Quality Assurance & Quality Control for Water Quality Monitoring Programs

Or

Dave Allan's Is This Weird or What

Prepared by Dave Allan

Presented to Real-Time Water Quality Monitoring Workshop,

St John's Newfoundland and Labrador

June 7 & 8, 2011

Allan Environmental Services Inc

What is Quality Assurance (QA) & Quality Control (QC)?

Quality Assurance

refers to planned systematic processes that provide confidence in a measurement process' ability to achieve its intended outcome

Quality Control

activities focus on finding defects in specific elements of the measurement process

QA/QC in Everyday Life

- Many do not realize the presence of QA/QC programs in their everyday lives.

- Whenever a product is measured to be sold, the device that measures the weight or volume has to be certified on a regular basis.

Examples:

- Automobile filling stations must have their gasoline pumps certified to deliver the correct volume by a government agency.

- Grocers must have certified weigh scales for meat or fish that is sold by mass.

The "True Value" What is Real?

- An important fundamental of any QA/QC program is determination of what will be considered the "true value" of a measurement.
- To determine the true value, many choose another means of measuring the parameter of interest, such as another instrument that is kept serviced and calibrated just for quality control purposes or a grab sample that is evaluated using a trusted laboratory technique.
- Calibration standards could be used as a reference as well.

QA/QC Program Fundamentals

- One of the most important considerations of QA/QC measurements is that they support or verify the measurements taken by the instrument whether for real-time, grab, or profile sampling.
- To eliminate variations caused by differences in time or sample location, the QA/QC measurement should be in the same place and time as the instrument making the measurement.
- This means that if an instrument is lowered to a certain depth, the QC measurement should be taken at the same depth as close to the same time as possible.

Eliminating Variation

- Eliminating all sources of variation in measurement process and proving data accuracy can quickly become impractical and cost prohibitive.
- Furthermore, as the amount of experience with instrumentation grows, whether through general use or rigorous data collection and analysis, it becomes clear that each instrument is slightly different and that calibration cannot be the sole measure of performance.
- Ultimately, reasonable acceptance criteria need to be established that can be used to evaluate measurement results.
- Thorough understanding of the variables that affect measurement results, minimizing the variations in the measurement process, and executing thoughtful QA/QC strategies will allow instrumentation users to establish acceptance criteria confidently and get the most useful water resource data from their equipment.

Planning For Quality Assurance (QA/QC)

- For most surface water sampling projects, planning for a minimum of 10% effort for QA/QC is a good rule-of-thumb.
- This means that one in ten samples should be a duplicate sample, laboratory blank, bottle blank, calibration check, etc.

Field Methods for QA/QC

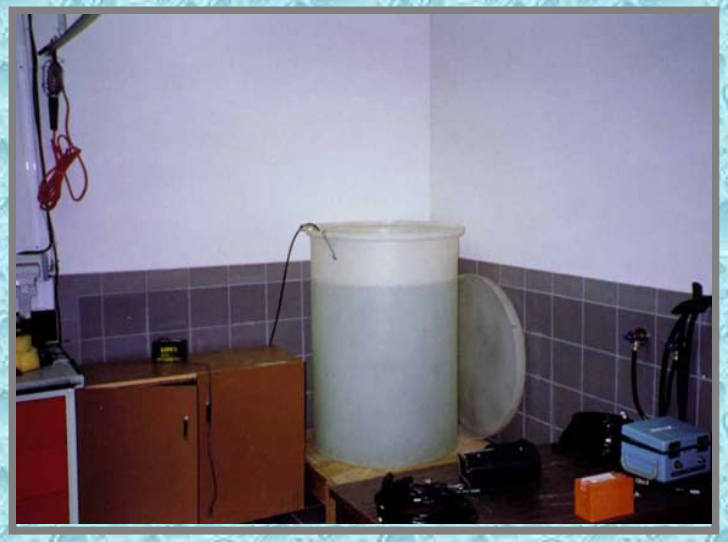
- Independent field measurements are extremely important in that they are the only check to determine the accuracy and performance of the water quality instrument's measurements.
- Field measurements should be obtained as frequently as budgets and practicality allow to verify performance of the instruments or to verify unusual occurrences.

Use of the QA/QC Data

- From the quality control measurements it will become evident just how long before sensor drift will begin to have an effect on data quality. Also it will help to determine if maintenance and calibrations have been done correctly.
- Usually dependent on the productivity of the water, fouling or sensor drift.
- Analysis of historical data from QA/QC programs allows the water resource professional to set strict acceptance criteria for the data collected.
- When QA/QC programs are executed rigorously, little of the data collected is rejected due to inability to meet the acceptance criteria

Laboratory Methods for QA/QC

- With more and more water quality instruments being used for most water monitoring programs, it quickly becomes evident that an efficient method of testing each instrument's performance is required.
- Tank testing can be used as a measurement of the precision and performance among the units of a group.
- With such a mass-testing approach, one is able to demonstrate that unit A is measuring the same as unit B, as is unit C, and so on.



Laboratory Methods for QA/QC

- Tank testing can be accomplished in a 600-liter water tank with the water circulated by a submersible pump inside the tank.
- Up to ten instruments can be tested together at one time to determine their performance as a group.
- Each unit is prepared, as it would be to go into the field and is allowed to stabilize in the test tank for a few hours before the test is to begin.
- Measurements for all parameters are recorded by each unit every five minutes for the 12 to 24 hours of the test.
- The data from each instrument are retrieved and graphed by parameter to show variation.
- Graphs for each parameter from each group of instruments should show a difference in variation less than the acceptance criteria for that parameter. Users can employ sophisticated statistical comparisons, or set up simple pass/fail criteria.

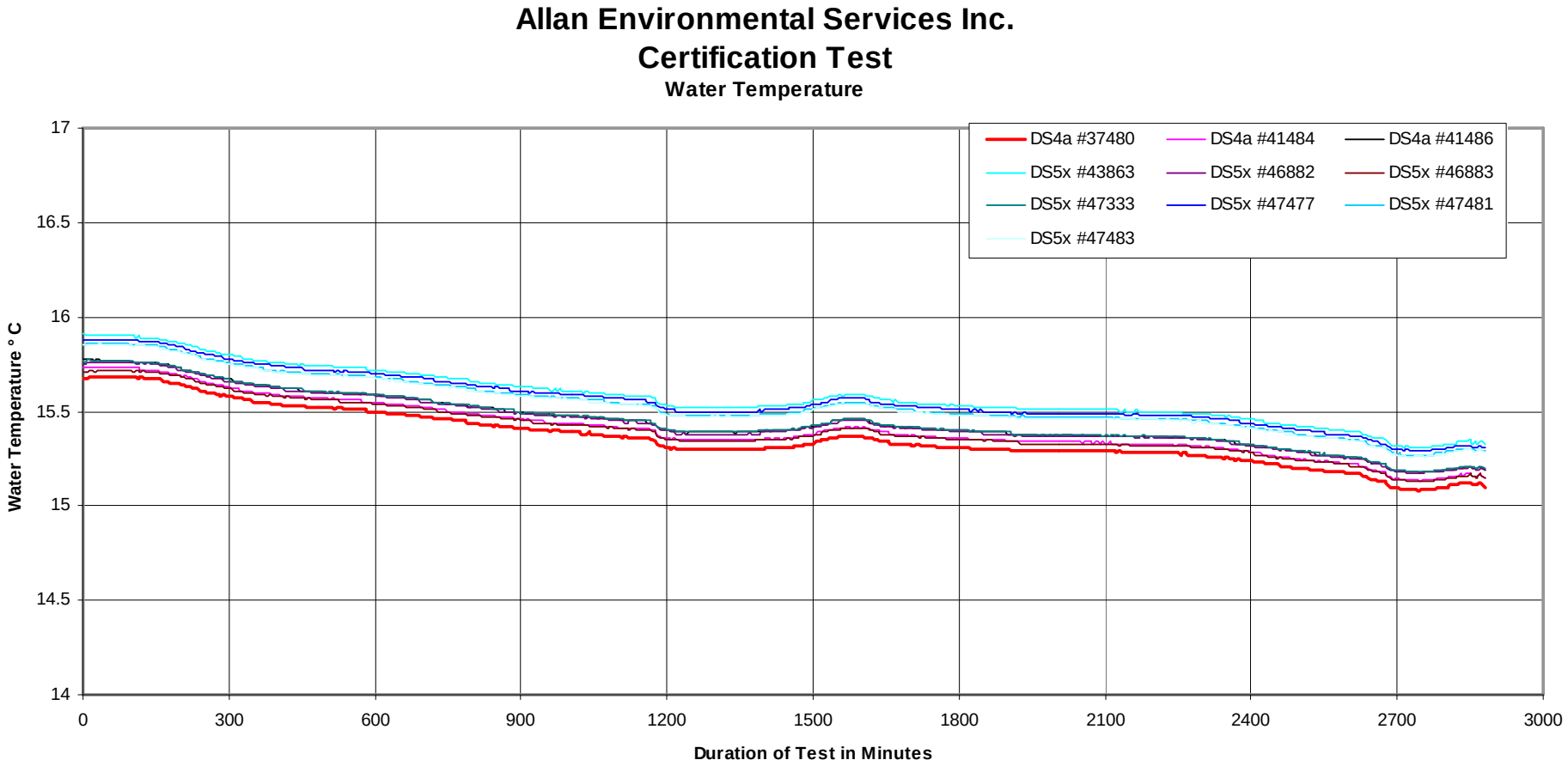
Laboratory Methods for QA/QC

- Individual units that appear to be outside the group or are obviously malfunctioning need to be repaired and then retested in the same manner.
- Some repairs are basic and can be done by the user while other instruments require changing a sensor or a board, dependent on the nature of the problem.
- More complicated repairs should be left to a trained professional.

