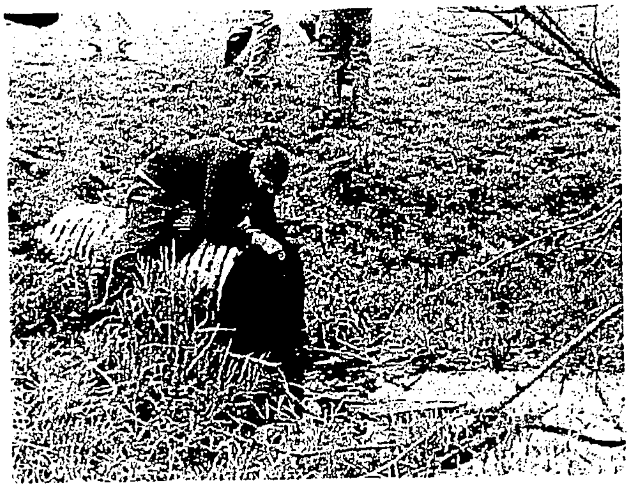
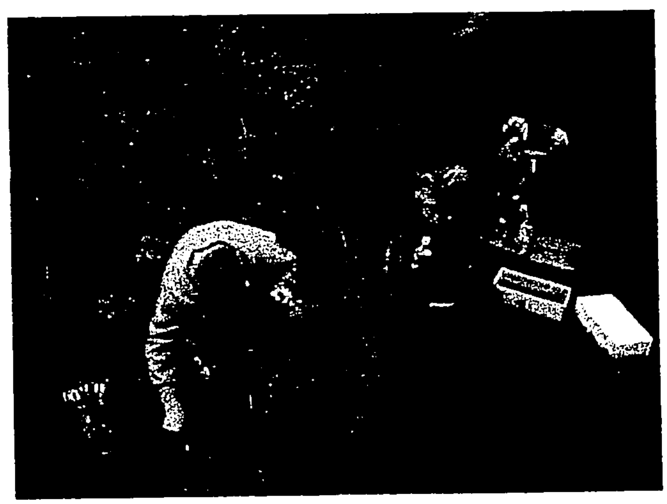
CENTRAL CATHOLIC HIGH SCHOOL



WATERSHED ACTION PLAN

POWELL BUTTE NATURE PARK



WATERSHED ACTION PLAN

POWELL BUTTE NATURE PARK

JULY 2001

CENTRAL CATHOLIC HIGH SCHOOL BIOLOGY STUDENTS

Danny Lundstrom, Fred Brugado, Eric Iverson, Bethany Lund, Brittni Lauinger, Helen Hudson, Tyler Anderson, Michael Stoops, Alyson Meyer, Sarah Dang, Kelly Shoenbeck, Vince Timoney, Jennifer Blevens, Mike Brockman, Bethany Sillls, Matt Colt, Erika Brunson, Nichole Rice, Je Heying, Josie Lennard, Jessica Rowley, Travis Olsen, Dina Zografos, Doug Brooks, Colin We Trevor Graves, Lindsay Stratton, Luke Huffstutter, Gabe Button, Mike Baron, Emily Guinc John Fox, Maureen O'Hara, Sarah Crane, John Mackin, Dan Parscale, Matt Zahler, Ty Trevartl Katie Evens, Anna Holmer, Candace Rusitti, Meredeth McDermott, Gill Parfait, Mickey Lenn Chris Stupfel, Jaclyn LeDoux, Heidi Boldman, Jill Grbavac, Kelly Walker, Greg Button.
Project Supervisor: Dan Vasen

Central Catholic High School

Achieving academic competence and intellectual excellence, formed in faith by community to be people for others.

Powell Butte Drainage Study
Central Catholic High School

Project Update 921691

Over the past two years, Central Catholic High School student's in Dan Vasen's senior marine biology class have participated in an intensive salmon education program. This program consisted of numerous classroom and and field activities, including a water quality monitoring project in the Powell Butte Nature Park. Forty-eight students participated directly in the program, which was directly funded by a METRO Salmonids Education and Enhancement grant, an Oregon Department of Fish & Wildlife STAC mini grant, and the Diack Ecology Fund. Indirectly, this salmon education program was supported by the donation of equipment, aerial photos and topographic maps, as well by parent volunteers who participated on field trips. Some of the program's details:

Students participated in the SalmonWatch program administered by Oregon Trout, which includes water quality testing and first-hand observations of spawning salmon in the Mt. Hood NF. The students visited Still Creek on 9/23/99 and the Salmon River on 9/20/00.

Students placed over 150 coho salmon carcasses into Still Creek working for the US Forest Service on two occasions. This project studies the effect of decomposing carcasses on nutrient levels in the riparian zone. The students placed 90 carcasses into the creek on 11/4/99 and placed another 60 carcasses into the creek on 11/7/00.

Students reared spring chinook salmon and rainbow trout to the fry stage in a classroom aquarium equipped with a chiller unit, and released the fish into local waterways. A total of 478 salmon fingerlings were released into the lower Willamette river on 12/15/00. A total of 2701 rainbow trout were released into Blue Lake: 455 fish were released on 12/8/99, another 416 on 12/1/00 and most recently 1830 fish were released on 3/09/01.

Students have taken four field trips to the Powell Butte Nature Park to undertake a water quality monitoring project. During these trips, the students located the seasonal streams which drain the butte and established monitoring stations where the streams cross major trails. The purpose of this research project is to assess the health of the Powell Butte watershed, to determine the quality of the runoff water draining the butte, and to evaluate the impact that this runoff water has on adjacent Johnson Creek's water quality and threatened salmon runs. The field trips took place on 12/6/99, 4/14/00, 12/6/00, and 5/9/01. Using monitoring equipment and GPS, the students measured temperature, pH, dissolved oxygen of the water, and recorded the coordinates of the monitoring stations.

By June 30,2001, the students will produce a final report of their findings in the form of a Powell Butte Watershed Action Plan, that will include recommendations for improving water quality in the park. For more information please contact Dan Vasen at (503) 235-3138.

TESTING WATER pH USING CALIBRATED PROBES

MAP AND COMPASS ORIENTEERING TO PROJECT SITES

AQUATIC MONITORING PROJECT AT POWELL BUTTE NATURE PARK

Marine biology students at Central Catholic High School have completed a two year aquatic monitoring project of Powell Butte Nature Park's natural seeps and seasonal wetlands and runoff streams, with the goal of assessing the health of the Powell Butte watershed. The students measured the water chemistry of a number of runoff streams on the butte, mapped these sites using GPS coordinates and revisited them on four different occasions to record data. A primary objective of the project was to evaluate the impact that these inputs of runoff water have on adjacent Johnson Creek's threatened salmon populations. This project provided over 50 students with hands-on training in aquatic sampling in the field, and established numerous partnerships with contributors and local community groups.

- The students have produced a Powell Butte Watershed Action Plan that recommends strategies for improving watershed health, identifies major sites of disturbance in the park and establishes a monitoring plan to evaluate the water quality of the streams and wetland areas. **Section A**

- Students have also produced written reports on Powell Butte land-use history, human impacts to the watershed, current Johnson Creek water conditions and the status of existing salmonid populations in the creek. **Section C**

- Students have used this data in conjunction with other sources to make evaluations about the nature of Powell Butte's water input into Johnson Creek, and to determine whether Powell Butte runoff affects threatened salmon and steelhead runs. **Section B**

These outcomes were achieved by the students who determined the drainage pattern of the butte by evaluating the contours using topographic maps and aerial photographs that were donated by local businesses. See. Fig. 1

The students divided the watershed into sub-basins, each of which contained a stream and/or wetland that drained a specific geographic area of Powell Butte. See Fig. 2 Field trips were taken to Powell Butte, during which student research groups located and identified a number of seasonal seeps, small streams and wetlands. The students established monitoring stations, determined the GPS coordinates of each site and photo-recorded the streams where they cross major trails. See Fig. 3

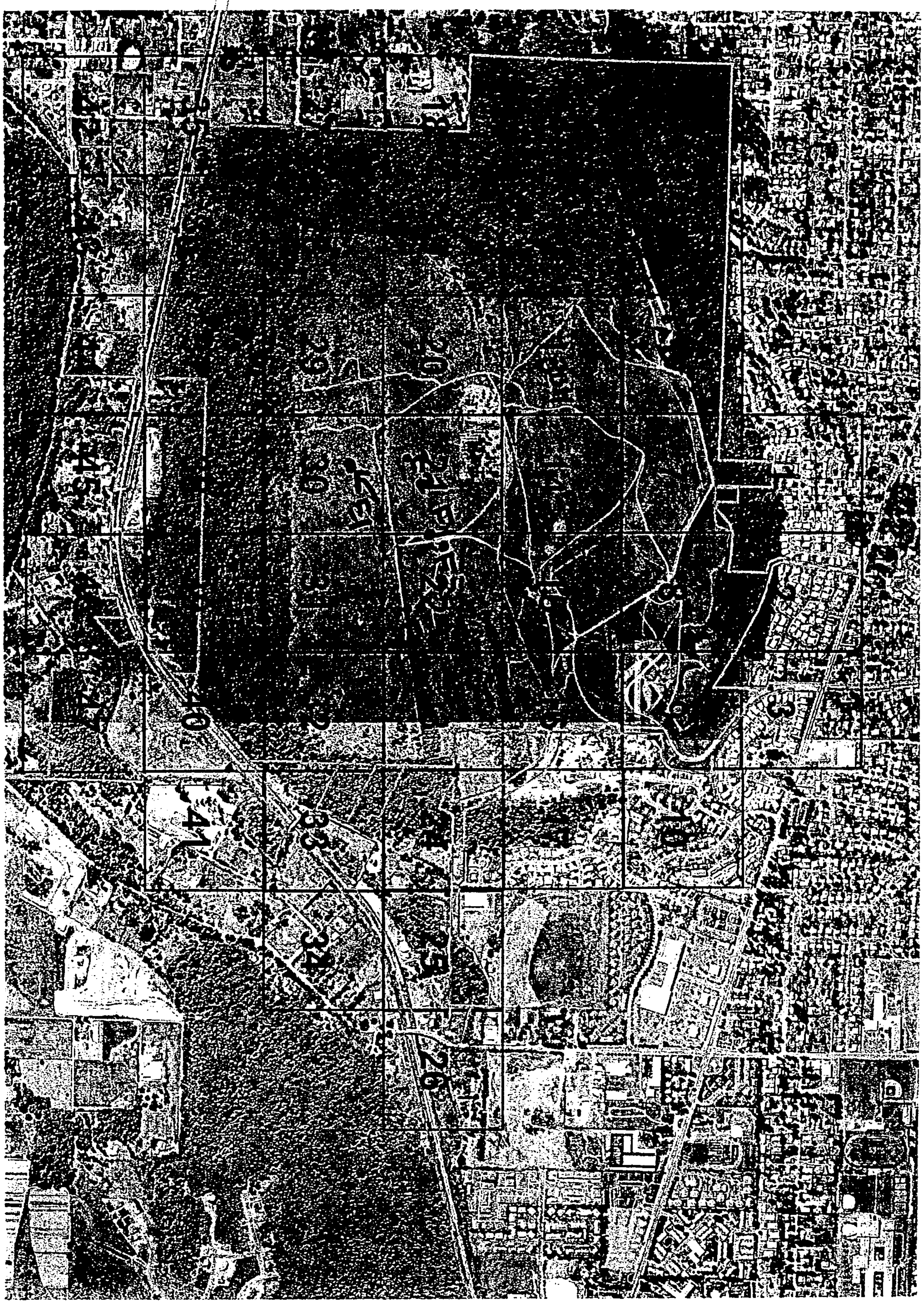
The students used calibrated instrumentation to determine water pH, temperature and dissolved oxygen and recorded the physical environment of each site on data sheets. See. Fig. 4

Fig. 2

APPROX. WATERSHED SUBBASINS
REFERS TO SITE DATA
A
B
C
D
E
F
EXISTING 50 MG. RESERVOIR
S.E. 162ND AVE.
POWELL
S.E. 145TH AVE.
PORTLAND TRACTION CO.
(O.W.P. & RY. CO.) (P.E.P. CO. RR.)
JOHNSON CREEK
S.E. FOSTER RD.
KELLY CREEK

FIG. 1

MAP OF POWELL BUTTE MONITORING STATIONS



Visit the website online at: www.centralcatholichigh.org/biologyproject.html

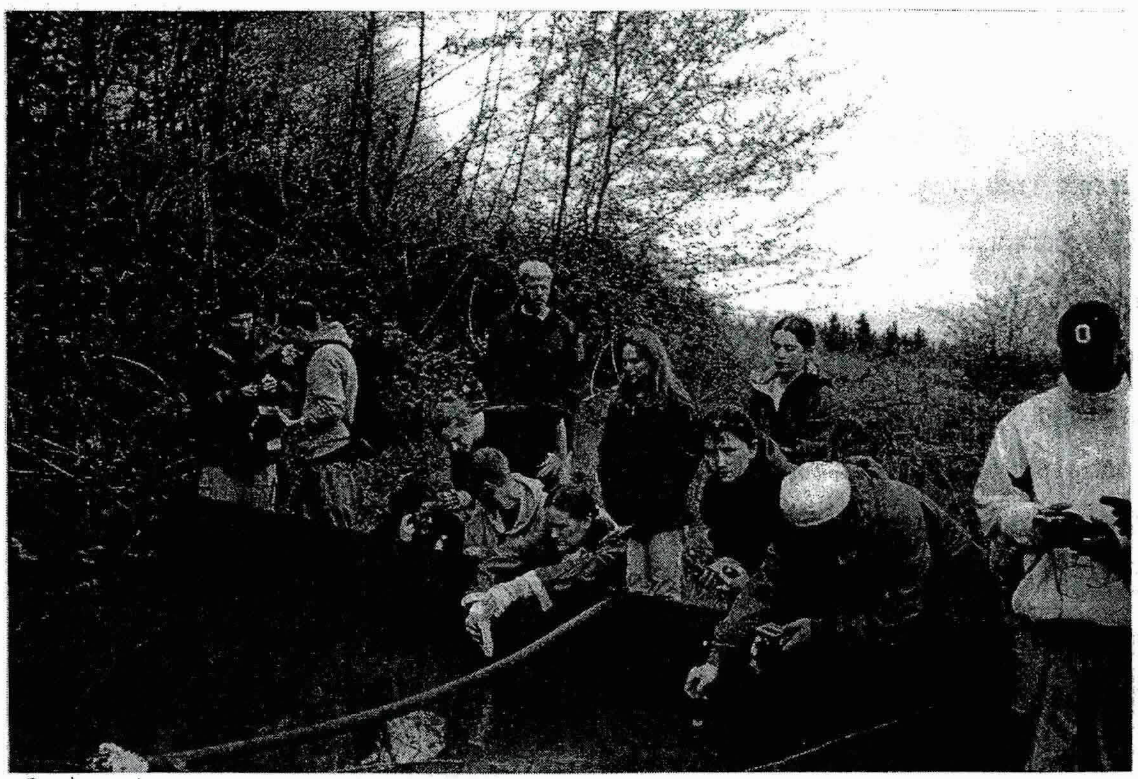
TASK-TRAINING

MAP & COMPASS ORIENTEERING TEAM
OHARA, ZAHLER, WEBER, WALKER, EVANS, LEDOUX - YEAR ONE
BRUNSON, TIMONEY, LUND, BLEVENS, STOOPS, DANG - YEAR TWO

GPS / DATA RECORDING
RUSCUTTI, GRAVES, LENNARD, MACKIN, FOX - YEAR ONE
BRUGADO, SILLS, OLSEN, HEYING, RICE, BROCKMAN - YEAR TWO

CBL MONITORING TEAM
YEAR ONE
HOLMER, CRANE, TREVARTHEN, STUPFEL, GRBAVAC, GUINDON, MCDERMOTT, PASFAITT, BUTTON, BARON, STRATTON, PARSCALE

YEAR TWO
BOLDMAN, ROWLEY, COLT, IVERSON, LAUINGER, MEYER, SCHOENBECK, LENNARD, ZOGRAFOS, HUDSON, LUNDSTROM, ANDERSON, BROOKS



CALIBRATING EQUIPMENT AT WATER TANK

Section A

Jessie Heying

Powell Butte

Water Quality Project

Sites of Disturbances:

A-5. This is a wetland/ lake area with a high level of pollution

B-1. B-2. B-3. All are areas which have been disturbed by high trail use.

C-1. C-2. C-3. C-4. Have some amount of disturbance.

C-5. Has a greater amount of disturbance than other sites in this area.

D-2. Is affected by animal disturbances and heavy trail use.

D-3. Also has a high level of trail use.

SLEW. Animal disturbances (cow pasture, horses, dogs). Pollution (dumping and cigarette butts).

E-2. This area was marked for having trail use.

F-1. F-2. These sites have heavy trail use, mountain biking, horse and dog remnants, and litter.

Specific Ideas for these Sites of Disturbances:

-Specific Trail markings, restricting use of bikes, horses, etc.

-Signs marking seasonal water and wildlife areas

-Garbage and recycling cans

-Pooper-scooper station

-Repair of Riparian zones

-Control stream trail crossings

-Reduce stream crossing with bridges over streams

-Exposed soil needs plants/ vegetation, especially on sides of runoff streams

-Buy polluted lake on the NW corner, near Mall Street, in order to repair

-Provide information on projects for visitors to read.

