



CLACKAMAS RIVER BASIN

SNAPSHOT MONITORING

PRESENTED BY PSU
STUDENT WATERSHED RESEARCH
PROJECT (SWRP)
SUMMER CAPSTONE
AUGUST 2013

PSU SENIOR CAPSTONE STUDENTS



STUDY AREA: LOWER CLACKAMAS RIVER BASIN

Rock Creek Sub-basin

1 Sieben Creek (SEB002)

2 Rock Creek (RCK000)

3 Rock Creek (RCK002)

Clear Creek Sub-basin

4 Clear Creek (CLE000)

5 Clackamas River (CLA024)

Richardson Creek Sub-basin

6 Richardson Creek (RCK003)

7 Richardson Creek (RCK002)

8 Richardson Creek (RCK005)

9 Richardson Creek (RCK004)

Deep Creek Sub-basin

10 Deep Creek (DEP002)

11 Goose Creek (GCK001)

12 North Fork Deep Creek (NFD001)

13 North Fork Deep Creek (NFD004)

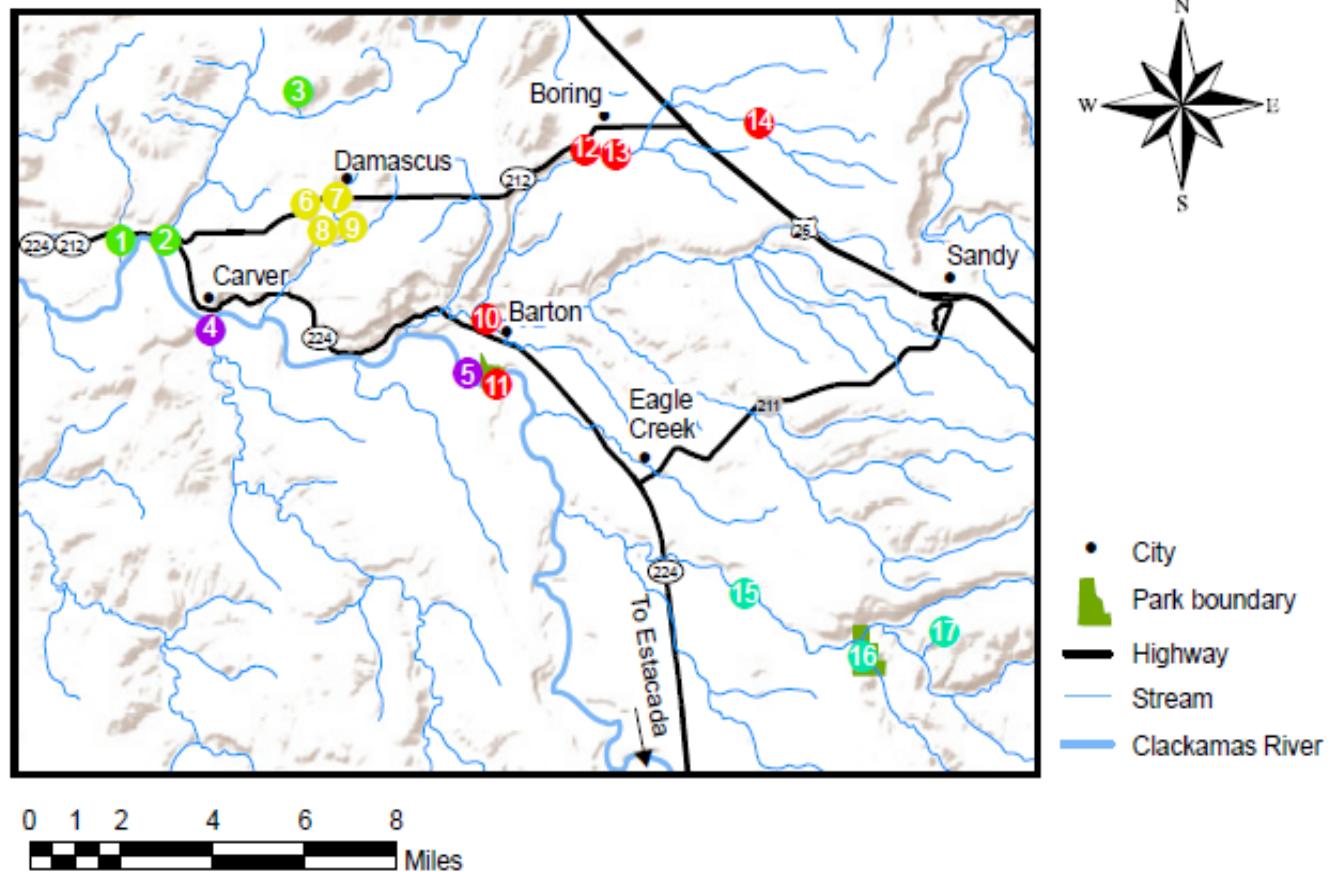
14 North Fork Deep Creek (NFD002)

