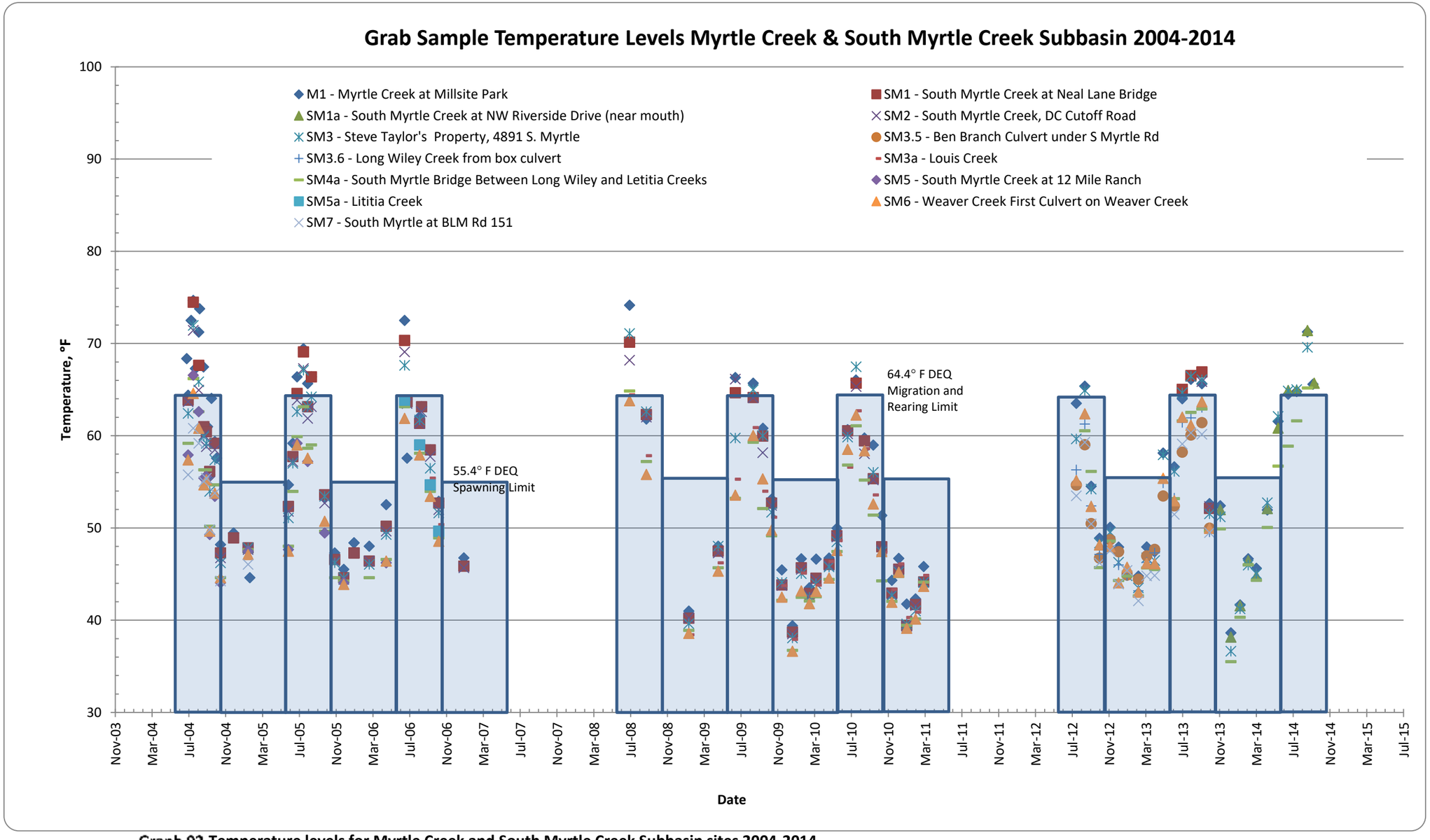
Map 13. Myrtle Creek PUR monitoring sites with ODEQ stream's spawning designations.



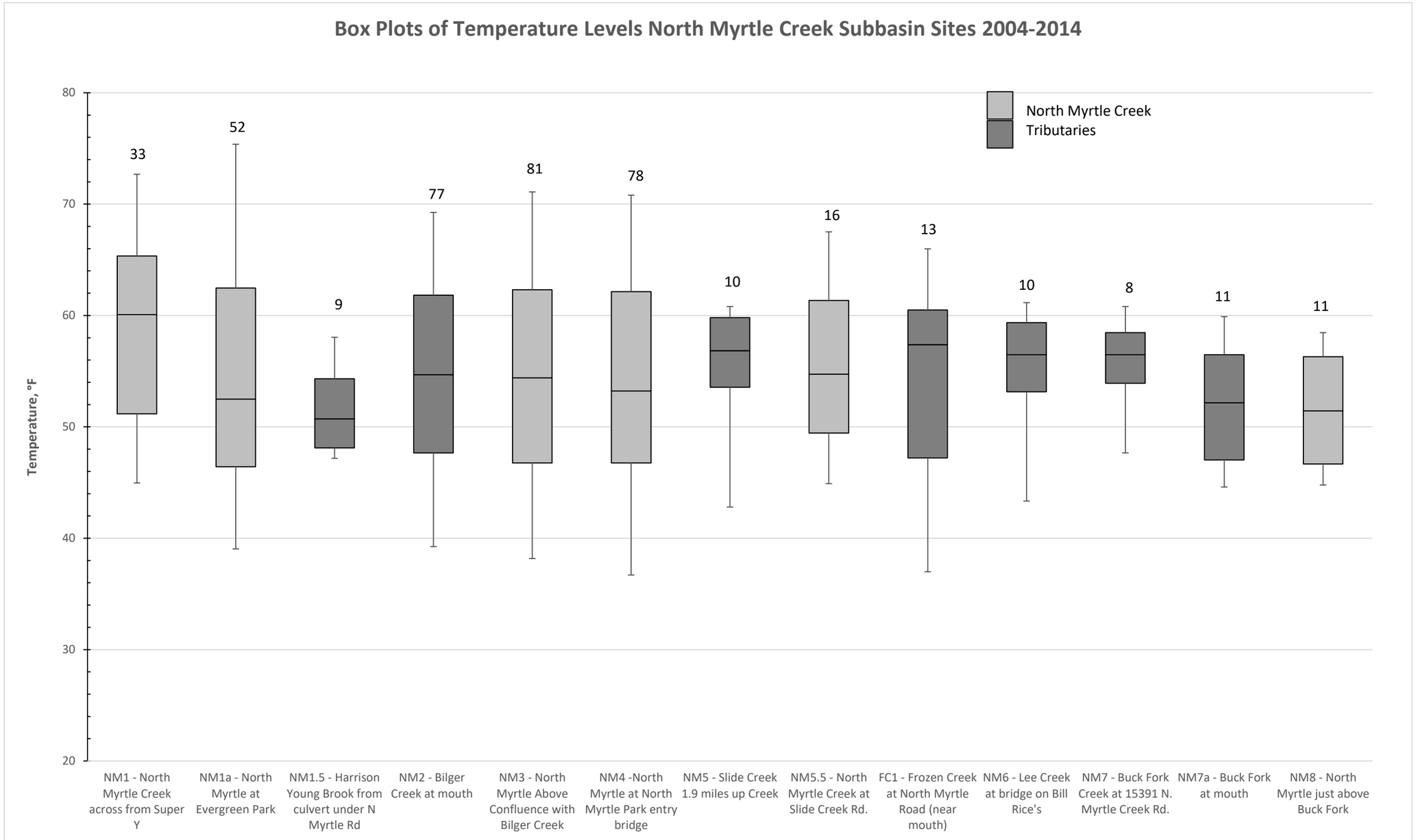
Graph 90. Grab sample temperature levels for all Myrtle Creek watershed sites and monitoring events sorted by month.



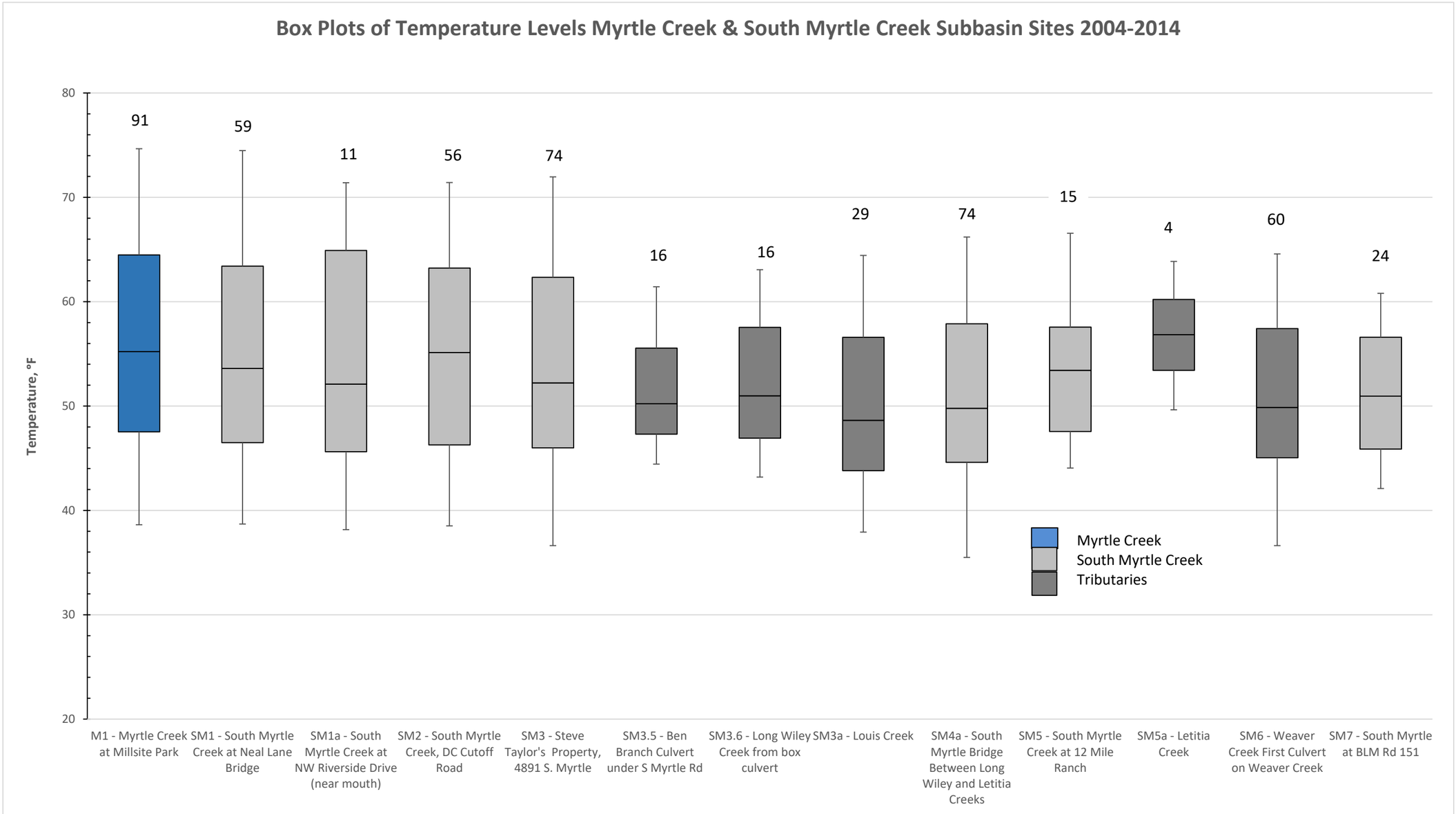
Graph 91. Grab sample temperature by site for North Myrtle Creek Subbasin sites 2004-2014.



Graph 92.Temperature levels for Myrtle Creek and South Myrtle Creek Subbasin sites 2004-2014.



Graph 93.Box plots of North Myrtle Creek Subbasin sites for temperature levels 2004-2014. Numbers above indicate the number of monitoring events.



Graph 94. Box plots of grab sample temperature levels for2004-2014 Myrtle Creek and North Myrtle Creek Subbasin sites. Numbers above each indicate the number of sampling events. Number above each box plot indicates the number of sampling events.

Myrtle Creek Watershed Grab Sample Temperature Rating 2004-2014		
Station ID - Site Description	Grab Sample Rearing and Migration May 16-Oct 14	Grab Sample Spawning Oct 15 to May 15
SM7 - South Myrtle Creek at Bridge BLM Rd 151		
SM6 - Weaver Creek at First Culvert on Weaver Creek		
SM5 - South Myrtle Creek at 12 Mile Ranch		
SM5a - Letitia Creek near Mouth		
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek		
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.		
SM3a - Louis Creek Near Mouth		
SM3.5 - Ben Branch Creek at S. Myrtle Rd		
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.		
SM2 - South Myrtle Creek above Golf Course		
SM1 - South Myrtle Creek at Neal Lane Bridge		
SM1a - South Myrtle Creek at NW Riverside Drive		
NM8 - North Myrtle Creek above Buck Fork Creek		
NM7 - Buck Fork Creek near Mouth		
NM5.5 - North Myrtle at Slide Creek Road		
NM5 - Slide Creek 1.9 miles up Slide Creek Road		
NM6 - Lee Creek at Bridge on Bill Rice's		
FC1 - Frozen Creek at N. Myrtle Road near Mouth		
NM4 - North Myrtle at N. Myrtle Park		
NM3 - North Myrtle Creek Above Bilger Creek		
NM2 - Bilger Creek near Mouth		
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.		
NM1 - North Myrtle Creek across from Super Y		
NM1a - North Myrtle Creek at Evergreen Park		
M1 - Myrtle Creek at Millsite Park		

Rating	Grab Sample Temperatures Rearing and Migration May 15-Oct 14	Grab Sample Oct 16 to May 14	Color
Good	≤64.4° F	≤ 55.4° F	
Needs Improvement	>64.4° F	> 55.4° F	

Table 53. Grab sample temperature ratings for all Myrtle Creek Watershed sites 2004-2014.

RESULTS – Myrtle Creek Watershed

Continuous Temperature

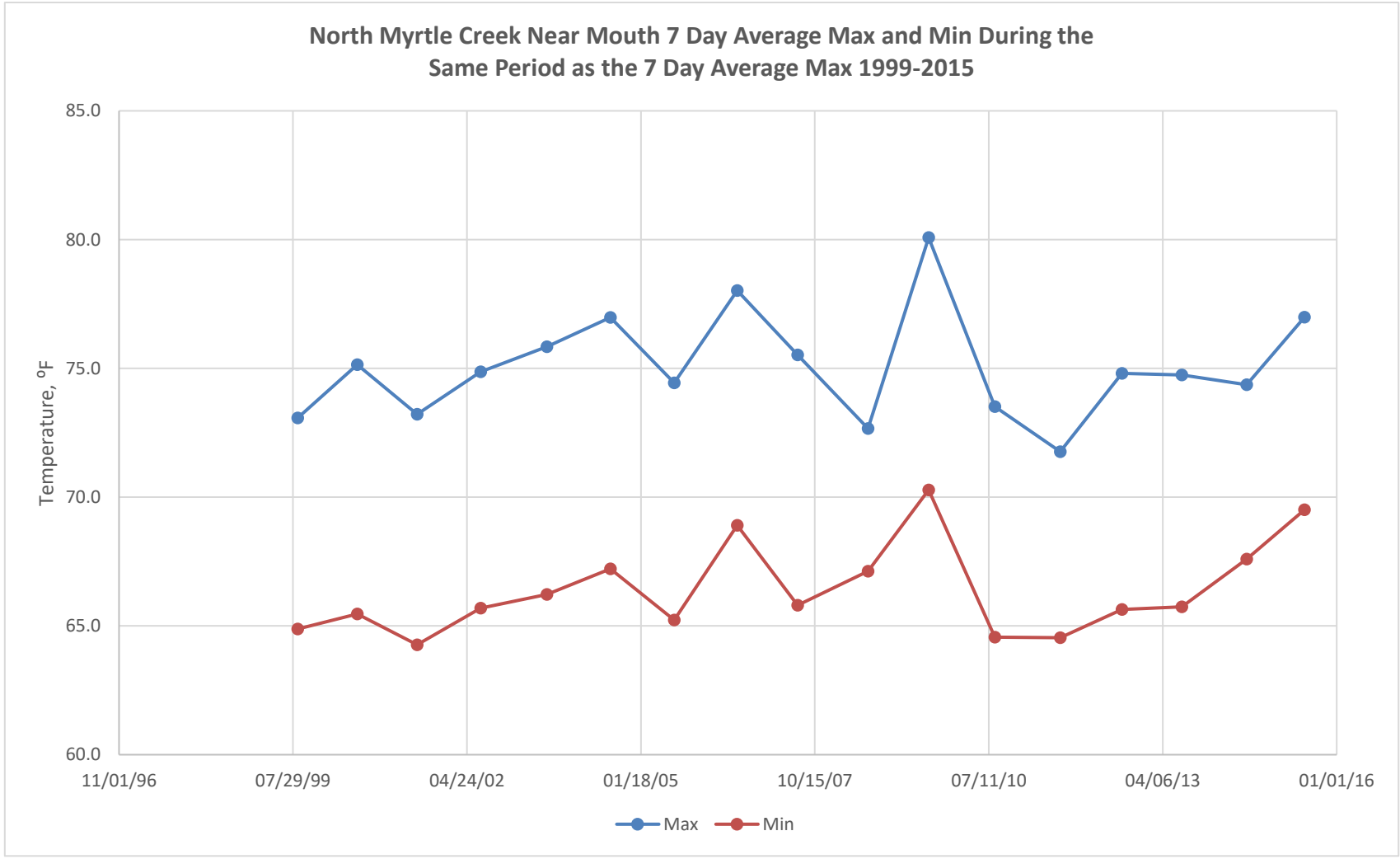
The Myrtle Creek area had 16 PUR continuous temperature monitoring sites (continuous monitoring was not conducted every year) and one Reference site "North Myrtle Creek at Mouth." This reference site is a long-term monitoring site originally monitored for the large-scale Umpqua Basin Stream Temperature Characterization Project (Smith, K., 2003) and annual updates 2005-2010 (Smith, K., 2005), (Dammann, D.M. and K. Smith, 2006), (Dammann, D.M., 2014). Dates of continuous summer stream temperature monitoring in the Myrtle Creek area, seasonal maximum and minimum stream temperatures, diurnal fluctuations, seven-day average maximum (7DAM) stream temperatures, and days above the DEQ criteria (ODEQ, 2003) and (ODEQ, 2011, p. 46) are listed in Appendix J: Summary of PUR Continuous Summer Temperature Data 2005-2010. All streams in the Myrtle Creek area fall into the designated fish use of salmon and trout rearing and migration (ODEQ, 2003) and therefore the 7DAM stream temperatures may not exceed 64.4°F (ODEQ, 2011, p. 46). The 7DAM stream temperatures for the streams monitored in the Myrtle Creek area during this study (2005-2014) ranged from 65.2°F to 80.7°F, all exceeding the DEQ criteria (**Appendix J**). However, with this updated report we placed 5 temperature loggers in the Myrtle Creek Watershed in the summer of 2011, see **Table 54**. Two of the five actually met criteria for this watershed for rearing and migration. These locations were SM6 - Weaver Creek at First Culvert on Weaver Creek and SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek. Looking at **Graph 95** which displays a graph of the Reference Temperature Study data (Dammann, D.M., 2015) for the site at the mouth of North Myrtle Creek from 1999 thru 2015 it is clear that 2011 had the lowest 7-Day Average Max temperature for all those years. **Table 55** displays the temperature ratings for all monitoring sites in the Myrtle Creek Watershed based on continuous and grab sample values.

Many monitoring sites exceeded the potentially lethal temperatures Bell (1990, p. 11.4) found for steelhead and cutthroat trout (75.0°F and 73.0°F respectively) (**Appendix J**). Some sites even exceeded the higher lethal stream temperatures (Brett, 1952) found for young coho and Chinook salmon of ≥78.8°. Brett found 50% mortality at this temperature after 16.7 hours. However, of those Myrtle Creek area sites that were ≥78.8°F they were only at this temperature for up to eight hours with a minimum temperature on the date of maximum stream temperature ranging from 68.4°F to 72.7°F. Though the temperatures of these sites may exceed the lethal limit for several days, this temperature did not last more than 8 hours/day. Therefore, it is unlikely that these lethal levels actually killed fish. None the less metabolic stress and increased possibility of disease likely occurred.

Site Name	Lat	Long	Start Date	Stop date	Seasonal Maximum		Seasonal Minimum		Seasonal Max ΔT		7-Day averages			
					Date	Value	Date	Value	Date	Value	Date	Maximum	Minimum	Δ T
Weaver Creek at first culvert	43.0522	-123.068	06/28/11	10/24/11	10/24/11	70.1	10/24/11	47.1	10/24/11	23.0	08/26/11	63.5	59.5	4.0
South Myrtle Creek at bridge	43.03044	-123.106	06/28/11	10/24/11	10/24/11	74.5	10/24/11	45.2	10/24/11	29.3	08/25/11	64.3	59.3	5.0
Louis Creek near mouth	43.03548	-123.148	06/28/11	10/24/11	10/24/11	71.3	10/24/11	47.1	10/24/11	24.2	08/25/11	67.5	61.0	6.5
South Myrtle Creek at Taylors	43.023	-123.21	06/28/11	10/24/11	08/25/11	74.2	10/24/11	45.7	10/24/11	28.4	08/25/11	72.3	62.9	9.4
North Myrtle Creek at Evergreen P	43.0233	-123.283	06/28/11	09/28/11	08/25/11	73.6	09/01/11	54.8	09/03/11	9.5	08/25/11	71.8	64.5	7.3

Site Name	Days > 55 F	Days > 64 F	Days > 70 F	Hours > 55 F	Hours > 64 F	Hours > 70 F	Warmest day of 7-day max			Agency
							Date	Maximum	Minimum	
Weaver Creek at first culvert	99	4	1	2018.5	25.5	0.5	08/25/11	64.7	61.1	PUR
South Myrtle Creek at bridge	99	5	1	2021.0	28.0	2.0	08/25/11	65.8	61.4	PUR
Louis Creek near mouth	107	38	1	2327.5	258.5	1.0	08/25/11	69.2	63.4	PUR
South Myrtle Creek at Taylors	115	75	18	2483.5	687.5	78.5	08/25/11	74.2	65.6	PUR
North Myrtle Creek at Evergreen P	93	76	13	2228.0	930.0	62.0	08/25/11	73.6	67.1	PUR

Table 54. Continuous temperature summary results for Myrtle Creek Watershed sites 2011.



Graph 95.North Myrtle Creek near mouth 7ADMax and & ADMin values from 1999-2015. Data provided by Kent Smith and Denise Dammann as part of the Reference Temperature Study for the Umpqua Basin.

Myrtle Creek Watershed Continuous Temperature Rating 2011	
Station ID - Site Description	
SM6 - Weaver Creek at First Culvert on Weaver Creek	
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek	
SM3a - Louis Creek Near Mouth	
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.	
NM1a - North Myrtle Creek at Evergreen Park	

Rating	Color	7 DAM May 15-Oct 15 Temperature Criteria
Good		≤64'4^{o} F
Needs Improvement		>64.4^{o} F

Table 55. Continuous temperature ratings for Myrtle Creek Watershed sites 2011.

Myrtle Creek Watershed Temperature Rating 2004-2014			
Station ID - Site Description	Grab Samples May 15-Oct 15	7 DAM May 15-Oct 15	Grab Samples Oct 16-May 14
SM7 - South Myrtle Creek at Bridge BLM Rd 151			
SM6 - Weaver Creek at First Culvert on Weaver Creek		5 of 6 years	
SM5 - South Myrtle Creek at 12 Mile Ranch			
SM5a - Letitia Creek near Mouth			
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek		6 of 7 years	
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.			
SM3a - Louis Creek Near Mouth			
SM3.5 - Ben Branch Creek at S. Myrtle Rd			
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.			
SM2 - South Myrtle Creek above Golf Course			
SM1 - South Myrtle Creek at Neal Lane Bridge			
SM1a - South Myrtle Creek at NW Riverside Drive			
NM8 - North Myrtle Creek above Buck Fork Creek			
NM7 - Buck Fork Creek near Mouth			
NM5.- North Myrtle at Slide Creek Road			
NM5 -Slide Creek 1.9 miles up Slide Creek Road			
NM6 - Lee Creek at Bridge on Bill Rice's			
FC1 - Frozen Creek at N. Myrtle Road near Mouth			
NM4 - North Myrtle at N. Myrtle Park			
NM3 - North Myrtle Creek Above Bilger Creek			
NM2 - Bilger Creek near Mouth			
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.			
NM1 - North Myrtle Creek across from Super Y			
NM1a - North Myrtle Creek at Evergreen Park			
M1 - Myrtle Creek at Millsite Park			

Rating	Grab Sample Temperatures Rearing and Migration May 15-Oct 14	7 DAM May 15-Oct 14	Grab Sample Oct 16 to May 14	Color
Good	<64.4° F	<64.4° F	≤ 55.4° F	
Needs Improvement	>64.4° F	>64.4° F	> 55.4° F	
No Data				

Table 56. Myrtle Creek Watershed monitoring sites 2005-2015 rated for temperature.

RESULTS – Myrtle Creek Watershed

Summary

What is apparent from our data, summary ratings in **Table 57**, is that there are significant water quality issues with turbidity, dissolved oxygen, *E. coli*, pH, and temperature in the Myrtle Creek Watershed. This data should prove useful in helping to prioritize streams for restoration efforts.

The sites rated best considering all parameters' ratings were high in the North Myrtle Creek watershed. They were NM7 - Buck Fork Creek near Mouth, NM5.5-North Myrtle at Slide Creek Road, NM5-Slide Creek 1.9 miles up Slide Creek Road and NM6 - Lee Creek at Bridge on Bill Rice's. The worst site of all was also in the North Myrtle Creek watershed but was lower in the drainage, this was NM2 - Bilger Creek near Mouth.

Summary Rating for Myrtle Creek Watershed Monitoring Sites – Six Water Quality Parameters 2004-2014

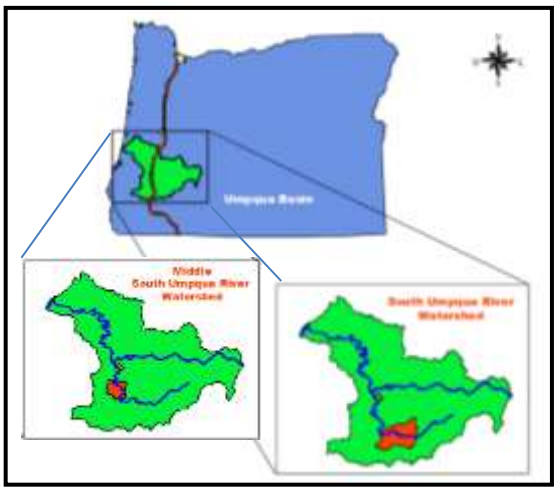
	Turbidity	pH	Dissolved Oxygen Non-Spawning Season May 16-October 14	Dissolved Oxygen Spawning Season October 15-May 15	Conductivity	*E. coli*	Temperature May 15-Oct 15	Temperature Oct 16- May 14
SM7 - South Myrtle Creek at Bridge BLM Rd 151								
SM6 - Weaver Creek at First Culvert on Weaver Creek								
SM5 - South Myrtle Creek at 12 Mile Ranch								
SM5a - Letitia Creek near Mouth								
SM4a - South Myrtle at Bridge Between Long Wiley and Letitia Creek								
SM3.6 - Long Wiley Creek from culvert at S. Myrtle Rd.								
SM3a - Louis Creek Near Mouth								
SM3.5 - Ben Branch Creek at S. Myrtle Rd								
SM3 - South Myrtle Creek at Private Property 4891 S. Myrtle Rd.								
SM2 - South Myrtle Creek above Golf Course								
SM1 - South Myrtle Creek at Neal Lane Bridge								
SM1a - South Myrtle Creek at NW Riverside Drive								
NM8 - North Myrtle Creek above Buck Fork Creek								
NM7 - Buck Fork Creek near Mouth								
NM5.5 - North Myrtle at Slide Creek Road								
NM5 - Slide Creek 1.9 miles up Slide Creek Road								
NM6 - Lee Creek at Bridge on Bill Rice's								
FC1 - Frozen Creek at N. Myrtle Road near Mouth								
NM4 - North Myrtle at N. Myrtle Park								
NM3 - North Myrtle Creek above Bilger Creek								
NM2 - Bilger Creek near Mouth					Going Dry			
NM1.5 - Harrison Young Brook at culvert N Myrtle Rd.								
NM1 - North Myrtle Creek across from Super Y								
NM1a - North Myrtle Creek at Evergreen Park								
M1 - Myrtle Creek at Millsite Park								

Table 57. Summary ratings for Myrtle Creek Watershed monitoring sites 2004-2014, – six water quality parameters. See tables for each parameter for color coding.

Middle & South Umpqua Watersheds

Area Description, Background & Monitoring Sites

PUR's "South Umpqua Volunteer Monitoring Run" encompasses sites within two fifth-field Watersheds – the South Umpqua Watershed and the Middle South Umpqua Watershed. This run also includes data from samples taken at the mouth of 3 other fifth fields: Cow Creek, Myrtle Creek and Lookingglass Creek all of which flow into the South Umpqua River in these watersheds.