-Improve trails with gravel or matting

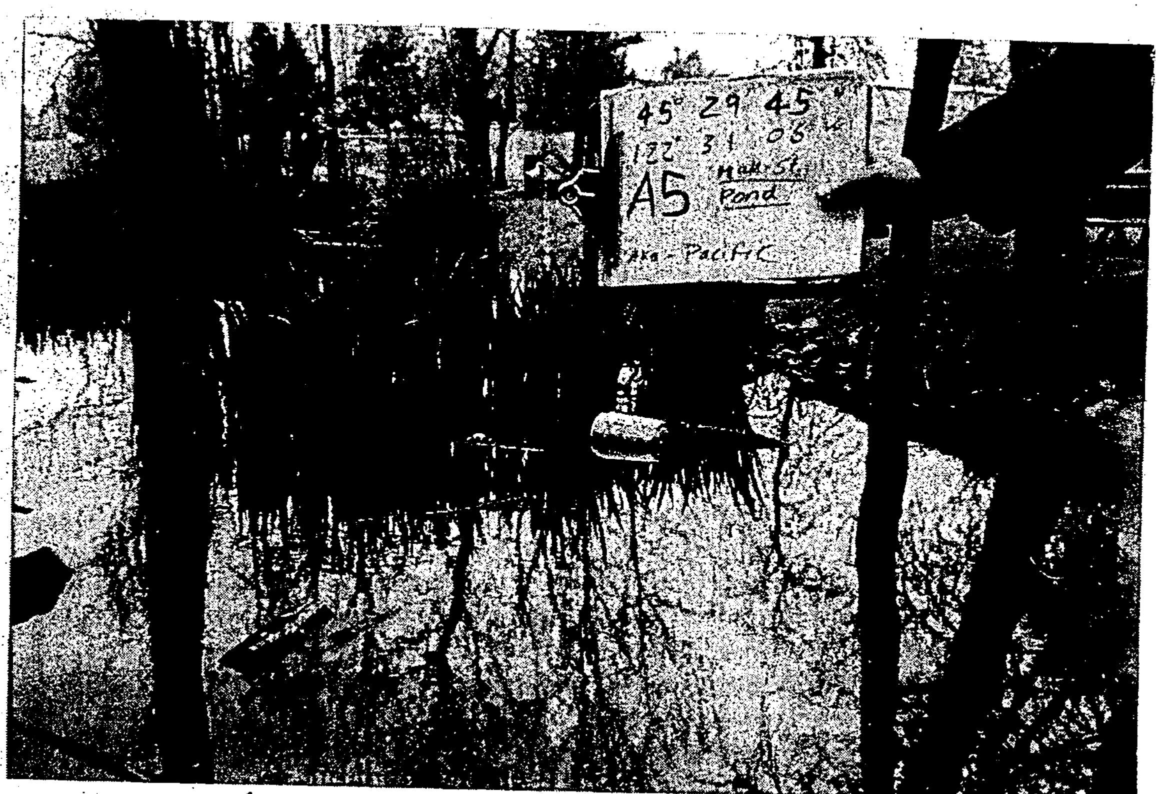
-Get rid of illegal trails, by reducing the number of hiking trails

-Bikers on cement trails only

-Limited access to wetlands

Improvements

1. More garbage cans through park
2. Steep trails need guard rails so people stay on main paths
3. Buy Mall Street pond property
4. No horses or limit access to areas with water
5. Make irrigation ditch angles less so snakes can get out
6. Test water quality monthly
7. Clear debris from streams
8. Block off unauthorized trails to streams
9. Repair fences surrounding water
10. Plant more plants around water (improve buffer zone)
11. Re-route slough so it does not pass through cow pasture
12. Bridges over streams crossing paths
13. Reinforce stream banks
14. Label trails better
15. Close off slough from animals



ALTHOUGH OUTSIDE THE PARK, THIS WETLAND IS A SITE OF HIGH IMPACT

Section B

Assessment of Potential Impacts of Powell Butte Runoff on Johnson Creek.

• Powell Butte runoff water appears to be of moderate quality, with pH, temperature and dissoved oxygen levels of appropriate range to support fish, but physical barriers, lack of gravel and seasonal flow rates prevent salmonids from using them butte.

• most of the stream draining the south side of the butte feed into a wetland area before crossing the springwater coordidor trail and entering the slow moving slough area prior to entering the creek's mainstem.

• Sedimentation of suspended solids is probably occuring along this stretch, so impacts from erosion in the park are probably not dramatically affecting Johnson Creek water quality.

• The location where Powell Butte runoff exits the park, crosses under the springwater corrridor trail, and feeds into to the main stem of Johnson Creek is near 162nd and S.E. Foster Road. This linkage crosses private land that is used for cattle grazing, and the impact that this situation has on the water quality has not been explored.

SITE A4

45°29'39"N
122° 31'07"W

Procedure

Jill Grbavac

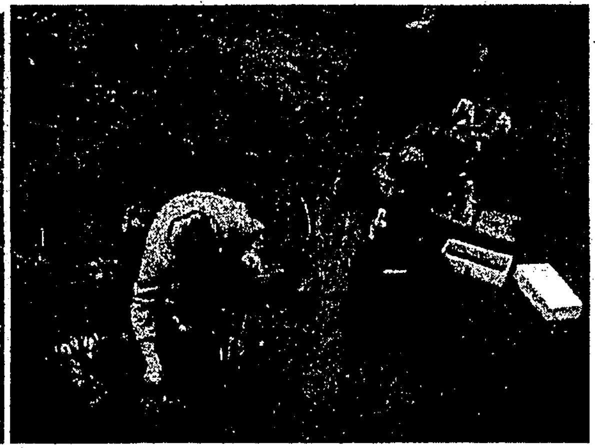
Thursday; September 23, 1999: Salmon Watch at Still Creek

The class arrived at Still Creek and broke up into three groups. Each group went to a different station, and the groups rotated to each of three stations. At every station the students took note of the weather and the position in the stream reach.

The water quality station allowed students to test the creek for pH level, dissolved oxygen content, and temperature. The students used chemical tests provided by the Salmon Watch coordinators. Groups also visually studied the water's appearance, the stream bed coating, and the odor of the water. These things are important to the health of the aquatic life in the stream, most importantly, the salmon. The ideal conditions for salmon habitat are clear, cold water with a good balance of nutrients. The water must have a high concentration of dissolved oxygen, and a neutral pH level.

The macroinvertebrate survey station provided students with the tools to catch a number of aquatic invertebrates to study. The groups hypothesized whether more invertebrates would be found living among the riffles, or in a deep pool in the stream. Volunteers ventured out with nets and chose to sample an area size one foot by four feet. They picked up rocks from the stream bed to rub the invertebrates off and into the net. After a significant number of samples were collected, the students observed which types of invertebrates were found, and where they were found. The greatest number of invertebrates was found among the riffles due to the increased flow of oxygenated water. Most invertebrates do not swim well, therefore clinging to rocks in the riffles allows them to catch prey that is washed downstream, and provides protection from predators. Macroinvertebrates are an indicator species. The presence of certain sensitive types indicates that the stream is healthy.

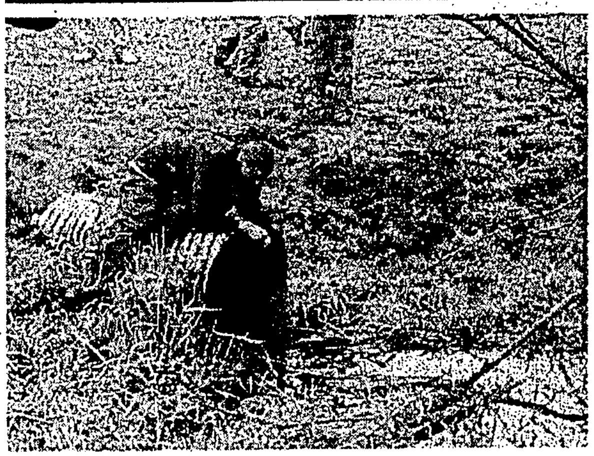
The stream reach survey station required students to observe the riparian zone and the surroundings of the stream. The width of the riparian zone and the types of vegetation present in it are very important to the health of the stream. There was significant vegetation cover both on the ground and overhead as a canopy. This coverage filters soil and runoff, and keeps the stream clear. It also shades the water to keep it cool. The groups studied the stability and structure of the banks on either side of the stream, and the amount and type of debris in the stream itself. These physical components are influential in the speed and shape

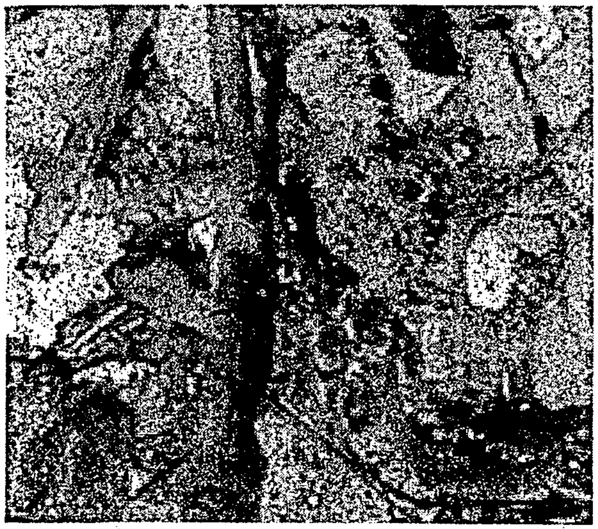



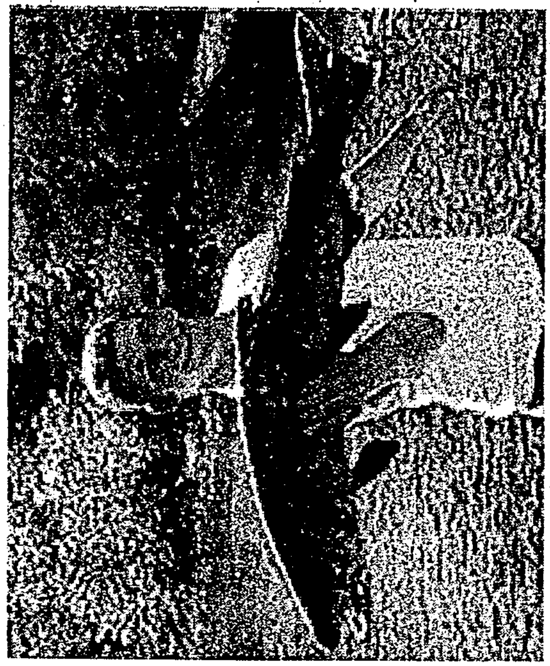
CENTRAL CATHOLIC HIGH SCHOOL

SALMON EDUCATION PROGRAM

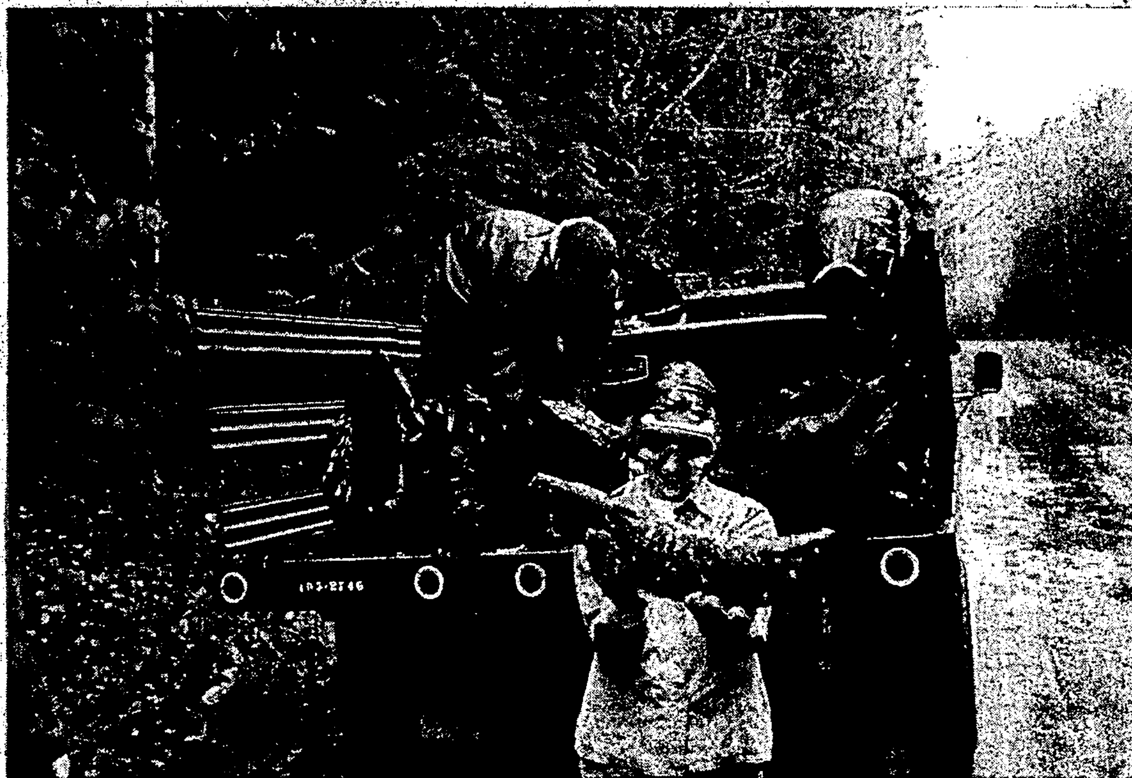
1999-2000







COHO SALMON CARCASS PLACEMENT @ STILL CREEK 11/5/99

KELLY WALKER AND ANNA WOINER WORK AT STREAMSIDE of the stream, which affects the salmon habitat and migration.

Friday; November 5, 1999: Salmon Carcass Placement at Still Creek

A small group of students arrived at the Forest Service headquarters and were given chest waders, latex gloves, and polarized glasses. Once the group arrived at the designated stream reach, each pair of students was given a large bag in which was placed smaller bags with a total of about eight salmon carcasses inside. Each pair of students was then given a radio and the responsibility to stock a section of the stream reach. The carcasses were placed in a variety of areas in the stream. Some had to be placed in deep pools, some in riffles, some in piles of debris, and some in the shallows at the edge of the water. The purpose of placing these carcasses into the stream is to compensate for the declining number of adult salmon completing their migration. After salmon spawn they die, and their bodies provide sustaining nutrients to the soil, the water, and other organisms in the stream. By placing the salmon carcasses in the stream, the health of that stream, and of the organisms that depend on it, is increased.

Emily Guindon

The Trout Raising Project

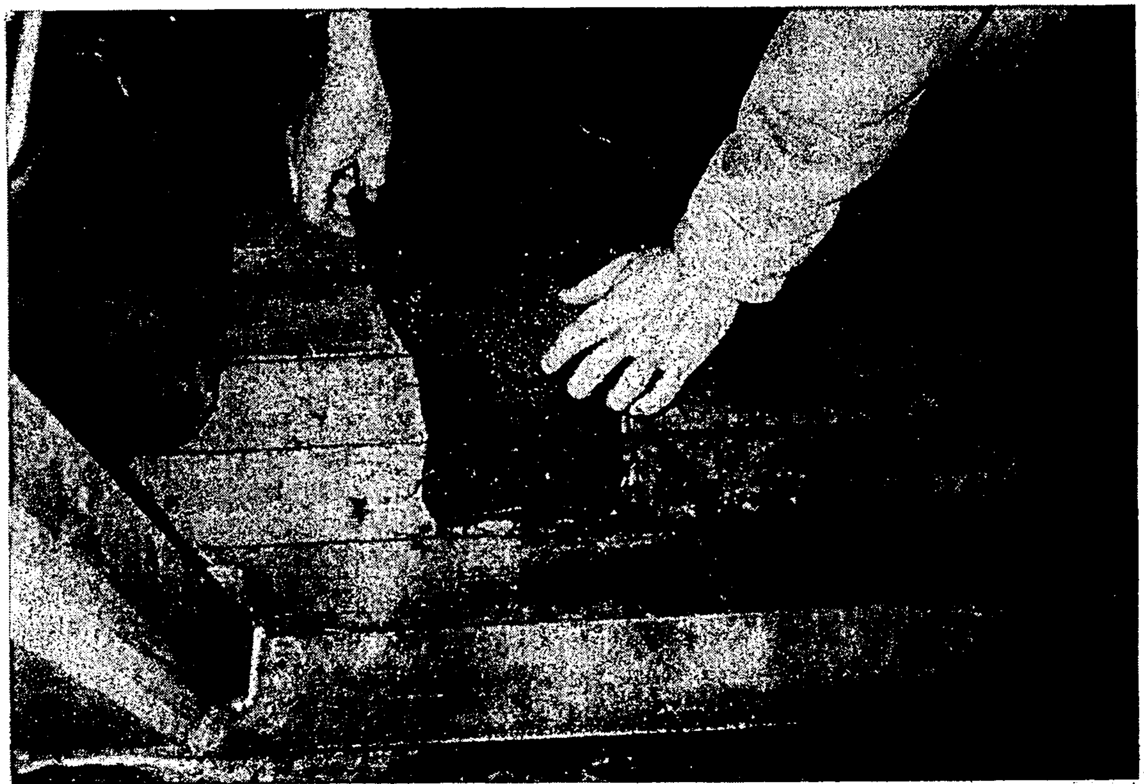
Preparation:

To prepare for this project we studied a unit on salmon that included their lifecycle, behavior, adaptations, and current status. We had already received all the necessary approvals from the Salmon-Trout Enhancement Program that is with the Oregon Fish & Wildlife Department last June, so we prepared a classroom incubator aquarium to raise the eggs/fry in. Then we put in the order for how many eggs we wanted.