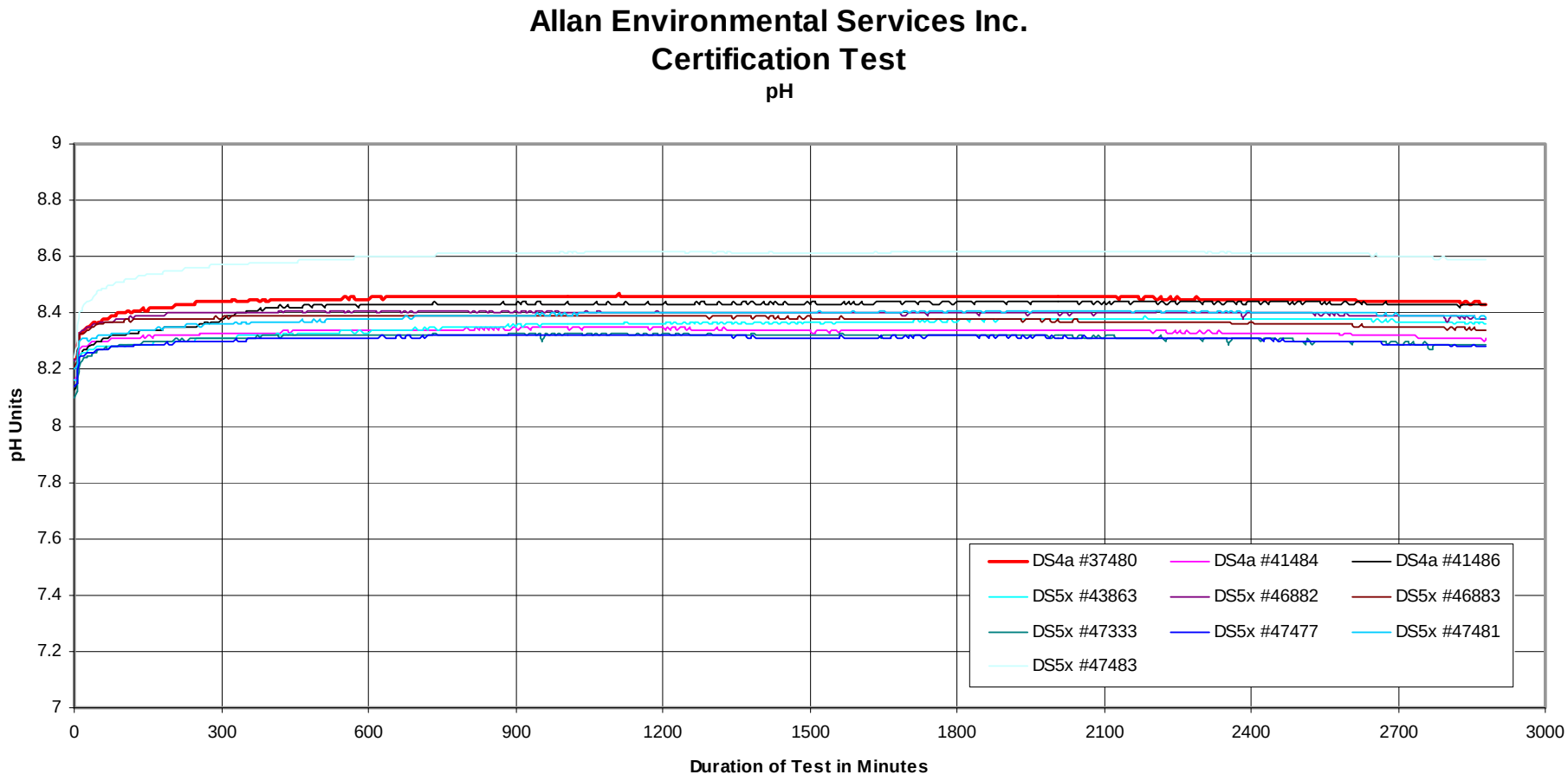
Dave Allan's

Is This Weird or What

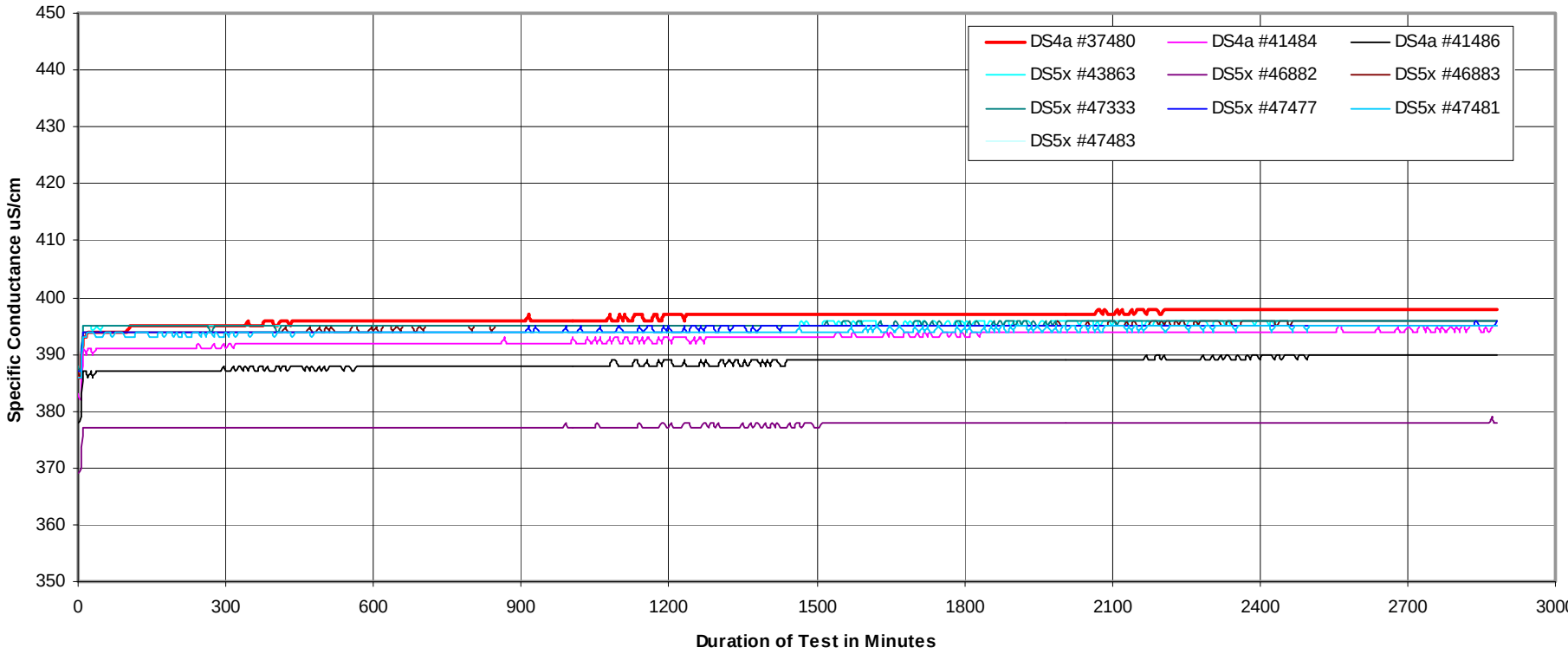
Laboratory Methods for QA/QC



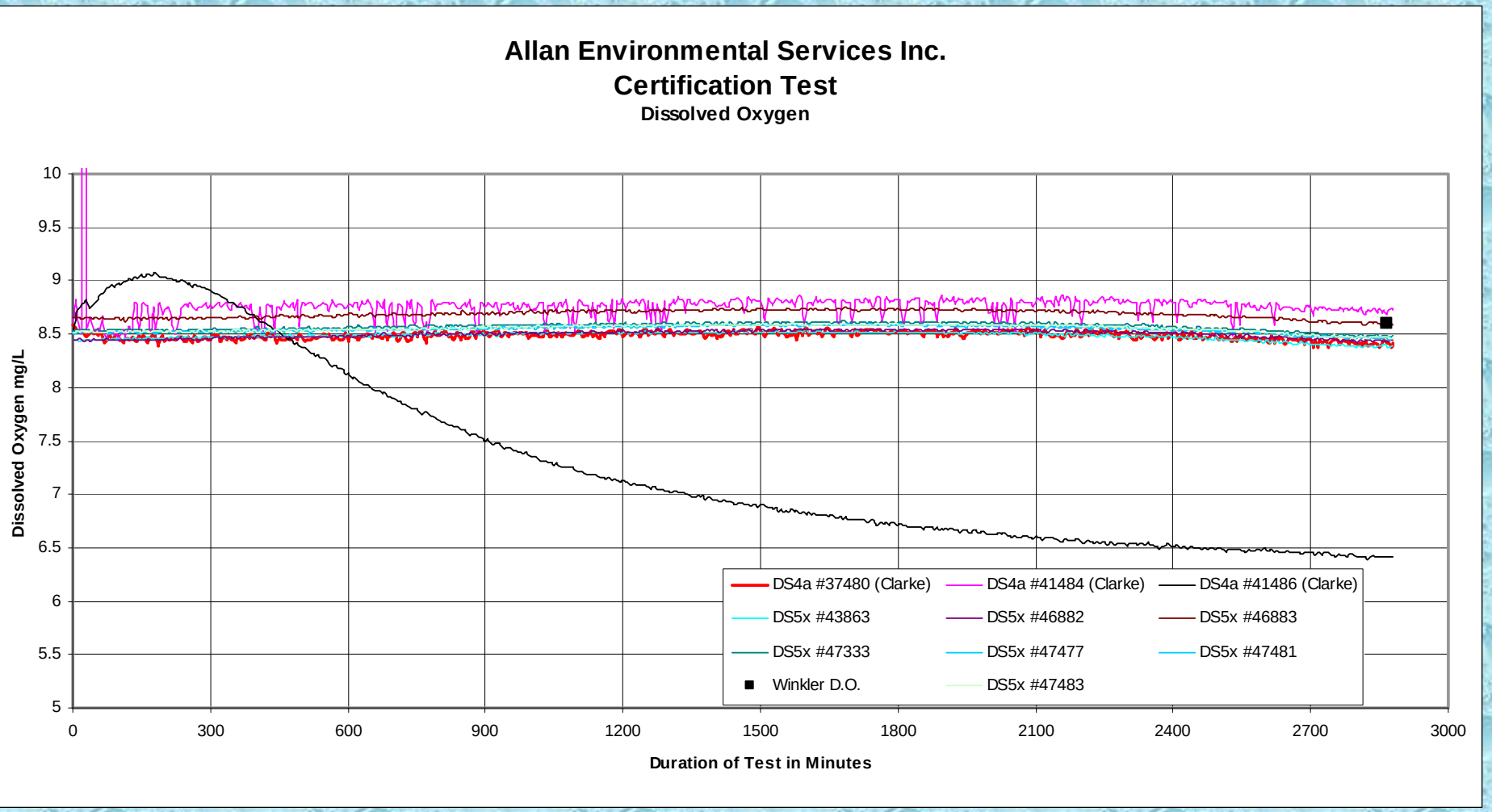
Laboratory Methods for QA/QC