Map 14. Middle and South Umpqua area maps.

The South Umpqua Watershed encompasses 141,575 acres stretching 14 miles north to south and 20 miles east to west. The only incorporated city in the areas is Canyonville; other unincorporated population centers include Days Creek and Milo. Interstate Five runs through the western portion of the watershed with Tiller Trail Highway following the South Umpqua River through the watershed for 28 miles of the South Umpqua River. The largest tributary in this region is Days Creek (13.9 miles). The largest land usage in the watershed is forestry at 89% of land base for public and private forestry. Agriculture constitutes 9% of the land usage being most prevalent along the South Umpqua and Days Creek floodplains. Residential, industrial and commercial lands each constitute approximately one percent of the watershed. Ownership is 55% private with public ownership mostly administered by BLM, City, state, county and the Cow Creek Tribe of the Umpqua Indians each constituting less than 1% of the watershed. Eighty percent of the watershed consists of ownership parcels that are over 100 acres. (Geyer, South Umpqua Watershed Assessment and Action Plan, 2003).

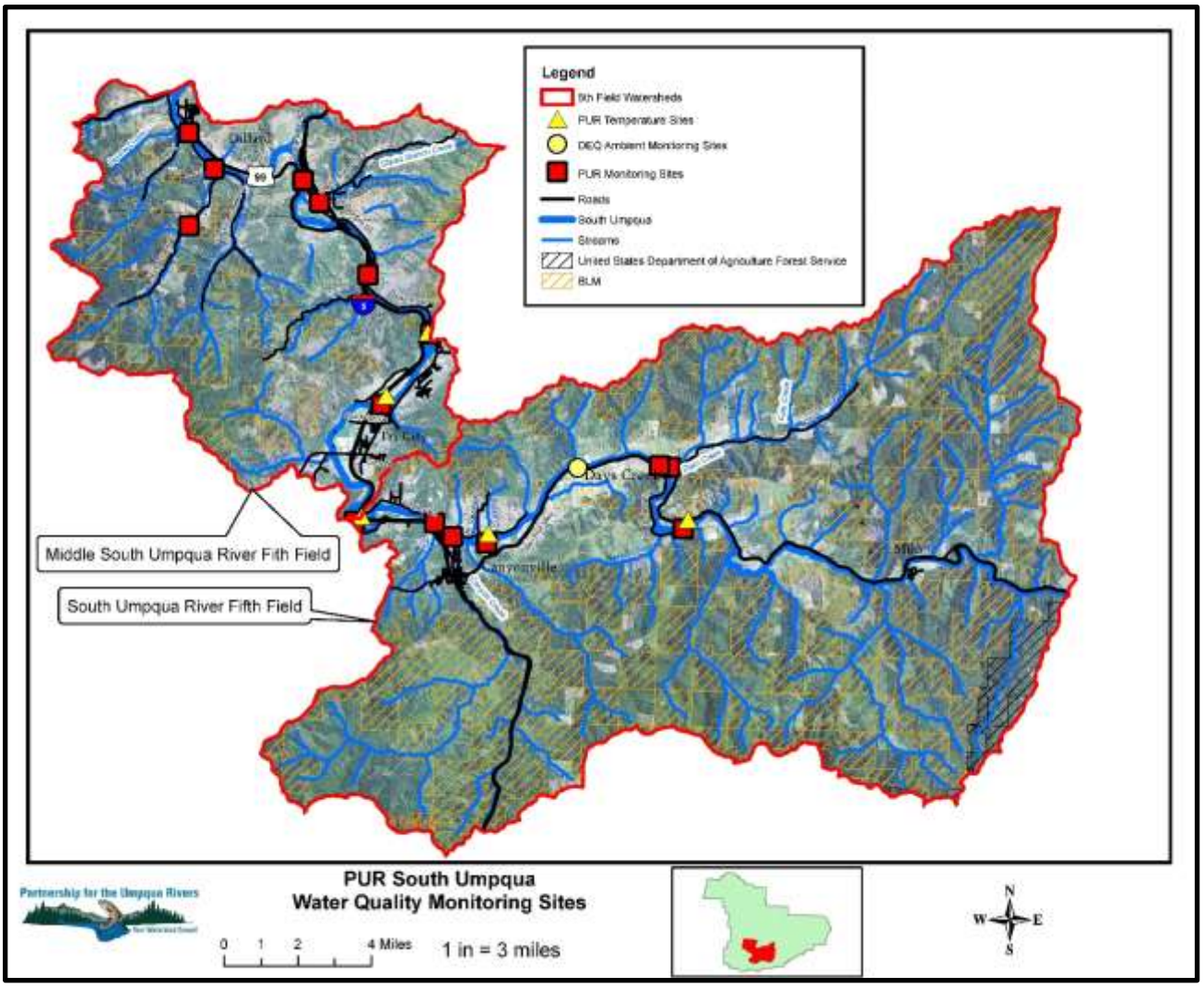
The Middle South Umpqua Watershed encompasses 59,441 acres downstream of the South Umpqua Watershed. It stretches 10.9 miles east to west and 10.6 miles north to

south. Small parts of Myrtle Creek fall within this watershed, as do all of Dillard and the Tri-City area. Interstate Five, Highway 99 and Highway 42 cross through the watershed. The watershed begins approximately 47 miles from the mouth of the South Umpqua River and proceeds for 22 miles upstream. There are numerous tributaries to the South Umpqua in this region, the largest being Rice Creek which is 7.3 miles long. Agriculture accounts for 40% of the land use in this region. Federal lands administered by the BLM make up 13% of the watershed. Lands owned by cities, Douglas County and the Cow Creek Band of the Umpqua Tribe of Indians each accounting for less than 1%. Over 66% of the tax lot parcels are over 100 acres. ODFW estimates the following stream miles supporting anadromous salmonids in the Middle South Umpqua Watershed: spring Chinook, 22 miles; fall Chinook, 24 miles; coho, 64 miles; and winter steelhead, 63 miles. Water use during the summer months is a concern. Galesville Reservoir has slightly increased summer flows but the South Umpqua can have less than 100 cfs flow during the summer. The largest use of water is for irrigation consuming 53.8%, with industry using 24.9% and municipal use at 16.5%. (Geyer, Middle South Umpqua Watershed Assessment and Action Plan, 2003).

Map 16 displays the streams in the Middle South and South Umpqua River Watersheds that are designated as “Spawning” and “Non-Spawning” use. **Figure 320A - Umpqua Basin Fish Use Designations from ODEQ** 2003 (Appendix I) indicates that these areas are in the “Salmon & Trout Rearing & Migration” designation.

Photo 10. South Umpqua River summer at Old Canyonville Park.

Photo 11. South Umpqua River winter at Old Canyonville Park.



Map 15. PUR water quality monitoring sites for the Middle and South Umpqua fifth-field watersheds.

Middle South Umpqua and South Umpqua River Watersheds
Monitoring Sites Description and Location

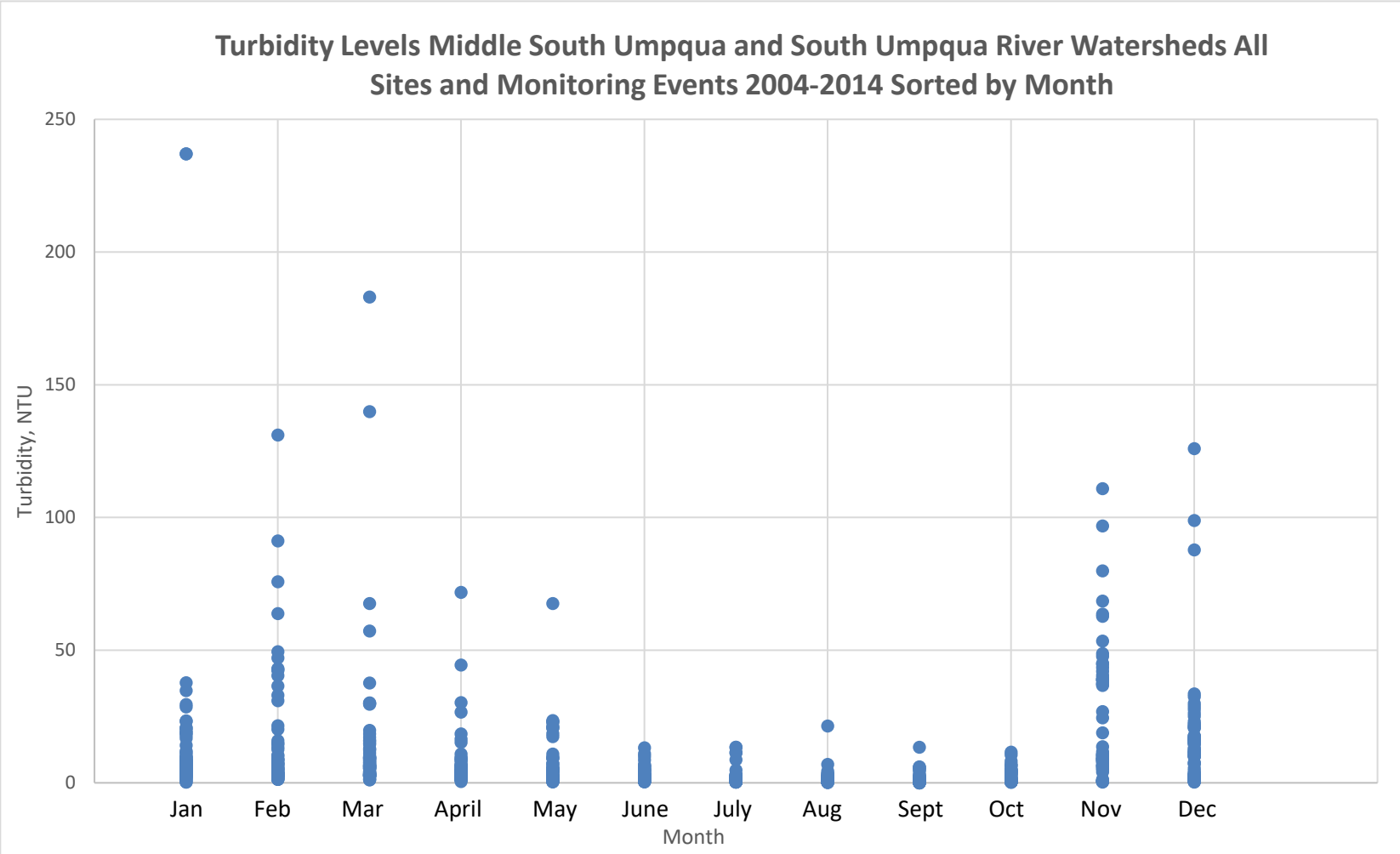
Site Name	Site Location	Type Site	Latitude	Longitude
Days Creek	Days Creek above Fate Creek at Foot Bridge	Below Project	42°59.241N	123°06.172W
Fate Creek	Near mouth of Fate Creek	Below project	42°59.241N	123°06.172W
Days Creek	Days Creek Above Perdue	Mid Days Creek	42°59.126N	123°07.448W
Days Creek	Days Creek at Woods Creek Road	Rural residential and agriculture	42°58.440N	123°08.995W
Woods Creek	Woods Creek near mouth	Rural Residential and agriculture	42°58.440N	123°09.003
Days Creek	Days Creek at Highway 1 Bridge	Rural residential and agriculture	42°58.351N	123°10.312W
South Umpqua	South Umpqua above Days Creek at Berry Farm Lane	Rural residential and agriculture	42°56.962N	123°09.412W
South Umpqua	South Umpqua at Days Creek Bridge	Residential/small town	42°58.351N	123°10.312W
South Umpqua	South Umpqua DC Cutoff Bridge	Rural Residential and agriculture	42°58.271N	123°12.845W
South Umpqua	South Umpqua at Canyonville Park	Rural Residential and agriculture	42°56.402N	123°15.926W
O'Shea Creek	O'Shea Creek at Tiller-Trail Hwy	Rural	42°55.880N	123°15.983W
Canyon Creek	Canyon Creek at Primary School Foot bridge	City	42°55.828N	123°16.702W
South Umpqua	South Umpqua Above Canyon Creek	City	42°56.548N	123°16.838W
Canyon Creek	Canyon Creek at mouth	City	42°56.545N	123°16.893W
South Umpqua	Gazley Road Bridge	City	42°56.619N	123°17.155W
South Umpqua	South Umpqua at Stanton Park	City and agriculture	42°56.867N	123°17.479W
Cow Creek	At Yokum Road bridge	Summation of Cow Creek	42°56.567N	123°20.207W
South Umpqua	South Umpqua at MC RR Trestle	South Umpqua River before Myrtle Creek	43°01.016N	123°17.993W
South Umpqua	South Umpqua below MC Bridge	South Umpqua below Myrtle Creek confluence	43°01.536N	123°17.808W
South Umpqua	Beach on South Umpqua just North of Boomerhill off side road	South Umpqua well below Myrtle Creek confluence	43°02.630N	123°19.858W
Clarks Branch	Clarks Branch at Dole Road Culvert	Summation of Clarks Branch	43°04.288N	123°21.524W
South Umpqua	Bridge at Brockway Road at Dillard	South Below Mill and before Dillard/Winston	43°05.891N	123°25.854W
Lookingglass Creek	Lookingglass at Highway 42 Bridge near Mouth	Downstream of Farmland and Rural Residential	43°07.062N	123°25.698W

Table 58. Site information on PUR water quality monitoring sites in the Middle and South Umpqua watersheds.

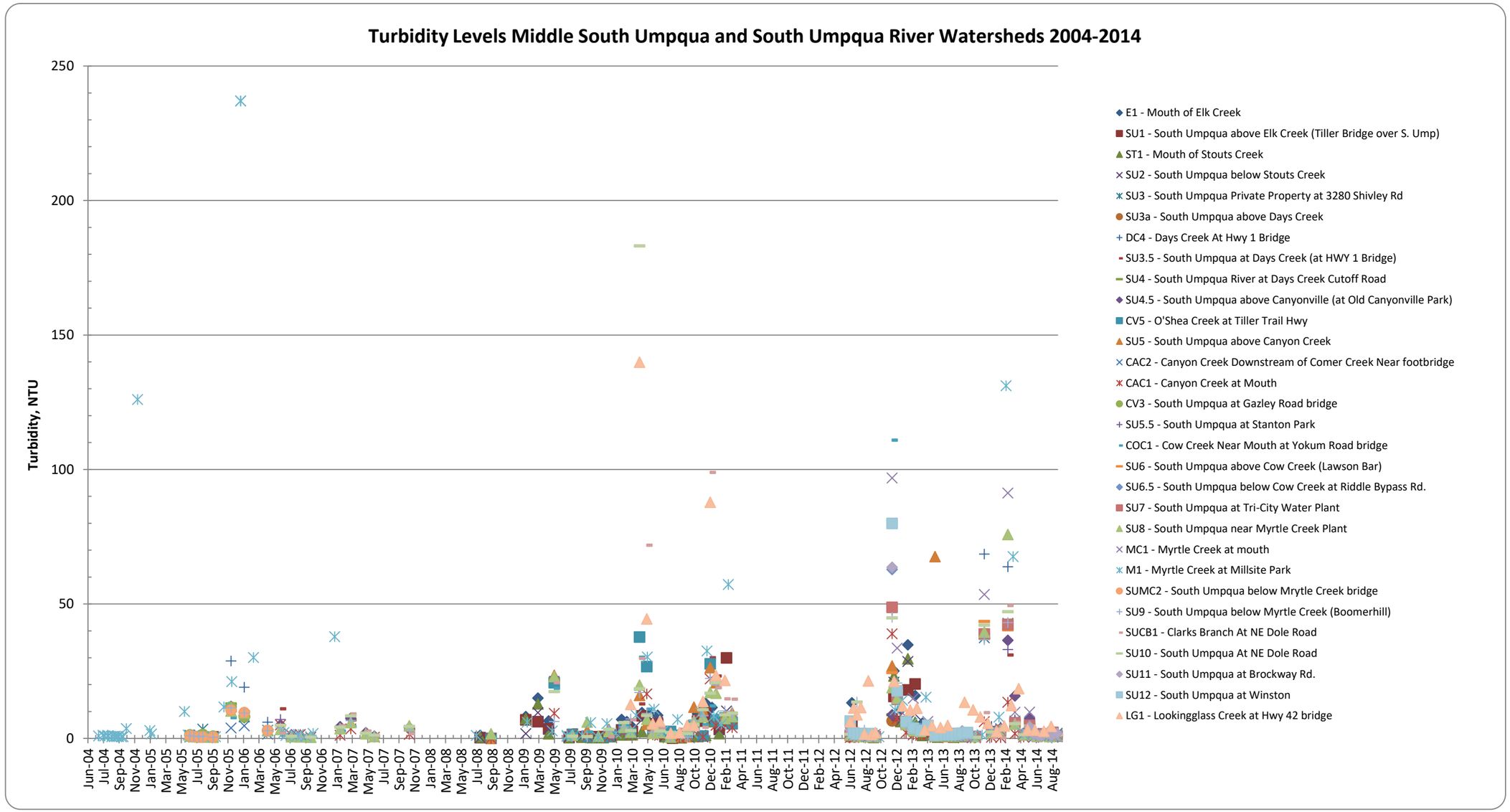
RESULTS – Middle South Umpqua and South Umpqua River Watersheds

Turbidity

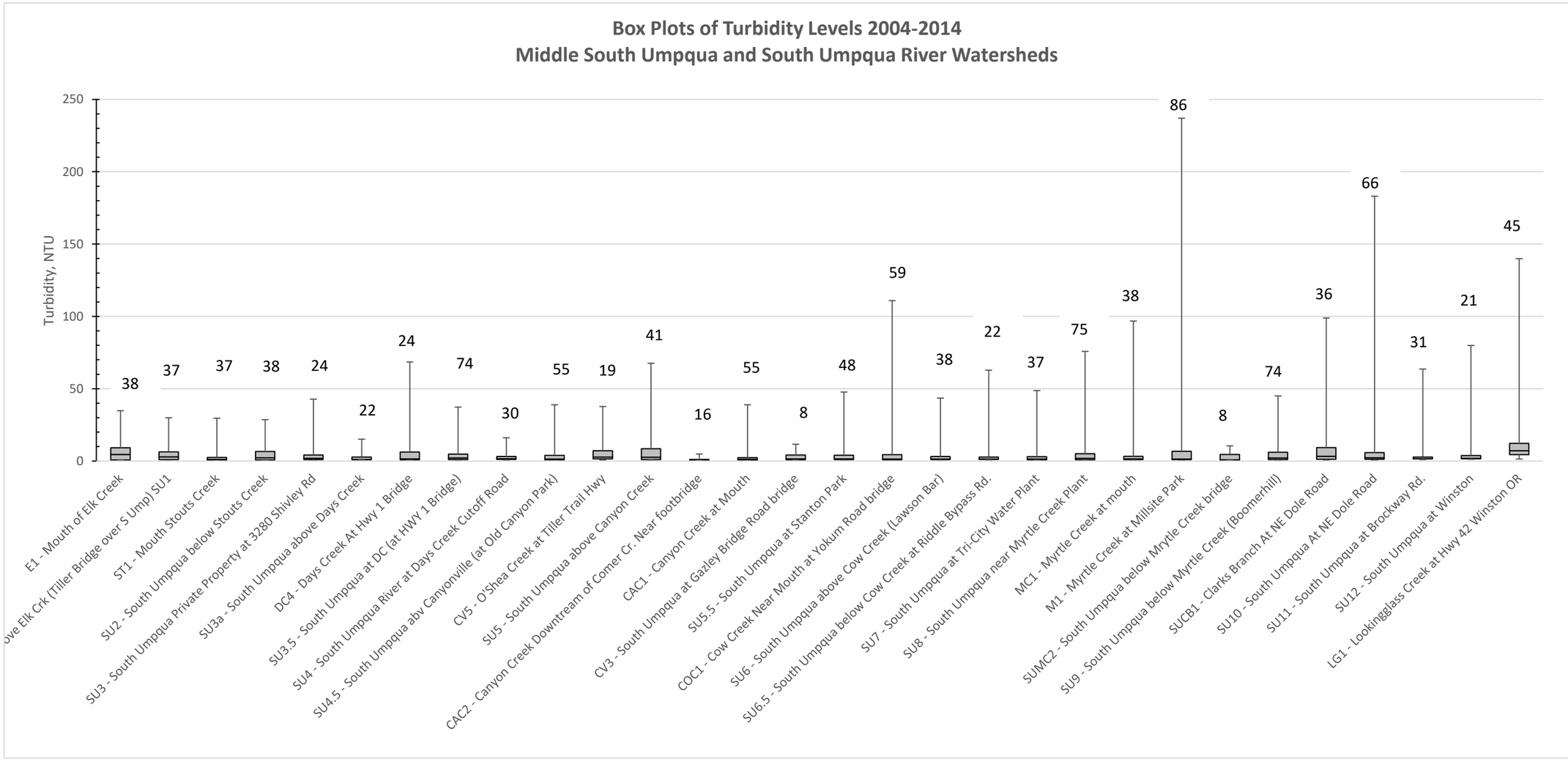
South Umpqua sites and tributary data are summarized and rated in **Table 59**. Only one site, CAC2 - Canyon Creek at the footbridge to the primary school, did not produce any readings over 10 NTU, either in summer or winter. LG1 - Lookingglass Creek at Hwy 42 had the most occurrences of 10 NTU's or greater at 42% of samples collected.



Graph 96. Turbidity levels of Middle South and South Umpqua Watershed, all sites and monitoring events sorted by month.



Graph 97.Turbidity levels by site for South Umpqua and Middle South Umpqua Watersheds 2004-2014.



Graph 98.Box plots of turbidity levels for all sites 2004-2014 Middle South and South Umpqua Watersheds 2004-2014. Numbers above each indicate the number of sampling events.

Turbidity Levels Middle South Umpqua and South Umpqua River Watersheds 2004-2014		10 NTU's or Greater	
Station ID - Site Description	# of Samples	Count	% of Samples
E1 - Mouth of Elk Creek	38	8	21%
South Umpqua above Elk Creek (Tiller Bridge over S Ump) SU1	38	4	11%
ST1 - Mouth Stouts Creek	37	3	8%
SU2 - South Umpqua below Stouts Creek	38	4	11%
SU3 - South Umpqua Private Property at 3280 Shivley Rd	24	3	13%
SU3a - South Umpqua above Days Creek	22	1	5%
DC4 - Days Creek At Hwy 1 Bridge	24	4	17%
SU3.5 - South Umpqua at DC (at HWY 1 Bridge)	75	10	13%
SU4a - South Umpqua River at Days Creek Cutoff Road	30	2	7%
SU4.5 - South Umpqua above Canyonville (at Old Canyon Park)	55	5	9%
CV5 - O'Shea Creek at Tiller Trail Hwy	20	4	20%
SU5 - South Umpqua above Canyon Creek	42	9	21%
CAC2 - Canyon Creek Downtream of Comer Cr. Near footbridge	16	0	0%
CAC1 - Canyon Creek at Mouth	56	4	7%
CV3 - South Umpqua at Gazley Bridge Road bridge	8	1	13%
SU5.5 - South Umpqua at Stanton Park	48	5	10%
COC1 - Cow Creek Near Mouth at Yokum Road bridge	59	6	10%
SU6 - South Umpqua above Cow Creek (Lawson Bar)	38	4	11%
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.	22	2	9%
SU7 - South Umpqua at Tri-City Water Plant	37	4	11%
SU8 - South Umpqua near Myrtle Creek Plant	76	9	12%
MC1 - Myrtle Creek at mouth	38	5	13%
M1 - Myrtle Creek at Millsite Park	86	16	19%
SUMC2 - South Umpqua below Myrtle Creek bridge	8	1	13%
SU9 - South Umpqua below Myrtle Creek (Boomerhill)	75	10	13%
SUCB1 - Clarks Branch At NE Dole Road	36	8	22%
SU10 - South Umpqua At NE Dole Road	66	11	17%
SU11 - South Umpqua at Brockway Rd.	31	2	6%
SU12 - South Umpqua at Winston	21	2	10%
LG1 - Lookingglass Creek at Hwy 42 Winston OR	45	19	42%

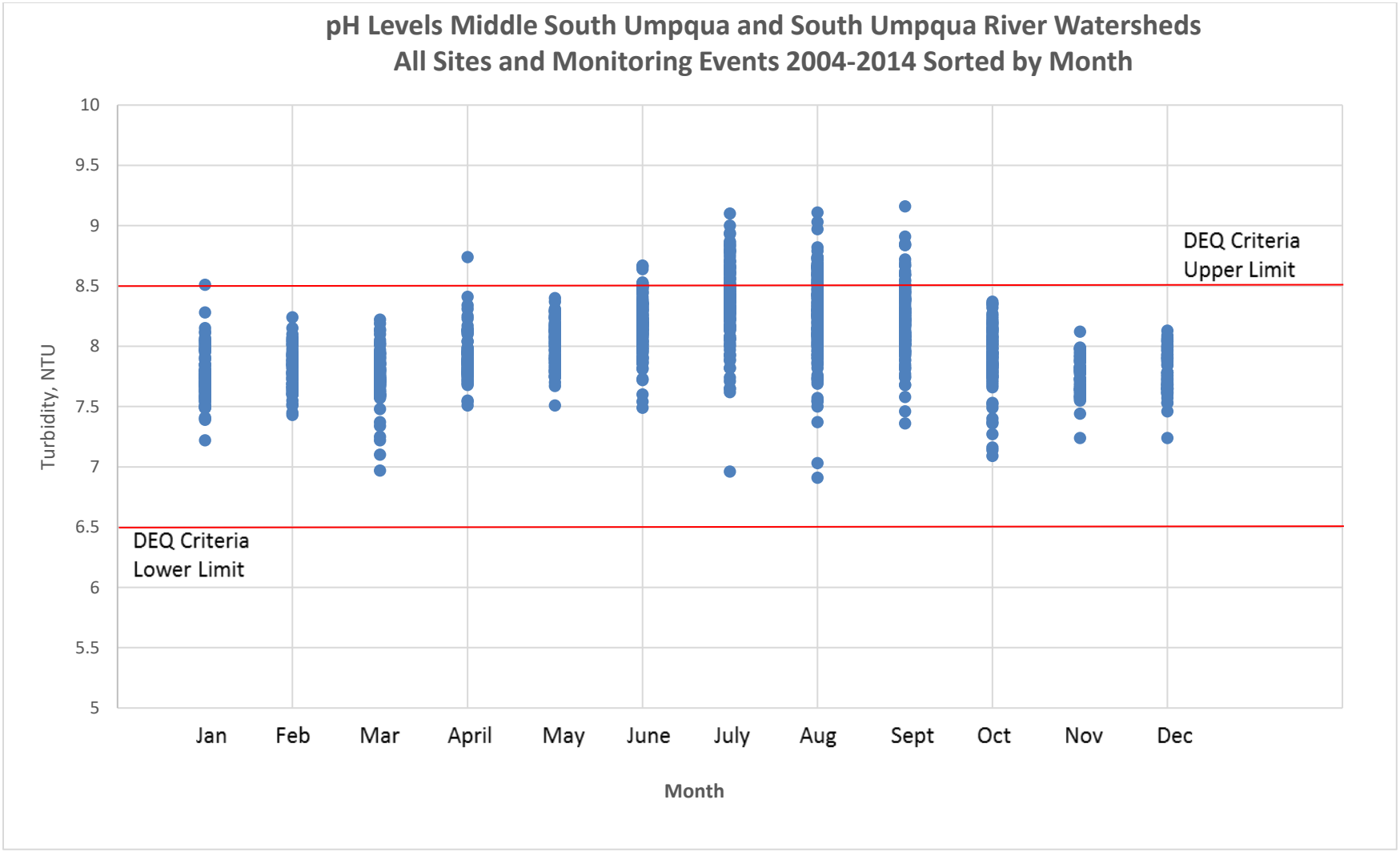
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	< 10 NTU
	Low Concern	Between 1 % and 9% of samples ≥10NTU
	High Concern	Between 10% and 20% ≥10 NTU
	Extreme Concern	20% or more ≥10 NTU

Table 59. Turbidity ratings for all Middle South and South Umpqua Watersheds 2004-2014.