Eagle Creek Sub-basin

15 Eagle Creek (EGL001)

16 Eagle Creek (EGL005)

17 Eagle Creek (EGL002)



SUB-BASINS TESTED

- Eagle Creek (1 Stream, 3 Sites)
- Clear Creek (2 Streams, 2 Sites)
- Deep Creek (2 Streams, 5 Sites)
- Rock Creek (2 Streams, 3 Sites)
- Richardson Creek (1 Stream, 4 Sites)

A close-up photograph of a person's hand holding three small, clear plastic vials with black caps. The vials contain a reddish-brown liquid. The person is wearing a silver ring on their ring finger. The background is a blurred outdoor setting with green foliage and a tree trunk. The text "WATER QUALITY DATA" is overlaid in a serif font across the middle of the image.

WATER QUALITY DATA

CHEMISTRY PARAMETERS AND METHODOLOGY

- Temperature ($^{\circ}\text{C}$)
- Dissolved Oxygen (O_2 mg/L)
- Turbidity (NTU)
- pH
- Nitrogen
 - Ammonia (N-NH_3 mg/L)
 - Nitrate (N-NO_3 mg/L)
- Phosphorous (SRP mg/L)



DEQ WATER QUALITY STANDARDS

Water Quality Standards

Parameters	Surface Water	Spawning	Drinking Water
ph	6.5 - 8.5		6.5 - 8.5
Temperature (°C)	≤ 17.8	≤ 12.8	
DO (mg/L)	≥ 6.0	≥ 11.0	
DO (% sat)	≥ 90%	≥ 95%	
Phosphorus (mg/L)	< 0.1		
Nitrate (mg/L)	< 10		≤ 10

EAGLE CREEK RESULTS

3 SITES TESTED

<u>Parameters</u>	<u>Meets</u>	<u>Does not meet</u>
pH	X	
Temperature	X	
Dissolved Oxygen	X	
Phosphorus	X	
Nitrate	X	



CLEAR CREEK RESULTS

2 SITES TESTED

<u>Parameters</u>	<u>Meets</u>	<u>Does not meet</u>
pH	X	
Temperature		X
Dissolved Oxygen	X	
Phosphorus	X	
Nitrate	X	

- CLE000 (Above Temperature specifications)



DEEP CREEK RESULTS

5 SITES TESTED

<u>Parameters</u>	<u>Meets</u>	<u>Does not meet</u>
pH	X	
Temperature		X
Dissolved Oxygen	X	
Phosphorus	X	
Nitrate	X	

- DEP002 and GCK001 (Above Temperature specifications)

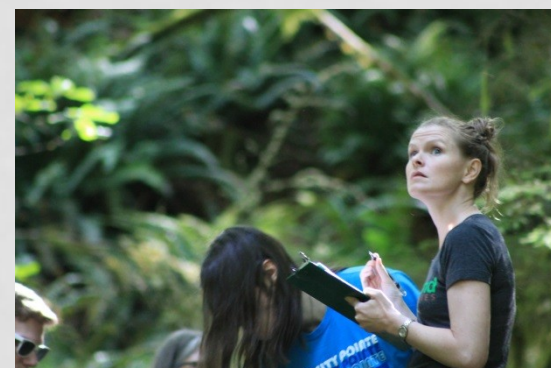


ROCK CREEK RESULTS

3 SITES TESTED

<u>Parameters</u>	<u>Meets</u>	<u>Does not meet</u>
pH	X	
Temperature	X	
Dissolved Oxygen	X	
Phosphorus		X
Nitrate	X	

- RCK000, 002 & SEB002 (Above Phosphorus specification)

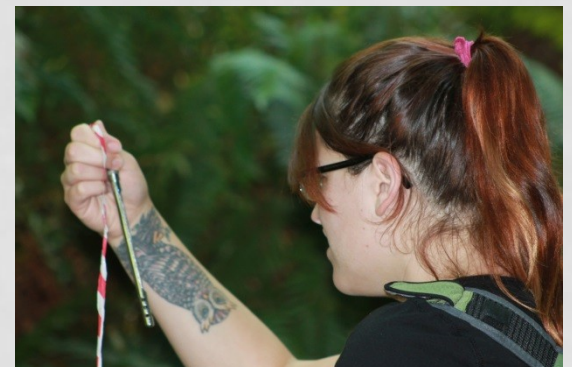


RICHARDSON CREEK RESULTS

4 SITES TESTED

<u>Parameters</u>	<u>Meets</u>	<u>Does not meet</u>
pH		X
Temperature		X
Dissolved Oxygen		X
Phosphorus	X	
Nitrate	X	