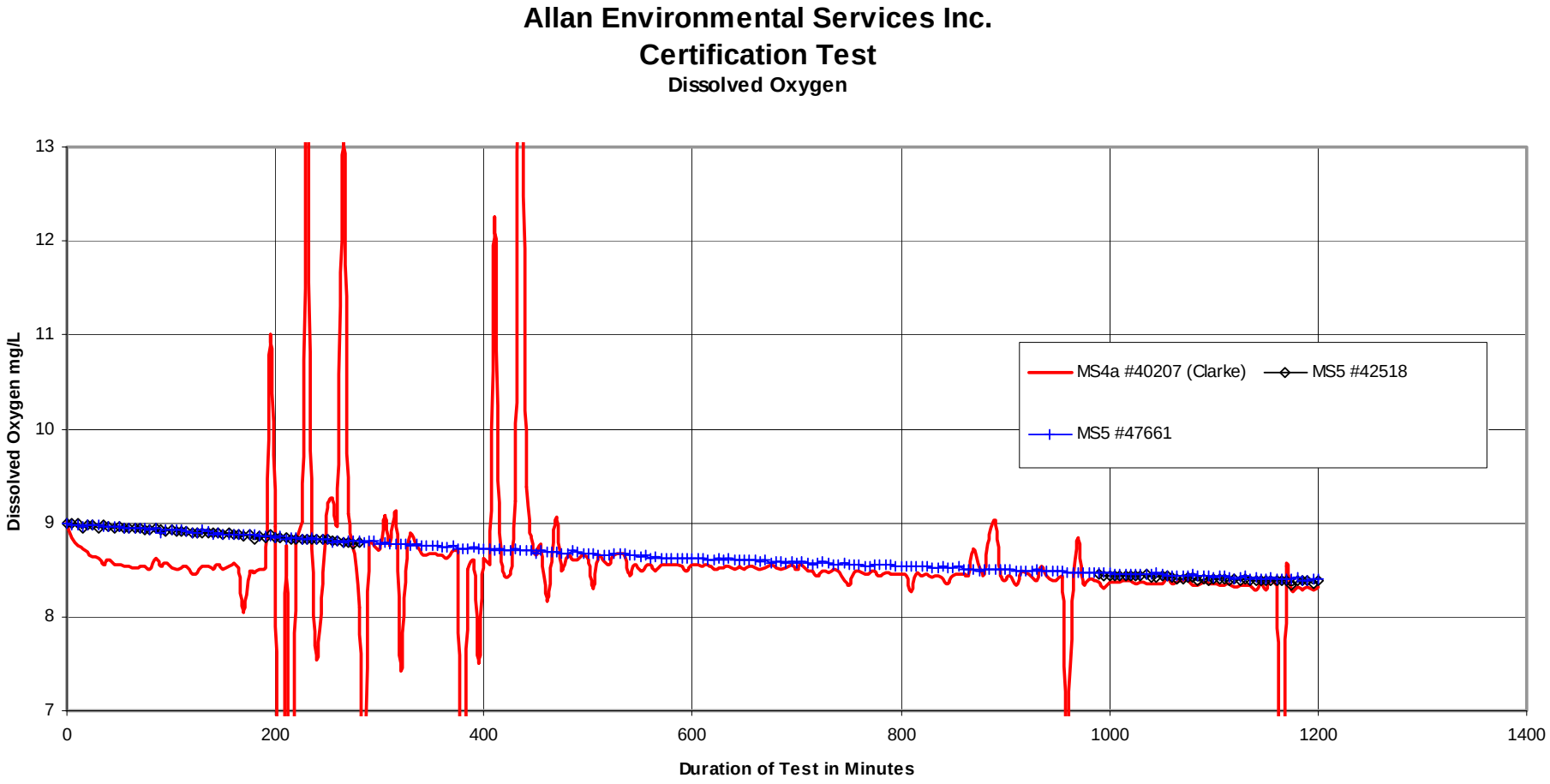
Laboratory Methods for QA/QC



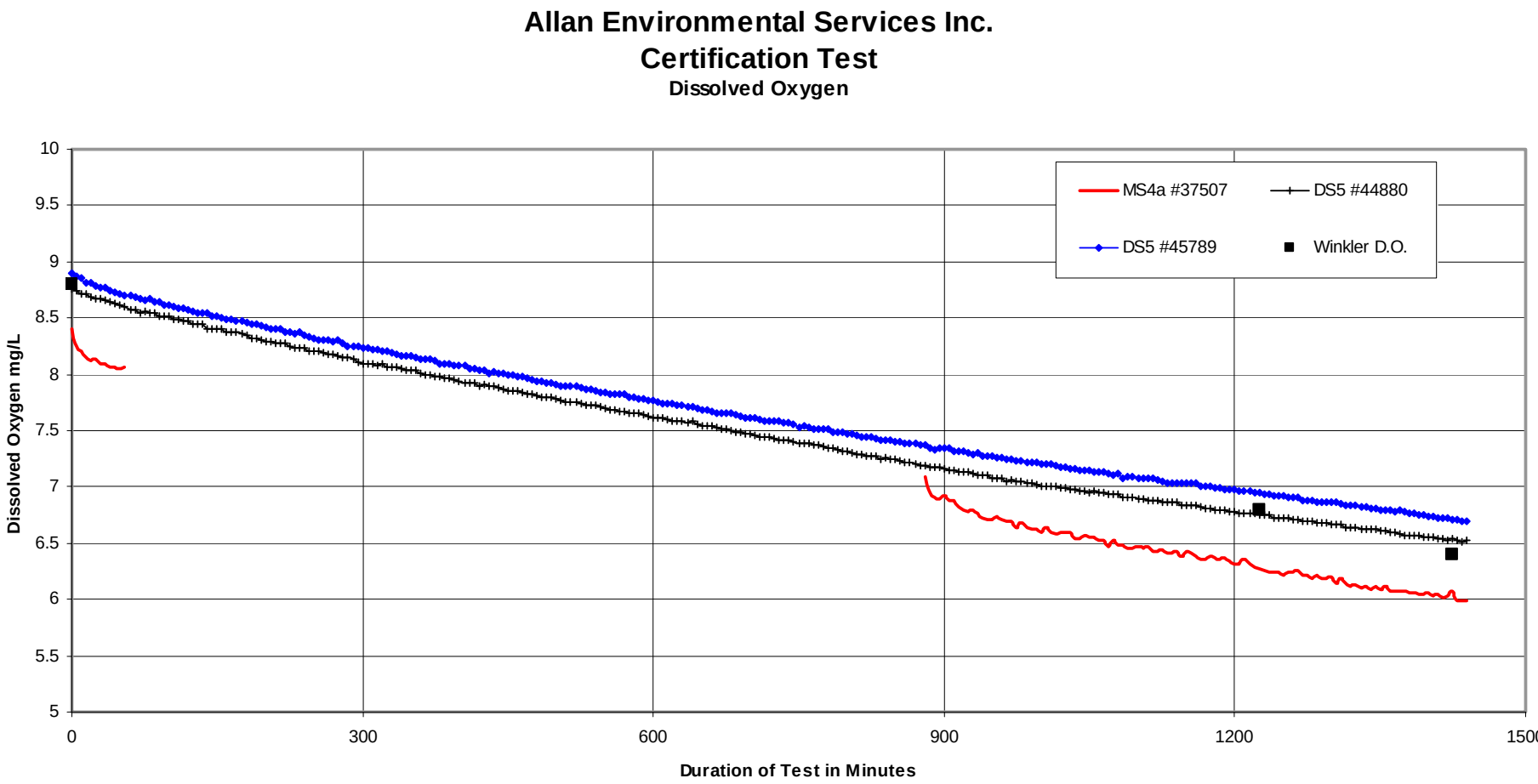
Laboratory Methods for QA/QC



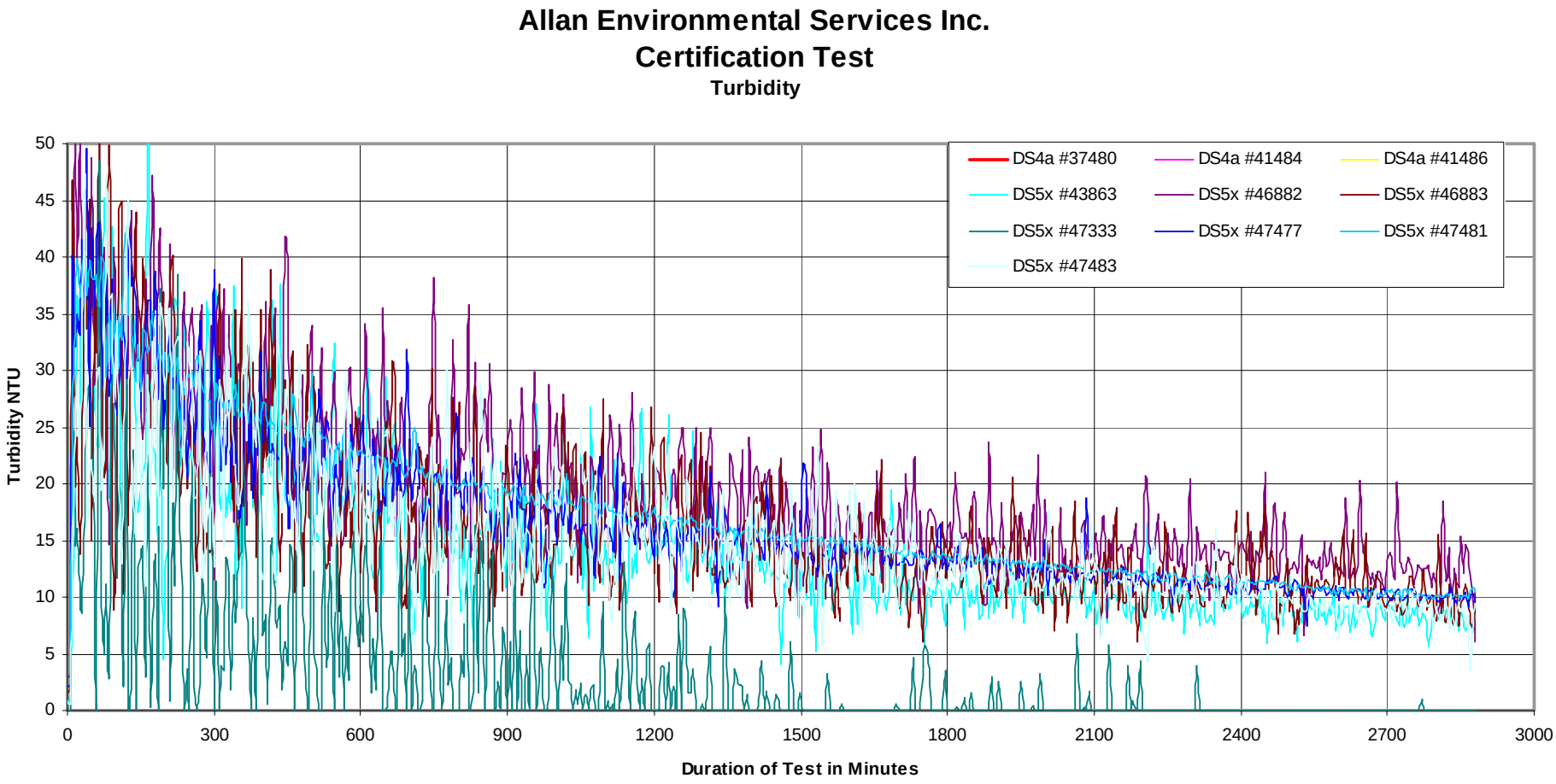
Laboratory Methods for QA/QC



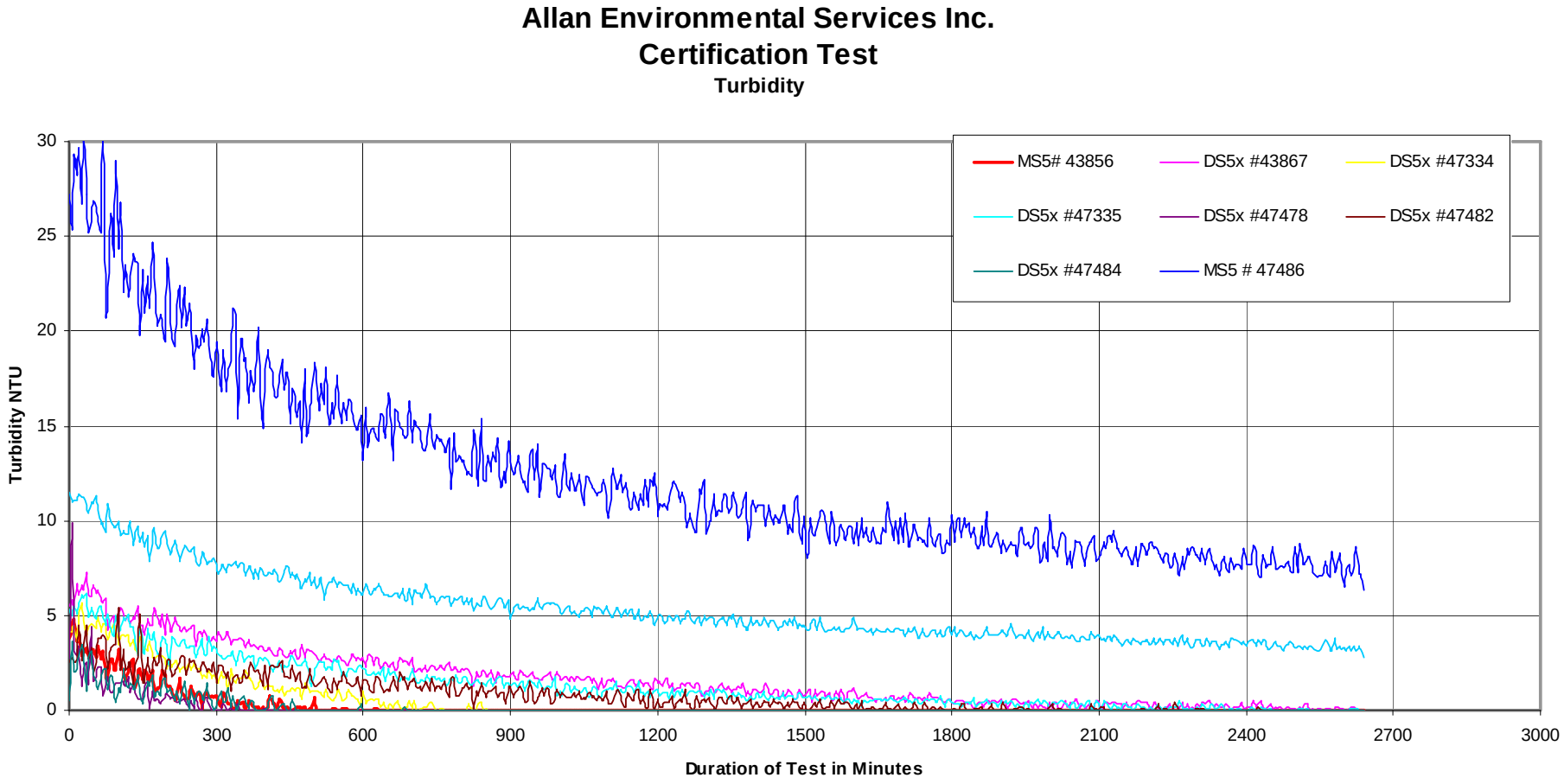