What We Did:

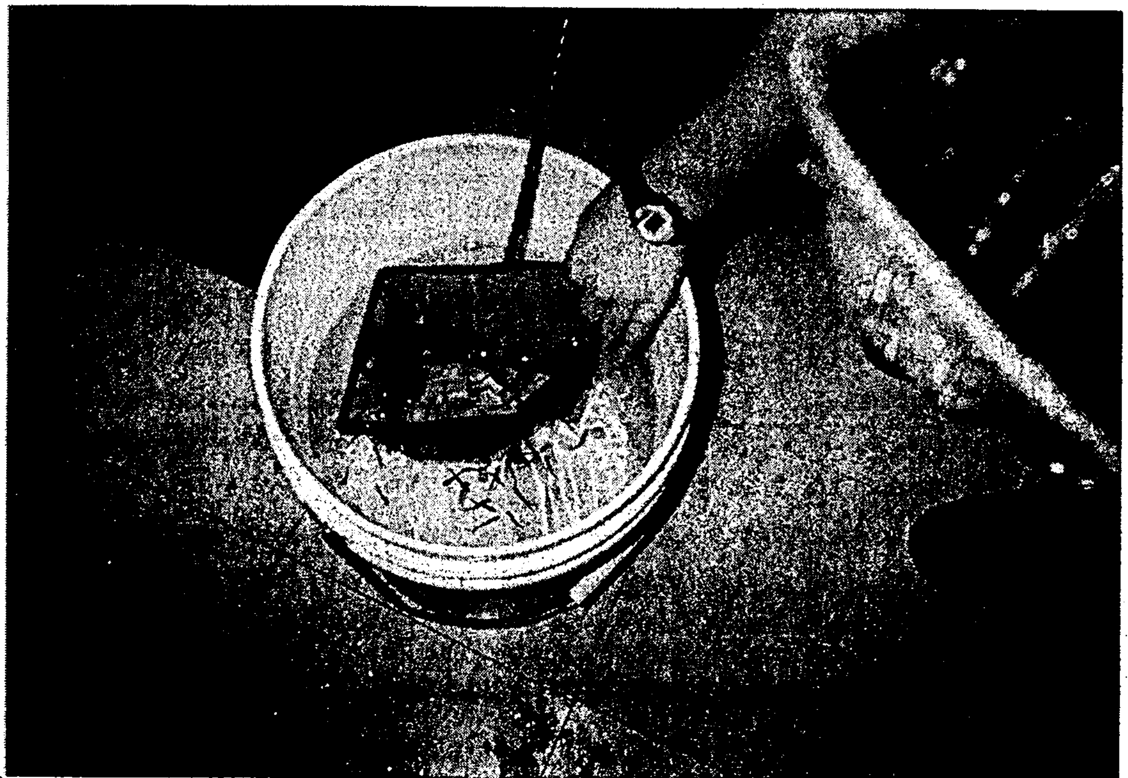
After receiving word that the eggs were ready we went to pick them up and brought them back to our aquarium. On October 21, 1999 we received 500 rainbow trout eggs from the Oaksprings hatchery, and on January 25, 2000 we received 1143 rainbow trout eggs from the Roaring River hatchery. We then raised them until they were mature enough to release.

A daily record was kept of egg/fry mortality, the water temperature of the aquarium, the temperature units, and the pH levels. Every student signed up for a day to check the tank and got a chance to test it and check up on the fish at least once. While the fry were nearing the appropriate



EGGS AT 452TU'S-PICKUP AT CLACKAMAS ODFW

COUNTING EGGS BEFORE PUTTING INTO CHILLER AQUARIUM



6~8 WEEKS LATER FRY HAVE BUTTONED UP AND ARE READY.

RELEASE INTO BLUE LAKE 12/8/99

maturity level for release we got approval of a release site for the fish.

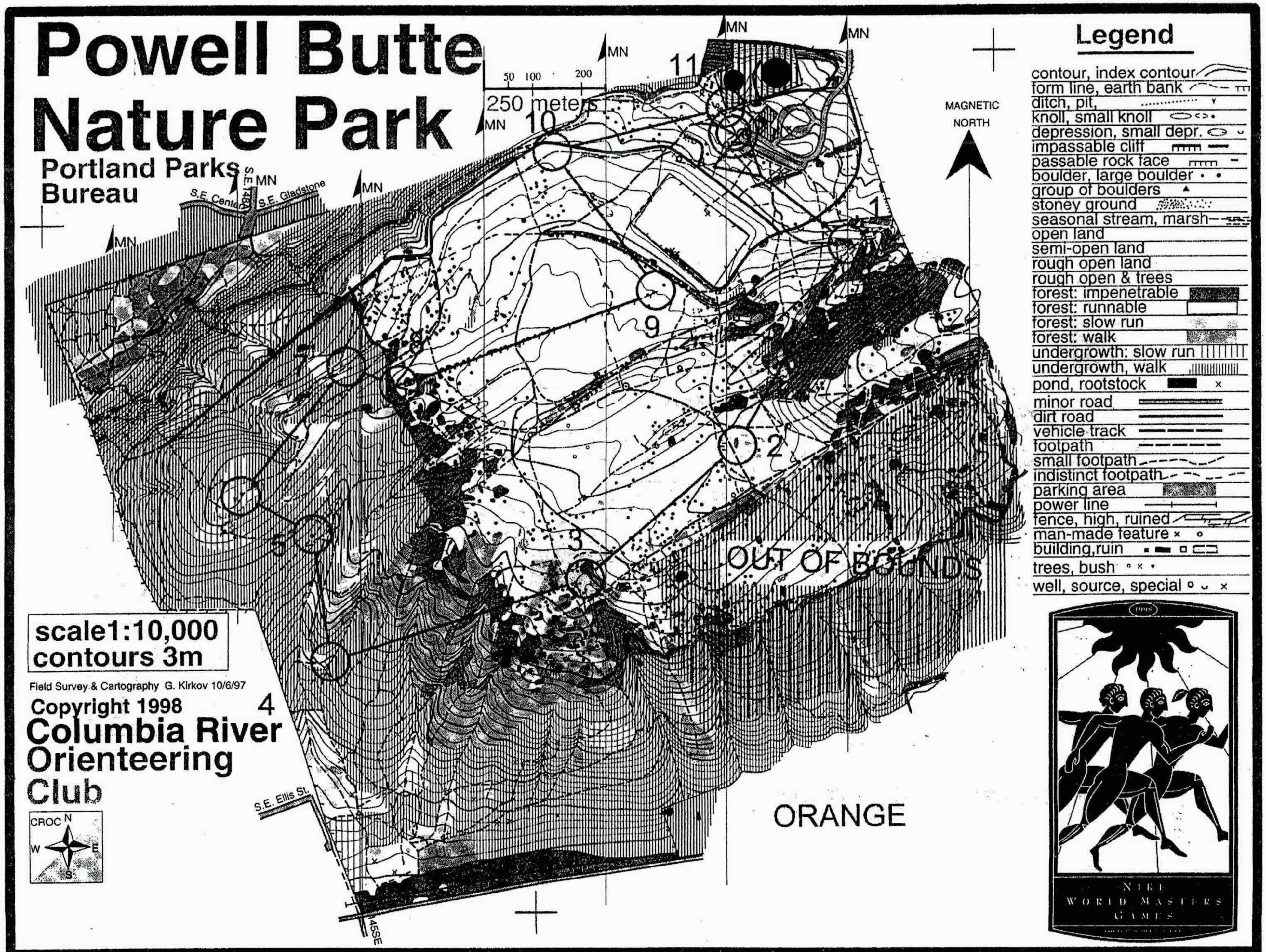
On December 12, 1999 we released 455 rainbow trout fry into Blue Lake. Our second batch was released on March 8, 2000 which consisted of 1123 fry that were also released into Blue Lake.

Colin Webber

Topographical Map

One of the important parts of the Powell Butte monitoring project was to accurately mapping the positions of the wetlands in the park. In order to do this we needed to get maps that were accurate to the nearest half foot. We also needed to have maps that were topographically accurate so that we could predict where the wetlands and runoffs would be. For this kind of accuracy we needed to find a company that would make maps using aerial photos for their maps. We decided to use the Spencer B. Gross photogrammetric engineering company. They also gave us a slight discount. Now the most important part of their job is to have accuracy in the way that the pictures are taken. By using markers on the ground they are able to follow a preset grid pattern. Each photo follows a straight line, and overlaps with the previous one forty percent. The pictures from different angles are what give the perspective needed to make a topographical map. Now after a set of pictures is taken the film is developed at the plant. Now the trick to the development is that the filmstrip is about five to eight hundred feet long. And while it is being run through the main processing machine it must be in total darkness. Not even light amplification goggles can be used due to the infer-red beam that they send out. Now the slot that the film is fed into is only a half inch longer on each side that the filmstrip. If the person doesn't lay it perfectly in about fifty feet the film will start to rub on the wall and it will ruin the pictures, and film. Now to get into this room there is this cool star trek looking thing that you have to go through. This is what produces the huge five-foot wide aerial photos.

Now the first step to making the topographical map is to take two overlapping photos and set them under a special pair of lenses. These lenses give two perspectives of the photos and this gives the illusion of a third dimension. Now from this point the pictures are fed into a computer that dose this. Using liquid crystal lenses that increase the third dimension allow a technician to draw the lines that make up a topographical map. Now in the days before computers a technician would have to use the split lenses and draw the map by hand. A map of the same size would take

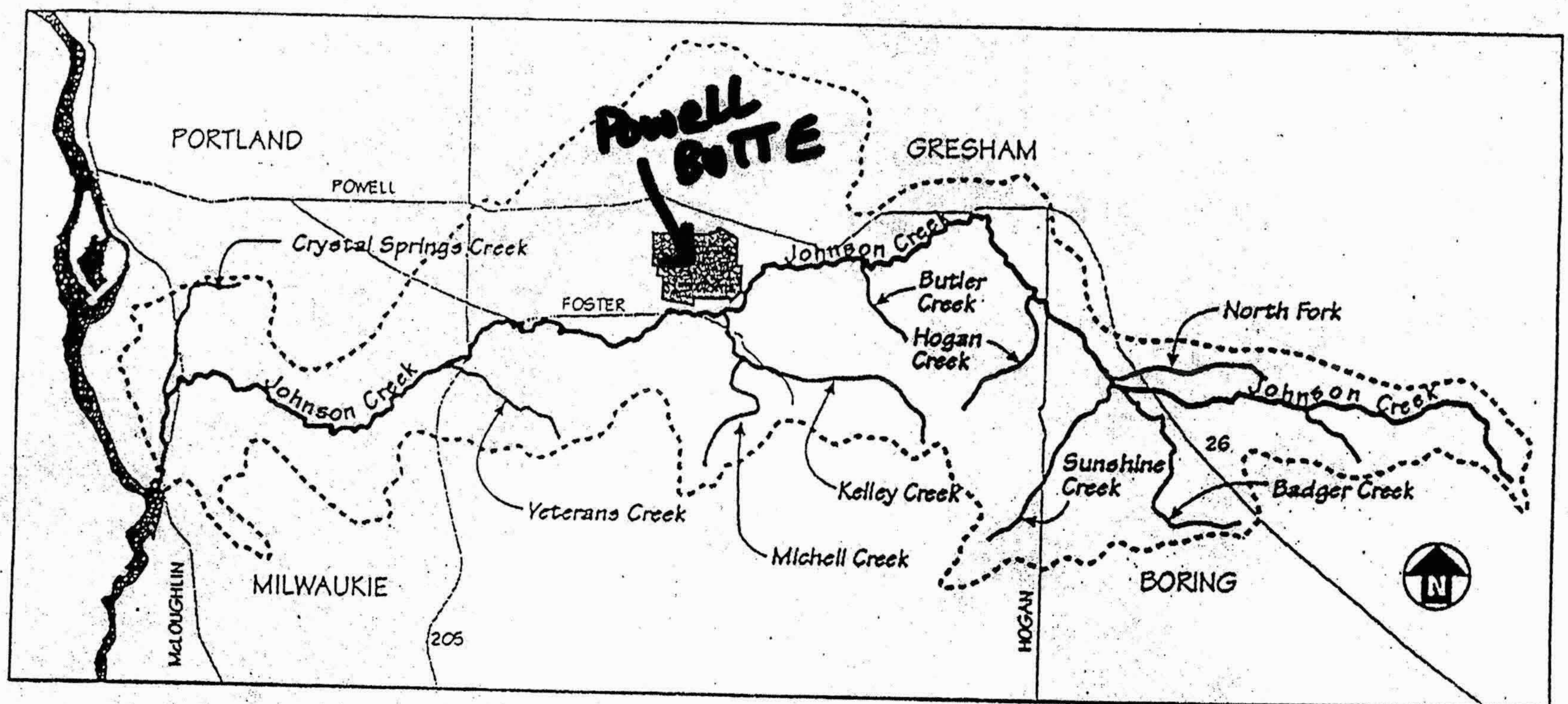


Powell Butte Nature Park
Portland Parks Bureau
250 meters
50 100 200
MN
MAGNETIC NORTH
S.E. Center
S.E. 148th
S.E. Gladstone
S.E. Ellis St.
145SE
OUT OF BOUNDS
ORANGE
1
2
3
4
5
7
8
9
10
11
scale1:10,000
contours 3m
Field Survey & Cartography G. Kirkov 10/6/97
Copyright 1998
Columbia River Orienteering Club
CROC
N
W
E
S
Legend
contour, index contour
form line, earth bank
ditch, pit,
knoll, small knoll
depression, small depr.
impassable cliff
passable rock face
boulder, large boulder
group of boulders
stoney ground
seasonal stream, marsh
open land
semi-open land
rough open land
rough open & trees
forest: impenetrable
forest: runnable
forest: slow run
forest: walk
undergrowth: slow run
undergrowth, walk
pond, rootstock
minor road
dirt road
vehicle track
footpath
small footpath
indistinct footpath
parking area
power line
fence, high, ruined
man-made feature
building,ruin
trees, bush
well, source, special
1998
NIKE WORLD MASTERS GAMES

FIG 3

3-7

Johnson Creek and Tributaries



phase of the Powell Butte trip, more sophisticated monitoring equipment would be used. Compasses, G.P.S., and C.B.L. units were used. Training for this equipment was given separately before phase one of the Powell Butte project.

The orienteering unit's task was vital for the first phase of the project. A standard compass and map were used in locating predicted run-off sites. Each orienteering unit was trained in basic orienteering skills including North and Magnetic North differences.

The G.P.S units required that they be in contact with at least three satellites orbiting the Earth. This was the first stage. After this, basic navigation and coordinate skills were given so that the G.P.S. unit would be competent and able to function in the field.

The C.B.L. units, made up of 2 students per C.B.L., received training in operating the calculator and tester unit. The units were vital to the project in that they were the only source of data on the water tested. For this reason, each unit had to be competent in operating their C.B.L.

Powell Butte: Phase One

On Monday, December 6th 1999, Central Catholic students went on-site to Powell Butte. Previously determined were six sub-basins that were to be monitored and have any run-off tested for the first time. Four students were assigned to each sub-basin, with each student responsible for a specific operation. The operations included G.P.S. monitoring, orienteering, and C.B.L. testing.

Before the research groups could break off, the instruments had to be standardized and calibrated. This was done at the water tank. After this was complete and all testing instruments were calibrated and operational, the students traveled to the mountain finder at the summit of Powell Butte. Here the G.P.S units were calibrated and groups began orienteering to their sub-basins.

The orienteering personnel were only operational during the first phase of the monitoring project. Their primary task was to direct the group to the approximated water run-off sites. A standard compass and topographical map were used. On it, the map had marked where predicted run-off sites would be. It was the orienteering unit's job to determine if the predicted site existed and if so, to lead the G.P.S. and C.B.L. units to it. Once the site was located, G.P.S. coordinates were taken

The G.P.S., or Global Positioning System, was used in determining the exact grid coordinates of each of the run-off sites. The coordinates were recorded for the benefit of three or four times longer. Using the topographical maps that the Spencer Gross company gave us we were able to predict where a watershed would be, and accurately map the position of known wetlands.

Michael Lennard

Preliminary Training

In October of 1999, two B.E.S. staff members were on site at Central Catholic to offer training in water-quality testing. The training was in preparation for the Powell Butte project in which students would have to identify and test water run-off. There were four areas of water-quality testing demonstrated: pH, dissolved Oxygen (D.O.), temperature, and turbidity. In each of the four cases, two samples of water were used: a sample of tap water, and a sample from a fresh water fish tank that was awaiting the arrival of Rainbow Trout eggs.

pH: Measures the intensity of acidity or alkalinity of the water sample (parts Hydrogen). The test was performed using the Hach Test Kit: Wide Range Indicator pH. Both the tap and the tank water were tested, with the results recorded by each testing group. The correct pH of water is vital to the survival of the organisms that live in it.

D.O.: Measures the amount of dissolved Oxygen present in water. The test was performed using the Chemets Kit: Dissolved Oxygen k-7512. Both tap and tank water were tested with results being recorded. D.O. is vital to those organisms that extract Oxygen from the water whether it be through gills or absorption.