- RCH005 (Below pH specifications)
- RCH004 (Above Temperature specifications)
- RCH004 & 005 (Below DO specifications)





WATER QUALITY DISCUSSION

MACROINVERTEBRATE
DATA

INTRODUCTION

- Anthropogenic land use activities near streams can have extensive impacts on water quality and the biota living within the stream.
- Benthic macroinvertebrate assemblages have been shown to be good indicators of stream health, as they are sensitive to changes in water quality.

MACROINVERTEBRATE IMPACTS

- Industrial toxins

- Pesticides

- Herbicides

- Excess nutrient loading from fertilizers and other sources

- Riparian disturbance

- Affects temperature, habitat, and dissolved oxygen and nutrients

General Aquatic Insect Morphology

General Aquatic Insect Morphology

Three orders of aquatic insects are used to describe defining characteristics. The following terms are used throughout the guide to describe defining characteristics.

Caddisfly (Trichoptera)



Image 1.01a Golden Stonefly used to illustrate main body features

Mayfly (Ephemeroptera)

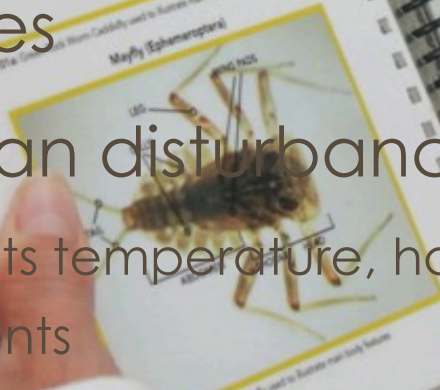


Image 1.01b Tapered Mayfly used to illustrate main body features

General Aquatic Insect Morphology

Stonefly (Plecoptera)



Image 1.02 Golden Stonefly used to illustrate main body features

Head: The anterior (forward) body segment where the eyes, antenna, and mouth are located.

Thorax: The middle segments where legs and wing pads (if present) are attached. In most stoneflies, gills are located on the thorax.

Abdomen: The posterior (rear) segment. Usually long with 6-11 segments. The abdomen of a stonefly is always attached to the thorax. The abdomen of a stonefly typically ends in a hook or claw appendage.

Wing Pads: Located on the thorax. Mayflies have visible wing pads and stoneflies have two sets. The wing pads represent the developing wings. In stoneflies, the wing pads are visible as small, dark, rectangular structures on the thorax.

OUR STUDY

- This study uses an Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies) (EPT) index calculation, as well as Oregon Watershed Enhancement Board (OWEB) Level 2 biotic water quality assessment methods as a measurement of stream health.



Mayfly larva



Stonefly larva



Caddisfly larva

A person wearing a red t-shirt and a black baseball cap is shown in profile, looking down at a small white container. They are holding a red pipette and dispensing liquid into the container. In the background, another person wearing a grey cap and a light-colored shirt is also looking down at the same area. The scene appears to be outdoors or in a well-lit lab space with greenery visible in the background.

METHODS

- Three kick technique, 500 micron net, at 25, 50, and 75% widths.
- 18 cell grid, selected at random, and species are tallied as they are being identified.

ANALYSIS

- OWEB scoring table where raw score is the total number of each order found for each metric in each stream sampled.

Metric	Raw Score	5	3	1	Score (circle one)
Taxa Richness		>18	10 - 18	<10	5 3 1
Mayfly Richness		>4	2-4	<2	5 3 1
Stonefly Richness		>3	1-3	0	5 3 1
Caddisfly Richness		>4	2-4	<2	5 3 1
% Diptera		<15	15-30	>30	5 3 1
% Dominance		<30	30-50	>50	5 3 1
					Sum the Score

ANALYSIS (CONT'D)

- OWEB table for estimating stream health based on Sum Score from Table 1.

Score Range	Stream Condition
>23	No impairment: passes Level 2 assessment. Indicates good diversity of invertebrates and stream conditions with little disturbance. Further sampling will help confirm the site's condition as unimpaired.
17 – 23	Moderate Impairment: Evidence of some water quality impairment exists. Requires further study and more detailed analysis.
<17	Severe Impairment: Fails levels 2 assessment. Evidence of stream disturbance exists. Further study may be warranted to confirm level of impairment and potential causes.