Laboratory Methods for QA/QC



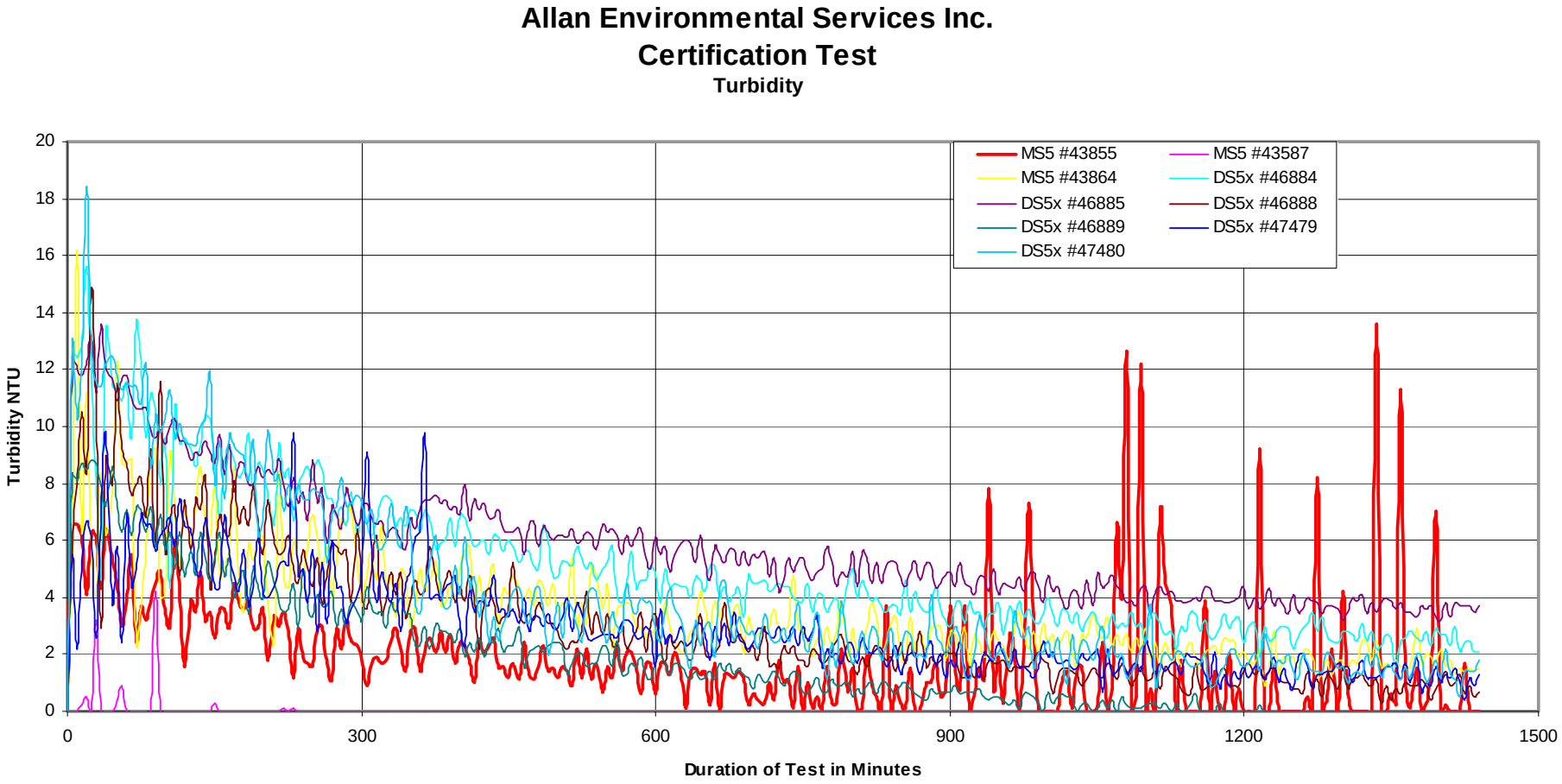
Laboratory Methods for QA/QC



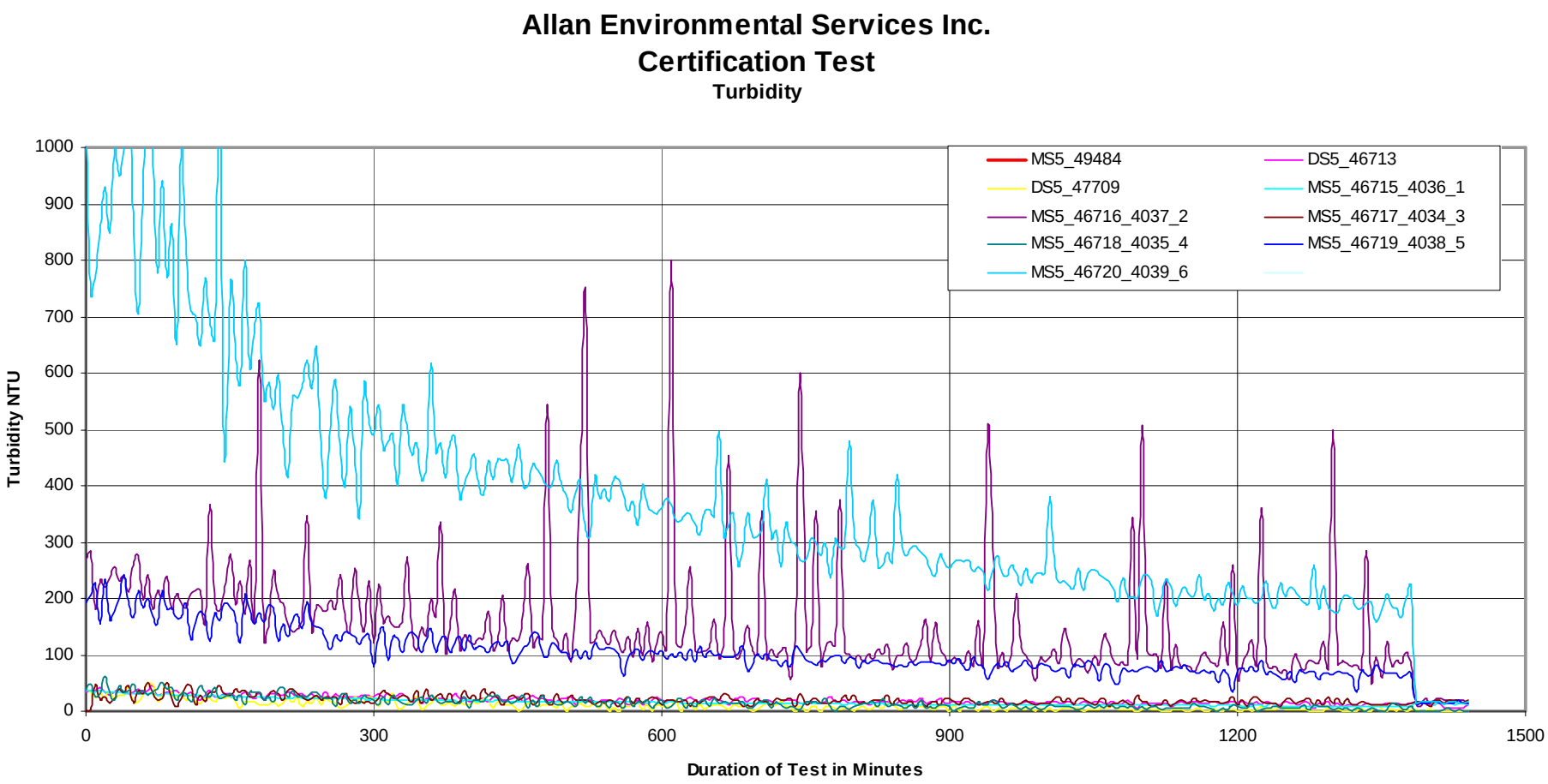
Laboratory Methods for QA/QC



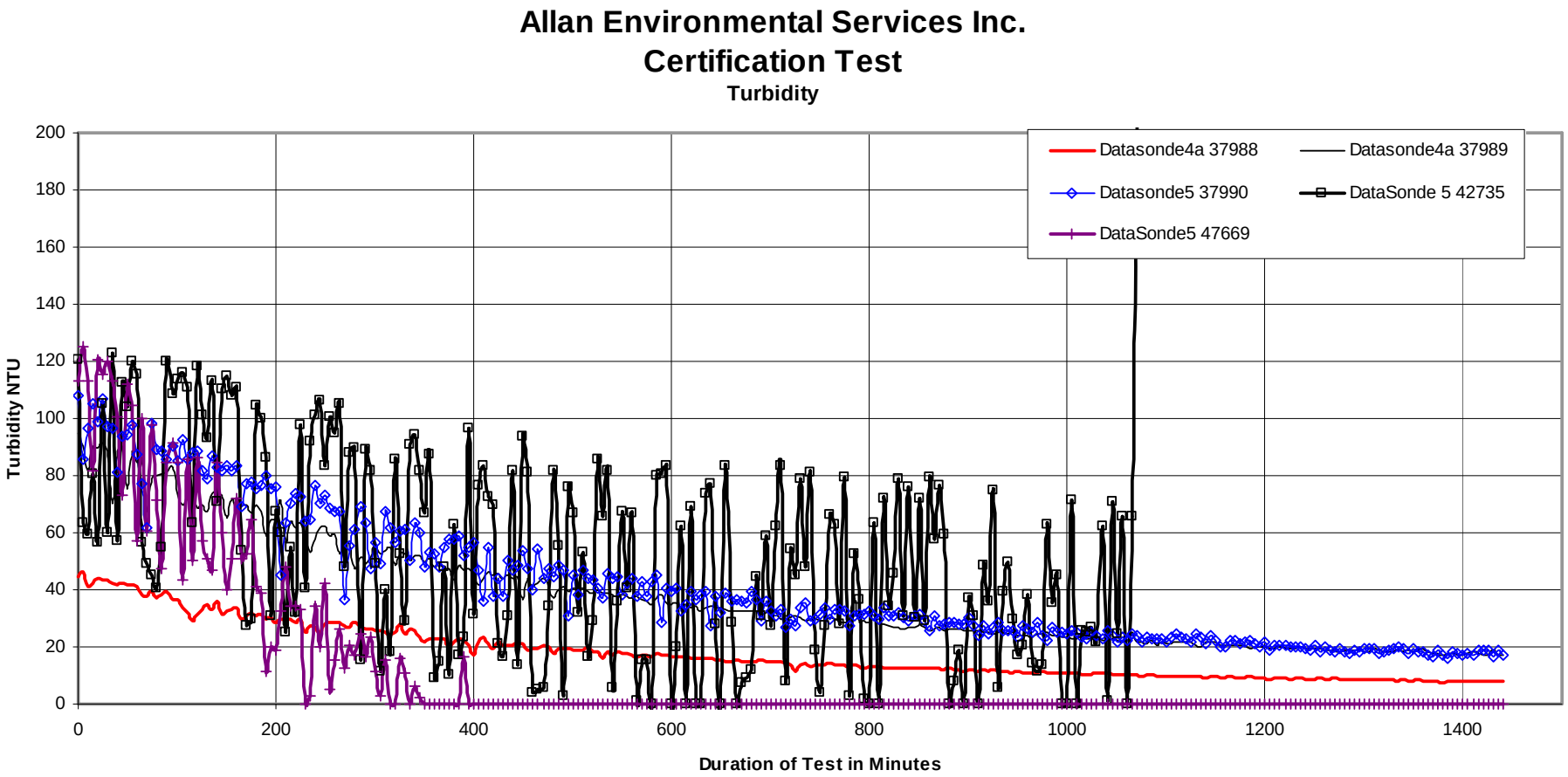
Laboratory Methods for QA/QC



