2011 In-Stream Temperature Monitoring Report

City of Corvallis
Public Works Department

November 2011

Created by James Green

Introduction

Purpose:

The 2011 In-stream Temperature Monitoring Project was a continuation of the 2010 monitoring season which began a collection baseline data for in-stream temperature influences that originate within the Corvallis City limits. The 2011 data is intended to be part of an ongoing data collection effort that can be used to inform future City of Corvallis water quality management decisions. This monitoring effort was conducted for educational purposes only and was not required by the Oregon Department of Environmental Quality (DEQ) or the United States Environmental Protection Agency (EPA).

Background:

According to DEQ Willamette Basin Rivers and Streams Assessment (*Mulvey 2009*), warm water is the single most extensive water quality impairment in the Willamette Basin. Nearly 70% of the streams and rivers within the basin were found to consistently exceed the state temperature criteria for protecting sensitive cold water fish like salmon and trout during summer months. The Upper Willamette Basin, which includes Corvallis, had the second greatest extent of biological impairment and was ranked fourth worst for overall water quality in DEQ's basin assessment. Leading water quality stressors were excessively high water temperatures, low dissolved oxygen levels, and high total suspended solids.

Oregon Water Quality Temperature Standards are established to protect each freshwater phase of the salmon and trout lifecycle. Standards identify where and when each phase of the lifecycle occurs and includes numeric criteria necessary to protect it. Currently Oregon Water Quality Temperature Standards *(Oregon Administrative Rules)* for fish use designations are as follows:

1) salmon /trout rearing and migration, 18.0°C
2) core cold water habitat identification, 16.0°C
3) salmon and steelhead spawning, 13.0°C

The water quality criteria that best applies to the Willamette River during the summer months is 18.0°C (*Ades 2007*). This is the water quality standard used throughout this report to analyze the 2011 in-stream temperature monitoring data.

Although it is not currently required by state or federal regulations, the City of Corvallis initiated this in-stream temperature monitoring effort as an anticipatory measure to collect baseline temperature data which will serve to inform future water quality management decisions. This data is not intended to meet any water quality permit or compliance requirements.

Methods

Previous Monitoring Efforts:

In compliance with federal Endangered Species Act (ESA) protection regulations, the City initiated the Salmon Response Plan (*Dillinger and Jones 2004*) to identify citizen

and city-sponsored activities that negatively impact Chinook salmon habitat in Corvallis, and to develop protocol aimed to prevent further degradation to salmon habitat and restore the health of impaired waters. As part of the ESA initiative, the City of Corvallis collected in-stream temperature data at 14 Corvallis stream sites in 2001, 2003, and 2004. The four streams that were targeted for in-stream temperature monitoring were Dixon, Dunawi, Oak and Sequoia. The City of Corvallis also voluntarily collects monthly water quality data, including water temperatures, from six downstream sites, to aid in the detection of illicit discharges, and to protect public health and safety.

Project Oversight:
The 2011 In-stream Temperature Monitoring project for the City of Corvallis was originally designed and implemented by AmeriCorps LINKS volunteer Miranda Adams, under the guidance of Gwenn Kubeck, Public Works Stormwater Program Specialist in 2010. Refer to the 'In-stream Temperature Monitoring Protocol' (*Adams 2010*) for a detailed explanation of the methods used to conduct this project, including data collection procedures and data analysis information.