Temperature: Measured the temperature (°F) of the water. A standard thermometer was used for this. Both tap and tank water were tested with results being recorded. Temperature affects both the survival and reproduction of organisms living in the water. It is also a factor in the amount of D.O. present.

Turbidity: Measures the cloudiness (JTU) of the water sample. The equipment used for this water quality testing area was a small disk with black and white counter-shading patterns on it. Both tap and tank water were tested with results being recorded. Turbidity is important as it is an indicator of the water quality.

The B.E.S. training was designed to demonstrate to students the methods involved in testing the four areas of water quality, and the equipment used in the testing process. The B.E.S. training provided the necessary skills needed for water-quality testing on Powell Butte.

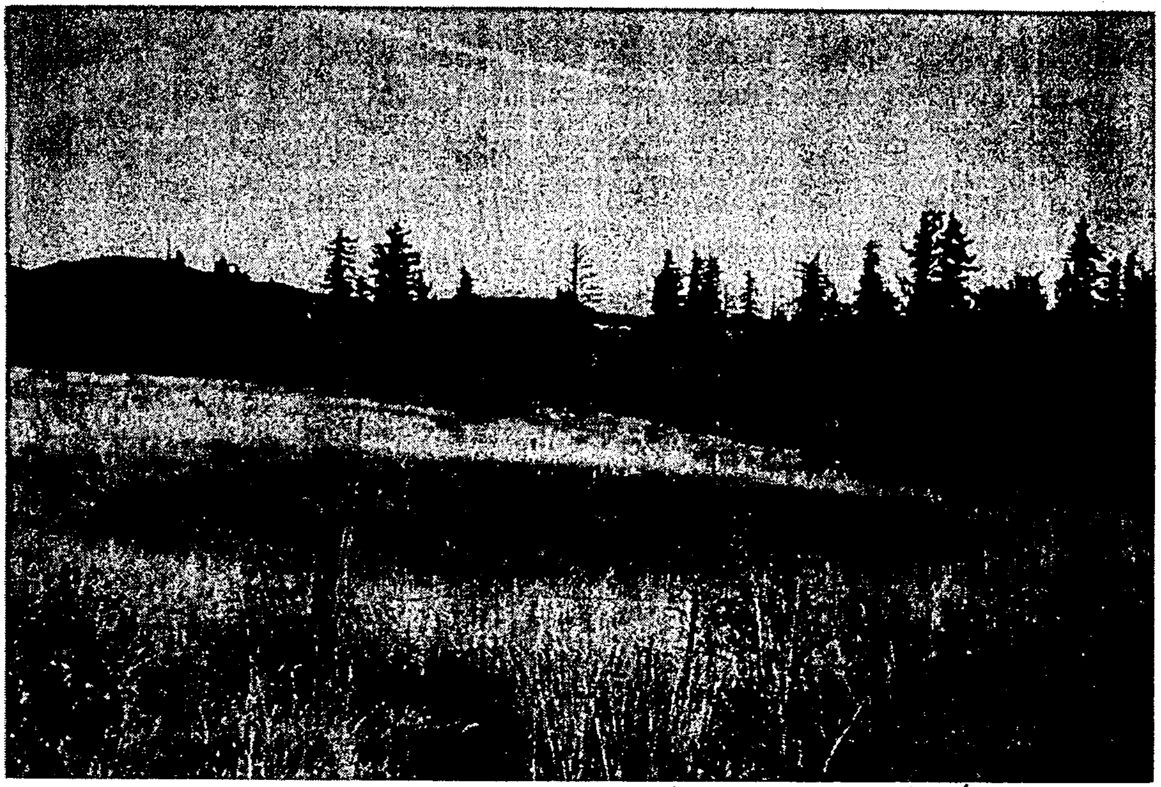
The equipment used during the B.E.S. training was not field equipment and was primarily designed to provide students with insight to the methods used. For the first the second phase of the monitoring project; enabling the sites to be located with relative ease and without the orienteering unit. The first task for the G.P.S. operator was to synchronize their unit with a standard location. This was done so that the coordinates would be standard across the field. At each site located, G.P.S. coordinates were taken down, and a photo with the G.P.S. coordinates was taken.

Once the site was located and documented, The C.B.L. unit, or Calculator Based Laboratory, tested the run-off. Measurements were taken of pH, D.O., and temperature. Each test was performed a minimum of twice to ensure accurate results.

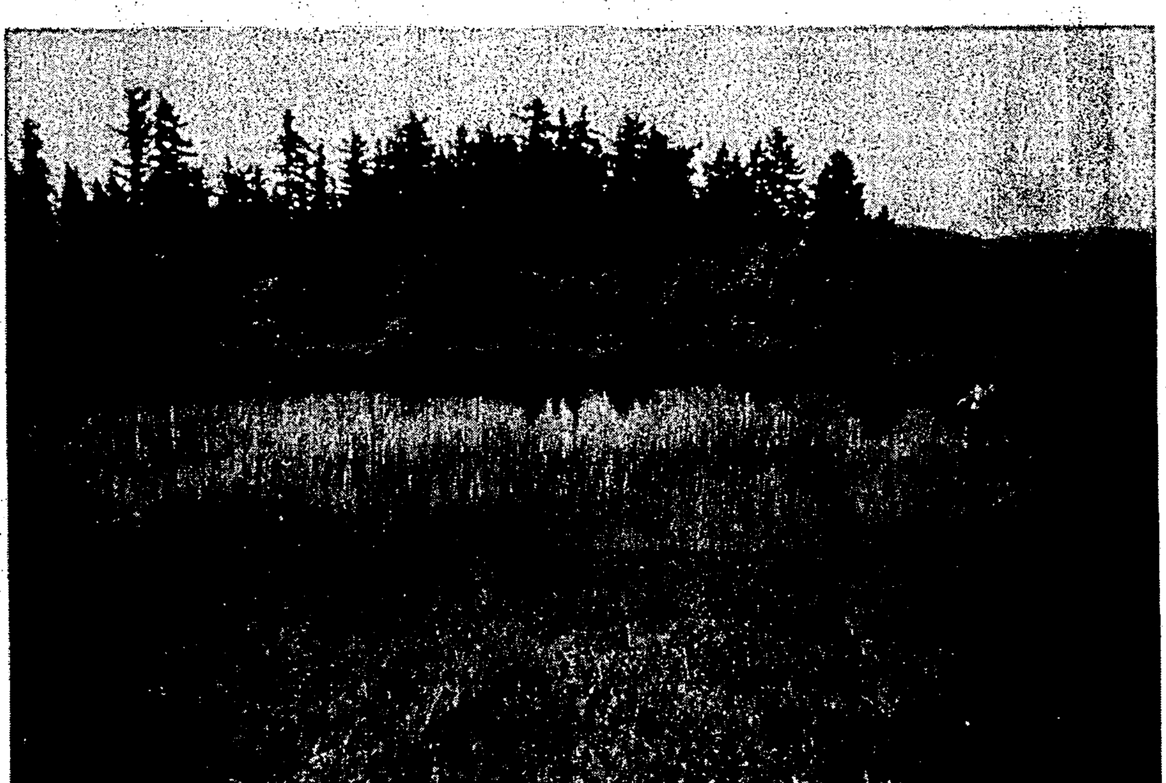
After all the documentation was complete, a sample of the water tested was taken and labeled for further laboratory examination. The data collected was used in concluding the investigative written portion of the project.

E1

45°29'5"N
122° 30' 28" W



SITE E1 10/3/99



SITE E1 5/9/01

4/16

Powell Butte Spring 2000

Site	pH	Temperature
A-1	6.07, 6.13, 5.96	8, 7.9
A-2	5.93, 6.54, 5.93	7.9, 7.8
A-3	5.39, 5.43	9.6, 9.5
A-4	6.06, 6.17	10.3, 10.3
A-5	6.25, 6.55	11.6, 11.5
B-1	4.9, 5.46, 5.54	9.6, 9.6
B-2	6.1, 6.03	9.3, 9.3
B-3	5.7, 5.8, 6.1, 6.1	9.6, 9.6
B-4	5.12, 5.47	12. 7, 12.7
C-1	6.89, 6.91, 7.17, 7.24, 7.05	9
C-2	Dry	Dry
C-3	6.53, 6.67	9.5
C-4	5.46, 6.52, 6.32, 6.17, 6.28	10.2
C-5 "JC slough"	6.36, 6.52, 6.61	12
C-5	4.42, 5.6, 5.35 (+2)	11.2, 11.1
D-1	4.5 (+2)	8.4, 8.4
D-2	Dry	Dry
D-3	4.48, 5.23, 5.63 (+2)	8.7, 8.7
D-3	5.36, 5.81 (+2)	9.0, 9.3
E-1	6.01,	11.57
E-2	4.87, 5.83, 5.93	11
E-3	6.01	11.57
F-1	5.72	12.1
F-2	5.98	12.4

12/6/99

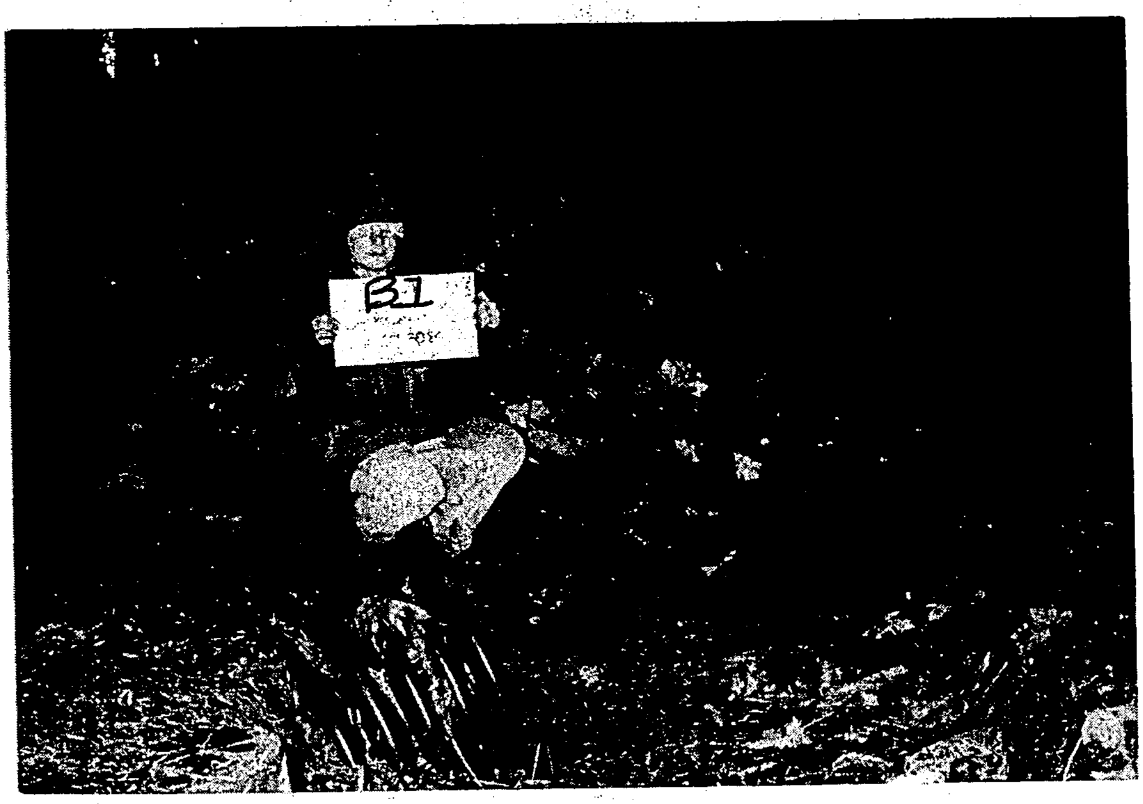
	PH	Temp
A-1	5.32	7.4
A-2		
A-3		
A-4		
A-5		
B-1	5.6	8
B-2	6.74,7.06	8.97
B-3	dry	
B-4	5.86,5.23,6.14,5.77	7.41,7.10
B-5		
C-1	5.4	8.3
C-2	dry	
C-3		
C-4		
C-5		
D-1	5.49	8
D-2	dry	
D-3	dry	
D-4		
D-5		
E-1	5.46,6.3,6.09,6.46,6.8	6.79
E-2	5.88,6.02,6.8	7.72
E-3		
E-4		
E-5		

SITE B-2

45° 29'01" N
122° 30.83" W

12/6/00

	pH	Temp		DO
A-1	dry			
A-2	dry			
A-3	dry			
A-4	7.36	453		
B-2	4.25	4.16		
B-2	6.84/6.18		4.6	
B-3	dry			
B-4	dry			
C-1	dry			
C-2	dry			
C-3	dry			
C-4	dry			
C-5	5.6,5.86		2.4,2.4	
D-1	dry			
D-2	dry			
D-3	dry			
D-4	dry			
E-1	7.4/6.48/6.54		2.1	11
E-2	no water			
F-1	6.8	1	9	
F-2	no water			
F-3	6.4		9	



SITE B1

45°28'29"N
122°30'84"W

Group A – Powell Butte Sites

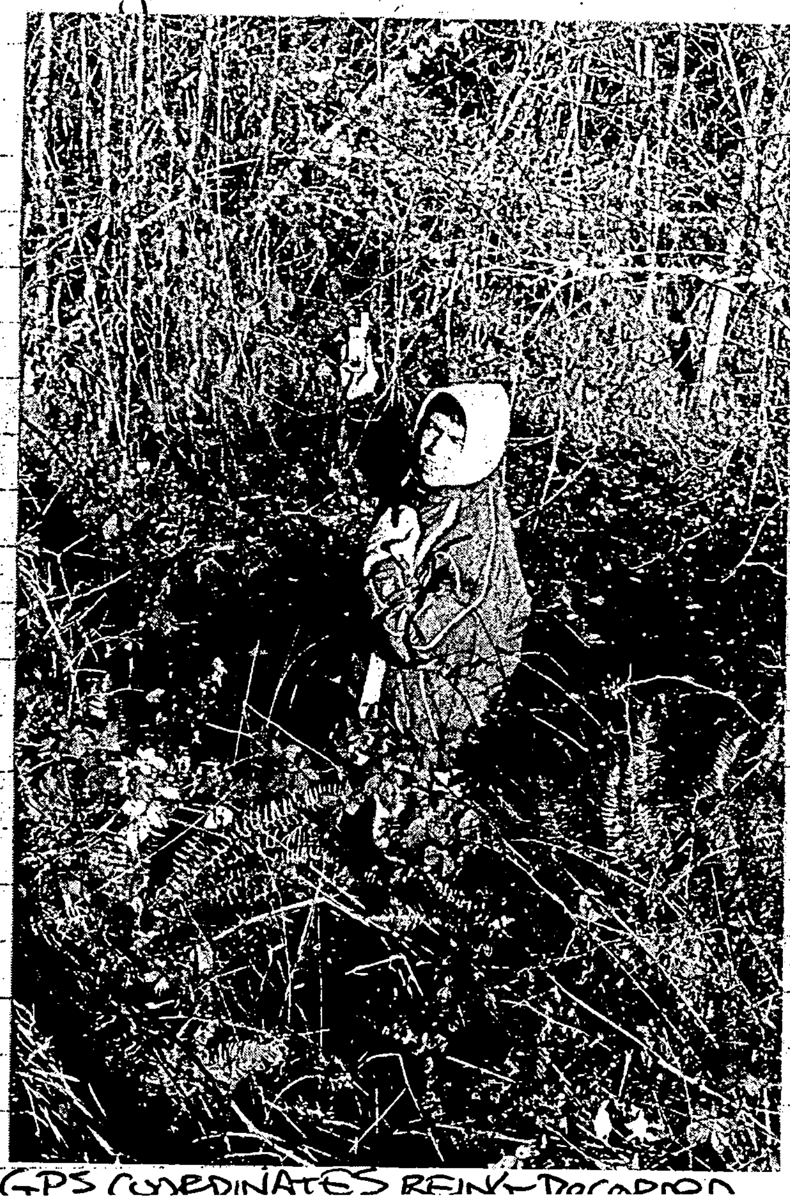
A-1 → latitude: 45° 29 min. 49 sec. N
longitude: 122° 31' 13" W

A-2 → latitude: 45° 29' 47" N
longitude: 122° 30' 33" W

A-3 → latitude: 45° 29' 35" N
longitude: 122° 30' 75" W

A-4 → latitude: 45° 29' 39" N
longitude: 122° 31' 07" W

A-5 → latitude: 45° 29' 45" N
longitude: 122° 31' 06" W



GPS COORDINATES [illegible]

Maureen O'Hara
Candace Ruscitti
Anna Holmer
Sarah Crane

Water Quality Testing Sites
GROUP B

B-1
Latitude: 45°, 28.89° N
Longitude: 122°, 30.84° W

B-2
Lat. 45°, 29.01° N
Long. 122°, 30.83° W

B-3
Lat. 45°, 29.03° N
Long. 122°, 30.84° W

} stream

B-4
Lat. 45°, 29.29° N (wetland)
Long. 122°, 30.44° W

SITE B-4 4/14/00

Ty Trevarthen
Group C
4-14-00

C-1	Latitude	45°N	28 m	85 s
	Longitude	122°W	30 m	80 s
C-2	latitude	45°N	28 m	83 s
	Longitude	122°W	30m	74 s
C-3	Latitude	45°N	28 m	83 s
	Longitude	122°W	30 m	60 s
C-4	Latitude	45°N	28m	78 s
	Longitude	122°W	30m	78 s
C-5	Latitude	45°N	28m	78 s
	Longitude	122°W	30m	86 s

TRAIL CULVERT AT SITE C3

Gabe Button
Mike Barron
Luke Huffstetter
Katie Evens

D1 - G.P.S. Latitude 45°N 28 min. 86s
Longitude 122 W 30 min. 44s

D2 - G.P.S. Latitude 45°N 28 min. 86s
Longitude 122° w 30 min. 55s

D3 - G.P.S. Latitude 45°N 28 min. 87s
Longitude 122° w 30 min. 52s

SITE A-4

12/6/99

NEXT TO EACH OTHER

F1:
Lat: 45° N
Long: 122° W

F2:
Lat: 45° N
Long: 122° W

E-1 → Lat: 45°N 29 min 5sec
Long: 122°W 30 min 28sec

Jaclyn LeDoux
John Mackin
Dan Parscale
Sarah Hainley

E-2 → Lat: 45°N 29 min 11 sec
Long: 122°W 30 min 21 sec

HARD TO FIND WETLAND NORTH OF E1 IS SMALL BUT EXISTS.