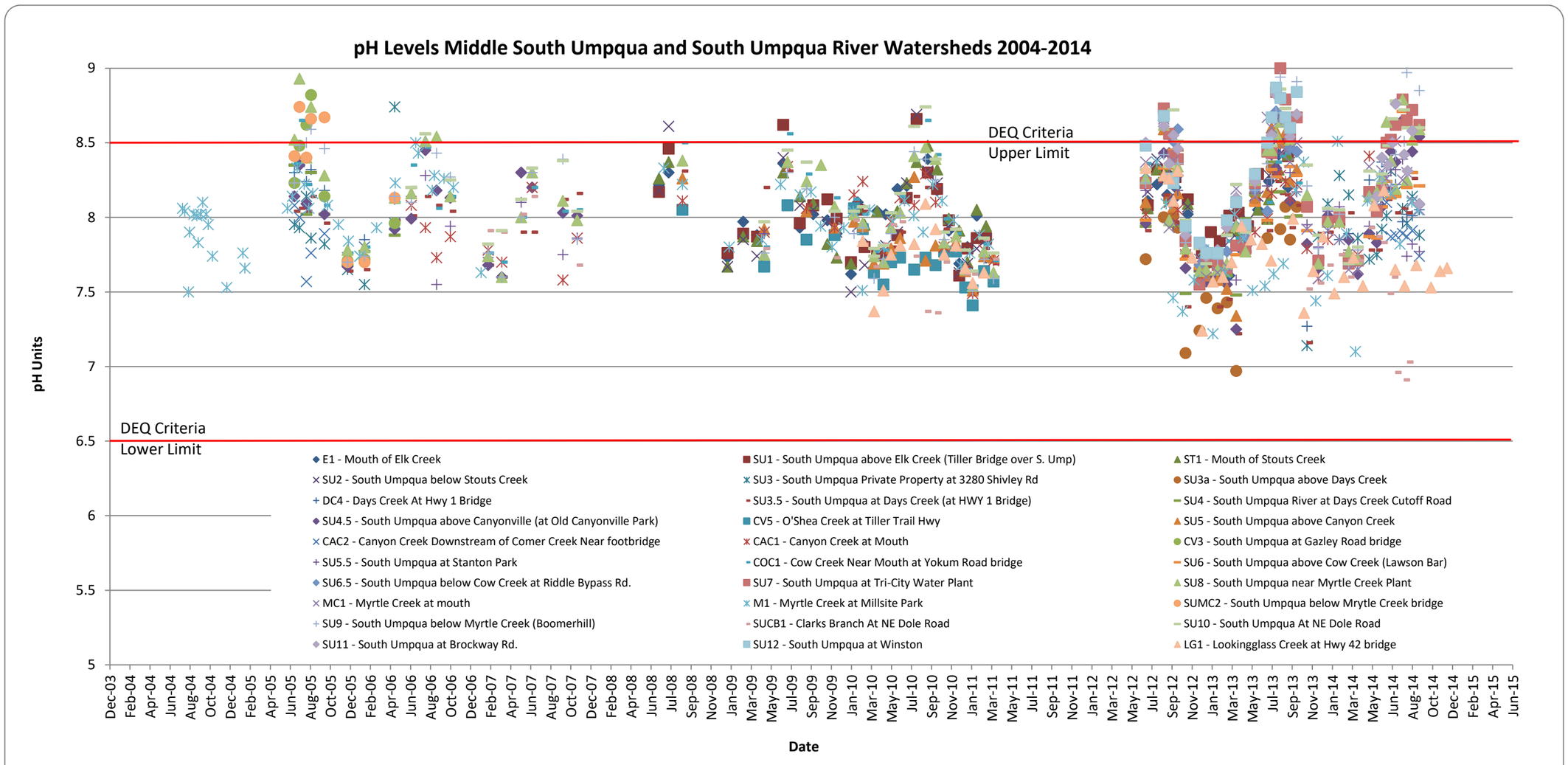
RESULTS – Middle South Umpqua and South Umpqua River Watersheds

pH

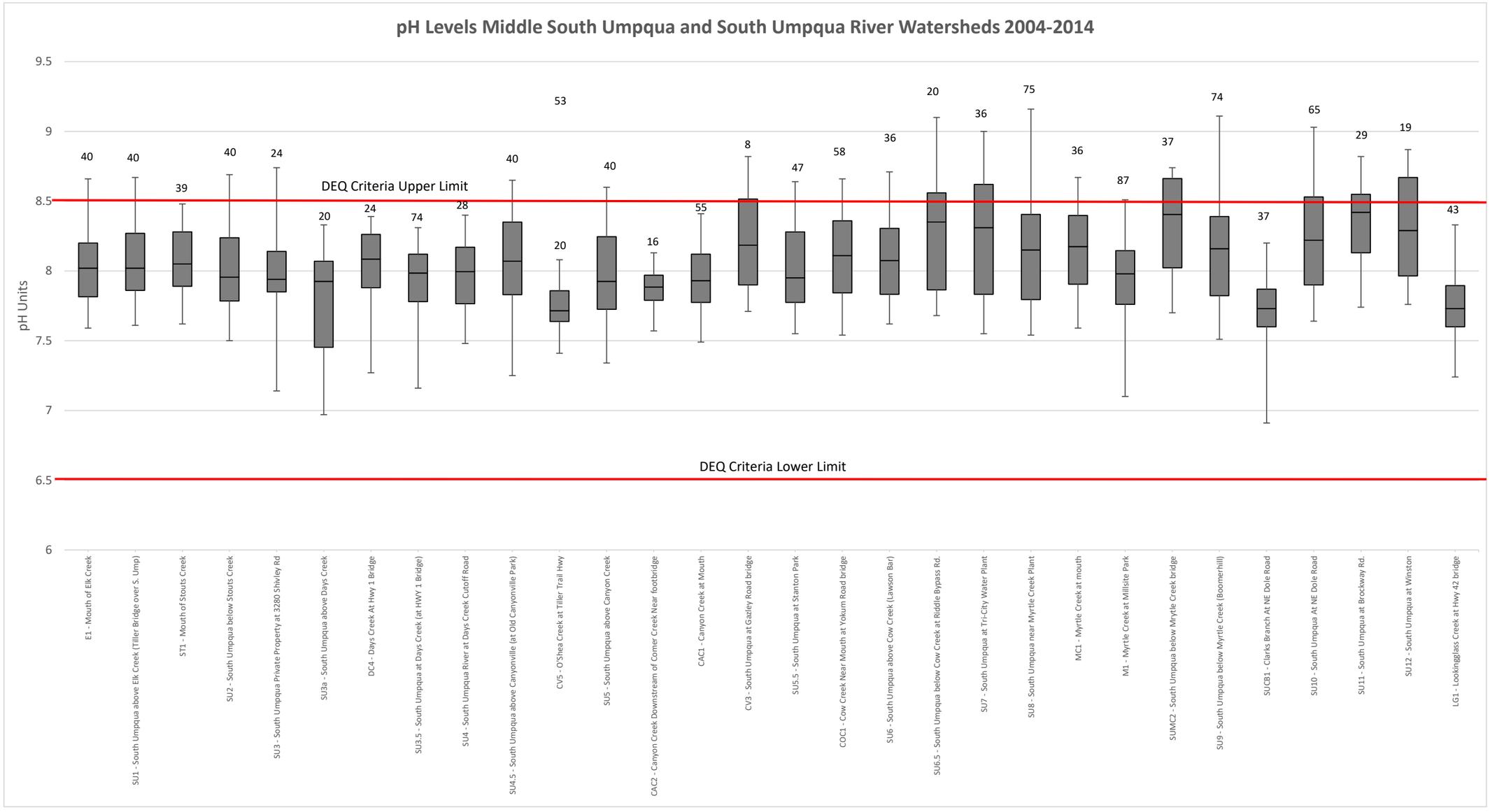
A number of sites in the South Umpqua area exceeded the upper pH limit of 8.5, as can be seen in **Graph 100**. As mentioned previously, more exceedances may have been detected if monitoring had occurred later in the day during summer months. No pH values of less than 6.5, the lower criteria limit, were ever detected. In fact, only 3 samples below pH 7.0 were measured. Streams of the South Umpqua area are summarized based on DEQ pH criteria exceedances in **Table 60.**



Graph 99.Middle South and South Umpqua monitoring pH levels for all monitoring sites and events 2004-2014 sorted by month.



Graph 100. Middle South and South Umpqua pH levels by site 2004-2014.



Graph 101. Box plots of pH for all Middle South and South Umpqua Watersheds monitoring sites 2004-2014. Numbers above each indicate the number of sampling events.

pH Levels Middle South Umpqua and South Umpqua River Watersheds 2004-2014	Upper	Lower
Station ID - Site Description	pH Criteria	pH Criteria
E1 - Mouth of Elk Creek		
South Umpqua above Elk Creek (Tiller Bridge over S Ump) SU1		
ST1 - Mouth Stouts Creek		
SU2 - South Umpqua below Stouts Creek		
SU3 - South Umpqua Private Property at 3280 Shivley Rd		
SU3a - South Umpqua above Days Creek		
DC4 - Days Creek At Hwy 1 Bridge		
SU3.5 - South Umpqua at DC (at HWY 1 Bridge)		
SU4a - South Umpqua River at Days Creek Cutoff Road		
SU4.5 - South Umpqua above Canyonville (at Old Canyon Park)		
CV5 - O'Shea Creek at Tiller Trail Hwy		
SU5 - South Umpqua above Canyon Creek		
CAC2 - Canyon Creek Downtream of Comer Cr. Near footbridge		
CAC1 - Canyon Creek at Mouth		
CV3 - South Umpqua at Gazley Bridge Road bridge		
SU5.5 - South Umpqua at Stanton Park		
COC1 - Cow Creek Near Mouth at Yokum Road bridge		
SU6 - South Umpqua above Cow Creek (Lawson Bar)		
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.		
SU7 - South Umpqua at Tri-City Water Plant		
SU8 - South Umpqua near Myrtle Creek Plant		
MC1 - Myrtle Creek at mouth		
M1 - Myrtle Creek at Millsite Park		
SUMC2 - South Umpqua below Myrtle Creek bridge		
SU9 - South Umpqua below Myrtle Creek (Boomerhill)		
SUCB1 - Clarks Branch At NE Dole Road		
SU10 - South Umpqua At NE Dole Road		
SU11 - South Umpqua at Brockway Rd.		
SU12 - South Umpqua at Winston		
LG1 - Lookingglass Creek at Hwy 42 Winston OR		

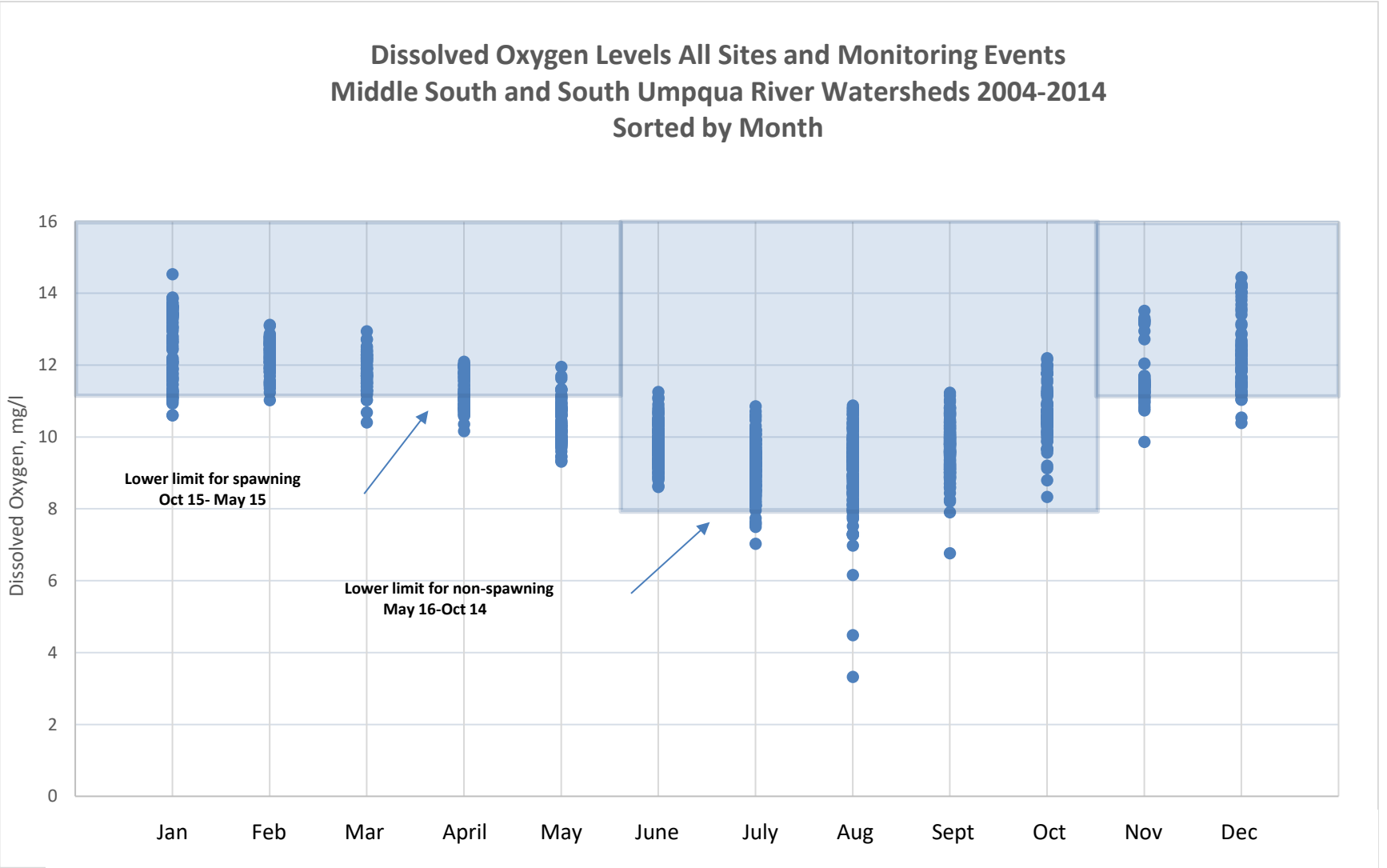
pH Rating Code			
Rating	Color	Upper pH Criteria	Lower pH Criteria
No Concern		None above 8.25	None below 6.75
Low Concern		1 ≥ 8.25	1 ≤ 6.75
Moderate Concern		2 or more ≥ 8.25 or 1 ≥ 8.5	2 ≤ 6.75 or 1 ≤ 6.5
Extreme Concern		2 or more ≥ 8.5	2 or more ≤ 6.5

Table 60. Middle South and South Umpqua Watershed sites 2004-2014 ratings for pH levels.

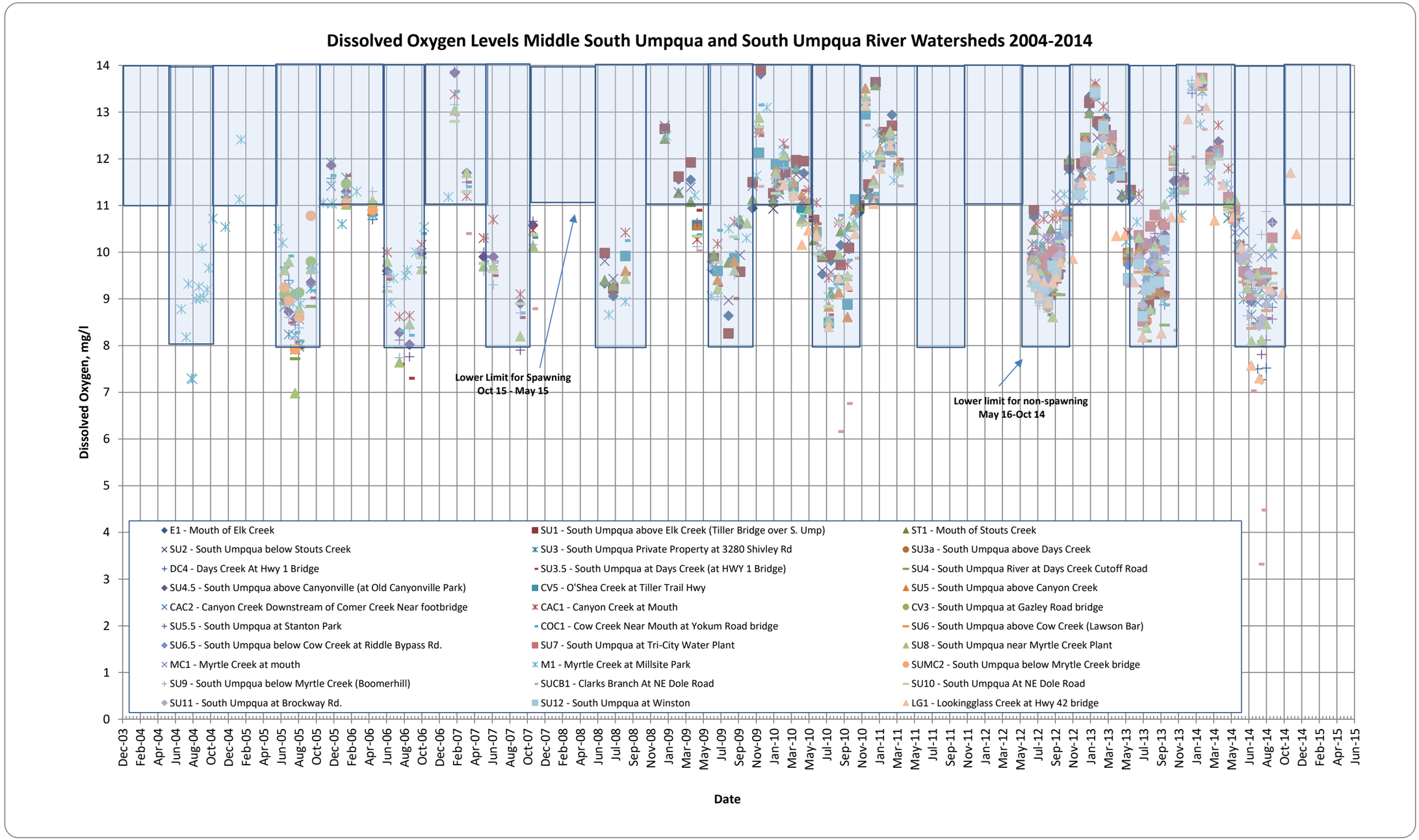
RESULTS – Middle South Umpqua and South Umpqua River Watersheds

Dissolved Oxygen

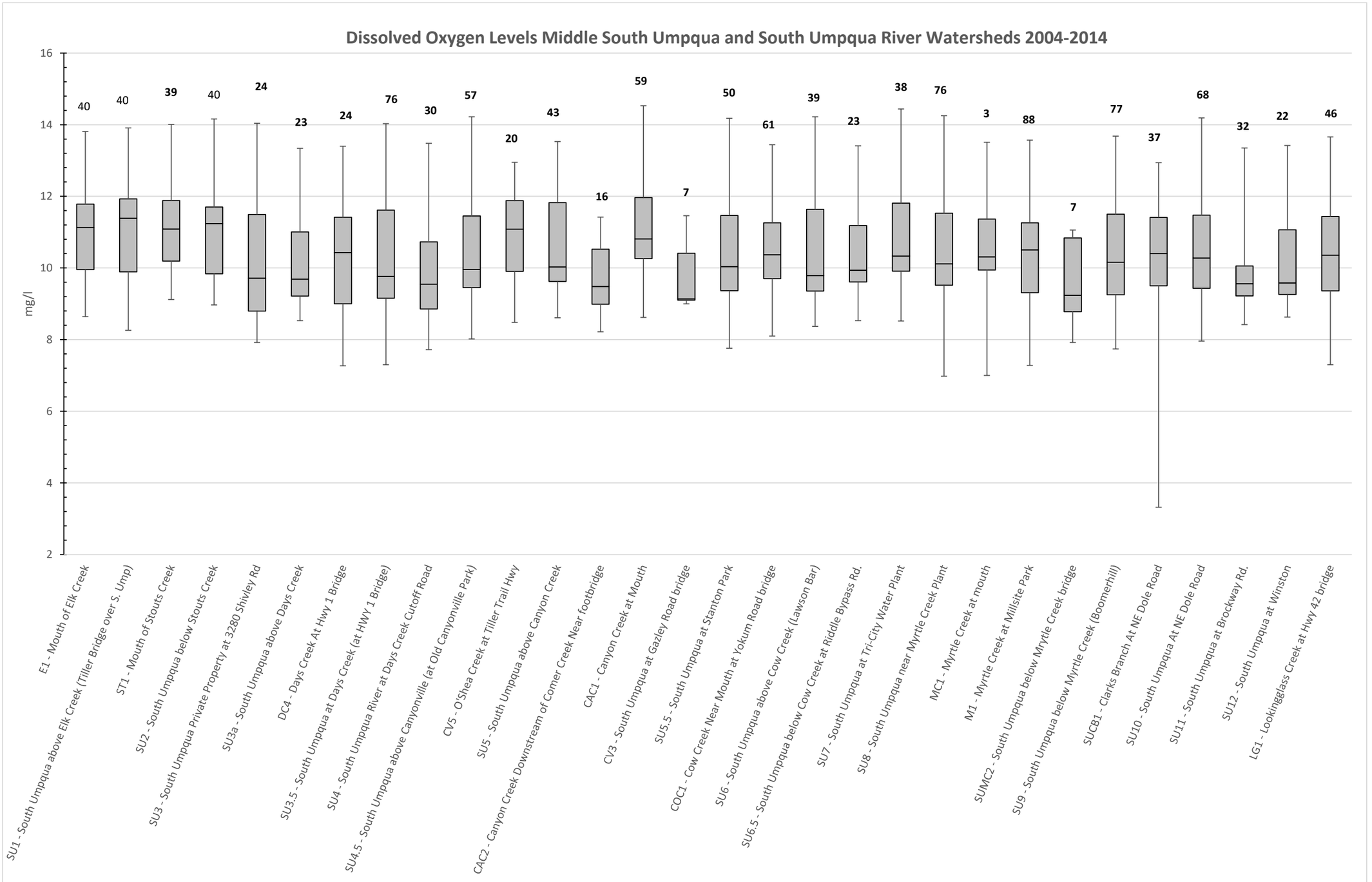
Graph 103 indicates that the majority of dissolved oxygen level readings in the South Umpqua monitoring area fell within the DEQ criteria for spawning and non-spawning time periods. **Table 61** summarizes the stream ratings for dissolved oxygen for the South Umpqua monitoring area. As can be noted from this table more sites failed during spawning season criteria than Non-spawning.



Graph 102. Dissolved oxygen levels for all sites and monitoring events from 2004-2014 for the South Umpqua River and Middle South Umpqua Fifth-Field Watersheds.



Graph 103. Dissolved oxygen levels by site for Middle South Umpqua and South Umpqua Rivers Watersheds 2004-2014.



Graph 104. Box plots for dissolve oxygen of sites in the Middle South and South Umpqua Watersheds 2004-2014. Number above the plots represent the number of monitoring events.

	Non-spawning Season May 16-October 14				Spawning Season October 15-May 15			
	Total # Samples	# Below Minimum D.O. Criteria of 8 mg/l	% Below Minimum D.O. Criteria of 8 mg/l	Rating	Total # Samples	# Below Minimum D.O. Criteria of 11 mg/l	% Below Minimum D.O. Criteria of 11 mg/l	Rating
E1 - Mouth of Elk Creek	18	0	0%		21	2	10%	
South Umpqua above Elk Creek (Tiller Bridge over S Ump) SU1	18	0	0%		22	0	0%	
ST1 - Mouth Stouts Creek	17	0	0%		22	1	5%	
SU2 - South Umpqua below Stouts Creek	18	0	0%		22	1	5%	
SU3 - South Umpqua Private Property at 3280 Shivley Rd	13	1	8%		11	3	27%	
SU3a - South Umpqua above Days Creek	15	0	0%		8	2	25%	
DC4 - Days Creek At Hwy 1 Bridge	13	3	23%		11	2	18%	
SU3.5 - South Umpqua at DC (at HWY 1 Bridge)	42	2	5%		34	7	21%	
SU4a - South Umpqua River at Days Creek Cutoff Road	20	1	5%		10	2	20%	
SU4.5 - South Umpqua above Canyonville (at Old Canyon Park)	34	0	0%		23	3	13%	
CV5 - O'Shea Creek at Tiller Trail Hwy	5	0	0%		15	4	27%	
SU5 - South Umpqua above Canyon Creek	23	0	0%		20	3	15%	
CAC2 - Canyon Creek Downtream of Comer Cr. Near footbridge	13	0	0%		3	1	33%	
CAC1 - Canyon Creek at Mouth	28	0	0%		30	5	17%	
CV3 - South Umpqua at Gazley Bridge Road bridge	5	0	0%		2	0	0%	
SU5.5 - South Umpqua at Stanton Park	31	3	10%		19	3	16%	
COC1 - Cow Creek Near Mouth at Yokum Road bridge	34	0	0%		27	8	30%	
SU6 - South Umpqua above Cow Creek (Lawson Bar)	23	0	0%		16	3	19%	
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.	14	0	0%		8	2	25%	
SU7 - South Umpqua at Tri-City Water Plant	22	0	0%		16	3	19%	
SU8 - South Umpqua near Myrtle Creek Plant	42	2	5%		34	7	21%	
MC1 - Myrtle Creek at mouth	23	0	0%		16	3	19%	
M1 - Myrtle Creek at Millsite Park	48	2	4%		40	8	20%	
SUMC2 - South Umpqua below Myrtle Creek bridge	5	1	20%		2	0	0%	
SU9 - South Umpqua below Myrtle Creek (Boomerhill)	41	1	2%		36	9	25%	
SUCB1 - Clarks Branch At NE Dole Road	13	3	23%	Goes dry	24	9	38%	
SU10 - South Umpqua At NE Dole Road	34	0	0%		33	9	27%	
SU11 - South Umpqua at Brockway Rd.	23	0	0%		9	3	33%	
SU12 - South Umpqua at Winston	14	0	0%		8	2	25%	
LG1 - Lookingglass Creek at Hwy 42 Winston OR	21	0	0%		24	10	42%	

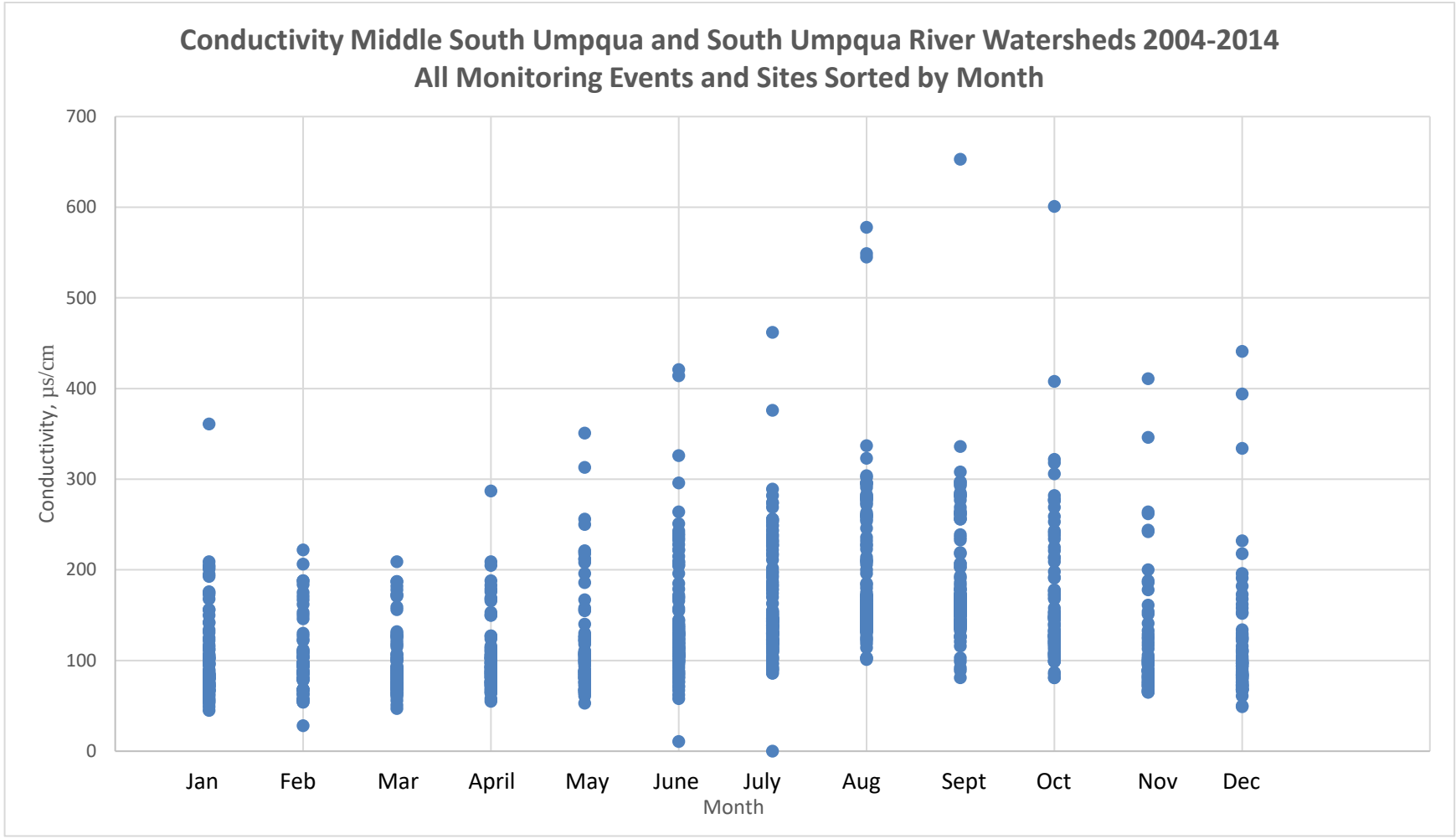
Color Key:	Level of Concern	Color Key Evaluation Criteria
	No Concern	0% (No Exceedances)
	Low Concern	≥1% ≤9% Exceedances
	High Concern	≥10% ≤19% Exceedances
	Extreme Concern	≥20% Exceedances

Table 61. Summary rating table for summer and winter dissolved oxygen levels for the Middle South and South Umpqua River Watersheds 2004-2014.