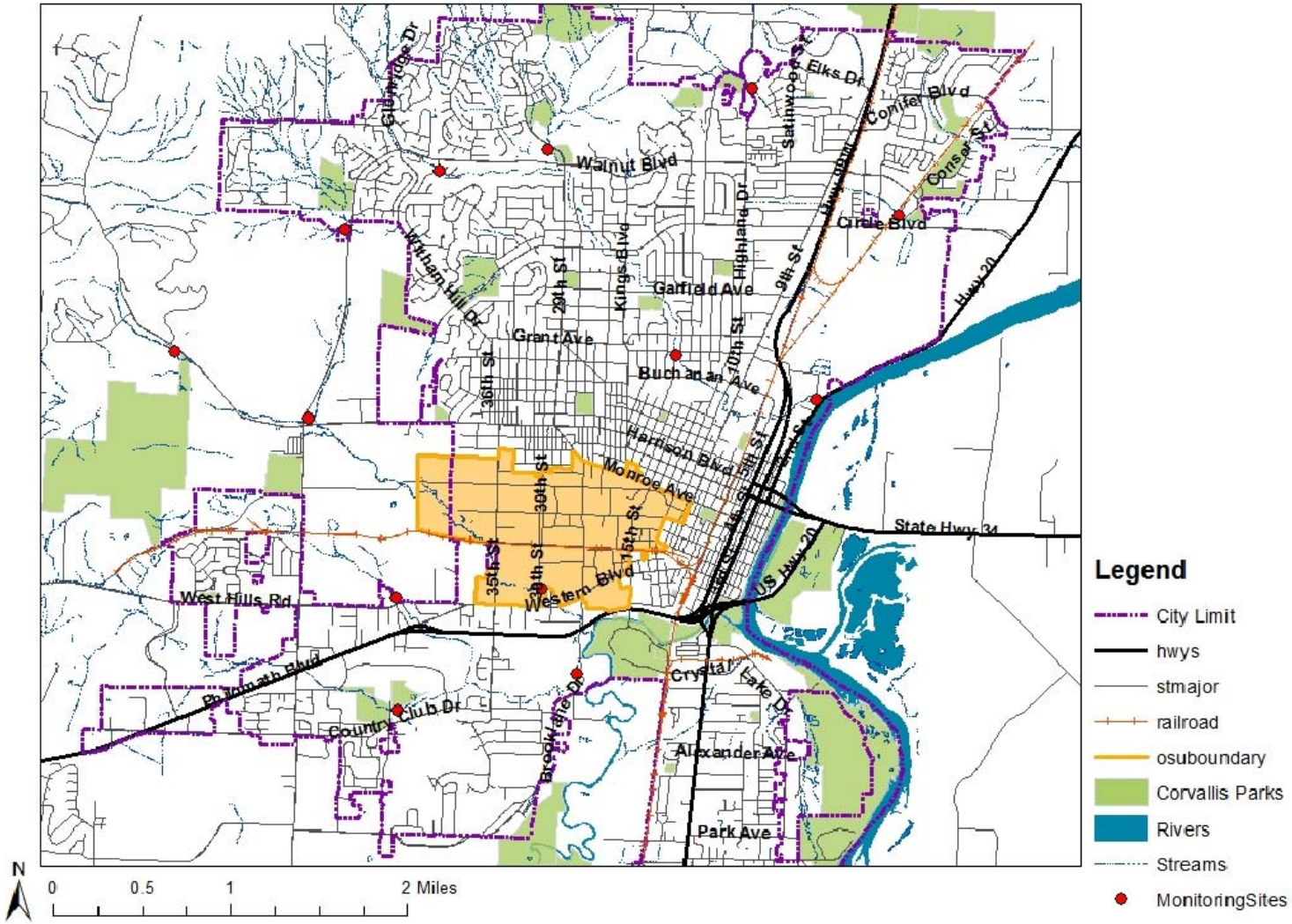
Monitoring Sites:
The same thirteen sites were selected for the 2011 monitoring season as were used in the 2010 preseason, closely mirroring the sites previously monitored as part of the City of Corvallis Salmon Response Plan (*Figure 1).*

Data Collection:
Water temperature data was collected at 30-minute intervals from May 1st through October 31, 2011. Pre-deployment accuracy checks were performed in the Wastewater Reclamation Plant water quality laboratory on April 25, by James Green. The data loggers were checked against a National Institute of Science and Technology (NIST)-calibrated thermometer.

Field audits were conducted approximately every 30 days. A NIST-calibrated field thermometer was used to ensure data accuracy. Additional information, including wetted width, depth, and weather conditions, was also collected during field audits. To prevent losing any data, the data was offloaded to a laptop during each field audit.

The data loggers were entirely retrieved from the field on November 17th, however only data through October 31st is necessary to report on. Final accuracy checks were performed in the Wastewater Reclamation Plant water quality laboratory on November 28th, by James Green. Data precision was achieved by placing duplicate loggers at three sites. All the data loggers returned Level B data or better for precision and accuracy. Level B data is approved by the DEQ for use in detecting water quality issues. Level A data is required for permitting and compliance purposes. Level B data is appropriate for this monitoring program, because the purpose of this program is to identify and research water quality issues only. **The City is not required to monitor or submit stormwater quality data for any permit or compliance purposes.** For more information on data precision and accuracy, refer to the 'In-Stream Temperature Monitoring Protocol' (*Adams 2010).*