JOHNSON CREEK
G.P.S. COORDINATES

① UPSTREAM BRIDGE EAST OF P.B. NEAR GUN CLUB
45°29'16" N 122°29'25" W

② UPSTREAM BRIDGE SE OF P.B. AT MILEPOST 13.5 SCT
45° 28' 97" N 122°29'52" W

③ 158TH STREET BRIDGE S OF P.B. / MANURE COMPOST
45° 28' 42" N 122° 30' 11' W

④ DRIVEWAY OFF FOSTER RD. B/W B. WELCH & 158TH (S. OF P.B)
45° 28' 69" N 122° 30' 57" W

⑤ J.C. SLOUGH (APPROX) → (SW OF P.B)
45° 28' 83" N 122°30' 89' W

⑥ FOSTER RD @ BARBARA WELCH OVERPASS BRIDGE (DOWNSTREAM SW OF P.B)
45°28'64" N 122° 30' 79" W

⑦ BARBARA WELCH JR. ACCESS (DOWNSTREAM SW OF P.B.)
45°28'55" N 122°30'86' W

Section 6

John Mackin, Sarah Hainley,
Dan Parscale, Jaclyn LeDoux
March 16, 2000
Marine Biology

Human Impacts on Powell Butte Park

Sarah Hainley

The Wilson Homestead was purchased in 1925 by the City Of Portland to preserve a site for future water reservoirs. It was farmed by a family, the Andereggs, who leased the property and acted as its caretakers. There were many proposals by various groups on how the land could be used in Powell Butte's early history. But by the 1950's, the city decided to continue with its first interest, which was to use Powell Butte as a site for water reservoirs.

A 1968 proposal would have allowed community activities, such as a highly developed park and a clubhouse, to be built on the Butte. But the Water Bureau didn't support these improvements and they ended up playing an important part in the protection of the land. People began to discover the many recreational outlets that Powell Butte had to offer as more and more became residents of southeast Portland. Since that time, off-road motor vehicles, dirt bikes, and motorcycles have had access to the Butte. The actions by those involved in such behaviors have scarred the vegetative cover of the open field and rutted the trails on the slopes. Erosion caused by this has brought damage to the surface of many trails that is past the point of repair.

In 1987, with help from the Water Bureau, the first Powell Butte Master Plan was adopted by the Portland City Council. It was made to provide Powell Butte as an option for park and recreational purposes as well as for water service uses. Under the Master

Plan, though, the Butte could only be used to "enhance appreciation of the natural environment of the Butte and offer outstanding visual experience while providing opportunities for physical fitness," as well as for educational activities. The plan set forth many guidelines for how Powell Butte could be used and protected.

The Master Plan also set forth zoning guidelines that restricted types of uses. For, example, in the Open Space area, only agricultural and minor park facilities are allowed without a permit. While in the forested area, development cannot be made unless it is "demonstrated that there are no alternative locations within the City for proposed improvements. Plus, in what is called an environmental overlay zone, the bulk use of hazardous substances is prohibited. All in all, major steps have been taken over the last few decades to improve the environment of Powell Butte and how it will be cared for in the future.

John Mackin

Humans have had many adverse impacts on Powell Butte Park. It is a popular park for recreation including mountain biking, hiking, and horse riding.

Mountain bikers who disobey the park rules and go off of the designated paths can trample and kill native plants, which in turn can result in erosion from the loss of roots holding the soil in place. This erosion often finds its way into Johnson Creek, causing clarity to the water to decrease. When excess soil is eroded and ends up in Johnson creek, it destroys fish habitat. If hikers go off of the designated paths, the same effect can occur.

People who ride their horses at Powell Butte also impact the water quality of Johnson Creek without knowing it. When the horse defecates, the feces will eventually find their way to the creek when it rains, unless they are picked up. Since Powell Butte is in the Johnson Creek watershed, the feces wind up in the creek. This affects water quality drastically. The feces act as a fertilizer, which increases algae growth to an unhealthy population. Other plants are choked out by this bloom, which reduces shading and other fish habitat. People often times bring dogs to the park, and when they don't pick up their dogs' feces, the same effect occurs.

When people bring antiseptic wipes, or soaps to wash their hands, or test kit liquids and spill them or use them, the resulting liquids will go to Johnson Creek. These can poison the water, affect pH, and also cause algae blooms if the poisons kill other plants or results in a warmth of temperature.

Powell Butte is used as a part of the drinking water system for the Portland Metropolitan Area. Underwater reservoirs of water mix with the chlorinated drinking water. The underground reservoirs in turn go into the Johnson Creek water system. This can result in the possible chlorinating of Johnson creek. Chlorine kills bacteria and other small organisms, and as a result of it being in Johnson Creek, it can seriously effect the water system. Nitrogen fixing bacteria and other bacteria that breaks down decomposing matter will be killed, resulting in the inability for plants to grow, and for dead plants and other decaying organisms to fertilize the area.

Jaclyn LeDoux

Powell Butte land use is generally divided into three main categories: Open Space (OS), Environmental Conservation (EC), and Environmental Protection (EP) zones; although most of Powell Butte is classified as OS. To protect significant natural resources, the OS has been further divided into the "c" zone, which applies primarily to the meadow, and the "p" zone, which applies to the forested areas.

Land use in the "p" zone is highly restrictive, but facility development in the "c" zone is allowed more readily for aesthetic, scenic, physical, recreational, and educational purposes.

Thus far, the human impact on the butte has been minimal, recreational use has affected the land. Specifically bike, horse, and foot trails are scattered throughout the butte that has influenced the surrounding wildlife. With the constant presence of humans, animals are pushed away from areas close to the trails. Littering on and around the trails creates a problem as well, leaving a new type of habitat and food source that spurs a chain reaction that is discussed in other parts of this report. Furthermore, constant usage of the same areas, and hikers meandering from trails stifles plant growth, thus inhibiting natural habitats.

Although trails cover very little of the OS area, their impact covers much more than just the trail. Like a river has a riparian zone, the trails also have zones beyond them where humans have affected the ecosystem. However, in the proportion of affected OS areas to non-affected OS areas, the affected areas are minimal. Further development on the butte would not be completely destructive if handled carefully.

Dan Parscale

The effects of human contact within Powell Butte are both noticeable and important. Some of these are in fact the involuntary side effects of positive activities, which include the use of various chemicals which are sprayed on the grounds of parking lots in an attempt to clear away dust and dirt. Rain water and other liquid contact causes find their way to the creek when it rains, unless they are picked up. Since Powell Butte is in the Johnson Creek watershed, the feces wind up in the creek. This affects water quality drastically. The feces act as a fertilizer, which increases algae growth to an unhealthy population. Other plants are choked out by this bloom, which reduces shading and other fish habitat. People often times bring dogs to the park, and when they don't pick up their dogs' feces, the same effect occurs.

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Jaclyn LeDoux

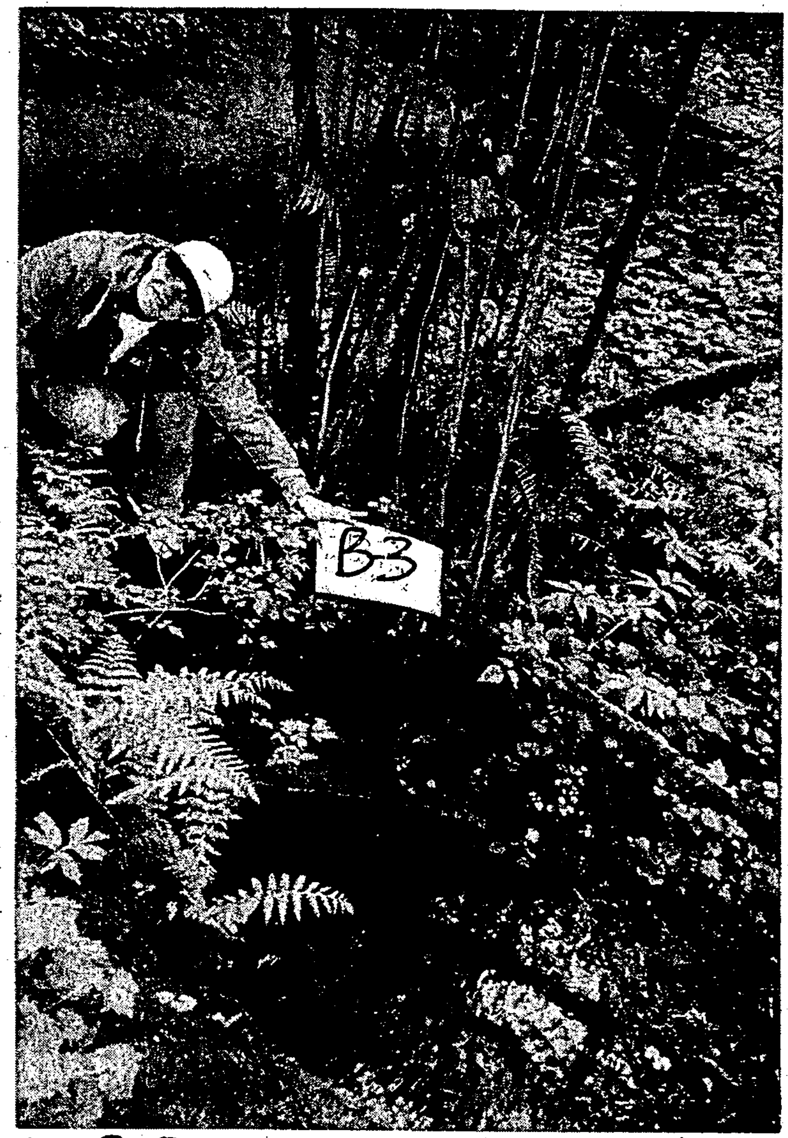
Powell Butte land use is generally divided into three main categories: Open Space (OS), Environmental Conservation (EC), and Environmental Protection (EP) zones; although most of Powell Butte is classified as OS. To protect significant natural the chemical to be carried off into nearby grates or land, thereby polluting the water and the surrounding area.

Perhaps more obvious to the casual passerby but no less unfortunate for nature is litter which is left by visitors to the park. Cigarette butts are a common find to the area which are exceedingly harmful to the water for a variety of reasons. Their light weight and small size makes it easy for them to be carried along by even the slightest current to a larger pool of water. Upon reaching this point, the various thousands of chemicals which inhabit the cigarette become exposed to the water supply with deadly ease. The body of the cigarette itself will allow it to remain decomposing for some time, forcing the habitat into accepting an unsightly neighbor. Apart from cigarettes, beer and soda cans are another pollutant in the area. Left carelessly by guests of the park, they also serve as slowly decomposing companions to the wildlife and are an eyesore to the scenery.

Picnic supplies appear to play a role in the decomposition of the site. Small plastic bags, paper bags, and other supplies such as plastic utensils and juice packages are a predictable left over for the park area. The plastics especially are an unacceptable pollutant which takes a great deal of time to decompose and be taken care of.

Various other human impacts can come as a result of simple human interaction. Walking through mud collects dirt on the bottoms of boots which often is deposited in puddles of water. Silt and dirt build up leads to create unclean and unhealthy water supplies in the river.

Studying at one pond site uncovered a victim of pollution such as these; a single dead frog was discovered near the edge of the pool of water. It's physical appearance gave just cause to believe that the frog had been deceased for some time, and the juice packet laying less than 10 feet from the pool served as a tell tale sign of the cause of the frog's demise. It should be noted as well that this particular area had been fenced off and had been labeled specifically to keep visitors away to keep litter away from the pond.



SITE B-3 4/14/00

Powell Butte Nature Park is a huge volcanic mound, unique in that it sits on a 50 million Gallons underground water reservoir, that is part of the Bull Run water system. It is the perfect location to serve as the hub of the water system. The Bull Run watershed supplies water by gravity to Mt. Tabor, Washington Park, and Washington County.

More than 85 percent of the water that the Portland Water Bureau supplies goes through the Powell Butte reservoir. Conduits from Bull Run can deliver up to 146,000 gallons per minute to Powell Butte. Pipelines also deliver water to Powell Butte form the Columbia South Shore, which is about 4.5 miles north of Powell Butte. This allows the Bureau to mix ground water from the wellfield with Bull Run at Powell Butte. The Water Bureau purchased Poell Butte in 1925 but did not build the reservoir until 1981.

The Bull Run watershed has been the City of Portland's primary water resource since 1895. The watershed is about 5 miles west of Mt. Hood and about 26 miles east of downtown Portland; it covers 102 square miles. Elevations range between 750 and 4,150 feet above sea level. Raw water quality is exceptional, and remains close to the chemical make-up of rainfall.

Human access to the watershed is restricted. Watershed protection is a tradition for this resource. The first legislative effort to protect Bull Run occurred in 1904. The natural purity of Bull Run water and Portland's nationally recognized watershed protection program allow the Water Bureau to meet federal and state water quality regulations without filtering the water. The watershed is part of the Mt. Hood National Forest. The Forest Service and the Water Bureau provide cooperative management.

Rain, fog drip, and snow melt are the primary sources of water in the Bull Run. Average annual rainfall ranges from 80 inches at the Headworks to 180 inches per year in some areas of the watershed. Average annual runoff at the Headworks is about 600,000 acre-feet. On peak flow winter days, several billion gallons of rain water may pour over the spillway at Bull Run. Although the Bull Run watershed is located in the northwest foothills of Mt. Hood, snowpack and glaciers on Mt. Hood do not drain into the Bull Run Watershed. Runoff from the west side of Mt. Hood drains into the Sandy and Willamette basins.

SITE B-4

45° 29' 29" N
122° 30' 44" W

Sarah Crane, Anna Holmer
Maureen O'Hara, Candace Ruscitti
3/16/2000
Marine Biology
Powell Butte Assessment

History of Powell Butte

Powell Butte, over looking the countryside in Southeast Portland, is one of a small series of volcanic lava domes that make up the Boring/East Buttes Lava domes. Many aspects of the butte have been studied over the years, but seasonal runoff is one of the few issues that has not been closely monitored. In order to conduct a thorough study of the effects Powell Butte's runoff has on the water quality of Johnson Creek, a brief history of the butte should be understood.

In April of 1925, Ordinance 46671 was passed, allowing the Portland Water Bureau to purchase 555.7 acres of land from George Wilson. $135,000 cash bought the Wilson property, at that time called Camp's Butte. Two years later, in May of 1927, after controversy surrounding improvements made by Henry Anderegg prior to the Water Bureau's purchase, an ordinance was passed to solve the conflict, and less than another two years after that, there was a public call for bids to lease Camp Butte. Anderegg began leasing the land for grazing on March 6, 1929. He agreed to pay $200.00 per year while maintaining any needed fencing he built. Not too long after, in June of 1931, another ordinance was passed permitting Anderegg's company, Mt. View Dairy Company, to lease the entire property of Camp Butte for $720.00 per year.

In the years of 1933-1935, discussions were held concerning the placement of site communication towers on the butte. In February of 1935, a joint report by the Bureau of Water Works and the City Attorney turned Camp Butte's future reservoir site to the federal government to establish a world wide radio monitoring station.

In March of 1937, a recommendation was made to demolish two barns on Camp's Butte, and in December of 1938, there was initial correspondence relating to the lease of property to Powell Valley Road Water District for the construction of the reservoir. In February of the next year, Ordinance 72011 authorized a five year lease of Camp Butte's property for grazing Meadowland livestock. (Although this is the latest record of a formal lease agreement on file, livestock grazed on the sit until the 1980's.) Finally, in April of 1939, the reservoir site issue was resolved when Ordinance 72235 was passed, allowing the Powell Valley Road Water District a 200,000 gallon tank.

Seven years later, in September 1946, Camp Butte was selected for the City prisoner rehabilitation farm, but the project was soon rejected due to high bids. In May of the next year, Girl Scout Day camp was held on Camp's Butte, but in the next year, a decision was made to halt leasing of Camp's Butte property because of various tax issues. Then, in April of 1950, a proposal was received from Mrs. Leo Rech of Gilbert Community Club, requesting the establishment of a community center on Camp Butte's reservoir site. The Water Bureau later decided not to pursue the proposal.