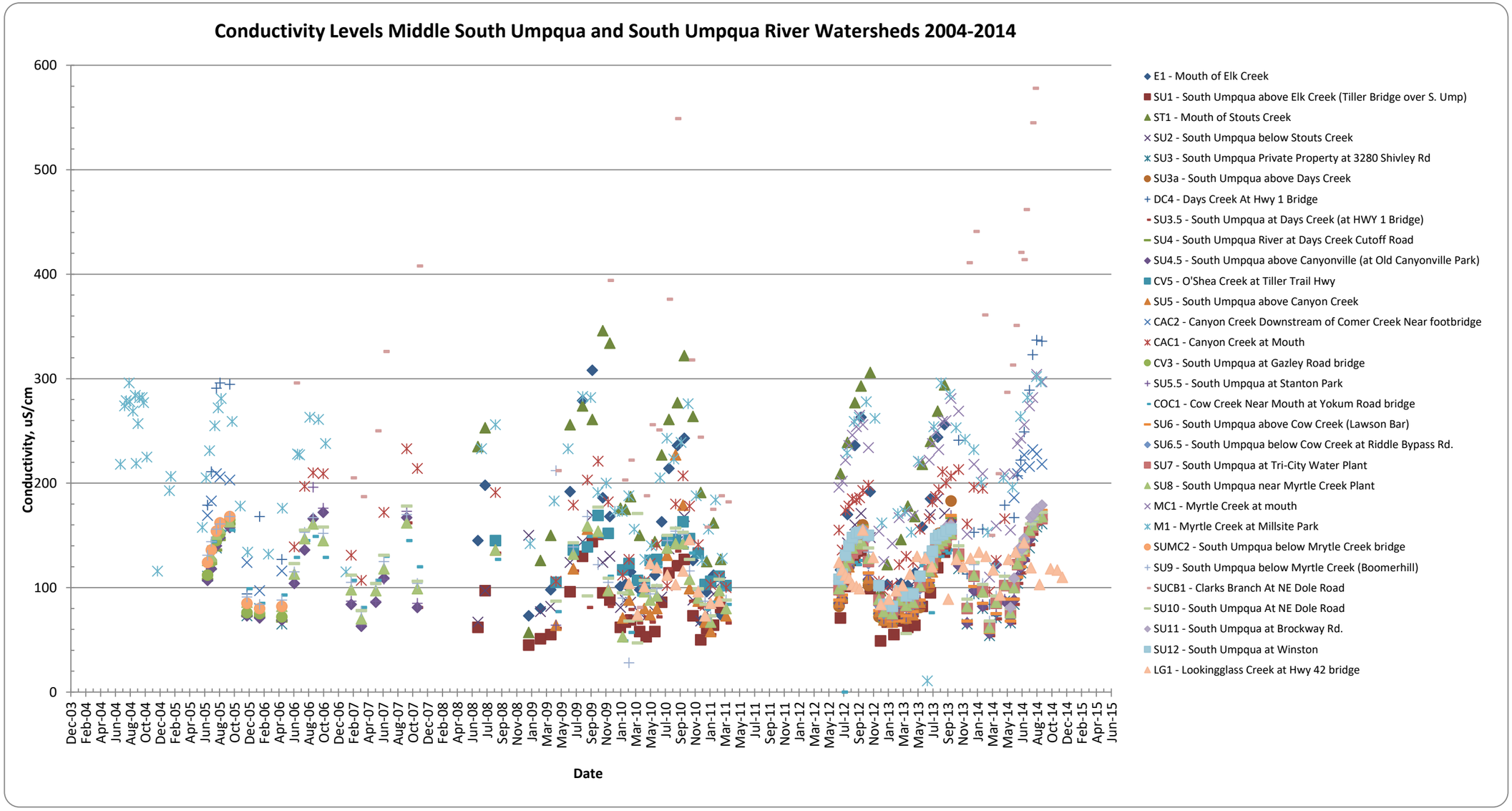
RESULTS – Middle South Umpqua and South Umpqua River Watersheds

Conductivity

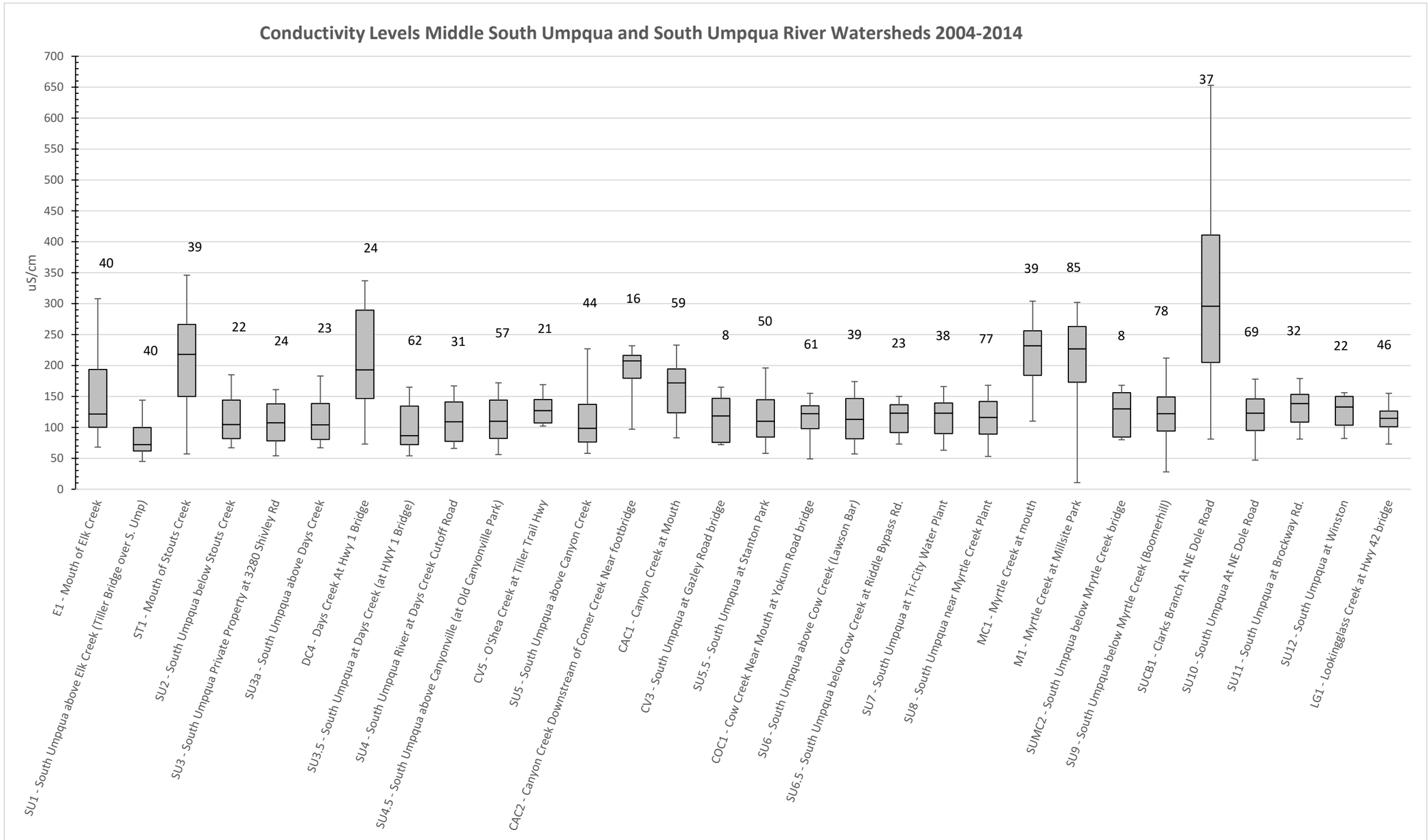
The South Umpqua monitoring area had only one monitoring site, Clarks Branch Creek, which exceeded 350 us/cm numerous times and exceeded 500 us/cm 3 times, its highest point was 578 us/cm. This was one of the two creeks that lost their surface flow for a period during summer. Like Bilger Creek, in the Myrtle Creek Watershed, as the stream flow reduced, concentration of natural minerals increased. All of the other streams were within normal conductivity range for the Umpqua Basin. **Table 62** rates the conductivity of all streams monitored in the South Umpqua area. With only SUCB1 - Clarks Branch at NE Dole Road being flagged with “Concern”.



Graph 105. Conductivity levels for Middle South and South Umpqua Watersheds 2004-2014 all monitoring sites and events sorted by month.



Graph 106. Conductivity levels by site for all Middle South and South Umpqua Watershed sites 2004-2014.



Graph 107. Box plots of all Middle South and South Umpqua River Watershed monitoring sites 2004-2014. Numbers above plots indicate number of monitor events.

Conductivity Level Ratings Middle South Umpqua and South Umpqua River Watersheds 2004-2014	
Station ID – Site Description	**Conductivity Rating**
E1 - Mouth of Elk Creek	
South Umpqua above Elk Creek (Tiller Bridge over S Ump) SU1	
ST1 - Mouth Stouts Creek	
SU2 - South Umpqua below Stouts Creek	
SU3 - South Umpqua Private Property at 3280 Shivley Rd	
SU3a - South Umpqua above Days Creek	
DC4 - Days Creek At Hwy 1 Bridge	
SU3.5 - South Umpqua at DC (at HWY 1 Bridge)	
SU4a - South Umpqua River at Days Creek Cutoff Road	
SU4.5 - South Umpqua above Canyonville (at Old Canyon Park)	
CV5 - O'Shea Creek at Tiller Trail Hwy	
SU5 - South Umpqua above Canyon Creek	
CAC2 - Canyon Creek Downtream of Comer Cr. Near footbridge	
CAC1 - Canyon Creek at Mouth	
CV3 - South Umpqua at Gazley Bridge Road bridge	
SU5.5 - South Umpqua at Stanton Park	
COC1 - Cow Creek Near Mouth at Yokum Road bridge	
SU6 - South Umpqua above Cow Creek (Lawson Bar)	
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.	
SU7 - South Umpqua at Tri-City Water Plant	
SU8 - South Umpqua near Myrtle Creek Plant	
MC1 - Myrtle Creek at mouth	
M1 - Myrtle Creek at Millsite Park	
SUMC2 - South Umpqua below Myrtle Creek bridge	
SU9 - South Umpqua below Myrtle Creek (Boomerhill)	
SUCB1 - Clarks Branch At NE Dole Road	Goes dry
SU10 - South Umpqua At NE Dole Road	
SU11 - South Umpqua at Brockway Rd.	
SU12 - South Umpqua at Winston	
LG1 - Lookingglass Creek at Hwy 42 Winston OR	

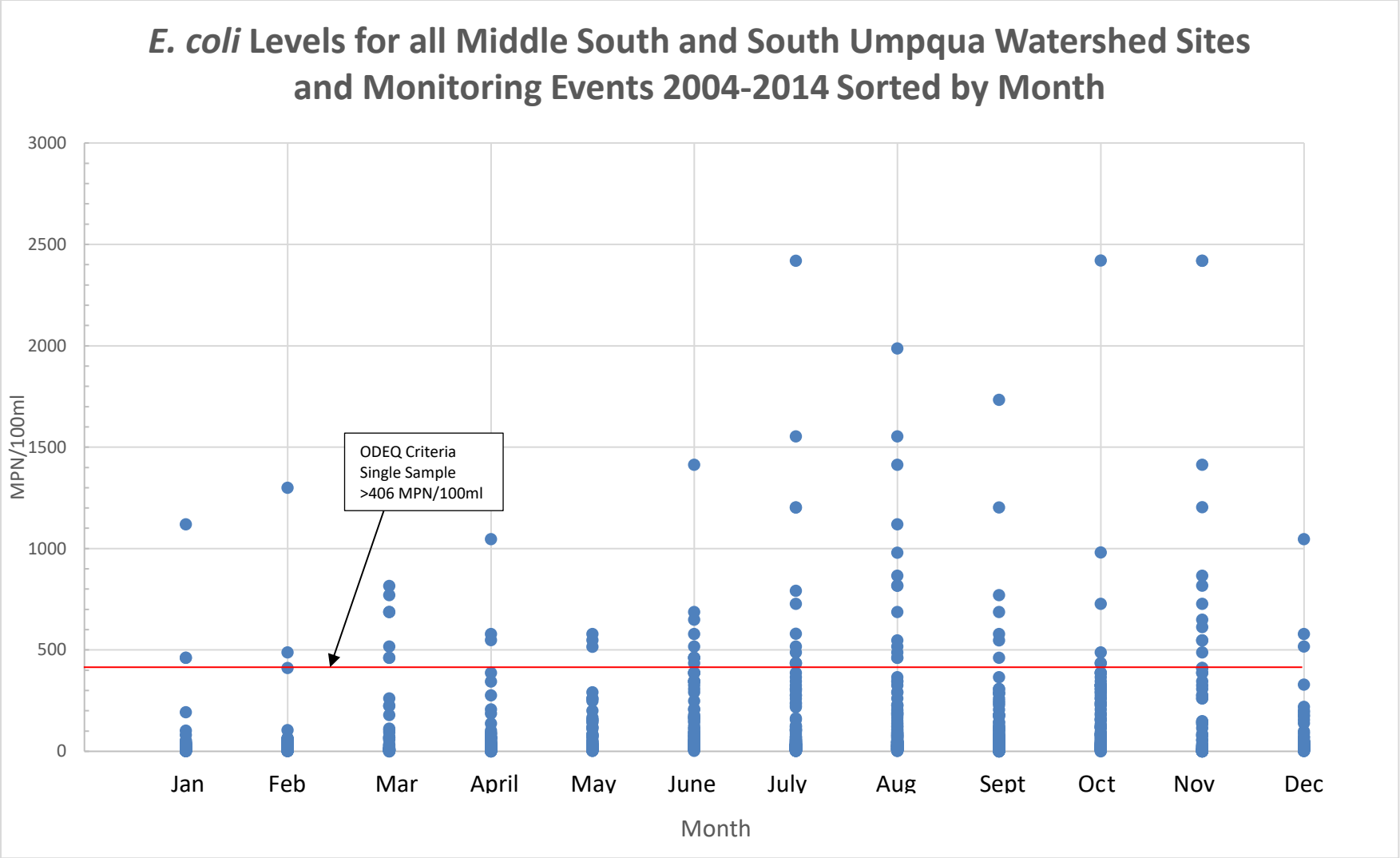
Rating	Color	Conductivity Level
No Concern		<500 uS/cm
Concern		>500 uS/cm

Table 62. Conductivity ratings for South Umpqua and Middle South Umpqua River Watersheds 2004-2014 with rating chart.

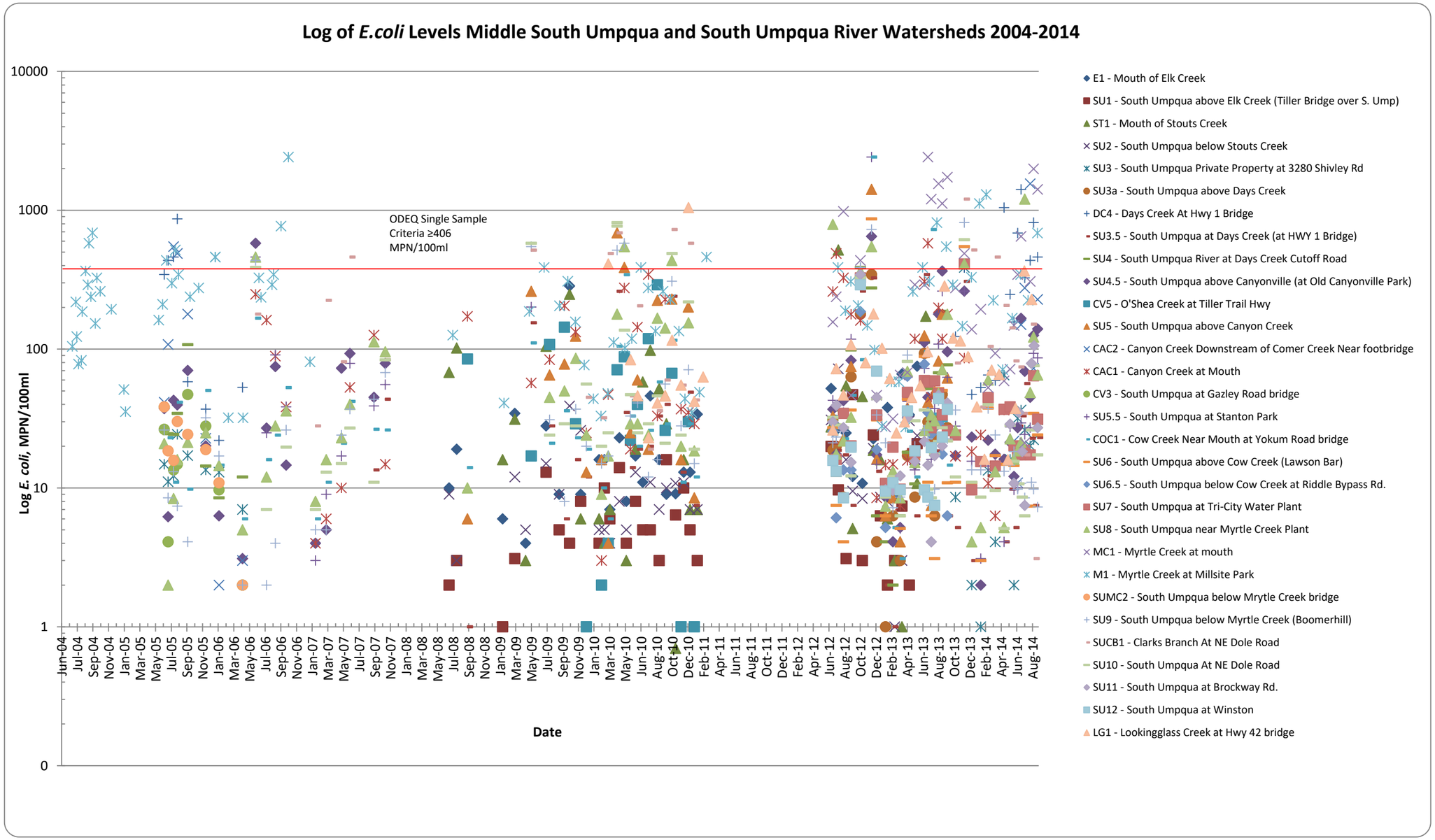
RESULTS – Middle South Umpqua and South Umpqua River Watersheds

E. coli

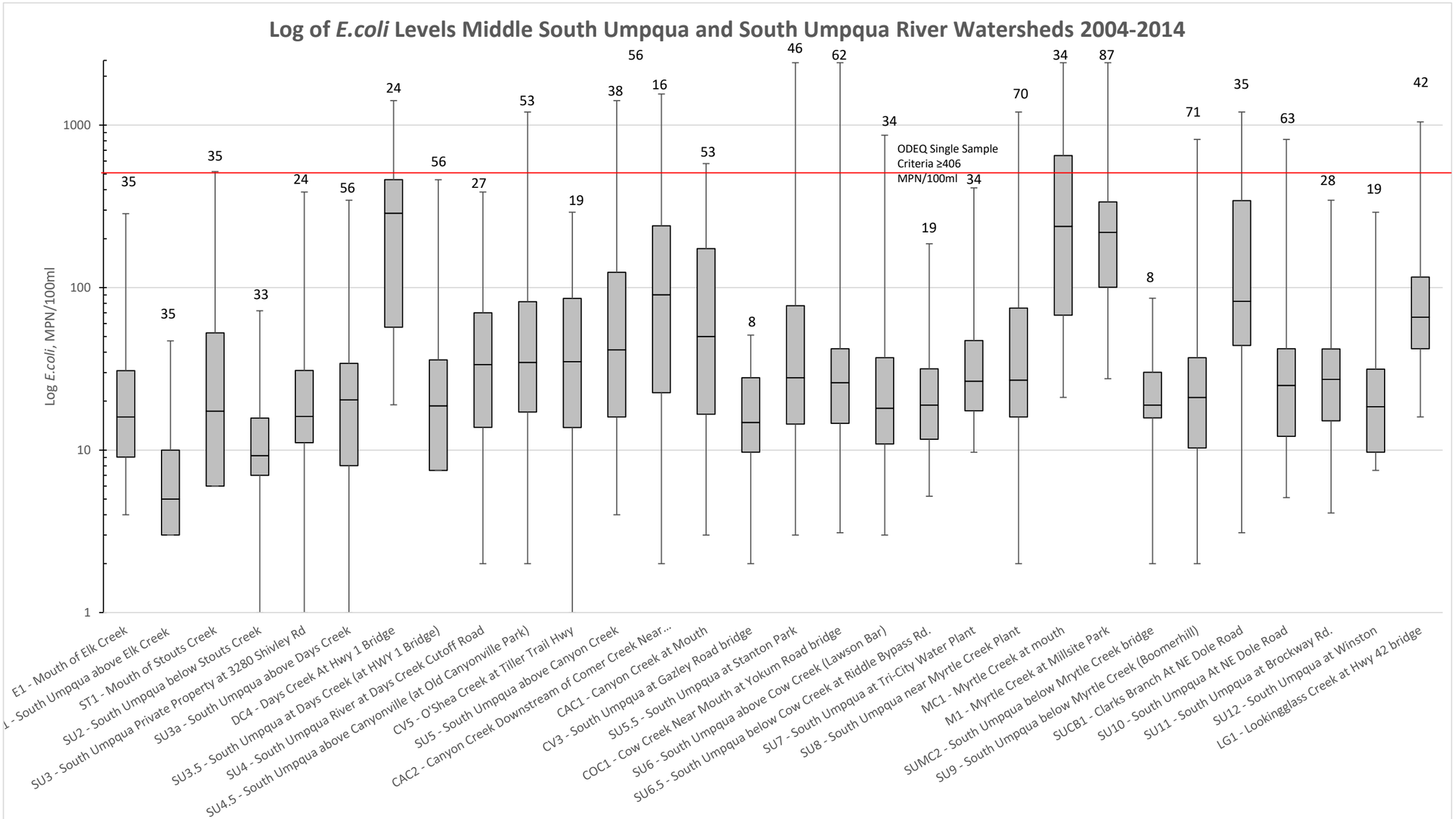
The Middle South Umpqua area presented serious E. coli problems with spikes exceeding the limits of the test (>2419.6 MPN/100ml) and numerous exceedances of ODEQ one-time sample criteria (≥406 MPN/100ml). These are evident in **Graph 109** and rated in **Table 64**. DC4 - Days Creek at Hwy 1 Bridge (near mouth) and MC1 – Myrtle Creek at mouth, had the most detections of 406 or greater with 39% and 34% respectively of samples collected.



Graph 108. *E. coli* levels for Middle South and South Umpqua River Watershed 204-2014 all sites and monitoring events sorted by month.



Graph 109. Log *E. coli* levels by site 2004-2014 for Middle South and South Umpqua River watersheds.



Graph 110. Box plots for log of *E. coli* levels for all Middle South and South Umpqua River watersheds monitoring sites 2004-2014. Numbers above plots indicate number of monitoring events.

Middle South Umpqua and South Umpqua River Watersheds	126 or Greater		235 or Greater		406 or Greater		
Station ID - Site Description	Count	% of Samples	Count	% of Samples	Count	% of Samples	# of Samples
E1 - Mouth of Elk Creek	1	3%	1	3%	0	0%	35
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump)	0	0%	0	0%	0	0%	35
ST1 - Mouth of Stouts Creek	3	9%	2	6%	1	3%	35
SU2 - South Umpqua below Stouts Creek	0	0%	0	0%	0	0%	33
SU3 - South Umpqua Private Property at 3280 Shivley Rd	1	4%	1	4%	0	0%	24
SU3a - South Umpqua above Days Creek	2	11%	1	5%	0	0%	19
DC4 - Days Creek At Hwy 1 Bridge	14	61%	13	57%	9	39%	23
SU3.5 - South Umpqua at Days Creek (at HWY 1 Bridge)	8	14%	7	13%	1	2%	56
SU4 - South Umpqua River at Days Creek Cutoff Road	3	11%	2	7%	0	0%	27
SU4.5 - South Umpqua above Canyonville (at Old Canyonville Park)	9	17%	6	11%	3	6%	53
CV5 - O'Shea Creek at Tiller Trail Hwy	2	11%	1	5%	0	0%	19
SU5 - South Umpqua above Canyon Creek	9	24%	5	13%	2	5%	38
CAC2 - Canyon Creek Downstream of Comer Creek Near footbridge	7	47%	4	27%	3	20%	15
CAC1 - Canyon Creek at Mouth	19	37%	8	16%	2	4%	51
CV3 - South Umpqua at Gazley Road bridge	0	0%	0	0%	0	0%	8
SU5.5 - South Umpqua at Stanton Park	6	13%	5	11%	2	4%	45
COC1 - Cow Creek Near Mouth at Yokum Road bridge	4	7%	3	5%	2	4%	56
SU6 - South Umpqua above Cow Creek (Lawson Bar)	3	9%	3	9%	2	6%	34
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.	1	6%	0	0%	0	0%	18
SU7 - South Umpqua at Tri-City Water Plant	2	6%	2	6%	1	3%	33
SU8 - South Umpqua near Myrtle Creek Plant	13	19%	8	11%	7	10%	70
MC1 - Myrtle Creek at mouth	21	66%	17	53%	11	34%	32
M1 - Myrtle Creek at Millsite Park	60	70%	40	47%	14	16%	86
SUMC2 - South Umpqua below Mrytle Creek bridge	0	0%	0	0%	0	0%	8
SU9 - South Umpqua below Myrtle Creek (Boomerhill)	8	11%	8	11%	6	8%	71
SUCB1 - Clarks Branch At NE Dole Road	15	44%	9	26%	9	26%	34
SU10 - South Umpqua At NE Dole Road	9	15%	7	11%	5	8%	62
SU11 - South Umpqua at Brockway Rd.	1	4%	1	4%	0	0%	27
SU12 - South Umpqua at Winston	1	6%	1	6%	0	0%	18
LG1 - Lookingglass Creek at Hwy 42 bridge	9	23%	5	13%	3	8%	39

Table 63. Criteria for *E. coli* levels in Middle South and South Umpqua River watersheds 2004-2014.