Map of Corvallis with 2011 In-Stream Temperature Monitoring Sites



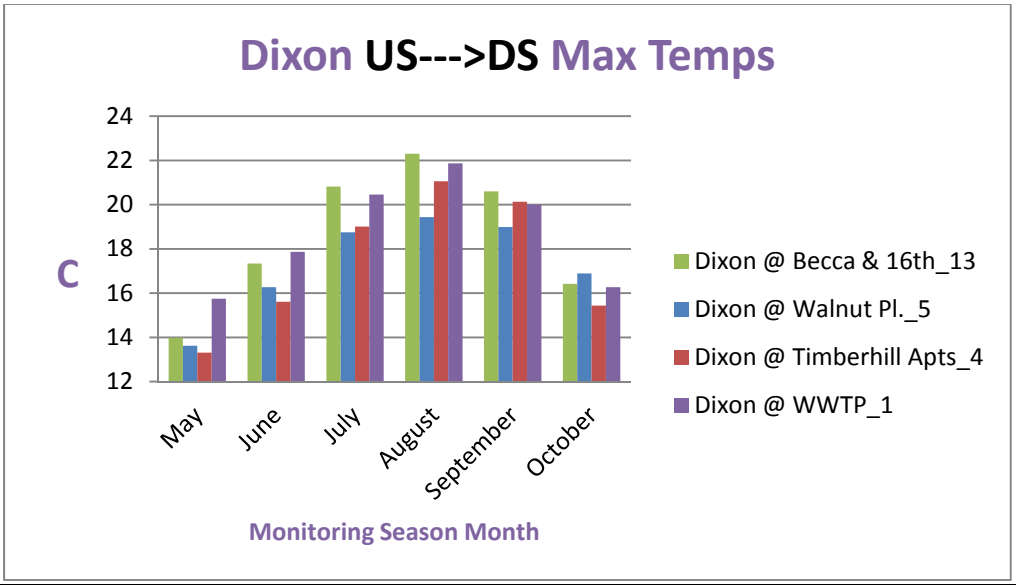
Results

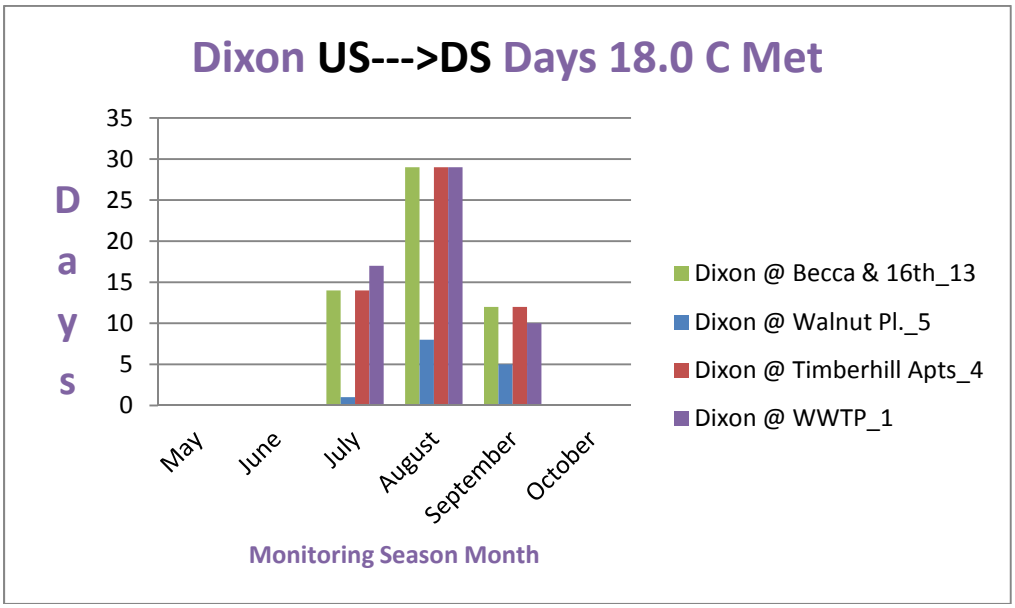
According to the 2010 In-stream Temperature Monitoring pilot project, "the data collected during the 2010 monitoring season confirms that Corvallis streams are contributing temperature pollution to the Willamette River through non-point source influences" (Adams 2010). The following data is set up to decipher whether or not the pre-selected creeks high temperature issues during the warm weather season is a problem that is getting worse.

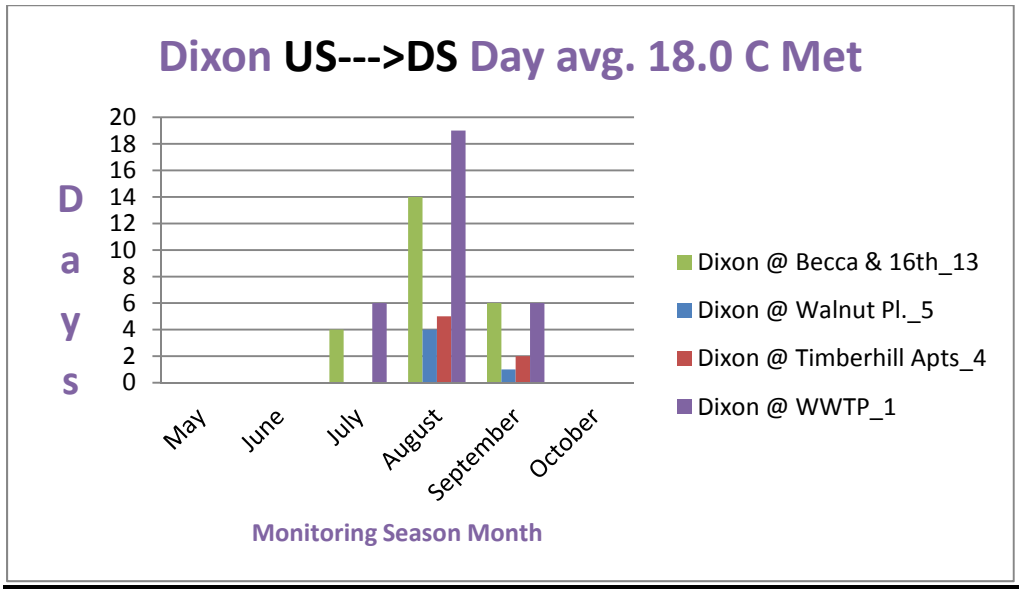
Stream	Logger ID	# of days temp hit > 18.0 C 2010	# of days temp hit > 18.0 C 2011	Worse in 2011?
Dixon	1	3	14	Yes
	2	28	26	No
	3	50	55	Yes
	4 & 5	58	56	No
Dunawi	6	54	67	Yes
	7	53	36	No
	8	8	39	Yes
Oak	9	2	5	Yes
	12	0	1	Yes
	11 & 12	7	8	Yes
	13	30	24	No
Sequoia	14	6	16	Yes
	15 & 16	58	63	Yes