After the proposal in July of 1950 asking to establish a community center on Camp Butte's Reservoir site was recommended not to be pursued another proposal in July of 1955 was proposed. This proposal suggested to construct several reservoirs at Camp's Butte, over a twenty year period to hold up a total of 500,000,000 gallons of water. The proposal included the possibility of site parking and playgrounds on top of the reservoirs. In January of 1958 the Water Bureau felt that the parking and possible playgrounds were not a good idea. They wrote a letter stating that all land above 550 feet in elevation will be used for storage in the future and no permenant structures should be laced and located on top of the reservoirs.

In March of 1958 discussions began on a proposal foe Camp's Butte Regional Park. They discussed the possibility of a airstrip but nothing more was said of an airstrip because it wasn't a realistic proposal.

A year later in March of 1959 Chaney Lumber requested that the Water Bureau put the timber on Camp's Butte up for sale. The Water Bureau denied that request, but a month later in April a small timber sale was recommend to provide right-of-way to Power Pacific and Light.

A letter from Mark Grayson the Commissioner of Public Utilities to Mayor Shrunk was written in September of 1959. The letter indicated the intent of the Water Bureau was to sell most of Camp's Butte property so that they would be able to finance the construction of the reservoir with the money that they received from selling the property.

A resolution was proposed by the Aviation Commission to Portland's City Council for the construction of a satellite airport on Camp's Butte in September of 1959. In February of 1960 a second resolution to reconsider Camp's Butte for a satellite airport was requested.

In April of 1962 ordinance 115062 granted easement for 3 MG reservoir to Powell Valley Road Water District. The water Bureau in August of 1963 suggested to the commissioner's Office that a part of the butte could be leased for rock excavation. A three dimensional model of Camp's Butte was constructed in February of 1964, for a approximate cost of $500. In the mid sixties Camp's Buttes named was changed to Powell Butte.

The Bureau of Parks proposed that a shooting range/park complex be set up for the police academy on Powell Butte,. This proposal was submitted in August of 1967. Later a 1968 proposal also included a community rifle range and clubhouse, plus a well developed park that would feature ball fields, archery, swimming, tennis, golf and horseback riding. However, the Water Bureau did not support these improvements and or suggestions.

In May of 1968 a initial file record of correspondence relating it the draining problem was submitted. Intermittent complaints followed into later years.

During the sixties the City entertained with the idea of putting together a residential development plan for parts of the butte that were deemed unnecessary for water reservoirs. The sale of residential properties was proposed to be used to pay for the development of the planned reservoirs.

SITE B-4 12/6/99

In the December of 1968, a proposal was made that a community rifle range, a Police headquarters, and police academy be built upon the land. This facility would include: a clubhouse, restaurant, camping, golf course, trails, picnic area, field sports, tennis, swimming, outdoor theater, lawn bowling, stables, 8 water tanks, barracks and many more. These would all be build on the Camp's Butte, although the Water Bureau did not support the ideas of these improvements. They made a big difference in stopping the construction of those things being built. Although, the Water Bureau later helped build storm drains to take the water away from areas of land at the bottom of the Butte.

Then, in March of 1974, the Powell Valley Water district prepared for construction of 7.5 MG reservoir. They prepared for the reservoir, and later in January of 1975, a geological reconnaissance of Powell Butte prepares for the bureau of Water Works.

After that, the idea of the rifle range resurfaced. The idea was reevaluated in September of 1976, and the Water Bureau did not object to the proposal. Last time the bureau did not like the idea and they did not reject the idea. Although, Southeast Portland was growing, and with that came more people to entertain. Officials noticed that more people were spending time outdoors. They liked hiking, biking, walking and many more. This was all occurring in April of 1977. The officials decided to make a reservoir, and so there was a public hearing about it and the Hearing Office approved. Along with the reservoir, $20,000 was included by the Bureau of Parks. This money made both the reservoir and recreation area possible. The development plan was made under the J.M. Montgomery contract. Then, in April of 1978, J.M. Montgomery made preliminary designs for Powell Butte.

Later, from May to September of 1978, various other things happened. First, there was a meeting on the reservoir, then Wilsey and Ham proposed a few ideas. They were ideas in which showed work for a Recreational study. This proposal took 276 hours of work. Then, in September a Meadowland Development Project Report came out about proposal for a dairy on the site. The dairy would be called Meadowland Dairy.

Since, off-road vehicles and dirt bikes had access to the Butte, that problem had to be monitored. These vehicles tore up the vegetation and did not help the land, so in April of 1979, a "Dirt Bike Patrol" was established. These people cracked down upon the many off-road bikes.

Finally, after lots of time and effort, in 1980 the 50 MG reservoir was constructed. This reservoir took lots of time and effort from different people. Later in November of 1981 a big mud slide occurred around the area of the reservoir and work and repair groups cleaned up in December.

SITE E-1 12/6/00

John Fox

In 1981 a covered reservoir that would store at least 50 million gallons of water was built on Powell butte, which was purchased by the Portland Water bureau in 1925. The reservoir is gravity fed its water. This means that the underground streams that come from the Bull Run watershed and feed the reservoir with ground water. The Bull Run watershed is at an elevation of 750 feet so the water uses gravity to flow into Powell Butte. The reservoir hardly needed any pumping to collect the ground water because the land formations provided the cheapest way of collecting water. Instead the streams were slightly altered to flow in the path of the reservoir.

Because of the rock and thick soil that holds most of Powell butte streams underground the water bureau of Portland had to alter the paths and tunneling that the streams follow. Large metal pipes now guide many of the streams. These pipes keep the streams from eroding away at the ground and changing their course. The Water bureau believed that it would be cheaper for them to install these pipes instead of installing pumping units to collect the water from streams that have eroded new paths.

Over the last 75 years Powell buttes streams have changed their pats dramatically. If the Portland water bureau hadn't put in the piping to reinforce the underground streams they could possibly have eroded 200-300 meters of course. The ground water that comes from the Bull Run and fills the Powell butte reservoir a source of 85% of Portland's drinking water. With the water from the Bull Run watershed the water bureau has produced more than 20 production wells. These wells store 90million gallons of water a day that the city has the right to use 300million gallons of it each day.

SITE OF EROSION AT B-2

Maureen O'Hara

Powell Butte Land Use History: 1982-1996

In the early 1980s, landslides on the steep slopes of Powell Butte occurred and "prompted the Water Bureau to construct major drainage canals on the site in 1982" (1996 Powell Butte Master Plan, 9). In February of 1982, the State Representative Lonnie Roberts wrote a letter in which she said how she was displeased with the City's handling of the Powell Butte landslides, and in April of the same year the Powell Butte Interdisciplinary Team was formed. Their purpose was to discuss means of providing a permanent solution to drainage problems. The result was the *drainage canals* ("slide mitigation improvements") constructed in August-November of 1982 at a cost of $200,000.

In 1983, "the Water Bureau and Parks Bureau agreed to participate in a collaborative effort to develop and manage the Butte as a park for outdoor recreation, in conjunction with planned water facilities" (P.B. Master Plan, 10). Also, in 1983 the Water Bureau and Portland Police Bureau developed a plan for dealing with *off-road vehicles* on Powell Butte.

A Master Plan for Powell Butte was prepared in 1986 by staff from the Parks Bureau. "Funds were allocated from the Water Bureau and obtained through a grant from the federal Land and Water Conservation fund for implementation of the Master Plan, including construction of needed park amenities" (P.B. M.P., 10).

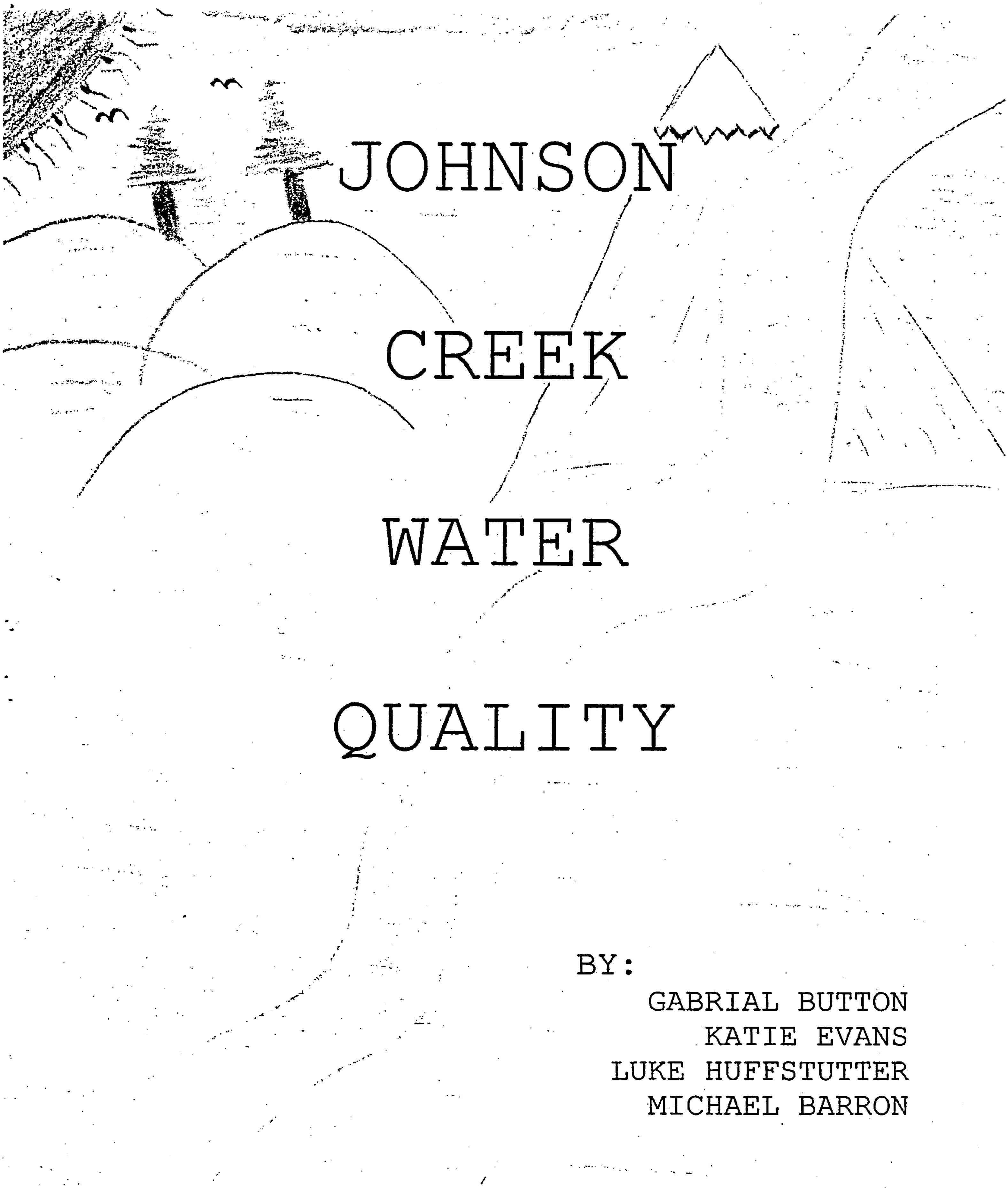
In 1987 the City of Portland adopted the InterBureau Agreement between the Water and Parks bureaus. It "set forth the specific roles, responsibilities, and uses of Powell Butte" between the two bureaus. The Water Bureau retained Butte ownership, and the Parks Bureau developed Powell Butte as a park based on the 1986 P.B. Master Plan. The Master Plan "provided for the joint development and utilization of Powell Butte by the Park Bureau for park and recreation purposes and the Water Bureau for water service-related uses. Multiple management policies, uses and planned facilities are identified in the plan including planned water reservoirs, park amenities and natural areas" (P.B. M.P., 11).

In July 1990, the Powell Butte Nature Park was opened to the public.

In August 1991, environmental overlay zones were adopted for protection of Powell Butte.

In 1995, the Johnson Creek Resources Management Plan was created to provide for "management of resources in the Johnson Creek watershed" (P.B. M.P., 11). Because Johnson Creek receives runoff water from Powell Butte, this plan was needed to "set forth specific natural resource management provisions" for Powell Butte.

In 1996, the Outer Southeast Community Plan was made to "guide growth and development in outer Southeast Portland to the year 2015. The plan designates Powell Butte as open space and contains provision for protection of natural areas on and around the Butte" (1996 Powell Butte Master Plan, 11).



JOHNSON CREEK WATER QUALITY

BY:
GABRIAL BUTTON
KATIE EVANS
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Marine Biology/4
March 17, 2000

Historical Stream and Runoff Conditions for Johnson Creek Watershed

With an estimated 150,000 people living in the Johnson Creek watershed, its waters are flowing better then it ever has before. It spans from the foothills in the Cascades to the low land of the Willamette River.

Only forty-eight percent of the watershed is protected for park use. The remaining percentage is commercial land use. Drainage in the Johnson Creek watershed is highly affected by Oregon's rain. With light to moderate showers, its waters drain into the Columbia Boulevard sewage treatment plant. In heavy rain, overflowing into the Willamette River can be a hazard.

Surprisingly, with the presence of obstacles such as most urban development, the stream flow is faster then in those areas with a large amount of vegetation or undeveloped areas. The stream flow has improved thirty percent over the last sixty years.

In the 1930's, Johnson Creek was channeled and rocks were added to reduce the cause of a flood, and to prevent erosion in the sediment. Farmers also play a vast role in the stream channels. These farmers have intentions to change the course of the channels and straighten them out. By doing this, the farmers land will experience new growth and produce better crops. Construction workers are also attracted to the watershed. The flat land is eye pleasing in urban development.

Luke Huffstutter

March 16, 2000

Mr. Vasen

Johnson Creek

Johnson Creek Water Quality

Johnson Creek has been in the midst of the salmon and steelhead crisis. This watershed is an important part to salmon stalks and runs. The water quality there has been in question for some years. With the help of Dr. Pan, a professor at Portland State University; his students from Portland State University; Bob Roth, from the Johnson Creek Watershed Council; Rachel, from EDS; and our own filed work at the creek, we have compiled information on the current situation.

Johnson Creek water comes from the surrounding area. Portland, Gresham, Happy Valley, Milwaukie, Clackamas County, and Multnomah County make up this water shed. Although most point pollution has been terminated, there is still much non-point solution to be dealt with. As we go through each area of the watershed we can see all the different kinds of pollution that cause the water quality to be the way it is.

The headwaters start near Gresham where they come across the non-point pollution, farming. Farmers put fertilizers on their crops and when the rain comes it gets washed into the watershed. As well the manure from farm animals gets washed into the watershed. This raises nitrogen levels and kills fish and insects. Then the water moves in to the city. There is a large variety of contaminants from this populated area that find there way to Johnson Creek. With 165,000 people living in the area, a lot of garbage finds it's way into the river such as: car oil, transmission fluid, soap, rubber, animal feces and everyday household Chemicals. Certain things can be done to help prevent chemicals and other pollution from the water. One very important factor is a buffer. A buffer is adequate space filled with vegetation that traps and filters contamination. The buffer surrounding Johnson Creek is minimal and thus ineffective. People can play a role protecting Johnson Creek's buffer and the water within. They can plant trees, shrubs, making sure that oil caps are on tightly, and properly disposing of household chemicals reduces the chance of it reaching the water.

Another thing that can be done is to watch what is poured into the street drains. Drains in Portland, Milwaukee and Gresham feed directly into Johnson Creek. These drains are connected to a system of "Disappearing Streams' says Bob Roth. The city has put these streams underground where they eventually feed to the surrounding creeks and rivers. When someone pours oil or trash into these drains it gets into the creek, killing and ruining the water and stream life.

It is important to understand what position the creek should be in at healthy levels to decide if it is unhealthy. Johnson Creeks Resource Management Plan by the Johnson Creek Corridor Committee had optimal levels for a creek with a salmon stalk. Compare these with our research results to decide if the water quality is of high enough standards.

In natural streams, Oxygen is gradually consumed as leaves, algae, and other vegetation decay. It is replaced by oxygen dissolved from the atmosphere above the stream. This is known as DO.[1] According to the Department of Environmental Quality (DEQ), DO shall not be below 6.5 mg/l. The current conditions in Johnson Creek show the DO to be .

Water temperature depends on the source of water, the volume of flow, weather conditions, and extent of shading by vegetation.[2] The optimal temperature for Coho Salmon is 18 degrees Celsius. The information we got on Johnson Creek shows it at .

[1] Johnson Creeks Resource Management Plan. Johnson Creek Corridor Committee.
[2] Johnson Creeks Resource Management Plan. Johnson Creek Corridor Committee.

Suspended sediment is not regarded as a pollutant unless it is present in excess. This is known as turbidity. High levels of sediment can directly injure fish and blanket the gravel beds needed for successful spawning.[3] The normal levels of turbidity are .

Currently Johnson Creek is at .

Parts Hydrogen (pH) is the measure of acid and alkaline in the water. It is measured on a scale from one to fourteen: one being high acidity, fourteen being high alkaline, seven being neutral. It is unhealthy for the water to be lower than 6.5 or above 8.5. The pH of Johnson Creek is currently .

Johnson Creek is not what it should be. There are many factors that contribute to the water quality. With non-point pollution unchecked, it is hard for any one group to control the problem. It takes a combined effort from the surrounding communities to keep the water clean. If we are successful, salmon and other species may be able to safely return to Johnson Creek.

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[3] Johnson Creeks Resource Management Plan. Johnson Creek Corridor Committee.