SITE	Summer (May1 – Sept 30)							Winter (Oct 1 – April 30)						
	Total # Sumer Samples	# Above EPA Criteria (235 MPN/100ml)	% Above EPA Criteria (235 MPN/100ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating	Total # Winter Samples	# Above EPA Criteria (235 MPN/100 ml)	% Above EPA Criteria (235 MPN/100 ml)	EPA Rating	# Above ODEQ Criteria (406 MPN/100ml)	% Above ODEQ Criteria (406 MPN/100ml)	ODEQ Rating
E1 - Mouth of Elk Creek	15	1	7		0	0		20	0	0		0	0	
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump)	15	0	0		0	0		20	0	0		0	0	
ST1 - Mouth of Stouts Creek	15	1	7		0	0		20	0	0		0	0	
SU2 - South Umpqua below Stouts Creek	14	0	0		0	0		19	0	0		0	0	
SU3 - South Umpqua Private Property at 3280 Shivley Rd	14	0	0		0	0		10	1	10		0	0	
SU3a - South Umpqua above Days Creek	12	0	0		0	0		7	1	14		0	0	
DC4 - Days Creek At Hwy 1 Bridge	13	11	85		9	69		10	2	20		1	10	
SU3.5 - South Umpqua at Days Creek (at HWY 1 Bridge)	31	2	7		1	3		25	5	20		0	0	
SU4 - South Umpqua River at Days Creek Cutoff Road	17	1	6		0	0		9	1	11		0	0	
SU4.5 - South Umpqua above Canyonville (at Old Canyonville Park)	32	0	0		0	0		21	3	14		1	5	
CV5 - O'Shea Creek at Tiller Trail Hwy	9	1	11		0	0		10	0	0		0	0	
SU5 - South Umpqua above Canyon Creek	21	1	5		0	0		17	3	18		2	12	
CAC2 - Canyon Creek Downstream of Comer Creek Near footbridge	12	5	42		4	33		3	0	0		0	0	
CAC1 - Canyon Creek at Mouth	26	7	27		2	8		25	3	12		2	8	
CV3 - South Umpqua at Gazley Road bridge	5	0	0		0	0		3	0	0		0	0	
SU5.5 - South Umpqua at Stanton Park	27	2	7.4		1	3.7		18	3	17		1	6	
COC1 - Cow Creek Near Mouth at Yokum Road bridge	32	1	3		1	3		24	2	8		1	4	
SU6 - South Umpqua above Cow Creek (Lawson Bar)	20	1	5		0	0		14	2	14		2	14	
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.	12	0	0		0	0		6	1	17		1	17	
SU7 - South Umpqua at Tri-City Water Plant	20	0	0		0	0		13	3	23		2	15	
SU8 - South Umpqua near Myrtle Creek Plant	40	3	8		3	8		30	5	17		4	13	
MC1 - Myrtle Creek at mouth	19	12	63		10	53		13	4	31		3	23	
M1 - Myrtle Creek at Millsite Park	43	29	67		9	21		43	13	30		6	14	
SUMC2 - South Umpqua below Myrtle Creek bridge	5	0	0		0	0		3	0	0		0	0	
SU9 - South Umpqua below Myrtle Creek (Boomerhill)	40	2	5		2	5		31	6	19		4	13	
SUCB1 - Clarks Branch At NE Dole Road	16	1	6		1	6		18	8	44		8	44	
SU10 - South Umpqua At NE Dole Road	34	2	6		1	3		28	6	21		5	18	
SU11 - South Umpqua at Brockway Rd.	22	0	0		0	0		6	2	33		1	17	
SU12 - South Umpqua at Winston	13	1	8		0	0		7	1	14		1	14	
LG1 - Lookingglass Creek at Hwy 42 bridge	18	2	11		0	0		21	4	19		4	19	

Table 64. ***E. coli*** **ratings for monitoring sites in the Middle South and South Umpqua River watersheds 2004-2014 separated by winter and summer with rating key table.**

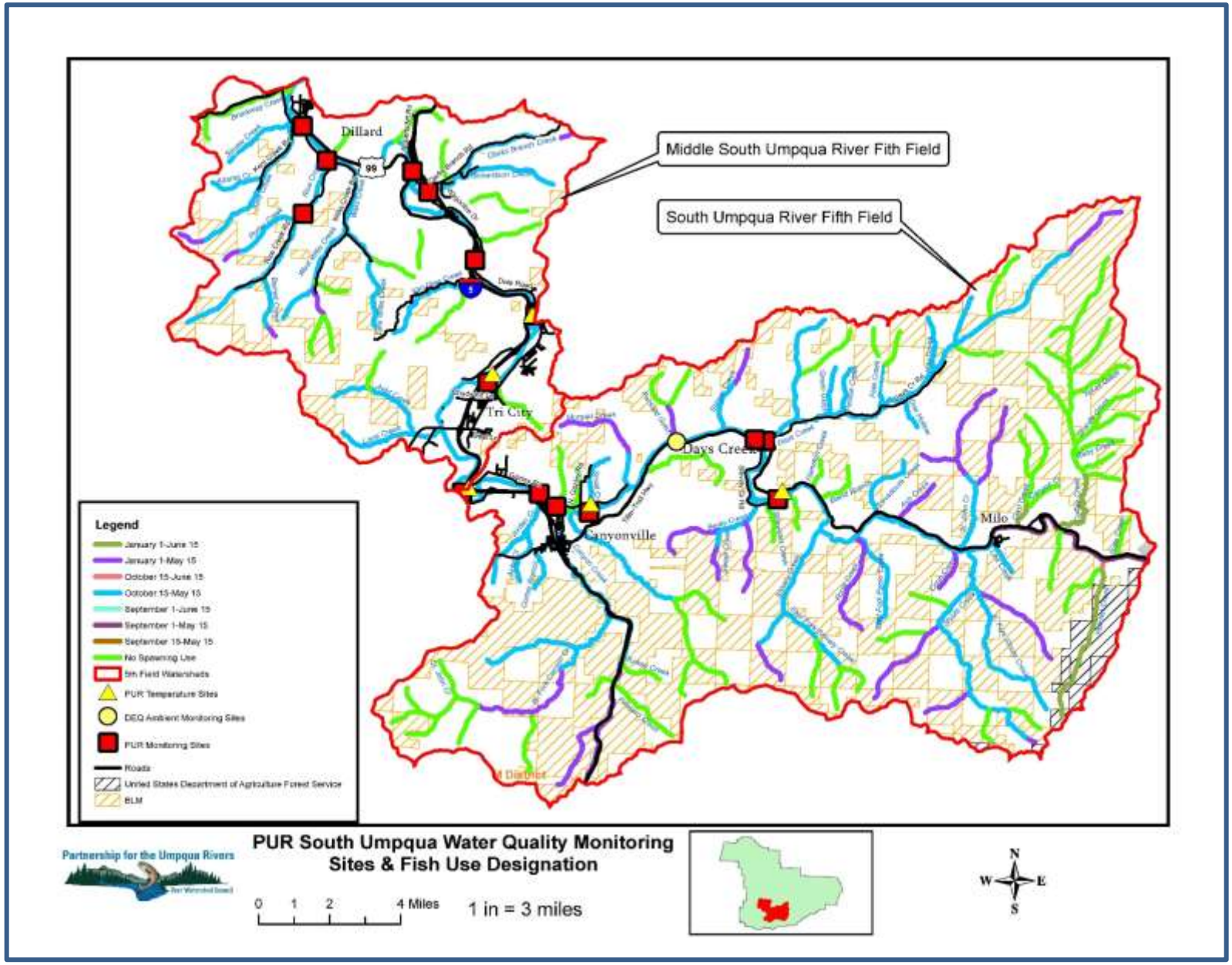
Rating	Color	EPA Criteria	ODEQ Criteria
No Concern (below standard criteria)		< 235	< 406
Concern (exceeds standard criteria)		≥ 235	≥ 406

RESULTS – Middle South Umpqua and South Umpqua River Watersheds

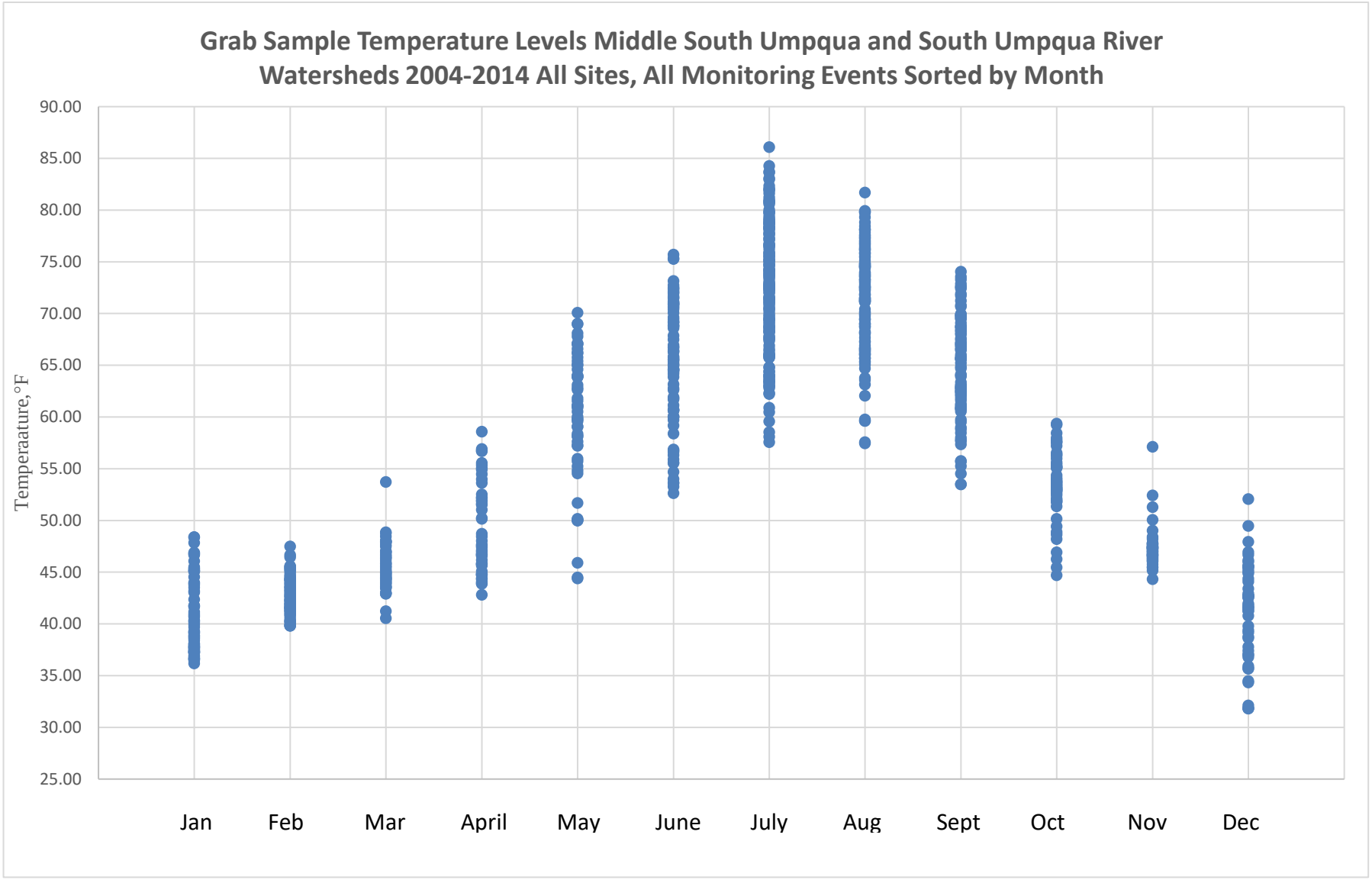
Grab Sample Temperature

Of the 24 monitoring sites in the South Umpqua area, we were able to record continuous temperature readings at only six sites. Temperature was recorded at each of our grab sample monitoring events, and though this does not allow evaluation for DEQ temperature criteria, it is included here for evaluation and stream rating in order to provide additional information for planning restoration sites.

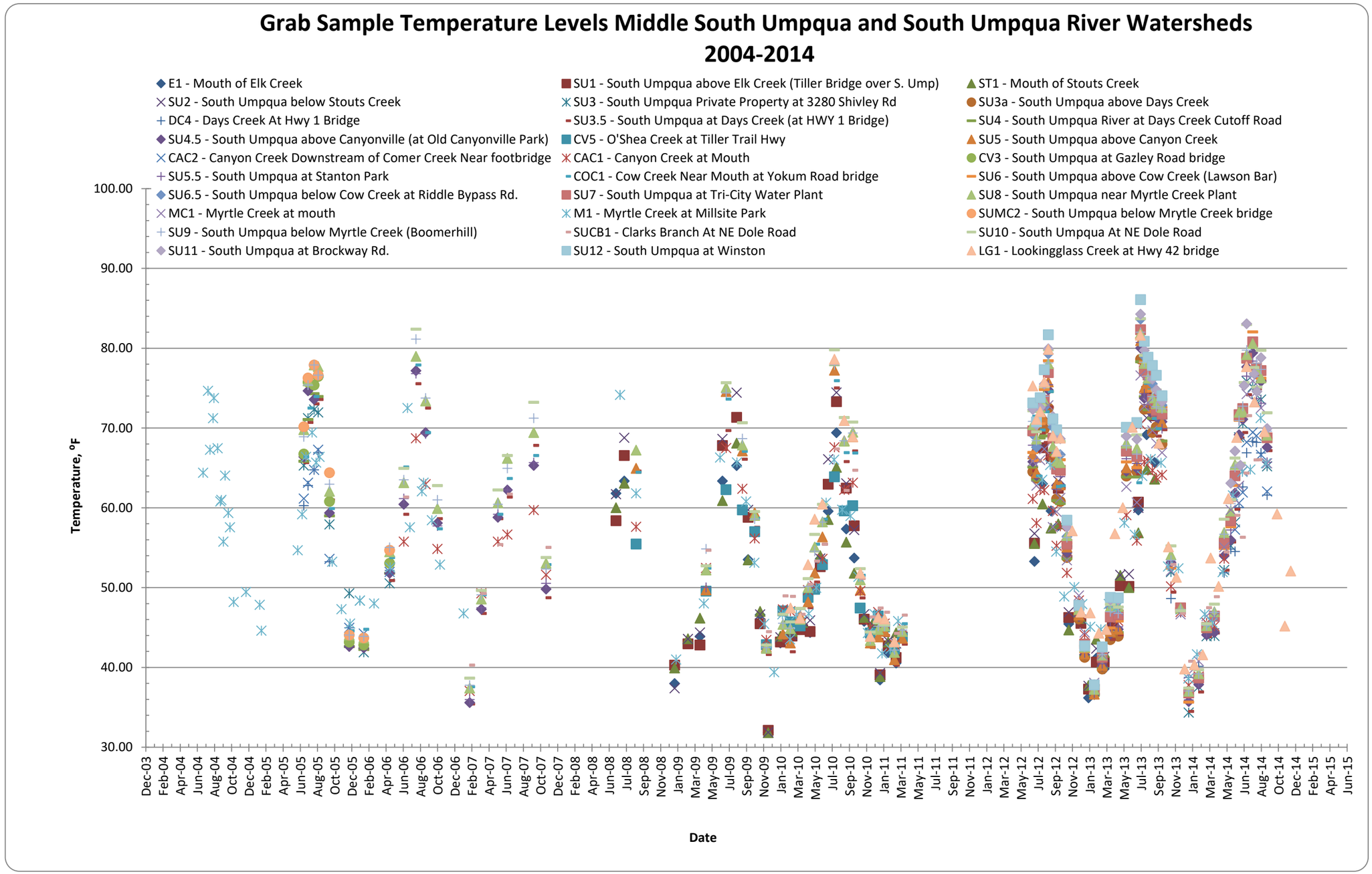
All creeks in these two fifth field watersheds had exceedances in “Rearing and Migration” criteria except for CV5 - O'Shea Creek at Tiller Trail Hwy. O'Shea Creek and 12 other sites did not exceed criteria for “Spawning” out of the 30 sites. All this information is summarized in the color coded rating **Table 65.**



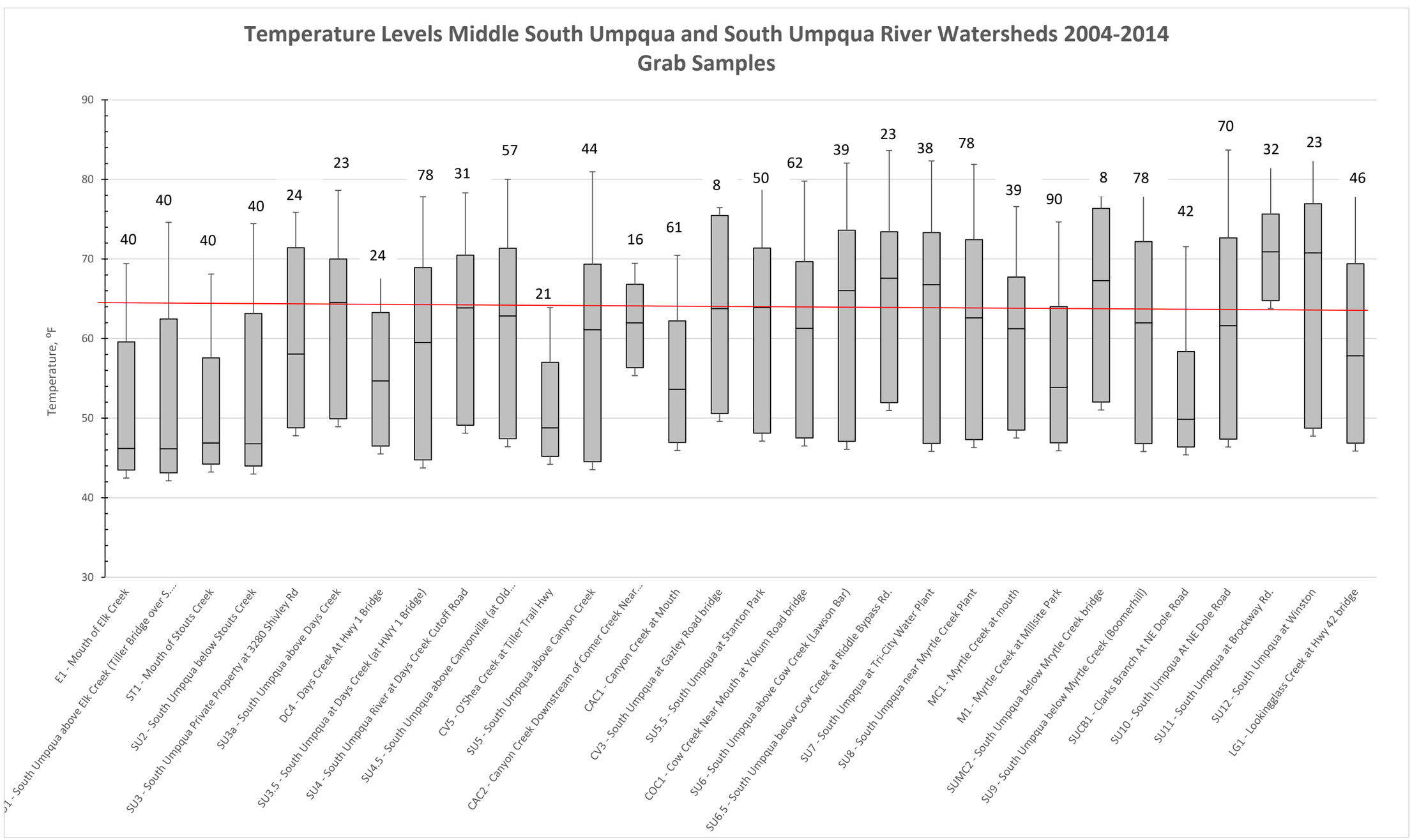
Map 16. PUR Middle and South Umpqua River fifth-field monitoring sites and spawning site designation.



Graph 111. Grab sample temperature levels for Middle South and South Umpqua River watersheds 2004-2014, all sites and monitoring events sorted by month.



Graph 112. Grab sample temperature levels by site for Middle South and South Umpqua River watersheds 2004-2014.



Graph 113. Box plots Grab sample temperature levels by site for Middle South and South Umpqua River watersheds 2004-2014. Numbers above plots indicate the number of monitoring events.

Grab Sample Temperature Levels Middle South Umpqua and South Umpqua River Watersheds 2004-2014	Rating based on Rearing and Migration Criteria	Rating based Spawning Criteria
Station ID – Site Description		
E1 - Mouth of Elk Creek		
South Umpqua above Elk Creek (Tiller Bridge over S Ump) SU1		
ST1 - Mouth Stouts Creek		
SU2 - South Umpqua below Stouts Creek		
SU3 - South Umpqua Private Property at 3280 Shivley Rd		
SU3a - South Umpqua above Days Creek		
DC4 - Days Creek At Hwy 1 Bridge		
SU3.5 - South Umpqua at DC (at HWY 1 Bridge)		
SU4 - South Umpqua River at Days Creek Cutoff Road		
SU4.5 - South Umpqua above Canyonville (at Old Canyon Park)		
CV5 - O'Shea Creek at Tiller Trail Hwy		
SU5 - South Umpqua above Canyon Creek		
CAC2 - Canyon Creek Downtream of Comer Cr. Near footbridge		
CAC1 - Canyon Creek at Mouth		
CV3 - South Umpqua at Gazley Bridge Road bridge		
SU5.5 - South Umpqua at Stanton Park		
COC1 - Cow Creek Near Mouth at Yokum Road bridge		
SU6 - South Umpqua above Cow Creek (Lawson Bar)		
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.		
SU7 - South Umpqua at Tri-City Water Plant		
SU8 - South Umpqua near Myrtle Creek Plant		
MC1 - Myrtle Creek at mouth		
M1 - Myrtle Creek at Millsite Park		
SUMC2 - South Umpqua below Myrtle Creek bridge		
SU9 - South Umpqua below Myrtle Creek (Boomerhill)		
SUCB1 - Clarks Branch At NE Dole Road		
SU10 - South Umpqua At NE Dole Road		
SU11 - South Umpqua at Brockway Rd.		
SU12 - South Umpqua at Winston		
LG1 - Lookingglass Creek at Hwy 42 Winston OR		

Rating	Grab Sample Temperatures Rearing and Migration May 16-Oct 14	Spawning Criteria Oct 15-May 15	Color
Good	≤64.4° F	≤55.4° F	
Needs Improvement	>64.4° F	>55.4° F	

Table 65. Ratings for grab sample monitoring site for Grab sample temperature levels by site for Middle South and South Umpqua River watersheds 2004-2014 with key rating table.

RESULTS – Middle South Umpqua and South Umpqua River Watersheds

Continuous Temperature

PUR monitored five continuous temperature sites in the South Umpqua area between 2006 and 2015 for varying number of years during this period. In 2015 the Forest Service at Tiller thanks to Amy Rusk also provided us with continuous temperature data for Elk Creek at its mouth and the South Umpqua River above Elk Creek. Dates of continuous summer stream temperature monitoring in the South Umpqua area, seasonal maximum and minimum stream temperatures, diurnal fluctuations, 7-day average maximum (7DAM) stream temperatures, and days above the ODEQ criteria (ODEQ, 2003) and (ODEQ, 2011, p. 46) are listed in **Appendix J**: Summary of PUR Continuous Summer Temperature Data 2005-2010 **Error! Reference source not found.**and the data not included in our last report is provided in **Table 66** and **Table 67**. All streams monitored in the South Umpqua area fall into the designated fish use of salmon and trout "Rearing and Migration" (ODEQ, 2003) and therefore the 7DAM stream temperatures may not exceed 64.4°F (ODEQ, 2011, p. 46). The 7DAM stream temperatures for the streams monitored in the South Umpqua area during this study (2006-2015) ranged from 65.4°F to 88.0°F, all exceeding the ODEQ criteria. This area should also meet the Biological Criteria for "Spawning" between October 15th and May 15th of ≤55.4^{o}F. Because we only recorded summer continuous temperatures the "Spawning" criteria will only be evaluated based on grab sample data. **Table 68** displays the continuous temperature ratings for the data collected between 2012 and 2015.

Some monitoring sites in the South Umpqua area exceeded the potentially lethal temperatures Bell (1990, p. 11.4) found for steelhead and cutthroat trout (75.0°F and 73.0°F respectively). These sites were Canyon Creek near mouth all years monitored, Days Creek above Fate Creek in 2006, Days Creek above Woods Creek all years monitored, South Umpqua above Canyon Creek all years monitored, and Woods Creek at mouth in 2009. (**Appendix J**). Some sites even exceeded the lethal stream temperatures Brett (1952, pg. 282-3) found for young coho and Chinook salmon, acclimated to 70°F, of ≥78.8°F (Table 26). Brett (1952, pp. 282-283) found 50% mortality at this temperature after 16.7 hours.

One site, South Umpqua River above Canyon Creek reached a maximum stream temperature of 89.3°F which was maintained above 78.8°F for 46 hours in July, 2009. While these river temperatures in the high 80's are extremely high and were maintained for almost 30 hours more than the 16.7 hours Brett (1952, pp. 252-253) found resulted in 50% mortality, there are ecological conditions that may reduce the likelihood of a lethal situation. Unlike in laboratory conditions, these fish have the ability to move out of the areas of high temperature either upstream or to cooler areas nearby. Pools in the river may be cooler than surface waters and create cool water refuges for fish (Bilby, 1984, p. 593). However, the South Umpqua River is broad and shallow during the summer in this location and there are few pools. The temperature of tributaries in this region is not providing any cooling since they are also quite high. Therefore, while temperatures may or may not be lethal, there is a likelihood that the high temperatures could cause metabolic stress and increased likelihood of diseases to salmonids living in those river temperatures.

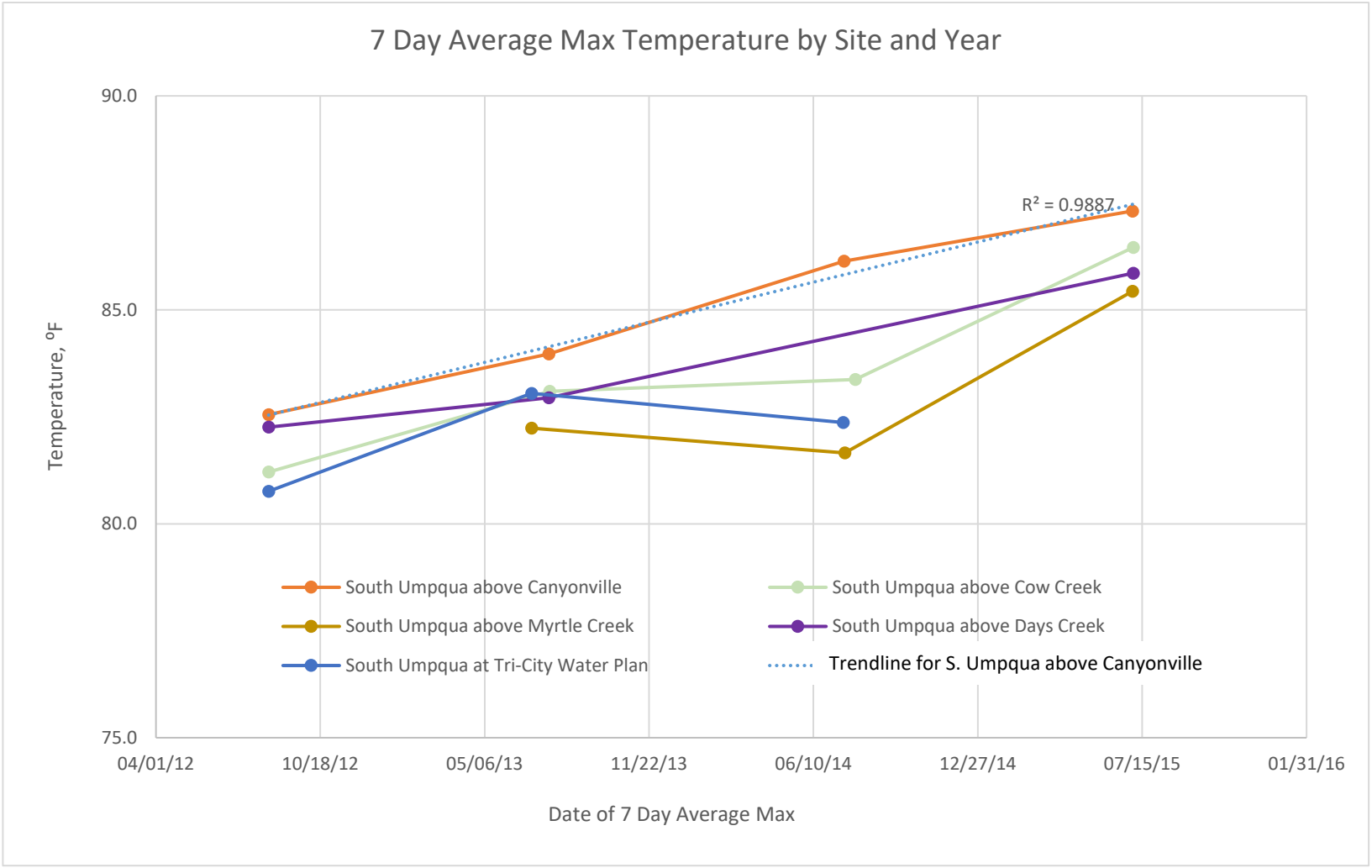
Graph 114 displays the 7ADM data from five sites on the South Umpqua River monitored between 2012 and 2015. The South Umpqua above Canyonville site displays a rather dramatic upward trend with a correlation value of 0.9887. The 7ADM increased 4.7^{o}F over four years. In general, all of the sites graphed here displayed an upward trend. Two of the sites are downstream of the mouth of Cow Creek and therefore are influenced by Galesville Reservoir discharges.