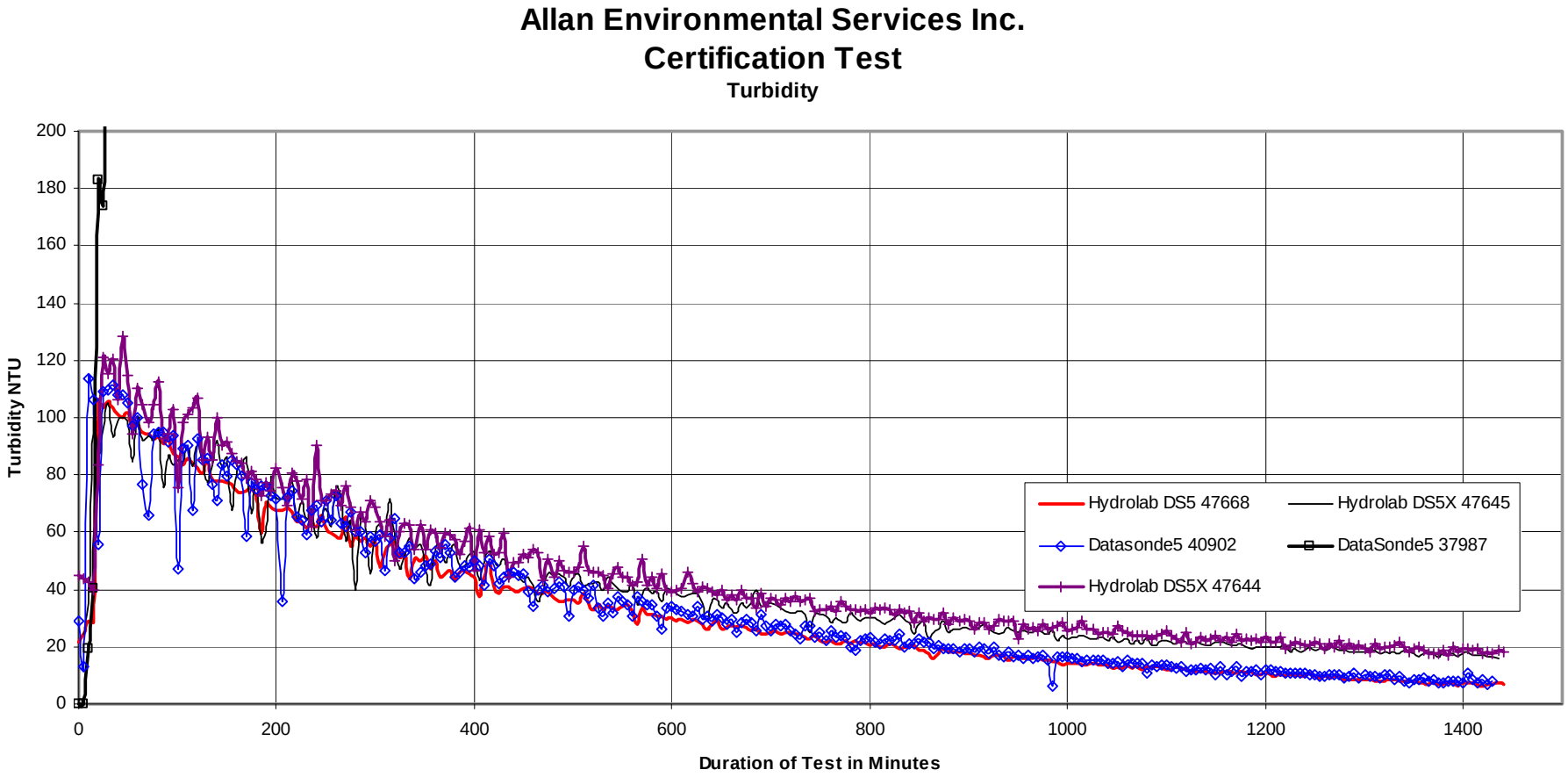
Laboratory Methods for QA/QC



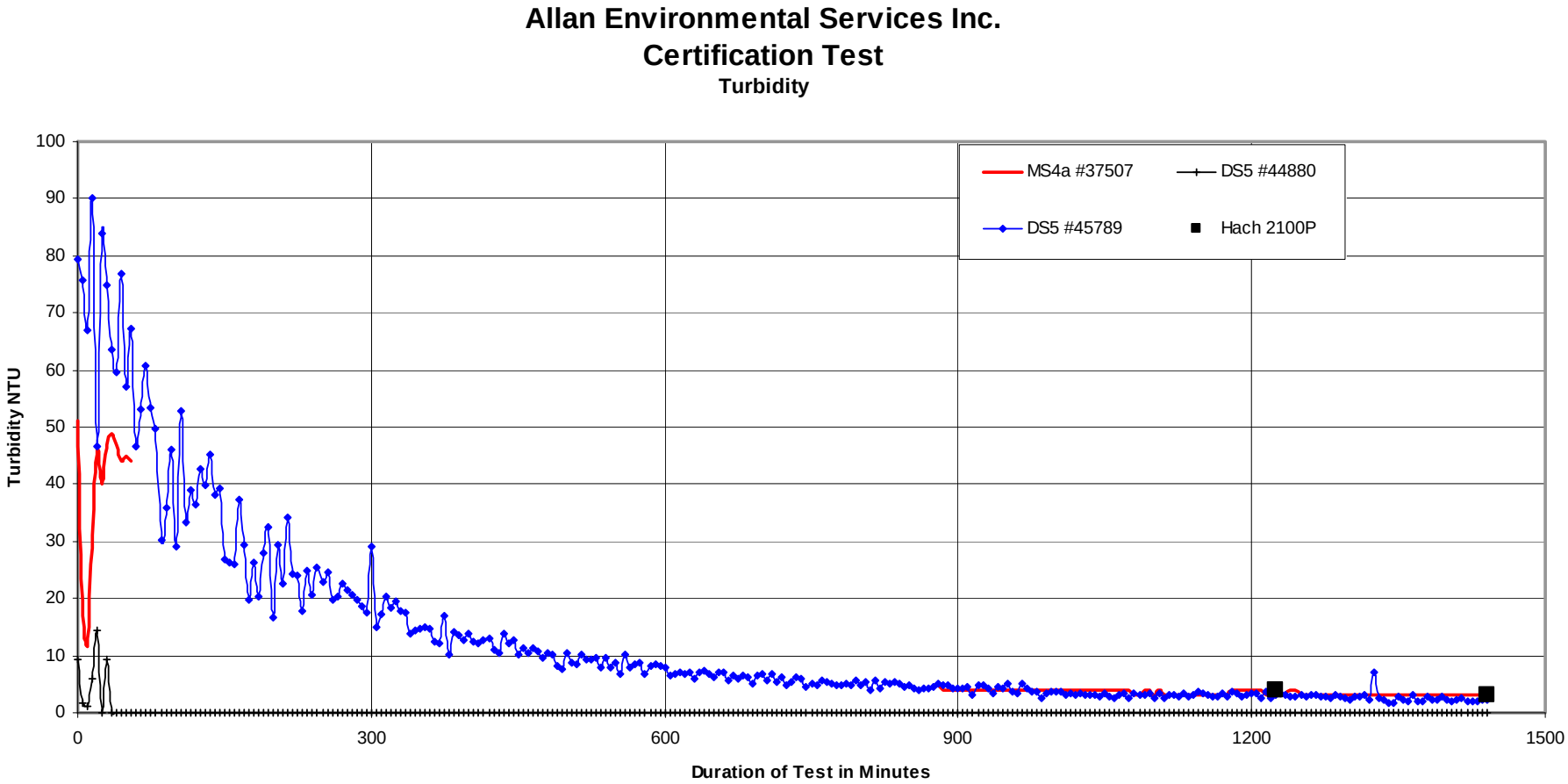
Laboratory Methods for QA/QC



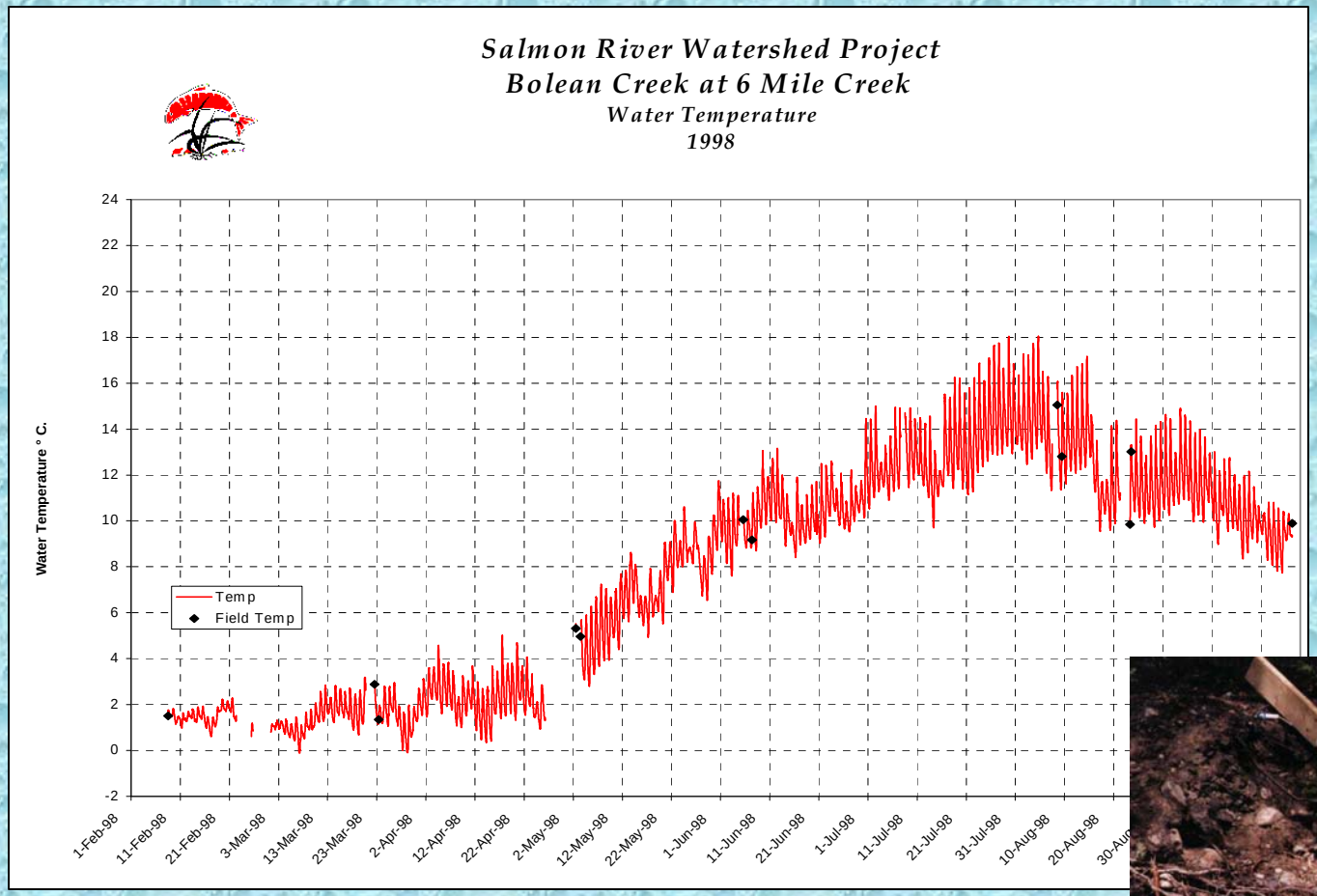
Laboratory Methods for QA/QC