Figure 1.0 Compares 2010 to 2011 Data

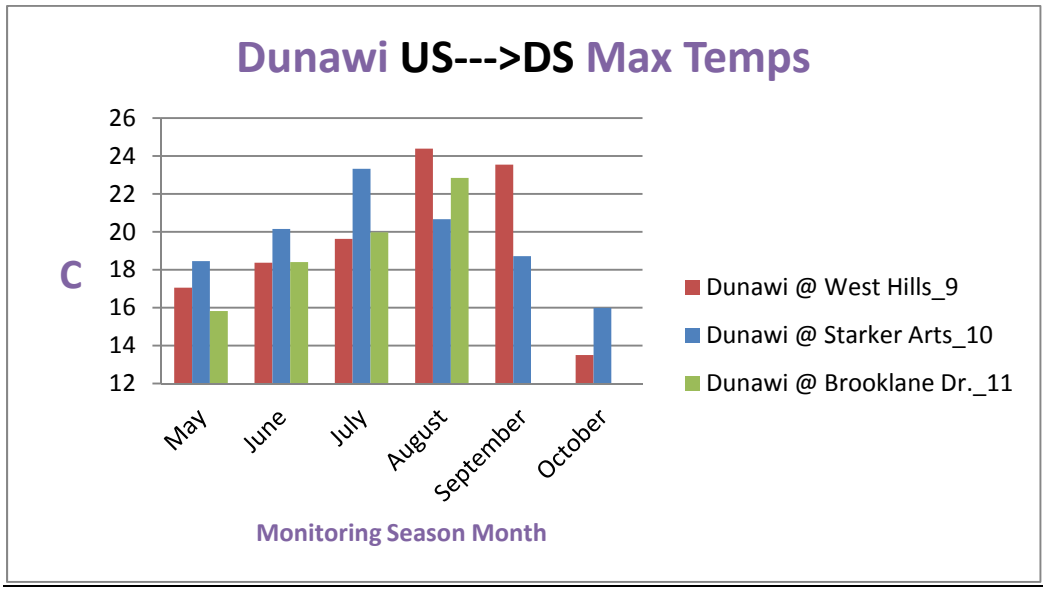
Dixon Creek

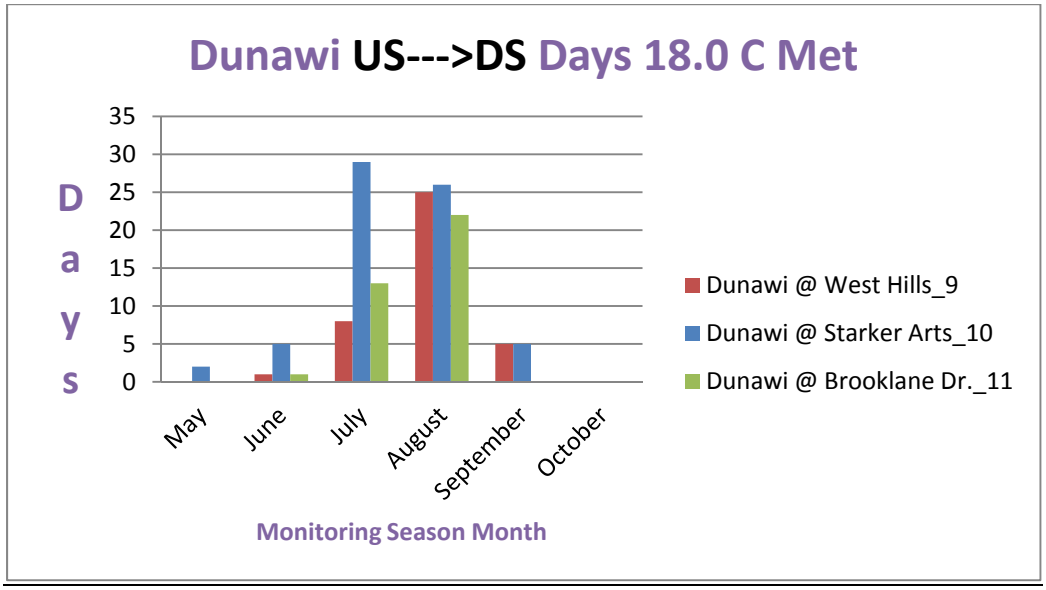


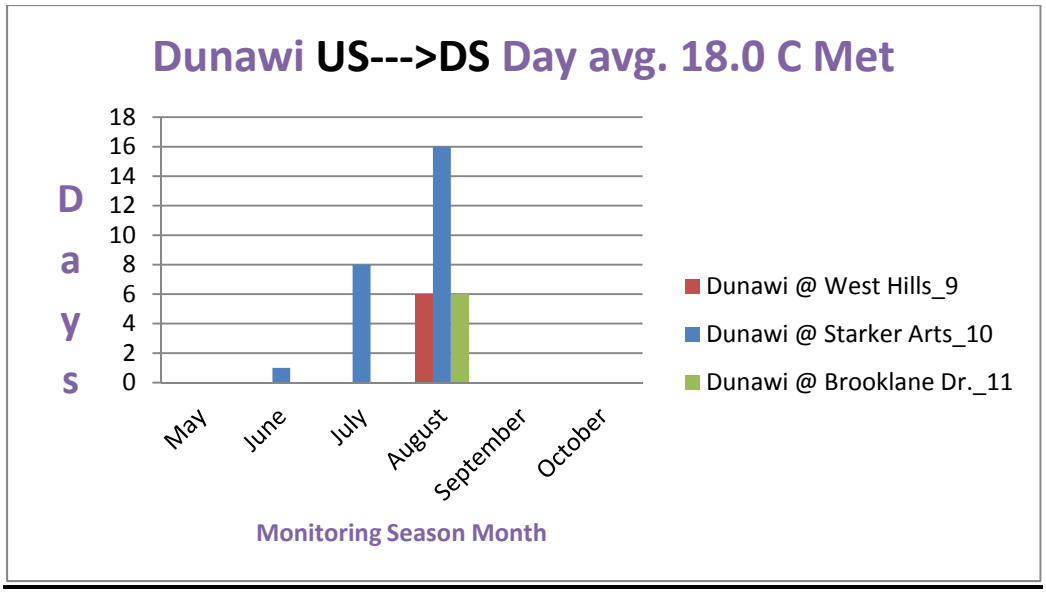

Dixon US--->DS Days 18.0 C Met
Days
35
30
25
20
15
10
5
0
May
June
July
August
September
October
Monitoring Season Month
Dixon @ Becca & 16th_13
Dixon @ Walnut Pl._5
Dixon @ Timberhill Apts_4
Dixon @ WWTP_1


Dixon US--->DS Day avg. 18.0 C Met
Days
20
18
16
14
12
10
8
6
4
2
0
May
June
July
August
September
October
Monitoring Season Month
Dixon @ Becca & 16th_13
Dixon @ Walnut Pl._5
Dixon @ Timberhill Apts_4
Dixon @ WWTP_1