Site Name	Lat	Long	Start Date	Stop date	Seasonal Maximum Date	Value	Seasonal Minimum Date	Value	Seasonal Max ΔT Date	Value	7-Day averages Date	Maximum	Minimum	Δ T
South Umpqua above Days Creek 2012	42.9492	-123.16	07/18/12	08/27/12	08/18/12	83.4	08/25/12	58.0	08/25/12	19.6	08/16/12	82.3	67.3	15.0
South Umpqua above Days Creek 2013	42.9492	-123.16	06/28/13	09/24/13	07/03/13	84.6	09/24/13	60.4	07/22/13	11.9	07/23/13	82.9	72.5	10.4
South Umpqua above Days Creek 2014														
South Umpqua above Days Creek 2015	42.9492	-123.16	06/24/15	09/22/15	07/02/15	86.9	09/19/15	60.6	09/22/15	20.1	07/04/15	85.9	77.2	8.7
South Umpqua above Canyonville 2012	42.9404	-123.26	07/05/12	09/24/12	08/16/12	83.9	09/12/12	60.8	08/04/12	10.9	08/16/12	82.6	73.6	8.9
South Umpqua abv Canyonville 2013	42.9404	-123.26	06/28/13	09/24/13	07/03/13	86.2	09/24/13	61.7	08/19/13	12.3	07/23/13	84.0	74.1	9.9
South Umpqua at Old Canyonville Park 2014	42.9404	-123.26	06/13/14	09/17/14	07/16/14	87.7	06/18/14	60.7	08/10/14	13.8	07/17/14	86.1	74.7	11.4
South Umpqua at Old Canyonville Park 2015	42.9404	-123.26	06/24/15	09/22/15	07/02/15	88.5	09/18/15	61.3	09/22/15	18.2	07/03/15	87.3	78.1	9.2
Canyon Creek at mouth 2012	42.9421	-123.28	07/18/12	09/24/12	08/17/12	72.3	09/12/12	55.6	07/19/12	7.2	08/16/12	70.9	67.1	3.8
Canyon Creek at mouth 2013														
Canyon Creek near Mouth 2014	42.9421	-123.28	06/13/14	09/17/14	07/29/14	75.7	06/18/14	53.4	07/07/14	10.7	07/31/14	73.6	66.5	7.2
Canyon Creek near Mouth 2015														
South Umpqua above Cow Creek 2012	42.9475	-123.34	07/18/12	09/24/12	08/17/12	82.8	09/12/12	63.4	07/25/12	8.1	08/16/12	81.2	76.5	4.7
South Umpqua above Cow Creek 2013	42.9475	-123.34	06/21/13	09/24/13	07/03/13	84.4	09/24/13	62.9	06/28/13	8.4	07/24/13	83.1	77.3	5.8
South Umpqua above Cow Creek 2014	42.9475	-123.34	06/13/14	09/17/14	07/30/14	84.7	06/18/14	61.4	06/18/14	8.7	07/31/14	83.4	77.6	5.8
South Umpqua above Cow Creek 2015	42.9475	-123.34	06/24/15	09/22/15	07/02/15	87.4	09/17/15	61.5	09/22/15	13.5	07/04/15	86.5	80.7	5.8
South Umpqua at Tri-City Water Plant 2012	42.9931	-123.32	07/18/12	09/24/12	08/17/12	81.9	09/12/12	63.9	08/04/12	7.0	08/16/12	80.8	76.0	4.7
South Umpqua at Tri-City Water Plant 2013	42.9931	-123.32	06/21/13	09/24/13	07/02/13	85.4	09/24/13	62.3	06/27/13	8.2	07/02/13	83.0	76.7	6.3
South Umpqua at Tri-City Water Plant 2014	42.9931	-123.32	06/13/14	09/17/14	07/17/14	83.6	06/18/14	63.0	07/01/14	8.3	07/16/14	82.4	77.6	4.8
South Umpqua at Tri-City Water Plant 2015														
South Umpqua above Myrtle Creek 2012														
South Umpqua above Myrtle Creek 2013	43.0226	-123.3	06/21/13	09/24/13	07/02/13	84.4	09/24/13	62.9	06/27/13	7.5	07/02/13	82.2	77.2	5.0
South Umpqua above Myrtle Creek 2014	43.0226	-123.3	06/13/14	09/03/14	07/16/14	82.9	06/18/14	63.3	06/19/14	7.1	07/18/14	81.7	76.9	4.7
South Umpqua above Myrtle Creek 2015	43.0226	-123.3	06/24/15	09/22/15	07/03/15	86.8	09/18/15	62.8	09/22/15	16.3	07/03/15	85.4	80.3	5.2

Table 66. Continuous temperature summary data for Middle South and South Umpqua River watersheds 2012-2015.

Site Name	Days > 55 F	Days > 64 F	Days > 70 F	Hours > 55 F	Hours > 64 F	Hours > 70 F	Warmest day of 7-day max Date	Maximum	Minimum	Agency
South Umpqua above Days Creek 2012	41	41	41	983.5	944.5	651.5	08/18/12	83.4	68.1	PUR
South Umpqua above Days Creek 2013	89	86	84	2135.5	2043.0	1709.5	07/25/13	83.6	72.8	PUR
South Umpqua above Days Creek 2014										
South Umpqua above Days Creek 2015	91	91	83	2183.5	2081.5	1742.5	07/02/15	86.9	77.5	PUR
South Umpqua above Canyonville 2012	82	82	81	1967.5	1898.5	1343.0	08/16/12	83.9	74.8	PUR
South Umpqua abv Canyonville 2013	89	89	84	2135.5	2056.5	1778.5	07/25/13	84.9	74.0	PUR
South Umpqua at Old Canyonville Park 2014	97	97	91	2327.5	2278.0	1792.5	07/16/14	87.7	76.2	PUR
South Umpqua at Old Canyonville Park 2015	91	91	83	2183.5	2102.0	1744.5	07/02/15	88.5	78.7	PUR
Canyon Creek at mouth 2012	69	46	6	1655.5	722.5	48.5	08/17/12	72.3	68.8	PUR
Canyon Creek at mouth 2013										
Canyon Creek near Mouth 2014	97	88	41	2315.0	1570.0	357.5	07/29/14	75.7	66.7	PUR
Canyon Creek near Mouth 2015										
South Umpqua above Cow Creek 2012	69	69	66	1655.5	1651.0	1209.5	08/17/12	82.8	78.1	PUR
South Umpqua above Cow Creek 2013	96	95	88	2303.5	2254.0	1978.0	07/25/13	84.0	77.3	PUR
South Umpqua above Cow Creek 2014	97	97	92	2327.5	2299.5	1954.0	07/30/14	84.7	78.5	PUR
South Umpqua above Cow Creek 2015	91	91	84	2183.5	2125.0	1853.0	07/02/15	87.4	81.3	PUR
South Umpqua at Tri-City Water Plant 2012	69	69	61	1655.5	1653.5	1164.0	08/17/12	81.9	77.6	PUR
South Umpqua at Tri-City Water Plant 2013	96	95	86	2303.5	2240.5	1976.5	07/02/13	85.4	78.8	PUR
South Umpqua at Tri-City Water Plant 2014	97	97	94.0	2327.5	2316.0	07/21/05	07/17/14	83.6	78.8	PUR
South Umpqua at Tri-City Water Plant 2015										
South Umpqua above Myrtle Creek 2012										
South Umpqua above Myrtle Creek 2013	96	95	88	2303.5	2251.0	1984.0	07/02/13	84.4	79.4	PUR
South Umpqua above Myrtle Creek 2014	83	83	79	1991.5	1985.5	12/20/04	07/16/14	82.9	78.6	PUR
South Umpqua above Myrtle Creek 2015	91	91	81	2183.5	2135.0	1842.0	07/03/15	86.8	81.0	PUR

Table 67. Continuous temperature summary data for Middle South and South Umpqua River watersheds 2012-2015.



Graph 114. Five sites 7 Day Average Max Temperature comparison 2012-2016.

Continuous Temperature Levels Middle South Umpqua and South Umpqua River Watersheds 2012-2015	
Station ID and Site Description	**Rating**
E1 - Mouth of Elk Creek (2015)	
South Umpqua above Elk Creek (Tiller Bridge over S Ump) SU1 (2015)	
SU3a - South Umpqua above Days Creek	
SU4.5 - South Umpqua above Canyonville (at Old Canyon Park)	
CAC1 - Canyon Creek at Mouth	
SU6 - South Umpqua above Cow Creek (Lawson Bar)	
SU7 - South Umpqua at Tri-City Water Plant	
SU8 - South Umpqua near Myrtle Creek Plant	

Rating	Color	7 DAM DEQ 2010 Temperature Criteria
Good		<64.4^{o} F
Needs Improvement		>64.4^{o} F

Table 68. Continuous temperature ratings for Middle South and South Umpqua River watershed sites 2012-2015.

RESULTS – Middle South Umpqua and South Umpqua River Watersheds

Summary

Table 69 displays the summary ratings for the Middle South and South Umpqua River Watersheds for all monitored parameters. Temperature (29 of the 30 sites) has the greatest concern followed by *E. coli* (20 of the 30 sites) followed by pH and Spawning DO concerns (both for 16 of the 30 sites).

From this table O'Shea Creek has the least number of parameters of concern which are turbidity and dissolved oxygen during spawning seasons, with O'Shea being the only creek in the watersheds that has no exceedance of temperature criteria.

	Turbidity	pH	Dissolved Oxygen Non-Spawning Season May 16-October 14	Dissolved Oxygen Spawning Season October 15-May 15	Conductivity	*E. coli*	Temperature
E1 - Mouth of Elk Creek							
SU1 - South Umpqua above Elk Creek (Tiller Bridge over S. Ump)							
ST1 - Mouth of Stouts Creek							
SU2 - South Umpqua below Stouts Creek							
SU3 - South Umpqua Private Property at 3280 Shivley Rd							
SU3a - South Umpqua above Days Creek							
DC4 - Days Creek at Hwy 1 Bridge							
SU3.5 - South Umpqua at Days Creek (at HWY 1 Bridge)							
SU4 - South Umpqua River at Days Creek Cutoff Road							
SU4.5 - South Umpqua above Canyonville (at Old Canyonville Park)							
CV5 - O'Shea Creek at Tiller Trail Hwy							
SU5 - South Umpqua above Canyon Creek							
CAC2 - Canyon Creek Downstream of Comer Creek Near footbridge							
CAC1 - Canyon Creek at Mouth							
CV3 - South Umpqua at Gazley Road bridge							
SU5.5 - South Umpqua at Stanton Park							
COC1 - Cow Creek Near Mouth at Yokum Road bridge							
SU6 - South Umpqua above Cow Creek (Lawson Bar)							
SU6.5 - South Umpqua below Cow Creek at Riddle Bypass Rd.							
SU7 - South Umpqua at Tri-City Water Plant							
SU8 - South Umpqua near Myrtle Creek Plant							
MC1 - Myrtle Creek at mouth							
M1 - Myrtle Creek at Millsite Park							
SUMC2 - South Umpqua below Myrtle Creek bridge							
SU9 - South Umpqua below Myrtle Creek (Boomerhill)							
SUCB1 - Clarks Branch at NE Dole Road			Goes dry		Goes dry		
SU10 - South Umpqua at NE Dole Road							
SU11 - South Umpqua at Brockway Rd.							
SU12 - South Umpqua at Winston							
LG1 - Lookingglass Creek at Hwy 42 bridge							

Table 69. Summary ratings for Middle South and South Umpqua River Watersheds monitoring sites 2004-2014, – six water quality parameters. See tables for each parameter for color coding.

ACRONYMS

- ODEQ: Oregon Department of Environmental Quality
- DO: Dissolved Oxygen
- EPA: Environmental Protection Agency
- NTU: Nephelometric Turbidity Units
- OWEB: Oregon Watershed Enhancement Board
- PUR: Partnership for the Umpqua Rivers
- QAPP: Quality Assurance Project Plan
- RAC: Secure Rural Schools and Self-Determination Act of 2000 (Public law 110-343)
- UBWC: Umpqua Basin Watershed Council

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Appendices:

Appendix A: Designated Beneficial Uses for the Umpqua Basin

Table 320A

Designated Beneficial Uses
Umpqua Basin
(340-41-0320)

Beneficial Uses	Umpqua R. Estuary to Head of Tidewater & Adjacent Marine Waters	Umpqua R. Main from Head of Tidewater to Confluence of N. & S. Umpqua Rivers	North Umpqua River Main Stem	South Umpqua River Main Stem	All Other Tributaries to Umpqua, North & South Umpqua Rivers
Public Domestic Water Supply[1]		X	X	X	X
Private Domestic Water Supply[1]		X	X	X	X
Industrial Water Supply	X	X	X	X	X
Irrigation		X	X	X	X
Livestock Watering		X	X	X	X
Fish & Aquatic Life[2]	X	X	X	X	X
Wildlife & Hunting	X	X	X	X	X
Fishing	X	X	X	X	X
Boating	X	X	X	X	X
Water Contact Recreation	X	X	X	X	X
Aesthetic Quality	X	X	X	X	X
Hydro Power			X	X	X
Commercial Navigation & Transportation	X				

[1] With adequate pretreatment (filtration & disinfection) and natural quality to meet drinking water standards.

[2] See also Figures 320A and 320B for fish use designations for this basin.

Table produced November, 2003

Appendix B: ODEQ Current Turbidity Rule

Turbidity Rule (OAR 340-041-0036) (Water Quality Standards, 2010)

Turbidity (Nephelometric Turbidity Units, NTU): No more than a ten percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied and one of the following has been granted:

1. Emergency activities: Approval coordinated by the Department with the Oregon Department of Fish and Wildlife under conditions they may prescribe to accommodate response to emergencies or to protect public health and welfare;
2. Dredging, Construction or other Legitimate Activities: Permit or certification authorized under terms of section 401 or 404 (Permits and Licenses, Federal Water Pollution Control Act) or OAR 14l-085-0100 et seq. (Removal and Fill Permits, Division of State Lands), with limitations and conditions governing the activity set forth in the permit or certificate.

Appendix C: British Columbia Turbidity and Suspended Sediment Standards

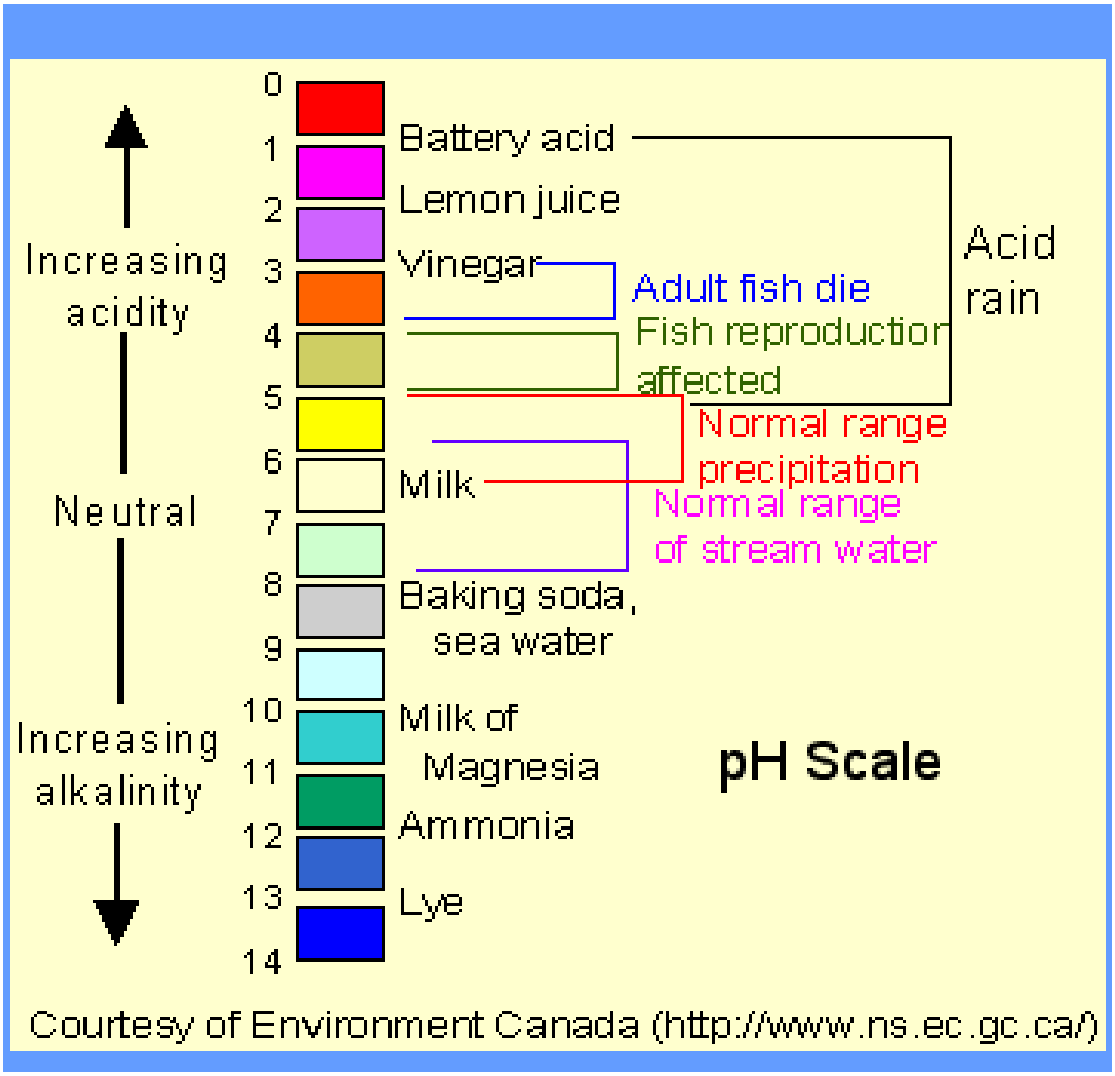
Taken from Bash, 2001, p. 70.

Table C-3. British Columbia turbidity and suspended sediment standards

Water Use	Maximum Induced Turbidity – NTU or % of background	Maximum Induced Suspended Sediments –mg/l or % of background	Streambed Substrate Composition
Drinking Water – raw untreated	1 NTU when background is less than or equal to 5	No guideline	No guideline
Drinking Water – raw treated	5 NTU when background is less than or equal to 50	No guideline	No guideline
Recreation and Aesthetics	Maximum 50 NTU ..... secchi disc visible at 1.2 m	No guideline	No guideline
Aquatic Life -fresh- -marine- -estuarine-	8 NTU in 24 hours when background is less than or equal to 8 .... Mean of 2 NTU in 30 days when background is less than or equal to 8	25 mg/l in 24 hours when background is less than or equal to 25 .... Mean of 5 mg/l in 30 days when background is less than or equal to 25	Fines not to exceed -10% as less than 2mm- -19% as less than 3mm- -25% as less than 6.35mm- at salmonid spawning sites
Aquatic Life -fresh- -marine- -estuarine-	8 NTU when background is between 8 and 80 .... 10% when background is greater than or equal to 80	25 mg/l when background is between 25 and 250 .... 10% when background is greater than or equal to 250	Geometric mean diameter not less than 12 mm .... Fredle number not less than 5mm
Terrestrial Life -wildlife- -livestock water- Irrigation Industrial	10 NTU when background is less than or equal to 50 .... 20% when background is greater than or equal to 50	20 mg/l when background is less than or equal to 100 .... 20% when background is greater than or equal to 100	No guideline

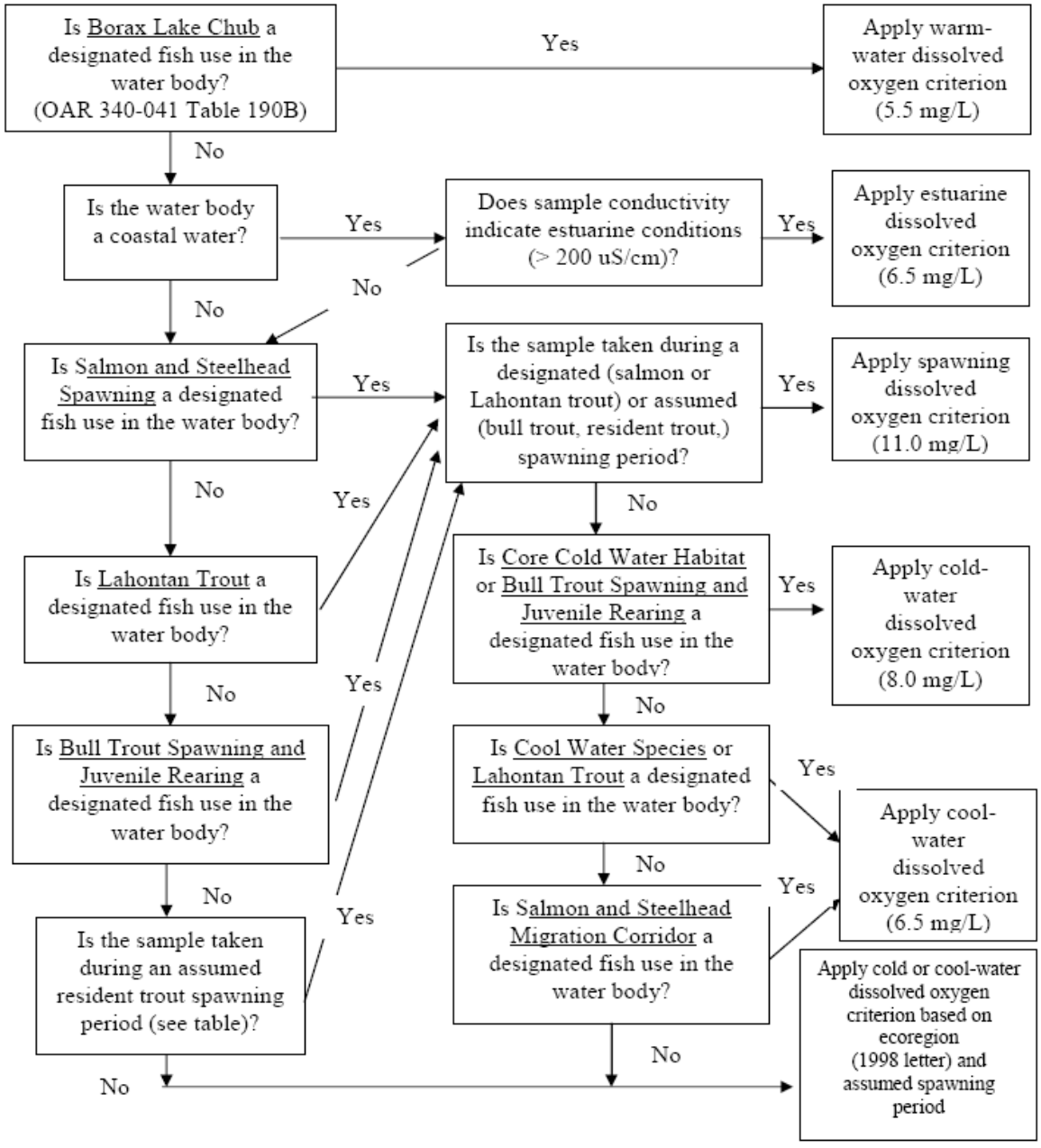
(Web Site Ref. #2)

Appendix D: pH Scale



Appendix E: Dissolved Oxygen Evaluation Flow Chart

Flow Chart illustrating the evaluation process for dissolved oxygen data collected from Oregon water bodies (Assessment Methodology for Oregon's 2004/2006 Integreated Report on Water Quality Status – ODEQ Water Quality Division)



Appendix F: Annual 7 Day Average Maximum Stream Temperature for Umpqua Basin Stream Characterization Project Reference Sites from 1998-2015 (Dammann, D.M., 2015, p. 2).

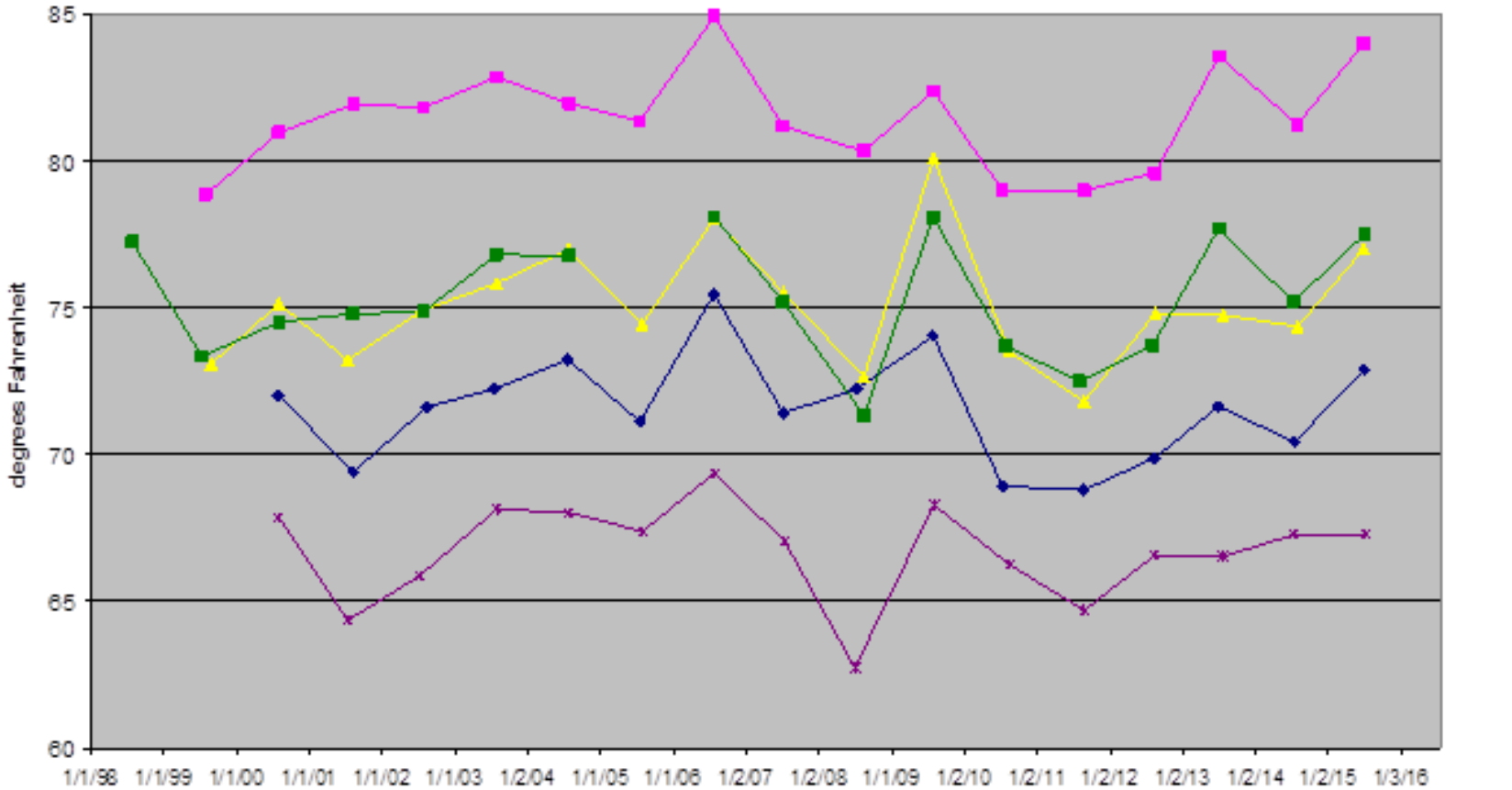


Figure 3. Annual 7-Day Average Maximum Daily (7DAM) Stream Temperatures for Reference Sites, 1998-2015, Umpqua Basin.