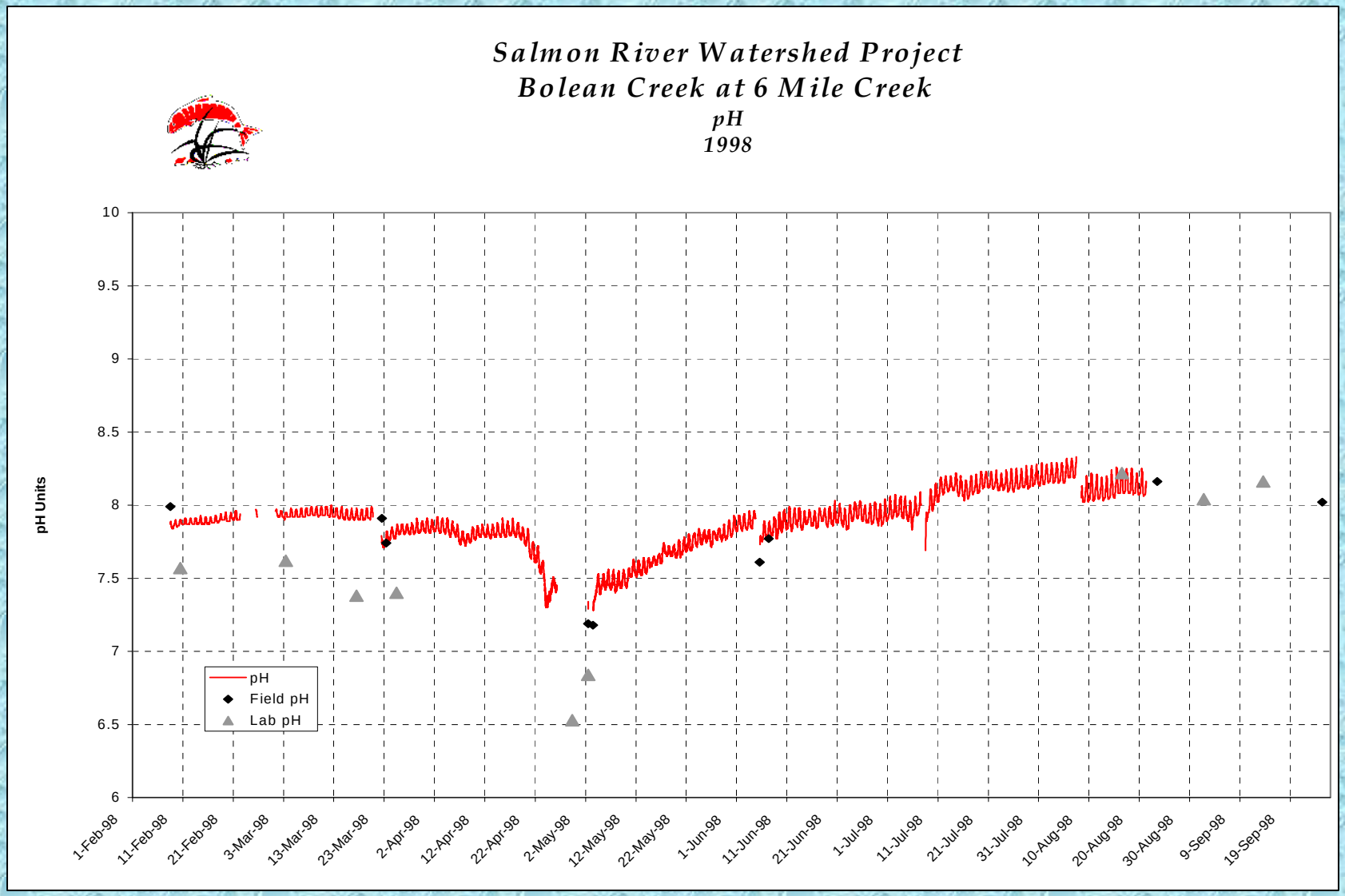
Laboratory Methods for QA/QC



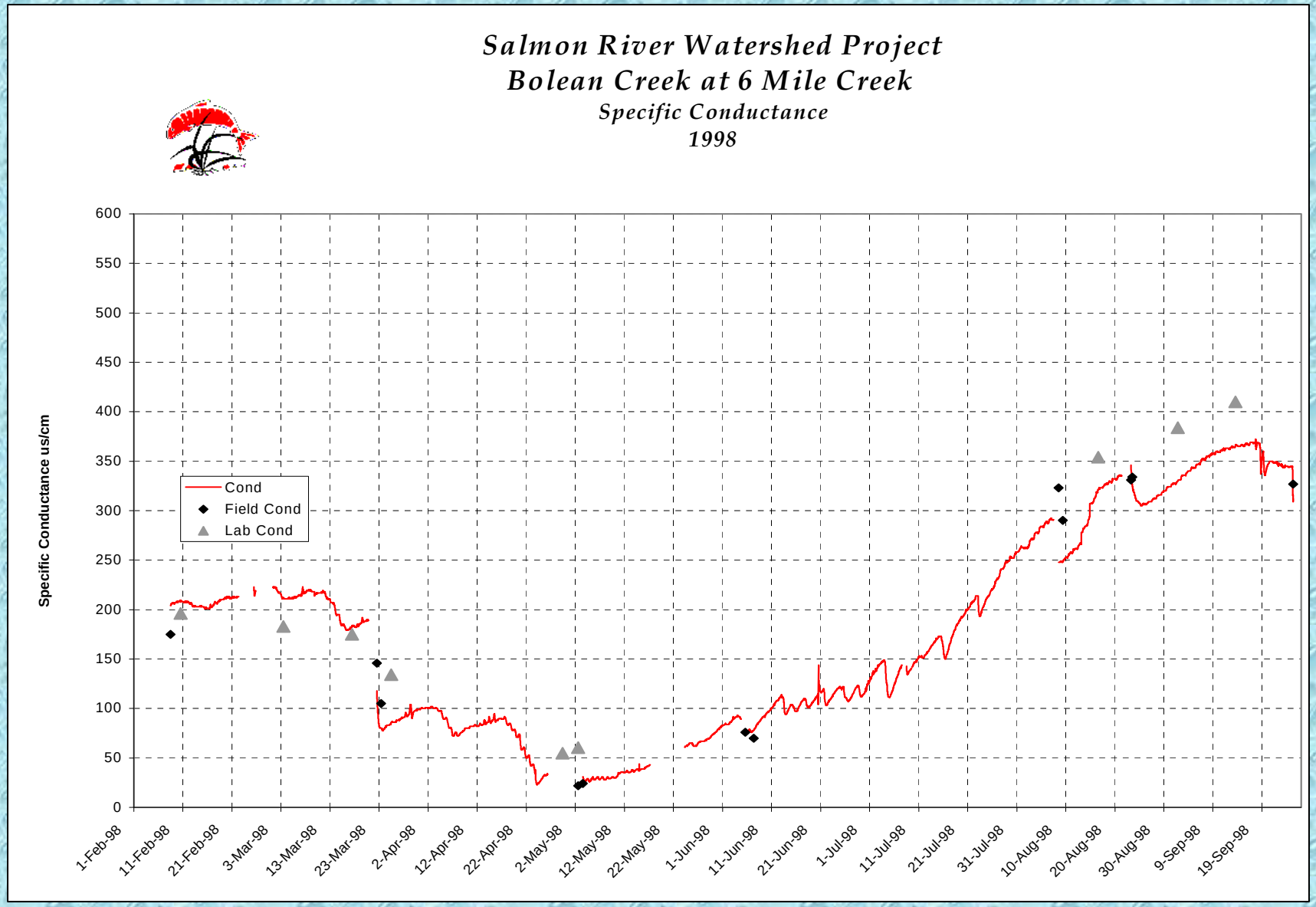
Real Life Examples



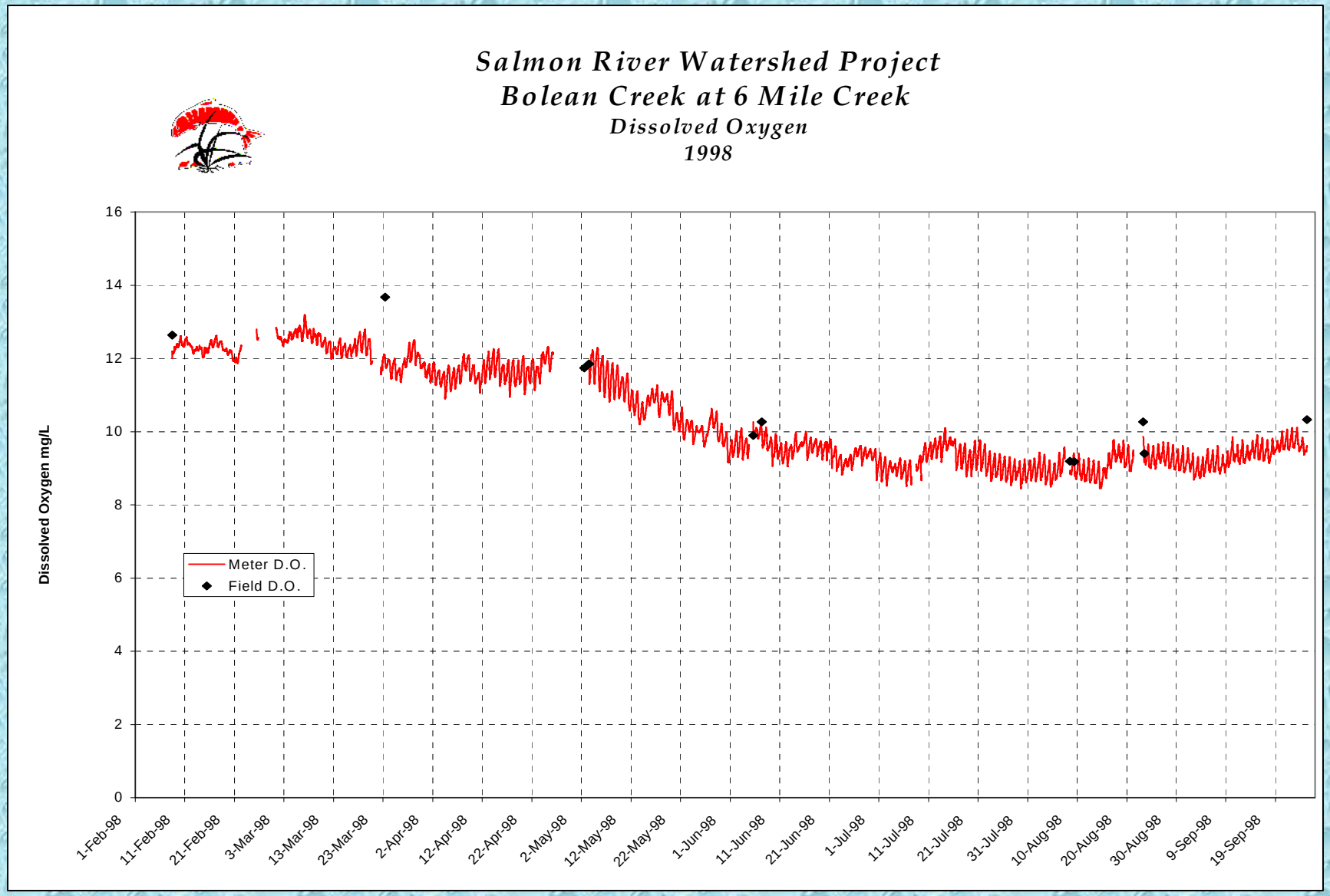
Real Life Examples



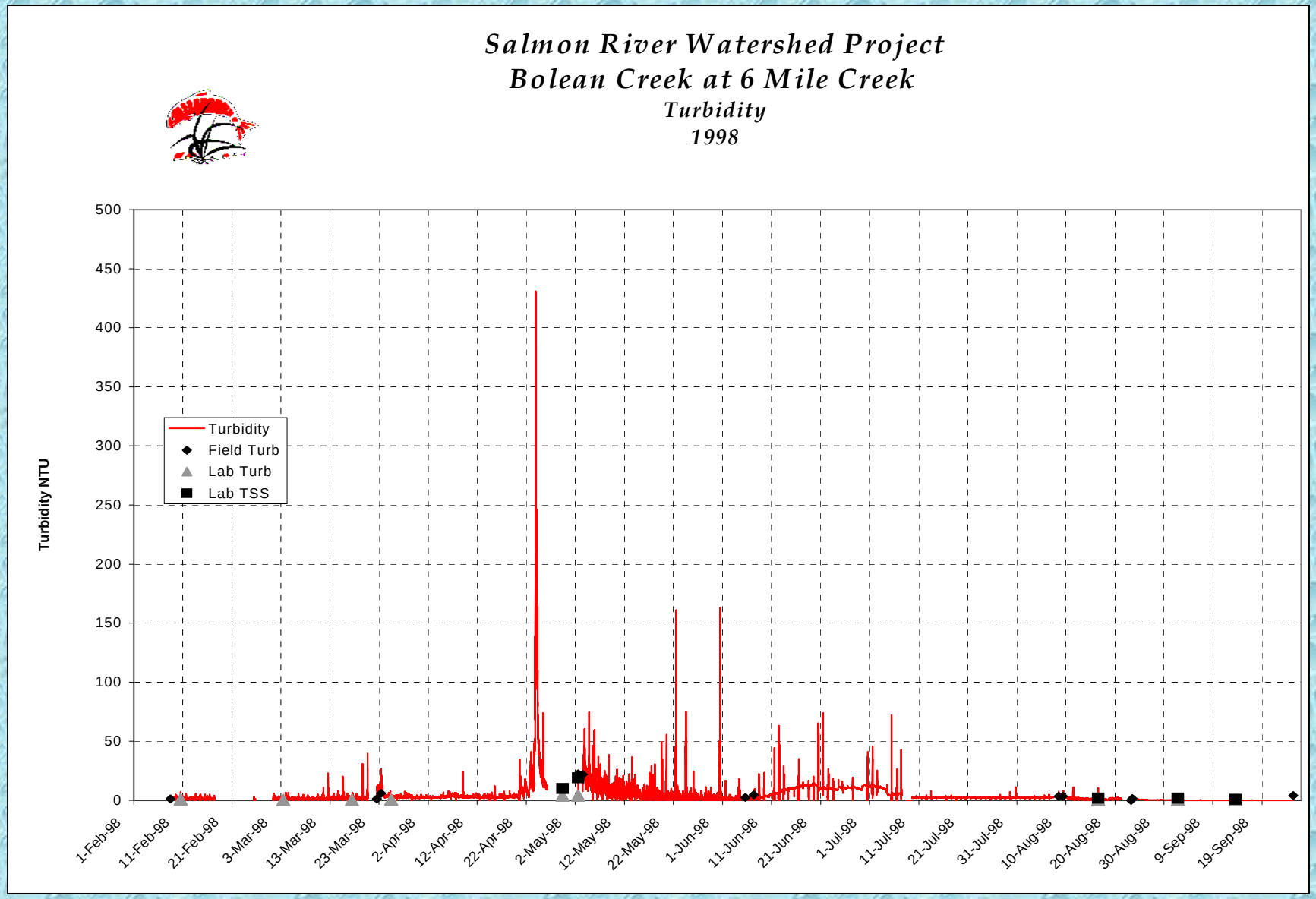
Real Life Examples



Real Life Examples



Real Life Examples



Summary/Conclusion

- **Today's water quality instrumentation is quite capable of producing high quality data for many applications.**
- **In the end, the commitment that water resource professionals place on the program dictate the QA/QC program that they carry out, and thus the quality of data that is generated.**
- **We can't assume any measurement is accurate unless he/she has the QA/QC measurement to back it up**.

Questions ?