EAGLE CREEK MACROS

Eagle Creek Macroinvertebrate Assessment		
OWEB Assessment	Raw Score	Ranking
Taxa Richness (# of Families)	16	3
Mayfly Richness	3	3
Stonefly Richness	2	3
Caddisfly Richness	3	3
% Diptera	12.5	5
% Dominance	55.2	1
Sum total score		18
EPT Assessment	0.58	2

- Highest richness of benthic invertebrates of the four sub-basins sampled at 16.
- OWEB score of 17-23 indicates moderate impairment.
- Some water quality impairment exists.

Healthiest Watershed Observed

CLEAR CREEK MACROS

Clear Creek Macroinvertebrate Assessment		
OWEB Assessment	Raw Score	Ranking
Taxa Richness (# of Families)	7	1
Mayfly Richness	2	3
Stonefly Richness	0	1
Caddisfly Richness	1	1
% Diptera	0	1
% Dominance	81.8	1
Sum total score		8
EPT Assessment	0.64	1

- Had the lowest richness of benthic invertebrates of the four sub-basins sampled at 7.
- EPT index of 0.64, the highest of the sub-basins.
- Lowest score of sub-basins in the OWEB level 2 assessment with a score of just 8 which indicates possible impairment
- Evidence of stream disturbance exists, but requires further study

DEEP CREEK MACROS

Deep Creek Macroinvertebrate Assessment		
OWEB Assessment	Raw Score	Ranking
Taxa Richness (# of Families)	8	1
Mayfly Richness	3	3
Stonefly Richness	0	1
Caddisfly Richness	0	1
% Diptera	16.7	3
% Dominance	55.6	1
Sum total score		10
EPT Assessment	0.33	4

- Second lowest richness of benthic invertebrates of the four sub-basins sampled at 8.
- EPT index of 0.33, severely low as stream health indicator and lowest of the sub-basins sampled here.
- Scored second lowest of the four sub-basins in the OWEB level 2 assessment with a score of just 10, indicates possible severe impairment.

ROCK CREEK MACROS

Rock Creek Macroinvertebrate Assessment		
OWEB Assessment	Raw Score	Ranking
Taxa Richness (# of Families)	10	3
Mayfly Richness	4	3
Stonefly Richness	1	3
Caddisfly Richness	1	1
% Diptera	18.5	3
% Dominance	73.8	1
Sum total score		14
EPT Assessment	0.55	3

- Second highest richness of benthic invertebrates of the four sub-basins sampled at 10.
- EPT index of 0.55, average for the sub-basins sampled.
- Scored second of the four sub-basins in the OWEB level 2 assessment with a score of 14, indicates possible severe impairment.

FURTHER DISCUSSION

Mayfly



Image 1.22: Mayfly adult



Image 1.22: Mayfly adult

Family Index:



Flathead
page 13



Small Midge
page 14



Prong Gill
page 15



Spiny Crawler
pages 16-17



Spiny Crawler
pages 16-17



Spiny Crawler
pages 16-17



Amphipod
page 18



Square Gill
page 19

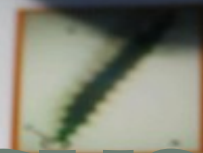


Image 1.23: Caddisfly Adult



Caddisfly
Trichoptera
The caddisfly order is the second largest of insects in the Pacific Northwest, with about 1,000 species. Caddisflies are found in many aquatic environments, from small streams to large rivers. They are known for their long, segmented bodies and long legs. Caddisflies have long-lived life cycles of up to two years. The Caddisfly order represents all feeding groups.



Net Spinner
page 20



Grasshopper
page 21



Case Maker
page 22



Green Rock Worm
page 23



Fingered
page 24



Sediment Case Maker
page 25



Tubemaker
page 26



Quillmaker
page 27



DAMASCUS DAYS

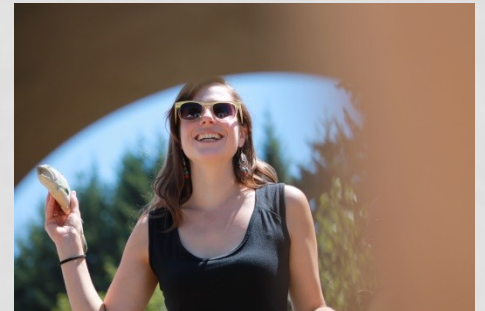
DAMASCUS DAYS

- Our role in the event was to educate the community about watershed health and provide educational activities for families.
- Students conducted on sight testing for Rock, Richardson and Deep Creeks.



SPECIAL THANKS

- Mary Ann Schmidt; Instructor of PSU Senior Capstone Stream Monitoring Course
- Clackamas River Basin Counsel; Outreach Specialist Chelsea White-Brainard
- Private and Public Land Owners





QUESTIONS AND COMMENTS