Dunawi Creek

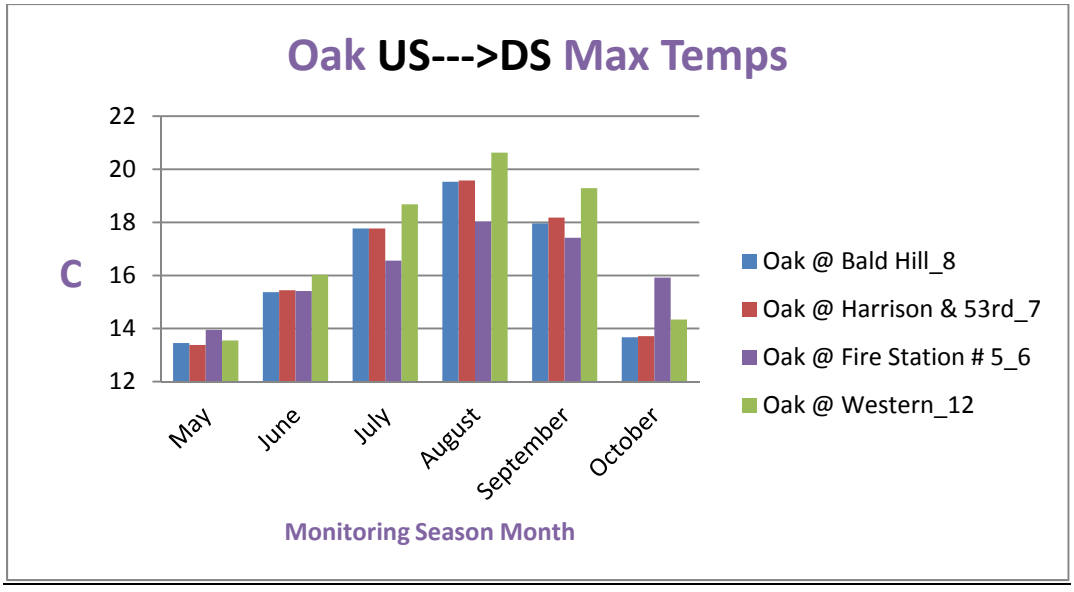


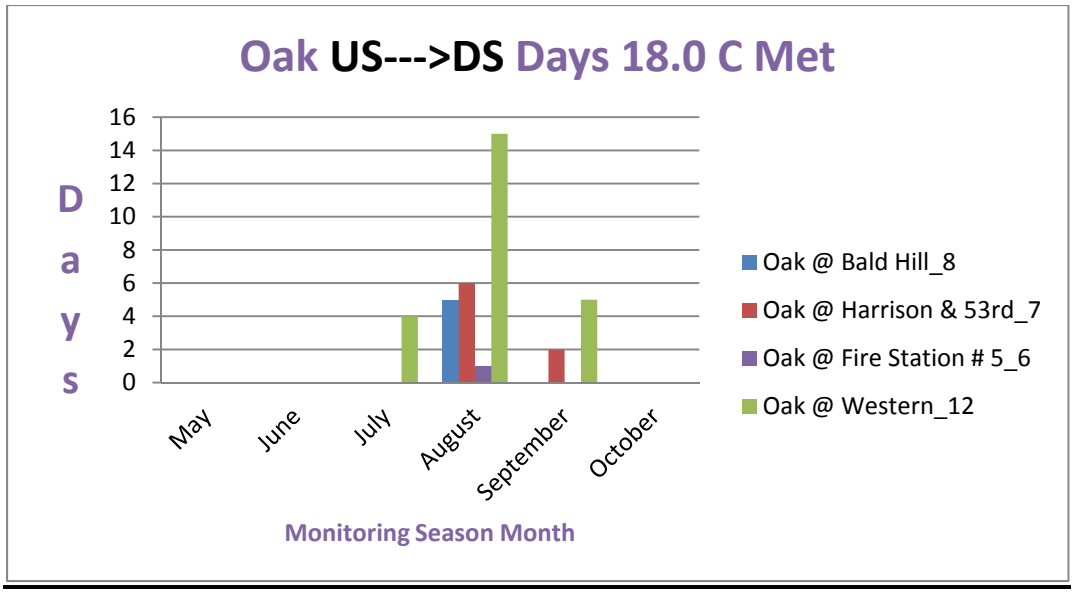


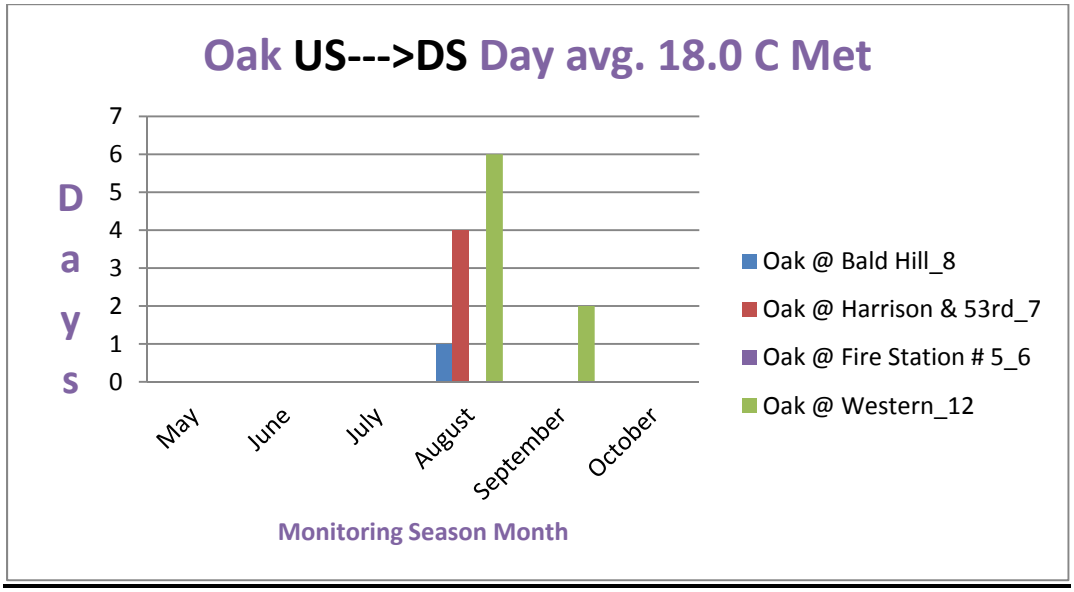

Dunawi US--->DS Day avg. 18.0 C Met
Days
18
16
14
12
10
8
6
4
2
0
May
June
July
August
September
October
Monitoring Season Month
Dunawi @ West Hills_9
Dunawi @ Starker Arts_10
Dunawi @ Brooklane Dr._11

.