North Myrtle Creek at Mouth

Start Date	Stop Date	Seasonal Maximum		Seasonal Minimum		Seasonal Max ΔT		7-Day averages				Days >	Days >	Days >	Hours >	Hours >	Hours >	Date of warmest day of 7-day max	Max	Min
		Date	Value	Date	Value	Date	Value	Date	Max	Min	Δ T	55 F	64 F	70 F	55 F	64 F	70 F			
07/01/99	09/13/99	08/28/99	74.3	09/11/99	54.7	08/16/99	11.3	08/25/99	73.1	64.9	8.2	75	72	40	1797.0	1092.0	271.5	08/24/99	74.3	64.6
06/30/00	09/15/00	07/30/00	77.3	09/10/00	55.6	07/20/00	11.1	08/01/00	75.1	65.5	9.7	78	69	30	1871.5	1146.0	229.5	07/30/00	77.3	67.3
06/19/01	09/11/01	07/09/01	75.5	09/06/01	55.6	06/20/01	12.5	07/11/01	73.2	64.3	8.9	85	81	37	2039.5	1339.0	212.0	07/09/01	75.5	63.9
06/23/02	09/19/02	07/10/02	77.8	09/08/02	54.7	06/25/02	12.0	07/12/02	74.9	65.7	9.2	89	83	35	2135.0	1402.5	325.5	07/10/02	77.8	66.1
06/27/03	09/15/03	07/21/03	77.8	09/14/03	57.0	06/28/03	11.8	07/28/03	75.8	66.2	9.6	81	80	62	1943.5	1604.5	570.5	07/30/03	77.5	68.1
06/24/04	09/16/04	07/24/04	78.6	09/07/04	57.4	07/23/04	11.7	07/26/04	77.0	67.2	9.8	85	84	59	2039.5	1574.0	603.0	07/24/04	78.6	68.9
06/28/05	09/19/05	07/18/05	76.0	09/19/05	54.3	07/26/05	11.0	07/29/05	74.4	65.2	9.2	84	74	47	2009.5	1337.5	404.5	07/29/05	75.6	66.6
06/22/06	09/23/06	07/24/06	81.0	09/23/06	53.7	06/24/06	11.6	07/25/06	78.0	68.9	9.1	94	94	94	2255.5	2255.5	2255.5	07/24/06	81.0	72.0
06/24/07	10/06/07	07/11/07	77.5	09/25/07	49.2	08/29/07	11.9	07/08/07	75.5	65.8	9.7	105	105	105	2519.5	2519.5	2519.5	07/11/07	77.5	70.5
06/02/08	09/23/08	08/16/08	74.6	06/02/08	51.8	07/13/08	9.4	08/15/08	72.7	67.1	5.5	114	114	114	2735.5	2735.5	2735.5	08/16/08	74.6	69.1
06/08/09	10/03/09	07/28/09	81.5	10/02/09	50.7	08/20/09	12.2	07/30/09	80.1	70.3	9.8	118	118	118	2831.5	2831.5	2831.5	07/28/09	81.5	70.8
06/21/10	09/25/10	08/16/10	75.0	06/21/10	54.4	08/25/10	10.8	08/15/10	73.5	64.6	9.0	97	97	97	2327.5	2327.5	2327.5	08/16/10	75.0	65.5
06/21/11	09/25/11	08/25/11	73.5	09/01/11	54.9	06/21/11	9.5	08/25/11	71.8	64.5	7.2	97	97	97	2327.5	2327.5	2327.5	08/25/11	73.5	67.1
06/17/12	10/12/12	08/16/12	76.6	10/05/12	46.5	09/03/12	18.2	08/15/12	74.8	65.6	9.2	118	118	118	2831.5	2831.5	2831.5	08/16/12	76.6	67.7
06/14/13	09/21/13	07/25/13	76.3	06/14/13	54.3	07/22/13	10.7	07/24/13	74.7	65.7	9.0	100	90	52	2395.0	1795.5	396.5	07/25/13	76.3	66.7
06/17/14	10/02/14	08/02/14	76.4	10/02/14	54.2	08/06/14	9.9	08/01/14	74.4	67.6	6.8	108	99	55	2581.0	1858.5	548.0	08/02/14	76.4	68.0
06/07/15	09/21/15	06/27/15	78.2	09/06/15	56.4	06/17/15	9.8	06/30/15	77.0	69.5	7.5	107	95	58	2567.5	2030.0	588.5	06/27/15	78.2	70.3

Appendix G: Oregon DEQ Data Quality Matrix

Data Quality Matrix
DEQ04-LAB-0003-QAG
Version 4.0

Oregon Department of Environmental Quality
March 09 2009
Page 1 of 2

Data Validation Criteria for Water Quality Parameters Measured in the Field

Quality Level	Quality Assurance Plan	Water Temperature Methods	pH Methods	Dissolved Oxygen Methods	Turbidity Methods	Conductivity Methods	Bacteria Methods	Data Uses
A+	DEQ QAPP approved by DEQ QA Officer	Thermometer Accuracy checked with NIST standards A ≤ ± 0.5°C P ≤ ± 0.5°C	Calibrated pH electrode A ≤ ± 0.2 S.U. P ≤ ± 0.3 S.U.	Winkler titration or calibrated Oxygen meter A ≤ ± 0.2 mgL^{-1} P ≤ ± 0.3 mgL^{-1}	Nephelometric Turbidity meter A ≤ ± 5% Standard value P ≤ ± 5% (± 1 NTU if NTU < 20)	Meter with temp correction to 25°C A ≤ ± 7% of standard value P ≤ ± 10%	DEQ Approved Methods Absolute difference between log-transformed values P ≤ 0.6 log	Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments)
A	External QAPP	External Data Thermometer Accuracy checked with NIST standards A ≤ ± 0.5°C P ≤ ± 0.5°C	External Data Calibrated pH electrode A ≤ ± 0.2 S.U. P ≤ ± 0.3 S.U.	External Data Winkler titration or calibrated Oxygen meter A ≤ ± 0.2 mgL^{-1} P ≤ ± 0.3 mgL^{-1}	External Data Nephelometric Turbidity meter A ≤ ± 5% Standard value P ≤ ± 5% (± 1 NTU if NTU <20)	External Data Meter with temp correction to 25°C A ≤ ± 7% of standard value P ≤ ± 10%	External Data DEQ Approved Methods Absolute difference between log-transformed values P ≤ 0.6 log	Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments)
B	Minimum Data Acceptance Criteria Met	Thermometer Accuracy checked with NIST standards A ≤ ± 1.0°C P ≤ ± 2.0°C	Any Method A ≤ ± 0.5 S.U. P ≤ ± 0.5 S.U.	Winkler titration or calibrated Oxygen meter A ≤ ± 1 mgL^{-1} P ≤ ± 1 mgL^{-1}	Any Method A ≤ ± 30% P ≤ ± 30%	Meter with temp correction to 25°C A ≤ ± 10% of standard value P ≤ ± 15%	DEQ Approved Methods Absolute difference between log-transformed values P ≤ 0.8 log	Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments) with professional judgment
C		A > ± 1.0°C P > ± 2.0°C	A > ± 0.5 S.U. P > ± 0.5 S.U.	A > ± 2 mgL^{-1} P > ± 2 mgL^{-1}	A > 30% P > 30%	A > ± 10% P > ± 15%	Absolute difference between log-transformed values P > 0.8 log	Void data. Not used for 303(d) and 305(b) assessments
D		Missing Data	Missing Data	Missing Data	Missing Data	Missing Data	Missing Data	Missing Data
E	No QAPP provided	No Precision Checks	Any Method No Precision Checks	Any Method No Precision Checks or A ≤ ± 2 mgL^{-1} P ≤ ± 2 mgL^{-1}	Any Method No precision checks	Meter without routine calibration No precision checks	Any Method No precision checks	Informational purposes only
F	See accompanying notes							

Appendix G: Oregon DEQ Data Quality Matrix

Data Validation Criteria for Water Quality Parameters Measured in the Field

Notes:

QA definitions of Data Quality Levels

A+ – Data of known Quality; collected by DEQ; meets QC limits established in the QAPP.

A – Data of known Quality; submitted by entities outside of DEQ; meets QC limits established in a *DEQ-approved* QAPP.

B – Data of known *but lesser* Quality; data may not meet established QC but is within marginal acceptance criteria; or data value may be accurate, however controls used to measure Data Quality Objective elements failed (e.g., batch failed to meet blank QC limit); the data may be useful in limited situations or in supporting other, higher quality data.

Note: Statistics for **turbidity, conductivity,** and **bacteria** are concentration-dependent; thus low-concentration B level data may be considered acceptable for all uses.

C – Data of unacceptable Quality; data are typically discarded (Void) in response to analytical failure. **Note:** There may be rare instances where there may be field data that may still meet DQOs as determined by the Project Officer. In these cases a result should be entered instead of "Void" however the grade must remain at C. There must also be a comment in the final report that explains the qualification.

D – Incomplete data; no sample collected or no reportable results, typically due to sampling failure.

E – Data of unknown quality or known to be of poor quality; no QA information is available, data could be valid, however, no evidence is available to prove either way. Data is provided for Educational Use Only.

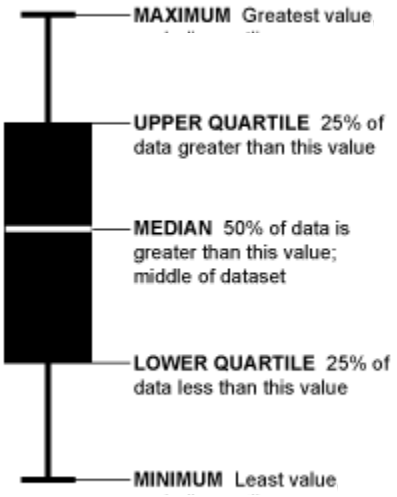
F – Exceptional Event; "A" quality data (data is of known quality), but not representative of sampling conditions as required by the project plan.(e.g., a continuous water quality monitor intended to collect background environmental conditions collects a sample impacted by a fire that created anomalous conditions to the environment).

Data Quality Level Grading Criteria:

A = Accuracy as determined by comparison with standards, e.g., during equipment calibration or pre- and post-deployment checks

P = Precision as determined by replicate measurements, e.g., during field duplicates, field audits, or split sample

Appendix H: Interpreting a Box Plot



(Yau, 2008)

Appendix I:

Figure 320A - Umpqua Basin Fish Use Designations from ODEQ 2003

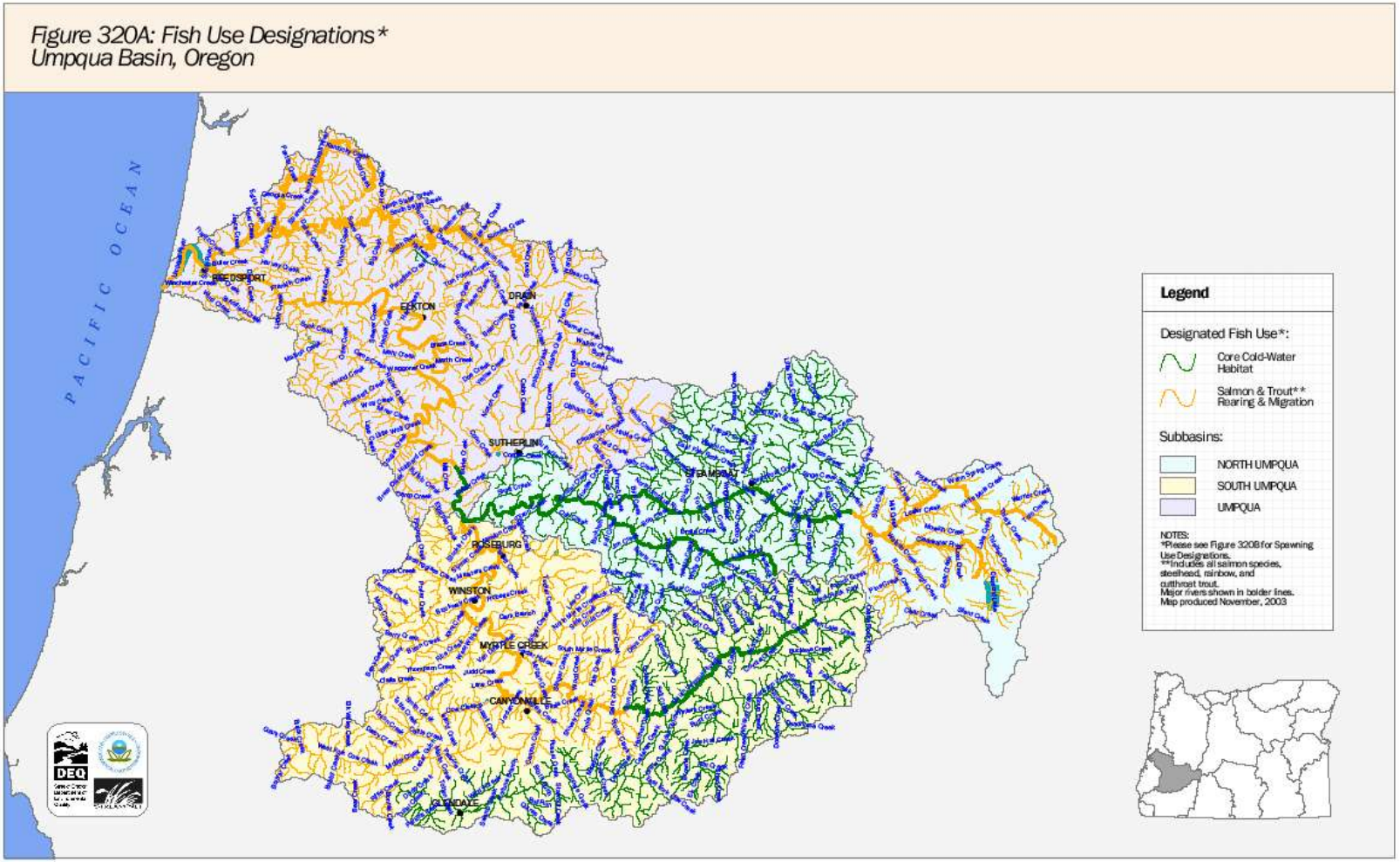
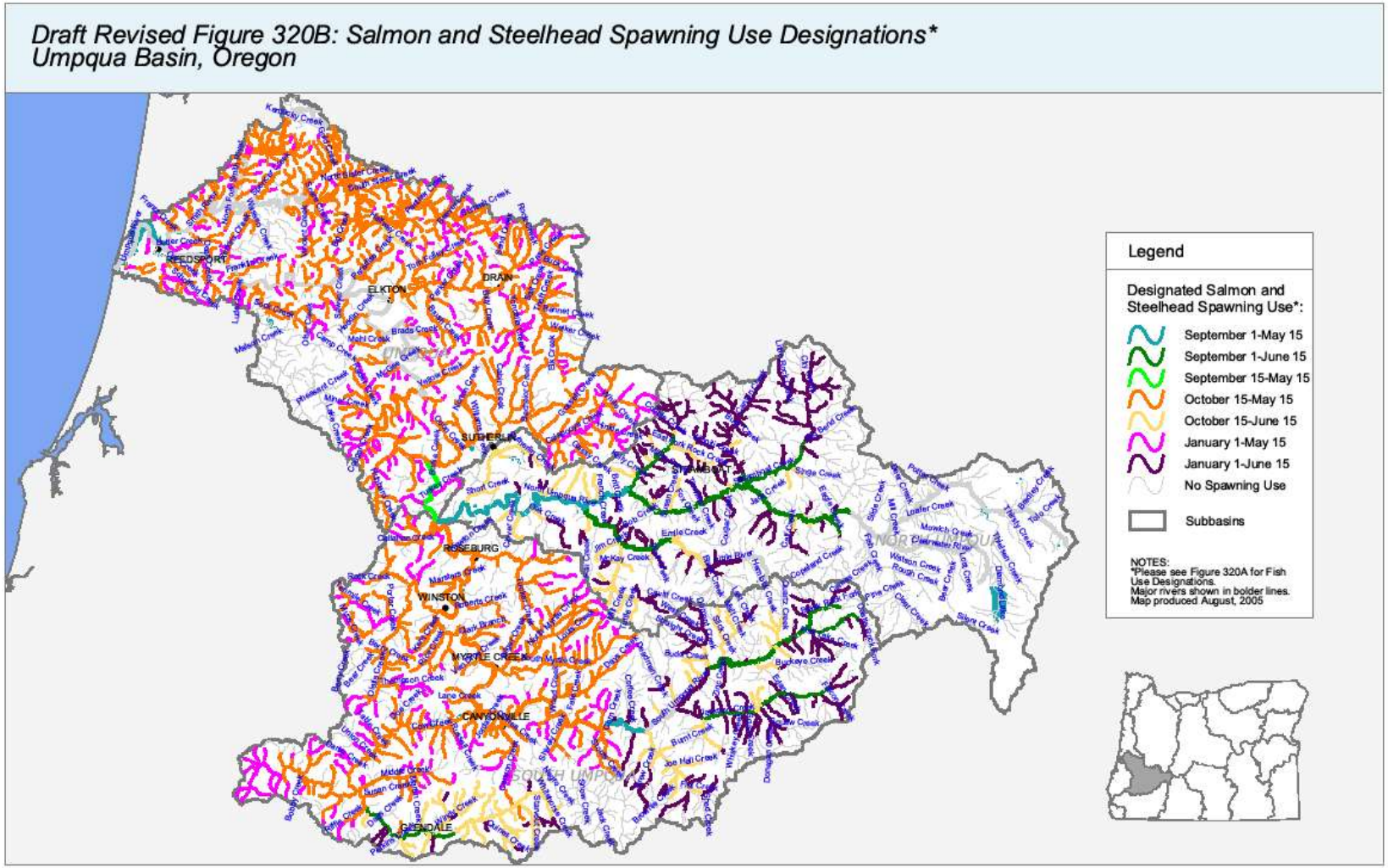


Figure 320B - Umpqua Basin Salmon and Steelhead Spawning Use Designations from ODEQ



Appendix J: Summary of PUR Continuous Summer Temperature Data 2005-2010

Summary of Continuous Summer Temperature Data from 2005-2010 for all Volunteer Monitoring Sites and Associated USFS and BLM Sites. ODEQ temperature criteria listed is from ODEQ (2003) and ODEQ (2011, p. 46). The North Myrtle Creek at Mouth Reference Site is a long-term stream characterization monitoring site (Smith, K., 2005), (Dammann, D.M. and K. Smith, 2006), (Dammann, D.M., 2007-2010).

Site Name			Seasonal Maximum Stream Temperature		Seasonal Minimum Stream Temperature		Seasonal Maximum ΔT		7-Day Averages			
	Start Date	Stop date	Date	(°F)	Date	(°F)	Date	(Δ °F)	Date	Maximum Temp (°F)	Minimum Temp (°F)	ΔT (Δ °F)
Myrtle Creek												
Bilger Creek near Mouth - 2008	07/03/08	09/02/08	07/05/08	67.6	09/02/08	55.0	08/03/08	4.3	07/07/08	66.8	64.1	2.7
Bilger Creek near Mouth - 2009	06/24/09	09/21/09	07/30/09	70.0	09/21/09	53.4	09/18/09	9.7	07/31/09	69.6	65.1	4.5
Buck Fork near Confluence with N. Myrtle Creek - 2006	07/06/06	09/19/06	07/24/06	72.3	09/17/06	48.8	07/20/06	10.1	07/25/06	70.0	62.8	7.2
Letitia Creek near Mouth - 2007	06/28/07	09/25/07	07/11/07	67.6	09/25/07	47.8	09/10/07	9.0	07/13/07	66.3	62.0	4.3
Louis Creek near Mouth - 2007	06/28/07	09/25/07	07/11/07	71.4	09/25/07	47.8	07/10/07	9.9	07/08/07	69.6	61.3	8.3
Louis Creek near Mouth - 2008	06/04/08	09/02/08	08/16/08	71.3	06/08/08	48.7	06/27/08	9.9	08/15/08	68.8	63.2	5.6
Louis Creek near Mouth - 2009	06/24/09	09/21/09	07/30/09	74.7	09/08/09	52.8	08/19/09	9.6	07/31/09	73.7	66.7	7.0
Louis Creek near Mouth - 2010	06/30/10	09/21/10	08/16/10	69.4	07/04/10	52.9	07/06/10	10.4	07/27/10	68.4	61.9	6.6
Myrtle Creek near Mouth - 2005	07/08/05	10/05/05	07/31/05	74.4	09/25/05	49.5	08/04/05	8.5	08/07/05	73.1	66.1	7.0
Myrtle Creek near Mouth - 2006	06/28/06	09/19/06	07/24/06	80.9	09/17/06	53.8	07/20/06	10.8	07/25/06	78.0	69.4	8.6
Myrtle Creek near Mouth - 2007	06/28/07	09/25/07	07/11/07	76.8	09/25/07	49.7	07/10/07	11.0	07/08/07	75.0	66.1	8.9
Myrtle Creek near Mouth - 2008	07/03/08	09/03/08	08/16/08	76.4	09/03/08	54.5	07/08/08	10.3	08/14/08	73.7	66.4	7.2
Myrtle Creek near Mouth - 2009	06/24/09	09/21/09	07/28/09	80.8	09/08/09	55.7	07/02/09	11.1	07/31/09	79.7	71.5	8.2
Myrtle Creek near Mouth - 2010	06/30/10	09/21/10	08/17/10	74.6	09/06/10	55.7	07/15/10	9.8	07/27/10	73.3	65.5	7.8
N. Myrtle Creek above Bilger Creek - 2005	07/08/05	10/05/05	07/18/05	75.9	09/25/05	49.0	07/17/05	11.5	07/20/05	73.7	64.6	9.1
N. Myrtle Creek above Bilger Creek - 2006	06/28/06	09/19/06	07/23/06	79.4	09/17/06	53.1	07/08/06	13.0	07/25/06	76.7	67.8	9.0
N. Myrtle Creek above Bilger Creek - 2007	06/28/07	09/25/07	07/10/07	76.0	09/25/07	49.4	06/30/07	11.8	07/08/07	74.2	64.9	9.3
N. Myrtle Creek above Bilger Creek - 2008	07/03/08	09/02/08	08/16/08	76.5	09/02/08	55.7	07/08/08	11.2	07/11/08	73.2	63.4	9.7
N. Myrtle Creek above Bilger Creek - 2009	06/24/09	09/21/09	07/28/09	78.9	09/08/09	55.0	06/27/09	12.9	07/30/09	77.4	69.5	7.9
N. Myrtle Creek above Bilger Creek - 2010	06/30/10	09/21/10	07/11/10	74.7	09/06/10	55.3	07/06/10	12.3	07/26/10	72.9	64.4	8.6
N. Myrtle Creek at Division St - 2005	07/08/05	10/05/05	07/18/05	75.9	09/25/05	49.1	07/26/05	11.2	08/07/05	74.6	65.1	9.6
N. Myrtle Creek at Division St - 2007	06/28/07	09/25/07	07/11/07	78.0	09/25/07	49.2	08/29/07	12.3	07/08/07	75.5	65.7	9.8
N. Myrtle Creek at Evergreen Park - 2008	07/03/08	09/03/08	08/16/08	78.8	09/03/08	53.9	07/13/08	12.1	08/14/08	75.2	65.7	9.5
N. Myrtle Creek at Evergreen Park - 2009	06/24/09	09/21/09	07/30/09	82.1	09/08/09	54.9	08/19/09	12.6	07/31/09	80.7	70.9	9.8
N. Myrtle Creek at Evergreen Park - 2010	06/30/10	09/21/10	08/17/10	75.2	09/06/10	54.7	08/25/10	11.3	08/15/10	73.6	64.4	9.3
N. Myrtle Creek at Mouth - Reference - 2005	06/28/05	09/19/05	07/18/05	76.0	09/19/05	54.3	07/26/05	11.0	07/29/05	74.4	65.2	9.2
N. Myrtle Creek at Mouth - Reference - 2006	06/22/06	09/23/06	07/24/06	81.0	09/23/06	53.7	06/24/06	11.6	07/25/06	78.0	68.9	9.1
N. Myrtle Creek at Mouth - Reference - 2007	06/24/07	10/06/07	07/11/07	77.5	09/25/07	49.2	08/29/07	11.9	07/08/07	75.5	65.8	9.7
N. Myrtle Creek at Mouth - Reference - 2008	06/02/08	09/23/08	08/16/08	74.6	06/02/08	51.8	07/13/08	9.4	08/15/08	72.7	67.1	5.5
N. Myrtle Creek at Mouth - Reference - 2009	06/08/09	10/03/09	07/28/09	81.5	10/02/09	50.7	08/20/09	12.2	07/30/09	80.1	70.3	9.8
N. Myrtle Creek at Mouth - Reference - 2010	06/21/10	09/25/10	08/16/10	75.0	06/21/10	54.4	08/25/10	10.8	08/15/10	73.5	64.6	9.0
N. Myrtle Creek at N. Myrtle Park - 2005	07/08/05	10/05/05	07/18/05	73.4	09/25/05	48.8	07/17/05	11.7	07/20/05	72.0	62.0	10.1
N. Myrtle Creek at N. Myrtle Park - 2006	07/06/06	09/19/06	07/24/06	77.5	09/17/06	52.8	07/08/06	12.1	07/25/06	75.5	66.1	9.4
N. Myrtle Creek at N. Myrtle Park - 2007	06/28/07	09/25/07	07/11/07	74.0	09/25/07	50.2	06/30/07	11.5	07/08/07	72.8	63.2	9.6
N. Myrtle Creek at N. Myrtle Park - 2008	07/03/08	09/02/08	08/16/08	72.6	09/02/08	56.6	07/08/08	10.5	07/11/08	71.1	61.6	9.4
N. Myrtle Creek at N. Myrtle Park - 2009	06/24/09	09/21/09	07/28/09	77.2	09/08/09	55.4	06/27/09	13.3	07/30/09	76.2	68.3	7.9
N. Myrtle Creek at N. Myrtle Park - 2010	06/30/10	09/21/10	07/11/10	73.0	07/04/10	53.9	07/07/10	13.1	07/26/10	71.9	61.9	10.0
N. Myrtle Creek near Confluence with Buck Fork Ck - 2006	07/06/06	09/19/06	07/24/06	71.2	09/17/06	48.8	07/20/06	10.3	07/25/06	69.1	61.0	8.1

Site Name	Start Date	Stop date	Seasonal Maximum Stream Temperature		Seasonal Minimum Stream Temperature		Seasonal Maximum ΔT		7-Day Averages			
			Date	(°F)	Date	(°F)	Date	(Δ °F)	Date	Maximum Temp (°F)	Minimum Temp (°F)	ΔT (Δ °F)
Myrtle Creek												
S. Myrtle Creek at 12 Mile Ranch - 2005	07/08/05	10/05/05	07/31/05	68.5	09/25/05	44.8	07/26/05	9.4	07/30/05	67.5	59.9	7.6
S. Myrtle Creek at Neal Lane Bridge - 2005	07/08/05	08/15/05	07/18/05	76.4	08/03/05	61.3	07/26/05	11.2	07/20/05	73.9	65.8	8.2
S. Myrtle Creek at Neal Lane Bridge - 2006	06/28/06	09/19/06	07/23/06	80.9	09/17/06	53.6	09/01/06	11.7	07/25/06	77.8	69.4	8.4
S. Myrtle Creek at Neal Lane Bridge - 2007	06/28/07	09/04/07	07/11/07	77.4	08/28/07	58.0	07/10/07	11.1	07/08/07	74.9	66.2	8.7
S. Myrtle Creek at Neal Lane Bridge - 2008	07/03/08	09/02/08	08/16/08	76.8	09/02/08	55.0	07/13/08	11.1	08/14/08	73.9	65.4	8.5
S. Myrtle Creek at Neal Lane Bridge - 2010	06/30/10	09/21/10	07/25/10	75.0	09/06/10	54.7	08/24/10	11.3	07/26/10	74.0	65.3	8.7
S. Myrtle Creek at Taylor's Property - 2005	07/08/05	10/05/05	07/18/05	76.3	09/25/05	49.7	07/17/05	11.5	07/20/05	74.5	64.9	9.6
S. Myrtle Creek at Taylors Property - 2006	06/28/06	09/19/06	07/24/06	80.3	09/17/06	52.6	07/08/06	13.5	07/25/06	77.9	67.8	10.1
S. Myrtle Creek at Taylors Property - 2007	06/29/07	09/25/07	07/11/07	77.6	09/25/07	50.0	06/30/07	12.7	07/08/07	75.5	64.7	10.8
S. Myrtle Creek at Taylors Property - 2008	06/04/08	09/02/08	08/16/08	77.1	06/05/08	48.6	06/27/08	14.5	07/11/08	74.6	62.4	12.2
S. Myrtle Creek at Taylors Property - 2009	06/24/09	09/21/09	07/29/09	78.6	09/08/09	55.6	06/27/09	13.3	07/30/09	77.9	70.4	7.5
S. Myrtle Creek at Taylor's Property - 2010	06/30/10	09/21/10	07/11/10	75.5	07/04/10	54.7	07/07/10	13.6	07/27/10	74.1	64.1	10.0
S. Myrtle Creek at Top of Golf Course - 2005	07/08/05	10/10/05	07/19/05	76.4	09/25/05	49.5	07/26/05	10.9	07/20/05	74.3	66.0	8.3
S. Myrtle Creek at Top of Golf Course - 2006	06/28/06	09/19/06	07/24/06	81.6	09/17/06	53.2	08/13/06	11.5	07/25/06	78.2	69.5	8.8
S. Myrtle Creek at Top of Golf Course - 2007	06/28/07	09/24/07	07/11/07	78.2	09/24/07	49.2	07/10/07	11.0	07/08/07	75.5	66.2	9.3
S. Myrtle Creek at Top of Golf Course - 2009	06/24/09	09/21/09	07/28/09	82.9	09/21/09	55.1	07/27/09	13.3	07/30/09	80.6	70.2	10.4
S. Myrtle Creek at Top of Golf Course - 2010	06/30/10	09/21/10	08/17/10	76.1	09/06/10	54.7	08/25/10	12.4	08/15/10	74.2	64.6	9.6
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2005	07/09/05	10/05/05	07/18/05	69.7	09/25/05	46.0	07/26/05	8.6	07/20/05	68.3	61.4	6.9
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2006	06/28/06	09/19/06	07/24/06	73.7	09/17/06	49.3	07/20/06	9.7	07/25/06	71.2	63.4	7.8
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2007	06/28/07	09/25/07	07/11/07	70.6	09/24/07	45.9	07/10/07	9.8	07/12/07	68.6	61.8	6.8
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2008	07/03/08	09/03/08	08/16/08	71.8	09/03/08	49.6	07/13/08	10.3	08/15/08	68.6	61.3	7.2
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2009	06/24/09	09/21/09	07/29/09	74.7	09/08/09	51.0	06/27/09	10.9	07/31/09	73.4	66.0	7.5
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2010	06/30/10	09/21/10	08/16/10	69.2	09/06/10	50.5	08/25/10	9.3	08/15/10	67.6	59.9	7.7
Weaver Creek above 1st Culvert - 2005	07/08/05	10/05/05	07/18/05	68.4	09/25/05	45.8	07/26/05	8.8	08/07/05	67.1	60.0	7.1
Weaver Creek above 1st Culvert - 2007	06/28/07	09/25/07	07/11/07	68.1	09/24/07	46.6	06/30/07	7.6	07/13/07	66.6	61.9	4.7
Weaver Creek above 1st Culvert - 2008	06/04/08	09/02/08	08/16/08	68.7	06/12/08	47.0	06/13/08	9.5	08/15/08	66.1	61.2	4.9
Weaver Creek above 1st Culvert - 2009	06/24/09	09/21/09	07/30/09	71.8	09/08/09	51.6	06/27/09	7.8	07/31/09	70.8	65.2	5.6
Weaver Creek above 1st Culvert - 2010	06/30/10	09/21/10	08/17/10	66.6	09/11/10	50.9	07/06/10	8.4	07/27/10	65.2	59.9	5.3