Trevor Graves

Michael Lennard

Ty Trevarthen

Matthew Zahler

The Condition of Fish in Johnson Creek

One of the objectives of the Johnson Creek Resources Management plan is to determine whether Johnson Creek can be rehabilitated to a level that will support natural spawning and rearing of anadromous salmonids. As a result, the City of Portland funded a study in 1992 to determine the species composition and relative abundance of fish species in the Johnson creek watershed. This was the first fish survey that attempted to provide a comprehensive look at the fish populations from the mouth of the creek to its headwaters. In addition to the city's study, interested citizens working in cooperation with Oregon Department of Fish and Wildlife (ODFW), conducted electrofishing surveys in 1993 in upper Johnson creek and in crystal Springs creek. These recent data sets as well as some recent information on habitat conditions are summarized in this memorandum and their significance to rehabilitation efforts are discussed. As discussed above, two fish surveys have been conducted in Johnson creek since the spring of 1992. The city of Portland's survey was conducted by Beak Consultants Incorporated and followed the quidelines of the U.S Environmental Protection Agency's (EPA) Rapid Bioassessment protocol V (Plafkin et al. 1989). Fish ware collected with a backpack electrofisher at six locations on mainstem Johnson creek. Each site was sampled in June and August, 1992 Data collected included species composition and numbers of each species . ODFW's fish survey was conducted in July 1993, using backpack electrofishing gear Four mainstem sites were sampled (Figure 1). Species composition and numbers of each species were recorded.

On February 26, the National Marine Fisheries Service proposed to protect under Federal Endangered Species Act more than a dozen West Coast salmon and steelhead populations faced with extinction. A final listing decision will be made next year. The Johnson Creek watershed is included in the boundaries of the Lower Columbia Chinook unit. According to William Stelle, head of the fisheries service's NW office, "Finally, the fundamental point is that our salmon populations are sick because our watersheds are sick. We won't recover salmon until we recover the health of our watersheds, which are their home. It is the heart of the problem, and the toughest part of the challenge." Declining salmon, steelhead, and trout runs are due to a variety of inter-related watershed conditions. Since these impacts have occurred over a centuty, improvement will require time as well. The Johnson Creek watershed is undergoing additional commercial and residential development which can degrade conditions further without careful implementation of conservation practices. Development in the watershed has caused significant loss of habitat for fish. Johnson Creek tributaries have been encased in pipes and put underground. Access to spawning and rearing habitat has been cut off by culverts. Lining stream banks with stonework and the removal of woody debris has also contributed to habitat decline. Native fish species are sensitive to water quality which has declined from point and non-point pollution sources. A historic example of point source pollution is the dumping of industrial waste into Johnson Creek for disposal. Non-point pollution sources include run off from agricultural operations, lawns, streets, and parking lots. Sedimentaton disrupts aquatic and spawning habitat, Sedimentation occurs as soil washes into the creek from construction sites, hillsides, and bare ground. Adequate water quantity is also a concern, partially for the chinook salmon navigating the creek during spawning season in September and October Low water levels are subject to decreased levels of dissolved oxygen, higher water temperatures, and higher concentrations of pollution in the creek.

The creek has been documented to support coho salmon, steelhead, cutthroat trout, and fall chinook. In response to declining native fish runs in Crystal Springs Creek, the Johnson Creek Watershed. Council submitted a Restoration and Enhancement Program proposal to the Oregon Department of fish and Wildlife. (ODFW)

Nothing is known about fish populations in Johnson Creek before European settlement. It seems likely, however, based on comparisons with less-disturbed stream's in the lower Willamette watershed, that Johnson Creek supported runs of steelhead trout sea-run cutthroat trout, coho and chinook salmon. Conditions for these fish declined after the watershed was settled, logged, and converted to agricultural and urban uses. Channelization of much of the creek by the Works Progress Administration in the 1930s, and the use of the creek for wastewater disposal, further exacerbated already deteriorated conditions. Water quality in the creek has probably improved somewhat in recent years. Currently, Johnson Creek contains many small non-game fish, but only a remnant of the historic salmonid runs. Salmonids tend to be more sensitive to environmental change than most fish species and are a good indicator of overall environmental health. Information on the fish in the Johnson Creek watershed is based on several surveys, fish kill the reports and occasional observations made by residents and wildlife agency personnel.

Different life stages of steelhead, coho and chinook salmon are, or could be, in Johnson Creek. Winter-run adult steelhead return to spawn in Johnson Creek from mid-November through May. There appear to be two separate runs of winter steelhead peaking in January and February and again in April and May.

Adult coho salmon have been observed in the lower reaches of Johnson Creek from late September through early November. A particular race of fall chinook, referred to as the "tule" have historically spawned in Johnson Creek. Chinook salmon probably enter Johnson Creek to spawn from mid-September through October. The other salmonid species present in Johnson Creek is the coastal subspecies of cutthroat trout. The coastal subspecies has both sea-run and resident forms. Although it is possible that both forms occur in Johnson Creek, no recent documentation of the sea-run form has been found. Data from electrofishing surveys conducted in 1992 and 1993 indicated that cutthroat trout are present in low numbers throughout the mainstem of Johnson Creek and are more abundant in the small headwater tributaries. Fry and juvenile life stages were found primarily in small tributary streams, although a few juveniles were found in the mainstem in the vicinity of Gresham.

One of the objectives of the Johnson Creek Resources Management Plan is to determine whether Johnson Creek can be rehabilitated to a level that will support natural spawning and rearing of anadromous salmonids.

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Cutthroat trout was the only salmonid species found throughout the length of Johnson creek. It was absent only from the collections at PM 4.5 and 12.5 juvenile rainbow trout (steelhead) were found only at the three lower sampling locations.

Stocking practices may partially explain why rainbow trout (steelhead) were found only in the lower 9.8 miles of the creek in 1992. Natural reproduction of steelhead and coho salmon in the Johnson creek watershed is supplemented by fry introduced from hatch boxes (small hatcheries) one hatch box has been maintained on Crystal springs Creek since 1981 by Clyde Brurumel with the help of the Sellwood-Moreland Improvement League (SMILE). A second hatch box was installed on the property of

Steven Johnson at RM 2.5 in 1991. Each hatch box incubates from 15 to 20 thousand fertilized steelhead and coho salmon eggs. The eggs are provided by ODFW as part of the Salmon and Trout Enhancement Program (STEP). The fry are released in Crystal springs Creek and in lower Johnson Creek at RM 2.5. Therefore, in years when few wild adults return to spawn, the hatchery fish probably account for most of the juvenile production in the creek. Since the areas where juvenile steelhead were captured were in the general vicinity of the hatch boxes, it is probable that most, if not all, of these fish were of hatchery origin. The absence of juvenile steelhead in the upper portion of the watershed suggests that wild spawning fish were not contributing much,.. if any, offspring to the upper watershed. Also the total absence of coho salmon in the 1992 samples from Johnson creek strongly suggests that survival of the hatchery fry was very low and that there was very little, if any, natural reproduction.

The presence of the single juvenile coho in the vicinity of Gresham (PM 14.5) in 1993 is encouraging in that it indicates that at least some natural reproduction of coho has occurred recently.

Salmonids (trout and salmon) generally comprised only a small percentage of the total catch. Their contribution to the catch exceeded 10 percent only in the vicinity of the Leach Botanical Gardens

The reach between Leach Botanical Gardens and 134th street contains some of the best riparian habitat along the creek and in stream habitat consists of a good mix of riffle and pool habitat. This might explain the increase in relative abundance of salmonids in this section of the creek.

In a healthy anadromous salmonid stream with adequate escapement of adult spawners, juvenile salmonids would be expected to comprise a substantially larger percentage of the electrofishing catch than was observed in the 1992 and 1993 surveys.

The two most abundant species in the catch at nearly all locations were reticulate sculpin and redside shiner. Both of these species are suspected of causing negative impacts to anadromous salmonid species. Reticulate sculpin can penetrate deeply into the substrate and has been observed to teed on salmon eggs.

Very little information is available regarding the number of adult salmon and steelhead which return to spawn in Johnson Creek. The only recent spawning survey data were collected by Beak Consultants Incorporated in May and early June of 1992. The survey was funded by the city of Portland and was scheduled to continue through the fall and winter of 1992 but was canceled after the first September survey due to funding constraints.

The surveys conducted in May and early June 1992 were designed to locate late-spawning steelhead. According to Clyde Brurninel who has made routine observations of crystal springs Creek and Johnson Creek below the confluence of Crystal springs Creek, there are two separate runs of adult steelhead. One begins in late November and continues into January and the other begins in late March and continues through mid Nay. Beak Consultants surveys were initiated 7 May 1992 and continued weekly through 4 4une 1992. A single survey was conducted 17 September 1992 by the same surveyor. The locations surveyed included the following: 1) the creek mouth to 82nd Avenue, 2) 122nd Avenue to 134th Avenue and 3) Gresham Main city park to Barnes Road.

During the Nay-June 1992 survey, no salmonid redds were observed. However, three live steelhead and one steelhead carcass were sighted during the survey period. Also three chinook salmon carcasses were found. All of the fish observed were downstream of 82nd Avenue. The surveyor also reported that residents at 4238 SE Tenino had observed two steelhead engaged in spawning activities opposite their property during the first two weeks of April, 1992.

They also reported that at least four additional steelhead had been observed during the same period in the pool below the gravel bed where the spawning pair was observed.

No salmon or salmon redds were observed during the 17 September survey. The September survey was terminated at the Tideman-Johnson park due to a temporary debris dam that would have blocked upstream access to adult salmonids

Another source of information on presence of adult salmon and steelhead in Johnson creek is the sport catch summaries developed by ODFW from salmon/steelhead punch card returns. Punch card data are available for Johnson creek from 1976 through 1992. The punch card data do not indicate the location within the creek where individual fish are caught; therefore, it was not possible to determine whether fish were caught in the lower or upper reaches. Reported catches of steelhead range from a high of 38 in 1984-85 to none in 1988. Table 3 shows that since 1988 there have been adult steelhead caught each year through 1992 with the catch in 1989 (28 fish) approaching the 1985-86 record high. These data tell us little about the actual size of the spawning runs but do indicate that at least some adult fish were present in the system during the past four years.

It is interesting to note that three chinook salmon were captured in March of 1990 (Table 3). These fish may have been spring chinook salmon that had strayed into Johnson creek by mistake.

In summary, there is recent evidence that small numbers of adult steelhead are returning to spawn in Johnson Creek. Some spawning apparently occurs downstream of 82nd Avenue. Inadequate information is available to determine whether upstream areas are presently being used by steelhead for spawning. No recent sightings of adults have been reported from upstream areas and no juvenile steelhead were captured above RN 9.8 in 1992 or 1993.

The status of adult coho in Johnson Creek appears bleak. Escapement of wild coho salmon to Columbia River and Oregon coastal streams has been very low for the past several years. Overfishing in the ocean, coupled with poor ocean conditions have been key factors in the recent decline of the wild coho runs. These factors coupled with poor habitat conditions in Johnson Creek are probably responsible for low abundance of coho in the watershed. The Only recent evidence for adult coho in the Johnson Creek watershed are observations of a few fish in Crystal Springs Creek (Brummel pers. comm 4/21/92) and the capture of a juvenile coho in the 1993 fish surveys near Gresham, indicating that spawning has occurred as recently as 1992.

During the tall of 1993, ODFW organized a group of interested citizens from the Johnson creek watershed to collect weekly information on spawning activity of salmon and steelhead in mainstem Johnson Creek. As of mid November, no salmon had been observed. Water conditions were unusually low through the fall months and fish may be waiting for tall freshets to move upstream.

Current conditions in Johnson Creek are considerably more favorable for steelhead trout than for coho salmon. Habitat suitability for chinook salmon is intermediate between that for steelhead and coho salmon. Limiting factors for each species are described in Figure 1.

Several sightings of adult steelhead in the vicinity of Gresham have been reported in the last 15 years. One juvenile chinook salmon was collected from Reach 1 during the 1992 surveys and several juveniles were collected from a short reach of Crystal Springs Creek in 1993. No other recent sightings of chinook have been reported. Because chinook salmon had not been stocked in the creek prior to the surveys, the juvenile fish are assumed to have been produced by natural spawning adults. Low flow upstream of the Johnson Creek/Crystal Spring Creek confluence is a major limiting factor for fall chinook.

The adverse effect of development on fish habitat is well understood. Natural streams exist in a state of dynamic equilibrium with their watersheds. Migratory salmonids evolved to take advantage of the characteristics of the rivers and streams of the Pacific Northwest. When development occurs the dynamic equilibrium between stream and watershed is disturbed. When a watershed is logged, large quantities of silt are often discharged into streams. The silt blankets the gravel that salmonids use to spawn. The loss of cover along stream channels increases water temperatures to injurious levels and facilitates predication of young fish. Discharge of urban wastewater introduces materials into the stream which are toxic to fish and the invertebrates they feed upon. Although these effects are well understood conceptually, it is still necessary to analyze the factors that actually limit fish populations in a given situation. Based on the analysis of limiting factors, a strategy for improvement can be developed.

The fish community of Johnson creek is presently numerically dominated by reticulate sculpin and redside shiner. Speckled dace are also widely distributed throughout the watershed and were relatively abundant in samples collected at RM 0.5 and RN 4.5. Only one coho salmon juvenile and one chinook salmon juvenile were collected during the 1992 and 1993 electrofishing surveys, respectively. Steelhead juveniles were captured in low numbers at several locations downstream of RM 9.8. Small numbers of cutthroat trout were collected at most sampling locations from near the mouth of the creek to the headwaters. Relative abundance of cutthroat trout in the catch was higher in the headwater region from RN 20.8 upstream.

In a productive salmonid stream, juvenile salmonids would be expected to be more abundant and comprise a larger percentage of the catch than was found in Johnson creek. Poor returns of adult spawners may account for part of the low abundance of juvenile salmonids, particularly in the case of coho salmon. However, substantial numbers of both coho salmon and steelhead fry have been planted in lower Johnson Creek and crystal springs Creek during the last few years. If these fish had survived, they should have been represented in the electrofishing catch. No coho juveniles and only a few steelhead juveniles were taken from the vicinity of the stocking sites.

Some of the possible reasons for poor sailmonid fry and juvenile survival in Johnson creek were examined and discussed. They included predation on eggs and fry by reticulate sculpin, competition from redside shiner during periods when water temperatures reach the 19 to 22 C range marginal food supply in the middle and upper reaches of the creek, high summer water temperatures, too little or too much pool habitat in some reaches, and a probable lack of suitable winter refuge habitat throughout most of the mainstem. This represents only a partial list of the factors which may be affecting growth and survival of salmonid fry and juveniles in Johnson Creek. A more detailed and comprehensive analysis of limiting factors will be prepared in a subsequent technical memorandum.

In conclusion, results of the recent Johnson Creek fish surveys indicate that a variety of factors are interacting to create marginal conditions for anadromous salmonids. Some of these factors could be addressed through short-term intervention (eq. provision of off-channel winter refuge habitat, or creation of more instream pool habitat). whether other factors such as high summer water temperatures and associated problems can be dealt with given the changes that have already taken place within the watershed will require further investigation. For example, we need to know whether improvement of stream shading can bring water temperatures back within the range preferred by salmonids. If shading alone is insufficient, can flow be supplemented during the summer to improve temperature conditions? Answers to these and other similar questions will be forthcoming as the various ongoing water temperature, hydrolo9ic and water quality studies are completed an interpreted relative to the requirements of anadromous salmonids.