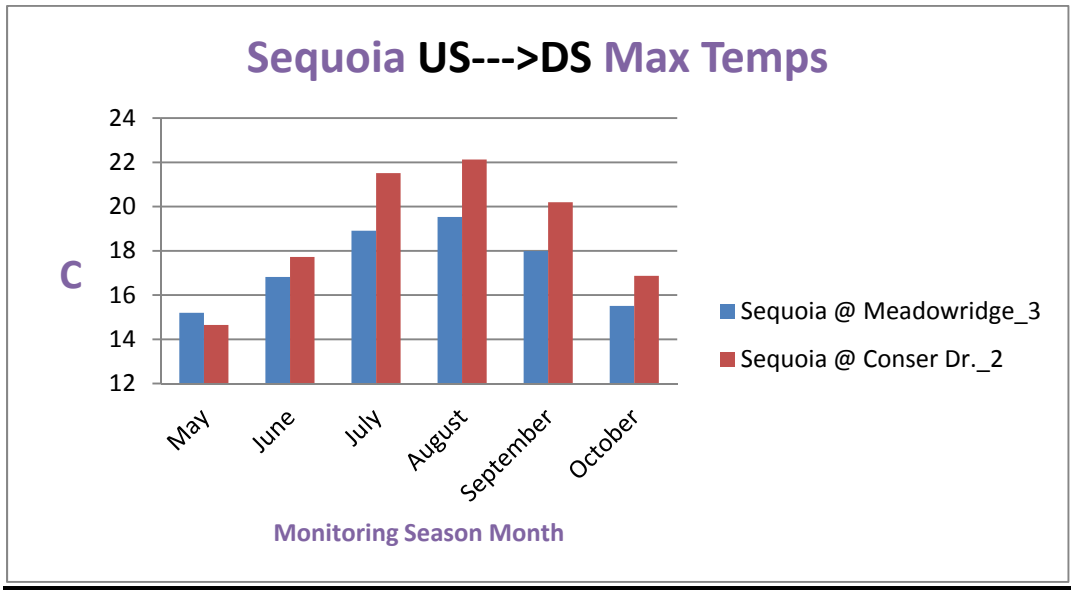
Oak Creek

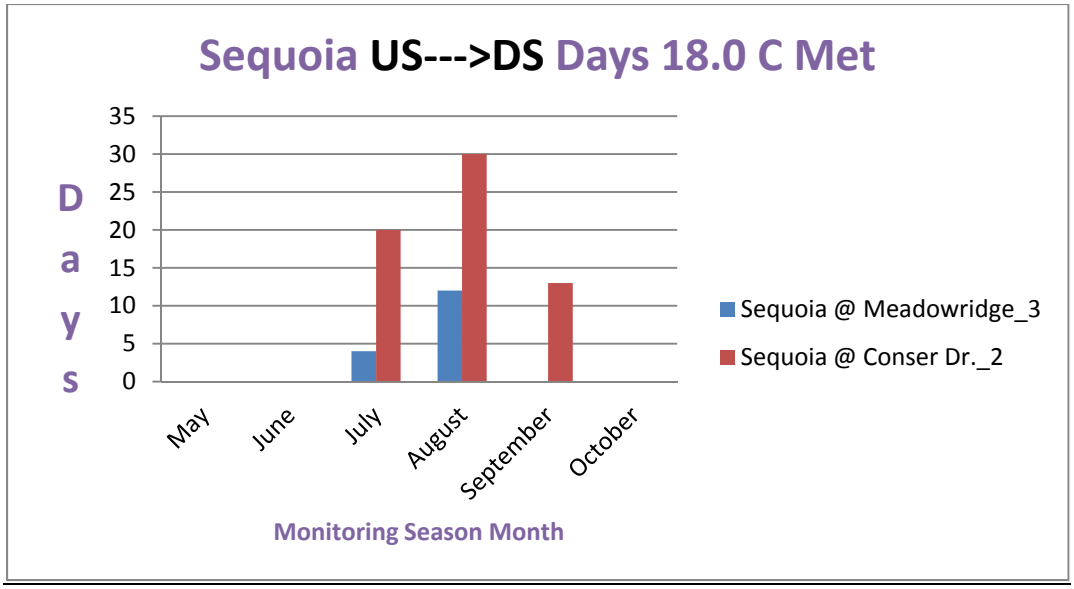

Oak US--->DS Max Temps
C
22
20
18
16
14
12
May
June
July
August
September
October
Monitoring Season Month
Oak @ Bald Hill_8
Oak @ Harrison & 53rd_7
Oak @ Fire Station # 5_6
Oak @ Western_12