Site Name	Total Monitored Days Exceeding ODEQ Criterias			% of Days from 7/9-9/2 Exceeding Criteria - Myrtle Sites			Warmest Day of 7-Day Maximum Stream Temperature			Monitoring Organization or Agency
	Days > 60.8 °F	Days > 64.4 °F	Days > 68 °F	% Days > 60.8 °F	% Days > 64.4 °F	% Days > 68 °F	Date	Maximum Temp (°F)	Minimum Temp (°F)	
Myrtle Creek										
Bilger Creek near Mouth - 2008	60	15	0	96	16	0	07/04/08	67.6	64.4	PUR
Bilger Creek near Mouth - 2009	90	69	14	100	84	18	07/30/09	70.0	65.5	PUR
Buck Fork near Confluence with N. Myrtle Creek - 2006	59	24	6	95	43	11	07/24/06	72.3	65.4	PUR
Letitia Creek near Mouth - 2007	76	34	0	100	50	0	07/11/07	67.6	63.3	PUR
Louis Creek near Mouth - 2007	78	53	18	100	80	23	07/11/07	71.4	66.1	PUR
Louis Creek near Mouth - 2008	74	54	15	95	75	14	08/16/08	71.3	65.1	PUR
Louis Creek near Mouth - 2009	88	62	24	100	88	38	07/30/09	74.7	67.8	PUR
Louis Creek near Mouth - 2010	63	48	11	95	79	20	07/28/10	69.4	63.3	PUR
Myrtle Creek near Mouth - 2005	73	62	47	100	100	84	08/05/05	73.8	66.7	PUR
Myrtle Creek near Mouth - 2006	81	77	59	100	100	84	07/24/06	80.9	72.7	PUR
Myrtle Creek near Mouth - 2007	82	77	59	100	100	84	07/11/07	76.8	70.7	PUR
Myrtle Creek near Mouth - 2008	63	59	52	100	95	82	08/16/08	76.4	69.1	PUR
Myrtle Creek near Mouth - 2009	90	83	70	100	100	91	07/28/09	80.8	71.5	PUR
Myrtle Creek near Mouth - 2010	83	62	50	98	95	82	07/25/10	74.1	65.1	PUR
N. Myrtle Creek above Bilger Creek - 2005	74	60	47	100	100	84	07/18/05	75.9	65.7	PUR
N. Myrtle Creek above Bilger Creek - 2006	81	72	48	100	96	70	07/23/06	79.4	69.2	PUR
N. Myrtle Creek above Bilger Creek - 2007	82	75	51	100	100	71	07/10/07	76.0	64.4	PUR
N. Myrtle Creek above Bilger Creek - 2008	62	58	43	100	93	66	07/09/08	74.7	64.6	PUR
N. Myrtle Creek above Bilger Creek - 2009	90	83	57	100	100	75	07/28/09	78.9	69.4	PUR
N. Myrtle Creek above Bilger Creek - 2010	81	63	48	98	95	79	07/25/10	73.9	64.2	PUR
N. Myrtle Creek at Division St - 2005	77	63	52	100	100	93	08/06/05	75.6	65.7	PUR
N. Myrtle Creek at Division St - 2007	83	79	65	100	100	89	07/11/07	78.0	70.3	PUR
N. Myrtle Creek at Evergreen Park - 2008	63	59	56	100	95	89	08/16/08	78.8	68.4	PUR
N. Myrtle Creek at Evergreen Park - 2009	90	86	74	100	100	95	07/29/09	82.1	71.1	PUR
N. Myrtle Creek at Evergreen Park - 2010	82	61	50	98	95	82	08/17/10	75.2	66.6	PUR
N. Myrtle Creek at Mouth - Reference - 2005	84	73	57	100	100	91	07/29/05	75.6	66.6	PUR - Reference
N. Myrtle Creek at Mouth - Reference - 2006	90	83	66	100	100	88	07/24/06	81.0	72.0	PUR - Reference
N. Myrtle Creek at Mouth - Reference - 2007	89	82	67	100	100	91	07/11/07	77.5	70.5	PUR - Reference
N. Myrtle Creek at Mouth - Reference - 2008	101	77	55	100	95	79	08/16/08	74.6	69.1	PUR - Reference
N. Myrtle Creek at Mouth - Reference - 2009	112	98	78	100	100	95	07/28/09	81.5	70.8	PUR - Reference
N. Myrtle Creek at Mouth - Reference - 2010	94	67	51	98	95	82	08/16/10	75.0	65.5	PUR - Reference
N. Myrtle Creek at N. Myrtle Park - 2005	70	61	45	100	100	80	07/18/05	73.4	62.6	PUR
N. Myrtle Creek at N. Myrtle Park - 2006	72	68	47	100	100	80	07/24/06	77.5	68.4	PUR
N. Myrtle Creek at N. Myrtle Park - 2007	81	77	48	100	100	70	07/10/07	74.0	62.8	PUR
N. Myrtle Creek at N. Myrtle Park - 2008	61	57	33	98	91	48	07/09/08	72.2	62.4	PUR
N. Myrtle Creek at N. Myrtle Park - 2009	90	83	62	100	100	84	07/28/09	77.2	68.1	PUR
N. Myrtle Creek at N. Myrtle Park - 2010	80	61	46	98	95	77	07/26/10	72.4	62.6	PUR
N. Myrtle Creek near Confluence with Buck Fork Ck - 2006	57	19	6	91	34	11	07/24/06	71.2	63.1	PUR

Site Name	Total Monitored Days Exceeding ODEQ Criterias			% of Days from 7/9-9/2 Exceeding Criteria - Myrtle Sites			Warmest Day of 7-Day Maximum Stream Temperature			Monitoring Organization or Agency
	Days > 60.8 °F	Days > 64.4 °F	Days > 68 °F	% Days > 60.8 °F	% Days > 64.4 °F	% Days > 68 °F	Date	Maximum Temp (°F)	Minimum Temp (°F)	
Myrtle Creek										
S. Myrtle Creek at 12 Mile Ranch - 2005	57	38	7	100	68	13	07/31/05	68.5	60.4	PUR
S. Myrtle Creek at Neal Lane Bridge - 2005	*39	*39	*36	*100	*100	*95	07/18/05	76.4	67.4	PUR
S. Myrtle Creek at Neal Lane Bridge - 2006	81	74	59	100	98	86	07/23/06	80.9	71.3	PUR
S. Myrtle Creek at Neal Lane Bridge - 2007	69	69	60	100	100	86	07/11/07	77.4	70.1	PUR
S. Myrtle Creek at Neal Lane Bridge - 2008	62	59	51	100	95	80	08/16/08	76.8	68.2	PUR
S. Myrtle Creek at Neal Lane Bridge - 2010	81	61	50	98	95	84	07/25/10	75.0	65.0	PUR
S. Myrtle Creek at Taylor's Property - 2005	71	63	51	100	100	91	07/18/05	76.3	65.8	PUR
S. Myrtle Creek at Taylors Property - 2006	80	77	59	100	100	84	07/24/06	80.3	70.6	PUR
S. Myrtle Creek at Taylors Property - 2007	81	76	62	100	100	91	07/11/07	77.6	69.1	PUR
S. Myrtle Creek at Taylors Property - 2008	82	76	64	100	95	91	07/09/08	75.9	63.5	PUR
S. Myrtle Creek at Taylors Property - 2009	90	84	65	100	100	86	07/29/09	78.6	70.9	PUR
S. Myrtle Creek at Taylor's Property - 2010	82	63	50	100	95	82	07/28/10	74.7	65.5	PUR
S. Myrtle Creek at Top of Golf Course - 2005	75	63	46	100	100	82	07/18/05	76.4	67.1	PUR
S. Myrtle Creek at Top of Golf Course - 2006	79	76	57	100	100	80	07/24/06	81.6	72.8	PUR
S. Myrtle Creek at Top of Golf Course - 2007	82	79	55	100	100	79	07/11/07	78.2	70.9	PUR
S. Myrtle Creek at Top of Golf Course - 2009	90	84	79	100	98	96	07/28/09	82.9	70.0	PUR
S. Myrtle Creek at Top of Golf Course - 2010	80	63	51	98	96	84	08/17/10	76.1	66.8	PUR
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2005	58	44	15	100	79	27	07/18/05	69.7	62.4	PUR
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2006	71	37	8	96	54	13	07/24/06	73.7	66.4	PUR
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2007	76	46	7	100	68	11	07/11/07	70.6	65.0	PUR
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2008	59	36	5	95	54	9	08/16/08	71.8	63.4	PUR
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2009	81	46	21	98	71	32	07/29/09	74.7	65.7	PUR
S. Myrtle Creek below Bridge at 11200 S. Myrtle Ck Rd - 2010	56	36	7	93	61	13	08/16/10	69.2	61.1	PUR
Weaver Creek above 1st Culvert - 2005	58	38	2	100	68	4	08/05/05	67.9	60.6	PUR
Weaver Creek above 1st Culvert - 2007	64	25	1	89	36	2	07/11/07	68.1	64.1	PUR
Weaver Creek above 1st Culvert - 2008	61	25	1	88	25	2	08/16/08	68.7	63.3	PUR
Weaver Creek above 1st Culvert - 2009	74	28	9	95	45	16	07/30/09	71.8	66.3	PUR
Weaver Creek above 1st Culvert - 2010	51	15	0	84	27	0	07/26/10	65.8	60.4	PUR

*Short Data Set

Site Name	Start Date	Stop date	Seasonal Maximum Stream Temperature		Seasonal Minimum Stream Temperature		Seasonal Maximum ΔT		7-Day Averages			
			Date	(°F)	Date	(°F)	Date	(Δ °F)	Date	Maximum Temp (°F)	Minimum Temp (°F)	ΔT (Δ °F)
South Umpqua												
Canyon Creek near Mouth - 2009	07/15/09	09/08/09	07/30/09	79.5	09/08/09	56.1	07/16/09	8.5	07/31/09	77.8	71.0	6.8
Canyon Creek near Mouth - 2010	06/17/10	09/29/10	08/17/10	73.4	06/20/10	53.4	07/07/10	10.2	08/16/10	71.7	65.1	6.6
Days Creek above Fate Creek - 2006	07/09/06	09/23/06	07/24/06	73.8	09/17/06	53.6	07/20/06	9.3	07/25/06	72.2	65.3	6.8
Days Creek above Fate Creek - 2008	07/02/08	08/14/08	07/09/08	69.4	08/03/08	57.0	07/13/08	8.7	07/11/08	68.5	60.4	8.2
Days Creek above Fate Creek 7.02.09 to 7.20.09 - 2009	07/02/09	07/20/09	07/04/09	68.5	07/07/09	57.8	07/04/09	8.7	07/17/09	67.0	59.9	7.2
Days Creek above Fate Creek 8.03.09 to 9.05.09 - 2009	08/03/09	09/05/09	08/03/09	69.3	09/03/09	57.8	09/02/09	6.3	08/06/09	65.6	63.2	2.4
Days Creek above Fate Creek - 2010	06/17/10	09/29/10	07/26/10	67.9	06/17/10	50.7	07/06/10	8.5	07/25/10	66.9	60.1	6.7
Days Creek above Woods Creek - 2008	07/02/08	09/02/08	08/16/08	79.2	09/02/08	53.1	07/13/08	13.6	08/14/08	75.2	64.5	10.7
Days Creek above Woods Creek - 2009	07/15/09	09/08/09	07/28/09	75.6	09/08/09	53.8	07/15/09	12.8	07/31/09	74.4	68.5	5.9
Days Creek above Woods Creek - 2010	06/17/10	09/29/10	07/11/10	74.2	06/17/10	51.5	07/15/10	12.9	07/26/10	73.0	63.1	9.9
Fate Creek at Lowest Extent of BLM - 2005	05/26/05	09/22/05	07/18/05	66.7	09/22/05	47.1	07/26/05	10.2	07/20/05	65.3	57.1	8.3
Fate Creek at Lowest Extent of BLM - 2006	05/26/06	10/25/06	07/24/06	70.4	10/11/06	43.3	06/24/06	11.1	07/25/06	68.2	59.4	8.8
Fate Creek at Lowest Extent of BLM - 2007	05/17/07	09/16/07	07/11/07	65.5	05/22/07	46.9	08/02/07	10.2	07/08/07	64.4	56.0	8.4
Fate Creek at Lowest Extent of BLM - 2008	06/10/08	09/24/08	08/16/08	66.6	09/23/08	47.1	07/13/08	9.9	08/14/08	64.2	56.6	7.6
Fate Creek at Lowest Extent of BLM - 2009	06/19/09	11/16/09	07/30/09	67.1	11/16/09	41.8	08/04/09	7.4	07/31/09	66.2	60.5	5.8
Fate Creek at Lowest Extent of BLM - 2010	05/26/10	09/21/10	08/17/10	65.1	09/05/10	47.9	09/05/10	9.5	08/15/10	63.8	55.9	8.0
Fate Creek near Mouth - 2006	07/09/06	09/23/06	07/24/06	67.0	09/23/06	50.6	09/01/06	5.0	07/25/06	65.4	62.1	3.3
Fate Creek near Mouth - 2010	06/17/10	09/29/10	08/17/10	68.6	09/12/10	50.8	08/24/10	9.4	08/16/10	67.0	59.2	7.8
S. Umpqua above Canyon Creek - 2008	07/02/08	09/02/08	08/16/08	86.2	09/02/08	61.5	07/26/08	11.6	08/14/08	82.7	73.1	9.6
S. Umpqua above Canyon Creek - 2009	07/15/09	09/01/09	07/30/09	89.3	08/24/09	66.3	08/19/09	12.2	07/31/09	88.0	78.2	9.8
S. Umpqua above Canyon Creek 6.17.10 to 7.13.10 - 2010	06/17/10	07/13/10	07/11/10	80.7	06/17/10	54.5	07/13/10	10.5	07/10/10	77.8	69.9	7.9
S. Umpqua above Canyon Creek 7.29.10 to 9.29.10 - 2010	07/29/10	09/29/10	08/16/10	83.4	09/23/10	59.6	08/24/10	11.9	08/16/10	81.9	72.7	9.1
Woods Creek at Mouth - 2008	07/02/08	09/02/08	08/16/08	71.1	09/02/08	53.4	08/05/08	8.3	08/15/08	68.4	63.2	5.2
Woods Creek at Mouth - 2009	07/15/09	09/08/09	07/30/09	75.7	09/08/09	52.8	08/19/09	9.3	07/31/09	74.0	67.6	6.5
Woods Creek at Mouth - 2010	06/17/10	09/29/10	08/17/10	68.2	06/17/10	51.4	07/06/10	7.5	08/16/10	66.6	61.4	5.3

Site Name	Total Monitored Days Exceeding ODEQ Criteria			% of Days from 7/16-8/31 Exceeding Criteria - SUmp. Sites			Warmest Day of 7-Day Maximum Stream Temperature			Monitoring Organization or Agency
	Days > 60.8 °F	Days > 64.4 °F	Days > 68 °F	% Days > 60.8 °F	% Days > 64.4 °F	% Days > 68 °F	Date	Maximum Temp (°F)	Minimum Temp (°F)	
South Umpqua										
Canyon Creek near Mouth - 2009	56	52	38	100	98	74	07/30/09	79.5	72.0	PUR
Canyon Creek near Mouth - 2010	93	64	41	98	91	70	08/17/10	73.4	67.2	PUR
Days Creek above Fate Creek - 2006	65	43	17	100	77	28	07/24/06	73.8	67.0	PUR
Days Creek above Fate Creek - 2008	*44	*38	*7	*97	*77	*0	07/09/08	69.4	61.3	PUR
Days Creek above Fate Creek 7.02.09 to 7.20.09 - 2009	19	18	1	100	21	7	07/16/09	67.6	59.2	PUR
Days Creek above Fate Creek 8.03.09 to 9.05.09 - 2009	34	6	2	see above	see above	see above	08/03/09	69.3	66.4	PUR
Days Creek above Fate Creek - 2010	68	32	0	83	49	0	07/26/10	67.9	60.9	PUR
Days Creek above Woods Creek - 2008	63	60	55	100	98	87	08/16/08	79.2	67.6	PUR
Days Creek above Woods Creek - 2009	55	45	28	100	87	57	07/28/09	75.6	68.4	PUR
Days Creek above Woods Creek - 2010	92	59	42	94	79	68	07/25/10	73.6	62.8	PUR
Fate Creek at Lowest Extent of BLM - 2005	60	21	0	87	43	0	07/18/05	66.7	58.0	BLM
Fate Creek at Lowest Extent of BLM - 2006	72	20	3	87	19	6	07/24/06	70.4	61.8	BLM
Fate Creek at Lowest Extent of BLM - 2007	54	5	0	70	4	0	07/11/07	65.5	59.8	BLM
Fate Creek at Lowest Extent of BLM - 2008	53	3	0	74	4	0	08/16/08	66.6	59.1	BLM
Fate Creek at Lowest Extent of BLM - 2009	30	9	0	57	19	0	07/30/09	67.1	60.8	BLM
Fate Creek at Lowest Extent of BLM - 2010	41	3	0	66	6	0	08/16/10	65.1	57.4	BLM
Fate Creek near Mouth - 2006	20	6	0	32	13	0	07/24/06	67.0	64.1	PUR
Fate Creek near Mouth - 2010	63	30	2	91	53	4	08/17/10	68.6	61.1	PUR
S. Umpqua above Canyon Creek - 2008	63	63	63	100	100	100	08/16/08	86.2	75.6	PUR
S. Umpqua above Canyon Creek - 2009	49	49	49	100	100	100	07/30/09	89.3	79.6	PUR
S. Umpqua above Canyon Creek 6.17.10 to 7.13.10 - 2010	24	23	20	100	100	97	07/11/10	80.7	72.9	PUR
S. Umpqua above Canyon Creek 7.29.10 to 9.29.10 - 2010	63	63	57	see above	see above	see above	08/16/10	83.4	73.4	PUR
Woods Creek at Mouth - 2008	60	38	5	98	51	11	08/16/08	71.1	65.5	PUR
Woods Creek at Mouth - 2009	53	40	20	100	77	43	07/30/09	75.7	68.4	PUR
Woods Creek at Mouth - 2010	65	29	2	91	49	4	08/17/10	68.2	63.3	PUR

*Short Data Set

Site Name	Start Date	Stop date	Seasonal Maximum Stream Temperature		Seasonal Minimum Stream Temperature		Seasonal Maximum ΔT		7-Day Averages			
			Date	(°F)	Date	(°F)	Date	(Δ °F)	Date	Maximum Temp (°F)	Minimum Temp (°F)	ΔT (Δ °F)
Umpqua												
Charlotte Creek near mouth - 2008	05/22/08	10/02/08	08/14/08	61.7	05/23/08	47.8	06/27/08	6.7	08/14/08	60.8	57.2	3.5
Dean Creek at Hitchcocks - 2008	05/23/08	05/26/09	07/09/08	79.7	12/17/08	41.0	07/08/08	13.0	07/09/08	76.7	66.0	10.7
Dean Creek at Hwy 38 Bridge - 2008	05/22/08	05/26/09	07/09/08	78.7	12/17/08	38.0	05/22/08	15.3	07/10/08	77.2	70.7	6.5
Dean Creek at Hwy 38 Bridge - 2010	07/24/10	11/01/10	07/24/10	75.4	10/27/10	49.9	08/23/10	9.4	07/27/10	73.0	66.5	6.5
Dean Creek at Furthest Upstream Bridge - 2008	05/23/08	09/29/08	07/09/08	65.3	06/08/08	48.0	06/19/08	11.1	07/11/08	64.3	58.0	6.3
Dean Creek at Furthest Upstream Bridge - 2009	08/05/09	10/04/09	08/11/09	63.6	10/04/09	50.9	08/10/09	5.2	08/11/09	63.1	59.7	3.4
Dean Creek at Furthest Upstream Bridge - 2010	07/24/10	11/01/10	07/24/10	65.1	10/27/10	49.7	07/24/10	6.1	07/27/10	63.1	59.2	3.9
Elk Creek near Mouth - 2010	07/24/10	11/01/10	08/16/10	79.3	10/29/10	50.0	08/24/10	10.4	08/15/10	77.7	69.7	8.0
Fitzpatrick Creek at Mehl Road - 2009	07/23/09	09/23/09	07/29/09	68.4	09/23/09	53.4	09/17/09	6.8	07/29/09	67.0	62.9	4.1
Heddin Creek Upstream from Mehl Road Culvert - 2009	07/23/09	10/04/09	07/29/09	71.7	10/04/09	46.1	09/22/09	10.0	07/29/09	69.2	63.8	5.4
Lutsinger Creek at Old Road Crossing - 2009	07/23/09	10/04/09	07/28/09	72.6	10/04/09	47.0	07/27/09	7.5	07/30/09	69.8	64.1	5.7
Mehl Creek at Mehl Rd - 2009	07/23/09	10/04/09	07/29/09	70.7	10/04/09	47.9	07/25/09	5.8	07/30/09	69.2	65.1	4.0
Mill Ck near end of Tidal Influence (1.4 mi. from Hwy 38)-2008	07/24/08	09/29/08	08/14/08	78.2	09/23/08	55.1	07/24/08	10.8	08/13/08	76.1	67.8	8.3
Mill Creek 0.3 Miles Upstream from Hwy 38 - 2008	07/23/08	09/29/08	08/16/08	76.7	09/28/08	59.7	08/29/08	7.9	08/16/08	75.8	69.3	6.5
Scholfield Creek above Hwy 101 Bridge - 2008	05/22/08	10/02/08	07/08/08	77.8	06/02/08	49.8	06/15/08	14.0	07/10/08	75.2	69.6	5.6
Umpqua River at Discovery Center - 2009	08/05/09	08/31/09	08/11/09	72.7	08/20/09	61.1	08/20/09	9.8	08/13/09	71.9	66.9	5.0
Umpqua River at Discovery Center - 2010	07/23/10	11/01/10	07/23/10	71.5	10/31/10	52.3	08/09/10	9.6	07/26/10	70.5	62.3	8.3
Weatherly Creek near Mouth - 2009	07/23/09	10/04/09	07/28/09	72.0	10/04/09	47.5	07/27/09	7.8	07/29/09	69.5	63.4	6.1
Yellow Creek near Mouth - 2008	06/26/08	09/29/08	08/16/08	76.4	09/23/08	51.1	08/11/08	11.1	08/14/08	74.1	64.7	9.5
Yellow Creek near Mouth - 2009	07/11/09	10/04/09	07/28/09	81.0	10/04/09	48.6	07/28/09	10.5	07/29/09	78.1	68.9	9.2

Site Name	Total Monitored Days Exceeding ODEQ Criteria			% of Days from 7/24-9/21 Exceeding Criteria - Umpqua Sites			Warmest Day of 7-Day Maximum Stream Temperature			Monitoring Organization or Agency
	Days > 60.8 °F	Days > 64.4 °F	Days > 68 °F	% Days > 60.8 °F	% Days > 64.4 °F	% Days > 68 °F	Date	Maximum Temp (°F)	Minimum Temp (°F)	
Umpqua										
Charlotte Creek near mouth - 2008	3	0	0	5	0	0	08/14/08	61.7	57.1	PUR
Dean Creek at Hitchcocks - 2008	126	94	80	100	100	83	07/09/08	79.7	67.7	PUR
Dean Creek at Hwy 38 Bridge - 2008	137	114	87	100	100	90	07/09/08	78.7	72.9	PUR
Dean Creek at Hwy 38 Bridge - 2010	86	75	57	100	100	87	07/24/10	75.4	66.8	PUR
Dean Creek at Furthest Upstream Bridge - 2008	63	3	0	63	0	0	07/09/08	65.3	58.9	PUR
Dean Creek at Furthest Upstream Bridge - 2009	32	0	0	53	0	0	08/10/09	63.6	58.4	PUR
Dean Creek at Furthest Upstream Bridge - 2010	44	1	0	63	2	0	07/24/10	65.1	58.9	PUR
Elk Creek near Mouth - 2010	79	71	53	100	100	80	08/14/10	79.3	70.3	PUR
Fitzpatrick Creek at Mehl Road - 2009	29	12	2	47	20	3	07/28/09	68.4	64.1	PUR
Heddin Creek Upstream from Mehl Road Culvert - 2009	49	16	5	80	27	8	07/29/09	71.7	66.1	PUR
Lutsinger Creek at Old Road Crossing - 2009	43	17	6	70	28	10	07/28/09	72.6	65.8	PUR
Mehl Creek at Mehl Rd - 2009	34	15	6	55	25	10	07/29/09	70.7	67.2	PUR
Mill Ck near end of Tidal Influence (1.4 Miles from Hwy 38) - 2008	67	55	42	100	92	70	08/14/08	78.2	68.7	PUR
Mill Creek 0.3 Miles Upstream from Hwy 38 - 2008	69	68	57	100	100	93	08/16/08	76.7	69.3	PUR
Scholfield Creek above Hwy 101 Bridge - 2008	124	100	72	100	95	70	07/08/08	77.8	70.1	PUR
Umpqua River at Discovery Center - 2009	*27	*27	*27	*45	*45	*45	08/11/09	72.7	67.7	PUR
Umpqua River at Discovery Center - 2010	85	75	43	100	100	68	07/23/10	71.5	63.1	PUR
Weatherly Creek near Mouth - 2009	51	18	6	83	30	10	07/28/09	72.0	64.9	PUR
Yellow Creek near Mouth - 2008	87	78	55	98	85	52	08/16/08	76.4	66.1	PUR
Yellow Creek near Mouth - 2009	74	57	36	98	75	43	07/28/09	81.0	70.5	PUR

* Short Data Set

Appendix K: ODEQ Heat Source Simulation for Olalla-Lookingglass Creek

Heat Source simulations were performed by ODEQ for July 12-31, 2002 for the Umpqua Basin TMDL. "These temperatures represent the summertime critical period for Olalla-Lookingglass Creek. This simulation began a few miles upstream of where Berry Creek enters Olalla Creek. Berry Creek's flows are augmented by cool reservoir withdrawals, resulting in about a 12°C reduction in temperature under the current conditions (at approximately river mile 19). The natural thermal potential simulation assumes that the reservoir does not exist, and uses "natural" flows and temperature inputs for Berry Creek. The result is that the natural thermal potential of Olalla-Lookingglass Creek is warmer than the current stream temperature in many reaches." (ODEQ, 2006)

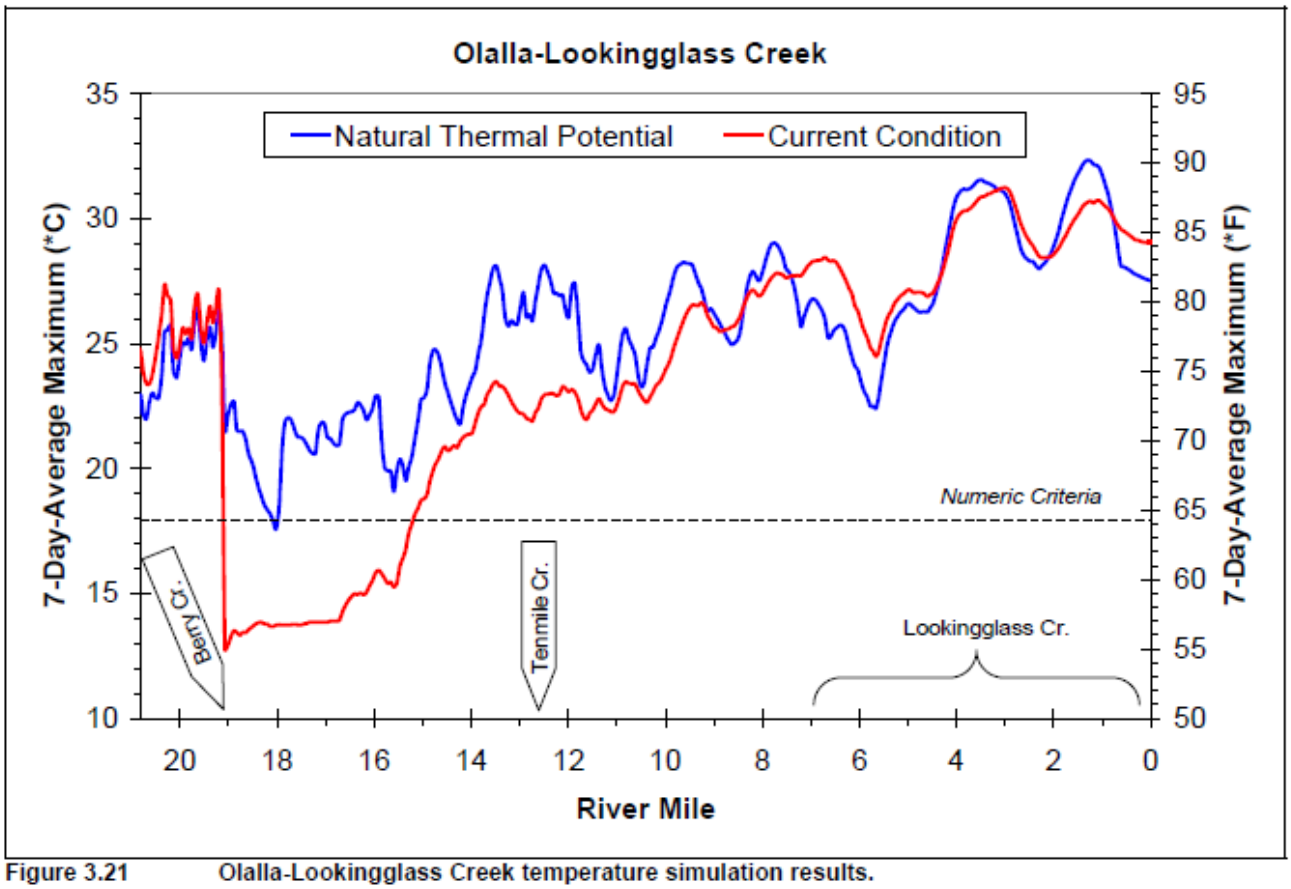


Figure 3.21 Olalla-Lookingglass Creek temperature simulation results.

(ODEQ, 2006)