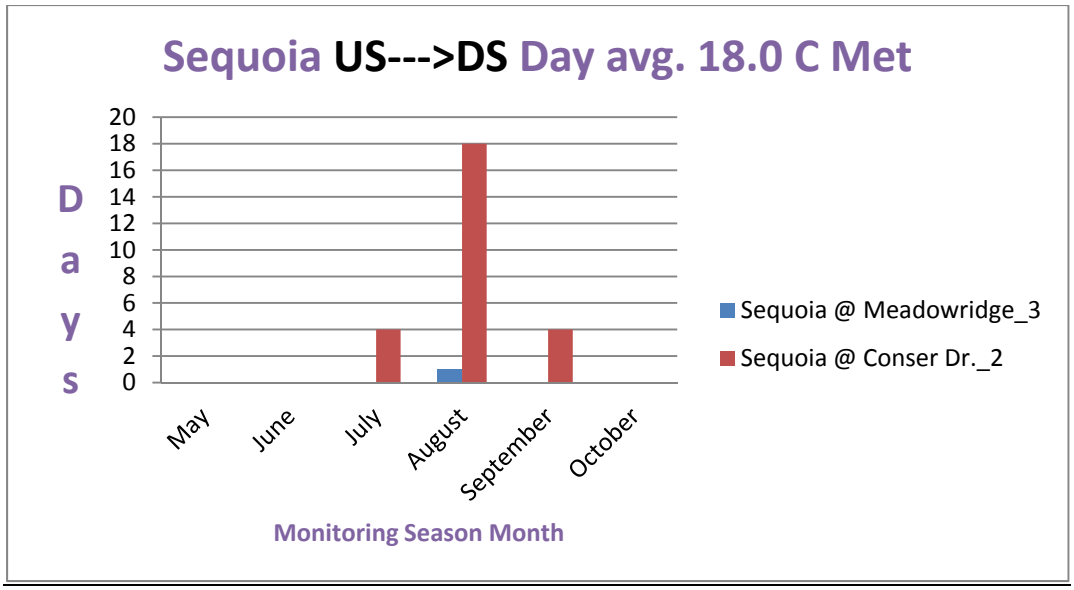

Oak US--->DS Days 18.0 C Met
Days
16
14
12
10
8
6
4
2
0
May
June
July
August
September
October
Monitoring Season Month
Oak @ Bald Hill_8
Oak @ Harrison & 53rd_7
Oak @ Fire Station # 5_6
Oak @ Western_12


Oak US--->DS Day avg. 18.0 C Met
Days
7
6
5
4
3
2
1
0
May
June
July
August
September
October
Monitoring Season Month
Oak @ Bald Hill_8
Oak @ Harrison & 53rd_7
Oak @ Fire Station # 5_6
Oak @ Western_12

Sequoia Creek







Discussion

Summary:

Figure 1.0 indicates that the problem of high temperatures in the Corvallis region is still an issue. However, because the number of monitoring days is not the same in 2010 and 2011 it's not fair to say in fact that it has gotten worse. Unfortunately, that conclusion could only come from a data set in which the same number of monitoring days was used. As stated before though, figure 1.0 proves that temperatures that exceed the state standard are still prevalent.

The data was plotted in bar graphs to make the problem areas in each creek easily noticed. It will be up to the City of Corvallis to decide what to do with the data collected in 2011 and for them to determine whether or not they see fit to address the sections of each creek that presented the highest temperatures > 18.0 C, the highest # of days in which the temperature exceeded 18.0 C, and even the creeks that presented the highest daily average of maintaining the temperature of greater than 18.0 C.

Although daily averages were not calculated in the 2010 pilot season of this project, they were calculated in 2011 to show that the creeks that were able to maintain an average temperature for any given # of days should be addressed before the creeks that were only able to peak above 18.0 C but were not able to maintain that threatening temperature limit.

Recommendations:

According to DEQ, canopy cover is the single most important factor affecting water temperature that human activities in a watershed contribute to (Mulvey 2009). The removal of riparian shading from stream banks results in increased water temperatures due to radiant solar energy. Sedimentation magnifies the effect of solar radiant heating as soil particles absorb more solar energy than water molecules do. Urban streams typically have inadequate riparian buffers due to land development. Rehabilitating riparian areas to restore more natural conditions would help

keep water temperatures within the optimal range for fish rearing and migration by providing shade, habitat, decreasing sedimentation to streams and retaining potentially warm run-off waters (Adams 2010).

As stated by Adams in the 2010 In-Stream Temperature Monitoring pilot project, these streams must be well shaded if they have any chance to maintain temperatures less than 18.0 C during the summer months. The continuation of data indeed shows that high temperatures still plague the creeks of Corvallis and are potentially contributing to increased temperatures within the Willamette River. Without flow metering devices or some sort of creek volume gauge at the point of entry into the Willamette, it is hard to determine what type of temperature loading/volume ratios we are dealing with.

The creeks that were monitored in 2011 were monitored at the same location within each stream. The creeks that completely dried up completely during the summer should be taken into consideration and given a closer look as to whether or not they are providing any useful data that helps the City of Corvallis assess temperature loading on the Willamette.

Also, it should be taken into consideration whether or not Salmon actually inhabit these creeks presently and if they are actually in danger to begin with. The entire point of this project is because of the endangered species act and to protect fish, but if we are not looking at actual fish habitats there is no point at all. The concept of maintaining a consistent region to collect creek temperatures from is important, but environments change over time and there might need to be some revision as to what is the most appropriate location within each creek to collect temperature readings from.

References

Adams, Miranda (2010). *In-Stream Temperature Monitoring Protocol*. City of Corvallis, Public Works Department.

Ades, Dennis (2007). *Reducing Temperature in the Willamette Basin*. Oregon Department of Environmetnal Quality, available at:
http://www.deq.state.or.us/wq/pubs/factsheets/willamette/07wq000_temperature.pdf

Dillinger, Robert, and Jones, Bill. (2004), *City of Corvallis Salmon Response Plan*, City of Corvallis Public Works Department.

Mulvey, Michael. (2009). *Willamette Basin Rivers and Streams Assessment*. Oregon Department of Environmental Quality, available at:
http://www.deq.state.or.us/lab/wqm/docs/WillametteBasinAssessment2009.pdf

Oregon Administrative Rules (2010). Oregon Department of Environmental Quality, available at:
http://arcweb.sos.state.or.us/rules/OARs_300/OAR_340/340_041.html

Oregon Department of Environmental Quality. (1999), *The Oregon Plan for Salmon and Watersheds*, Water Quality Monitoring Guidebook, Version 2.0.a