Works Cited

1. Johnson Creek Resources Management Plan, May 1995

2. Johnson Creek Resources Management Plan, June 1994

3. Roth, Bob, "Better Times for Steelhead in the City" The Northwest Steelheader

4. Johnson Creek, Vol. 6 #1, Spring 1998

Figure 1

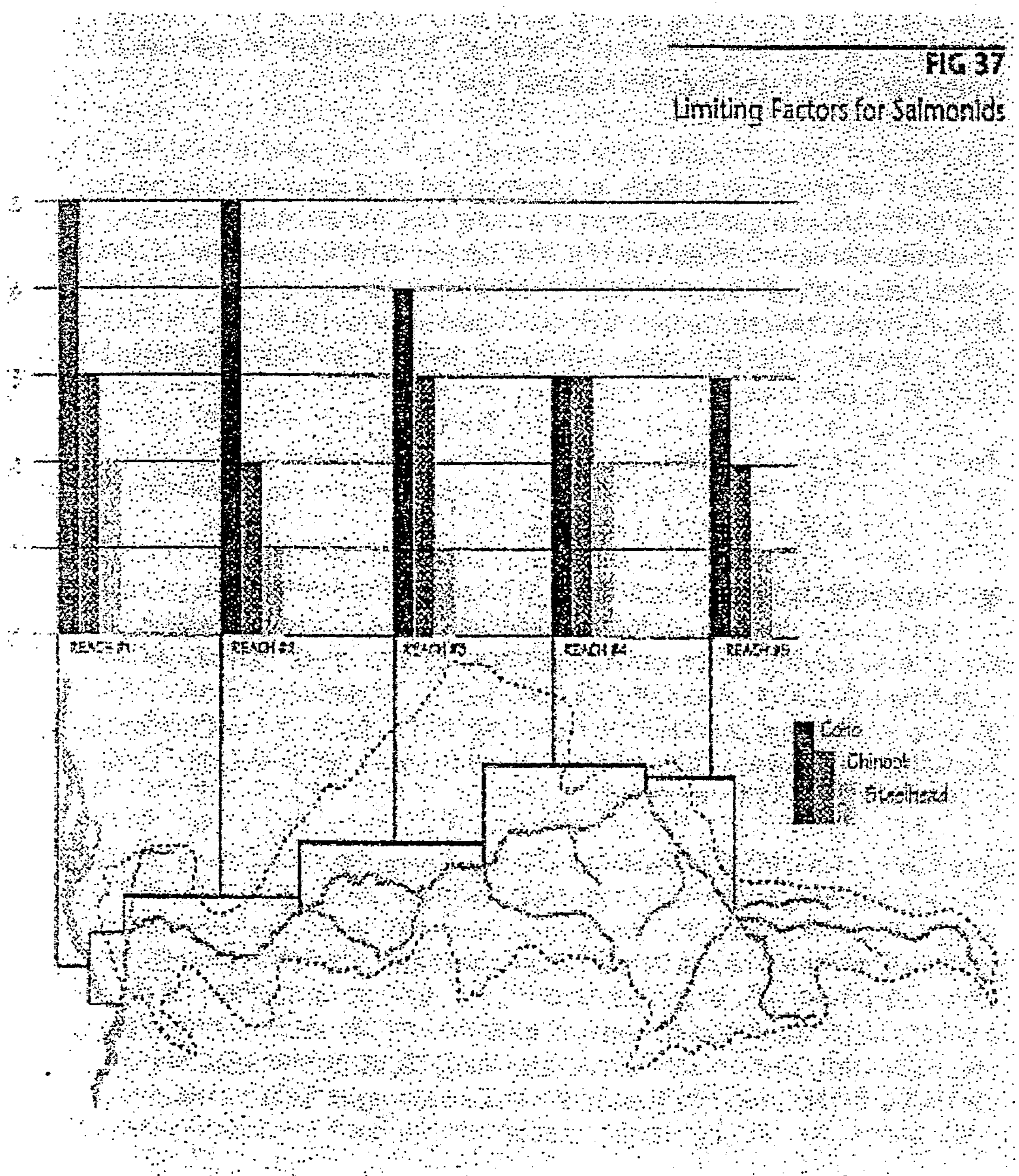
FIG 37
Limiting Factors for Salmonids
REACH #1
REACH #2
REACH #3
REACH #4
REACH #5
Coho
Chinook
Steelhead

TRIP #1
FALL 1999

Site #
Subbasin A
Latitude
Longitude

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy none

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present? trail use

Water quality data:

pH 5.32

temperature 7.4

dissolved oxygen

total dissolved solids

Site # B
Subbasin
Latitude
Longitude

Which best describes the site? wetland

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data:

pH 5.6

temperature 8

dissolved oxygen

total dissolved solids

Site #   Latitude

Subbasin C   Longitude

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy

Distance of water feature to nearest trail   (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH 5.4

temperature 8.3

dissolved oxygen

total dissolved solids

Site # D   Latitude

Subbasin   Longitude

Which best describes the site? wetland

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail   (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH 5.49

temperature 8

dissolved oxygen

total dissolved solids

Site # B-2 Latitude 45° 29.01°N

Subbasin B Longitude 122° 30.83 W

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? debris, erosion

Water quality data: pH 5.84, 5.58; 6.74, 7.06

temperature 8.97, 8.97

dissolved oxygen

total dissolved solids

Site # B-1 Latitude 45° 28.89 N

Subbasin B Longitude 122° 30.84 W

Which best describes the site? stream

Direction of water flow (drains to) south south-east

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? logs, sediment, erosion

Water quality data: pH 5.34, 5.28; 6.78, 6.89

temperature 7.8, 7.72

dissolved oxygen

total dissolved solids

Site # B-3 Latitude 45° 29.03 N

Subbasin B Longitude 122° 30.84 W

Which best describes the site? stream

Direction of water flow? (drains to) southwest

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? leaves, logs, erosion

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # B-4 Latitude 45° 29.29 N

Subbasin B Longitude 122° 30.44 W

Which best describes the site? wetland

Direction of water flow (drains to)

What is the condition of the tree canopy? none

Distance of water feature to nearest trail 7-8 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present?

Water quality data: pH 5.86, 5.23, 6.14, 5.77

temperature 7.41, 7.10

dissolved oxygen

total dissolved solids

Site # 2 | Latitude 45° N 28m 85s

Subbasin C | Longitude 122° 30m 72s

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy closed

Distance of water feature to nearest trail 2 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # | Latitude

Subbasin | Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site #

Subbasin

Latitude

Longitude

Which best describes the site?

Direction of water flow? (drains to)

What is the condition of the tree canopy

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # 2

Subbasin C-2

Latitude 45°N 28m83s

Longitude 122°W 30m74s

Which best describes the site?

Direction of water flow (drains to) south

What is the condition of the tree canopy? closed

Distance of water feature to nearest trail 3 (meters)

Degree of disturbance in area of site? med-high

What signs of disturbance are present? erosion, trail

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site #

Latitude

Subbasin

Longitude

Which best describes the site?

Direction of water flow? (drains to)

What is the condition of the tree canopy

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-1

Latitude 45°N 28m84s

Subbasin D

Longitude 122°W 30m39s

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? erosion

Water quality data: pH 6.73, 6.57

temperature 7.4, 7.4

dissolved oxygen

total dissolved solids

Site #

Latitude

Subbasin

Longitude

Which best describes the site?

Direction of water flow? (drains to)

What is the condition of the tree canopy

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-2

Latitude 45°N 28m 84s

Subbasin D

Longitude 122°W 30m 53s

Which best describes the site? erosion channel

Direction of water flow (drains to) south-west

What is the condition of the tree canopy? closed

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site #

Latitude

Subbasin

Longitude

Which best describes the site?

Direction of water flow? (drains to)

What is the condition of the tree canopy

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-3

Latitude 45° N 28m 89s

Subbasin D

Longitude 122° W 30m 57s

Which best describes the site? stream

Direction of water flow (drains to) southwest

What is the condition of the tree canopy? closed

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # E-1 Latitude

Subbasin Longitude

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy none

Distance of water feature to nearest trail 86 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? trash, fencing, trail

Water quality data: pH 5.46/6.3 6.09 16.46 16.8

temperature 6.79°C

dissolved oxygen

total dissolved solids

Site # E-2 Latitude

Subbasin Longitude

Which best describes the site? seep

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? trail/trash

Water quality data: pH 5.88/6.02 16.8

temperature 7.72°C

dissolved oxygen

total dissolved solids

Site #

Latitude

Subbasin wetland

Longitude

Which best describes the site?

Direction of water flow? (drains to)

What is the condition of the tree canopy none

Distance of water feature to nearest trail 86 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? trash, fencing, trail

Water quality data: pH 5.46/6.3

temperature 6.79

dissolved oxygen

total dissolved solids

Site # E-1

Latitude

Subbasin

Longitude

Which best describes the site? seep

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site?

What signs of disturbance are present? trail, trash

Water quality data: pH 5.88

temperature 7.72°C

dissolved oxygen

total dissolved solids

Trip #2
SPRING 200[illegible]

Site # A
Latitude 45°N 29m49s
Subbasin A-1
Longitude 122°W 30m13s
Which best describes the site?
Direction of water flow? (drains to) northeast
What is the condition of the tree canopy none
Distance of water feature to nearest trail 1 (meters)
Degree of disturbance in area of site? high
What signs of disturbance are present? road, litter, horse poop, tree poachers
Water quality data: pH 6.09, 6.13, 5.96
temperature 8, 7.9
dissolved oxygen 51%, 54%
total dissolved solids 22.9, 20.9

Site # A
Latitude 45°N 29`47"
Subbasin A-2
Longitude 122°W 30`33"
Which best describes the site? wetland
Direction of water flow (drains to) north
What is the condition of the tree canopy? none
Distance of water feature to nearest trail 50 (meters)
Degree of disturbance in area of site? med.
What signs of disturbance are present? trails, people, dogs
Water quality data: pH 5.93, 5.92, 6.54
temperature 7.9°C, 7.8°
dissolved oxygen 77%, 38%
total dissolved solids 24. mg/L, 17.6

Site #

Subbasin A-3

Latitude 45°N 29`35"

Longitude 122°W 30`75"

Which best describes the site? seep

Direction of water flow? (drains to) northwest

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? beer cans

Water quality data: pH 5.39, 5.43

temperature 7.6°C, 9.5°C

dissolved oxygen

total dissolved solids

Site # A-4

Subbasin

Latitude 45°N 29`39"

Longitude 122°W 31`7"

Which best describes the site? seep

Direction of water flow (drains to) west

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 2 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present?

Water quality data: pH 6.06, 6.77

temperature 10.3°C, 10.3°C

dissolved oxygen

total dissolved solids

Site # A-5 Latitude 45°N 29`45"

Subbasin Longitude 122°W 31`6"

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? litter, oil drum, trash

Water quality data: pH 6.25, 6.55

temperature 11.6°C, 11.5°C

dissolved oxygen

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # B-1 Latitude 45° 28.91°

Subbasin Longitude 122° 30.84°

Which best describes the site? stream

Direction of water flow? (drains to) southeast

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? bridge, trail, litter, debris, erosion

Water quality data: pH 4.9, 5.46, 5.57

temperature 9.6, 9.6

dissolved oxygen

total dissolved solids

Site # B-2 Latitude 45° 28.99 N

Subbasin Longitude 122° 30.85 W

Which best describes the site? stream

Direction of water flow (drains to) southwest

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 20 (meters)

Degree of disturbance in area of site? med-high

What signs of disturbance are present? trail, sediment, erosion, logs, debri

Water quality data: pH 6.1, 6.03

temperature 9.3, 9.3

dissolved oxygen

total dissolved solids

Site # B-3 Latitude 45° 29.06°

Subbasin Longitude 122°30.82°

Which best describes the site? erosion channel

Direction of water flow? (drains to) southwest

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? trail, runoff, erosion, logs

Water quality data: pH 5.7/5.8 6.1/6.1

temperature 9.6, 9.6

dissolved oxygen

total dissolved solids

Site # B-4 Latitude

Subbasin Longitude

Which best describes the site? wetland

Direction of water flow (drains to)

What is the condition of the tree canopy? none

Distance of water feature to nearest trail 20 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? people

Water quality data: pH 5.12, 5.47

temperature 12.7, 12.7

dissolved oxygen

total dissolved solids

Site # C-1 Latitude 45N 28m85s

Subbasin C Longitude 122W 30m80s

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy closed

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? erosion, people, litter

Water quality data: pH 6.89, 6.91, 7.17, 7.24, 7.05

temperature 9°C

dissolved oxygen

total dissolved solids

Site # C-2 Latitude 45N 28m83s

Subbasin C Longitude 122W 30m74s

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? open

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? erosion, plants trampled

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-3 Latitude 45°N 28m83s

Subbasin C Longitude 122°W 30m60s

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 2 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? trail erosion, plants trampled

Water quality data: pH 6.53, 6.67

temperature 9.5°C

dissolved oxygen

total dissolved solids

Site # C-4 Latitude 45°N 28m78s

Subbasin C Longitude 122°W 30m78s

Which best describes the site? wetland

Direction of water flow (drains to) south

What is the condition of the tree canopy? none

Distance of water feature to nearest trail 5 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present?

Water quality data: pH 5.46, 6.5, 6.32, 6.17, 6.28

temperature 10.2°C

dissolved oxygen

total dissolved solids

Site # C-5 Latitude 45°N 28m78s

Subbasin C Longitude 122°W 30m86s

Which best describes the site?

Direction of water flow? (drains to) south

What is the condition of the tree canopy open

Distance of water feature to nearest trail 5 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? erosion, horse pasture land

Water quality data: pH 6.36, 6.52, 6.61

temperature 12°C

dissolved oxygen

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-5

Latitude 45N 28m78s

Subbasin

Longitude 122W 30m86s

Which best describes the site?

Direction of water flow? (drains to) south

What is the condition of the tree canopy open

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? pastureland, horses/cows

Water quality data: pH 4.42, 5.35, 5.6, 5.35

temperature 11.2°C 11.1°C

dissolved oxygen

total dissolved solids

Site # D-1

Latitude 45N 28m87s

Subbasin D

Longitude 122W 30m35s

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? trail causes erosion

Water quality data: pH 4.5

temperature 8.4°C, 8.4°C

dissolved oxygen

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow? (drains to)

What is the condition of the tree canopy

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-1 Latitude 45N 28m86s

Subbasin D Longitude 122W 30m44s

Which best describes the site? seep

Direction of water flow (drains to) southwest

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? animal and trail disturbance

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-2 Latitude 45N 28m 86s

Subbasin D Longitude 122W 30m 55s

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? trail use

Water quality data: pH 4.48, 5.23, 5.63

temperature 8.7°C, 8.7°C

dissolved oxygen

total dissolved solids

Site # D-3 Latitude 45N 28m 87s

Subbasin D Longitude 122W 30m 52s

Which best describes the site? stream

Direction of water flow (drains to) southwest

What is the condition of the tree canopy? closed

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? heavy trail use

Water quality data: pH 5.36, 5.81

temperature 9°C, 9.3°C

dissolved oxygen

total dissolved solids

Site #

Latitude

Subbasin

Longitude

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy none

Distance of water feature to nearest trail 86 (meters)

Degree of disturbance in area of site?

What signs of disturbance are present? fence, trail

Water quality data:

pH 6.01

temperature 11.57°C

dissolved oxygen

total dissolved solids

Site # E-2

Latitude

Subbasin

Longitude

Which best describes the site? seep

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? prints, bikes, erosion, trail

Water quality data:

pH 4.87 / 5.83 / 5.93

temperature 11°C

dissolved oxygen

total dissolved solids

Site # F-1 Latitude 45N

Subbasin Longitude 122W

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy open

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? bikes, trail, horses

Water quality data: pH 5.72

temperature 12.1°C

dissolved oxygen

total dissolved solids

Site # F-2 Latitude

Subbasin Longitude

Which best describes the site? wetland

Direction of water flow (drains to)

What is the condition of the tree canopy? open

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? same as above

Water quality data: pH 5.98

temperature 12.4°C

dissolved oxygen

total dissolved solids

Trip #3
FALL 200X

Site # 1
Latitude 45N 29'25"
Subbasin A
Longitude 122W 30'18"
Which best describes the site? stream
Direction of water flow? (drains to) north
What is the condition of the tree canopy open
Distance of water feature to nearest trail 1.5 (meters)
Degree of disturbance in area of site? low
What signs of disturbance are present?
Water quality data: pH
temperature
dissolved oxygen
total dissolved solids

Site # 2
Latitude 45N 29'38"
Subbasin A
Longitude 122W 30'21"
Which best describes the site?
Direction of water flow (drains to)
What is the condition of the tree canopy? open
Distance of water feature to nearest trail 40 (meters)
Degree of disturbance in area of site? low
What signs of disturbance are present? trails
Water quality data: pH
temperature
dissolved oxygen
total dissolved solids

Site # 3 Latitude 45N 29`47"

Subbasin A Longitude 122W 30`76"

Which best describes the site? stream

Direction of water flow? (drains to) north

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 2 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? trails

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # 4 Latitude 42N 29`38"

Subbasin A Longitude 122W 31`7"

Which best describes the site? seep

Direction of water flow (drains to) north

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail crosses (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? rock trail

Water quality data: pH 7.36

temperature .453°C

dissolved oxygen 12

total dissolved solids

Site # 5 Latitude 45N 29`47``

Subbasin A Longitude 122W 31`9``

Which best describes the site? wetland

Direction of water flow? (drains to) west

What is the condition of the tree canopy

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH 7.21

temperature 1.5°C

dissolved oxygen 12

total dissolved solids

Site # 5 Latitude 45N 29' 1"

Subbasin B Longitude 122W 30'83"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? foot traffic, erosion

Water quality data: pH 7.6, 7.32

temperature 2.4°C

dissolved oxygen 7

total dissolved solids

Site # 1 Latitude 45N 28'89"

Subbasin B Longitude 122W 30'84"

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? branches

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # B-2 Latitude 45N 29' 6"

Subbasin B Longitude 122W 30' 85"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 15 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? erosion, dog poop

Water quality data: pH 5.84, 6.18

temperature 4.6°C, 4.6°C

dissolved oxygen 10

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # B-4 Latitude 45N 29'36"

Subbasin B Longitude 122W 30'49"

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy none

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # 3 Latitude 45N 29'3"

Subbasin B Longitude 122W 30'79"

Which best describes the site? stream

Direction of water flow (drains to) west

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? trees, leaves, bottles

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-3 Latitude 45N 28`87"

Subbasin C Longitude 122W 30`68"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? trail

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-1 Latitude 45N 28`79"

Subbasin C Longitude 122W 30`77"

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? bike trail, cut trees

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-2

Latitude 45N 28`83"

Subbasin C

Longitude 122W 30`67"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? trail, erosion, bikes

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-4

Latitude 45N 28`80"

Subbasin C

Longitude 122W 30`79"

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? open

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? concrete, path, posts, powerlines, eros

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-5 Latitude 45N 28`77"

Subbasin C Longitude 122W 30`60"

Which best describes the site? wetland

Direction of water flow? (drains to) south

What is the condition of the tree canopy open

Distance of water feature to nearest trail 4 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? erosion, concrete path, powerlines

Water quality data: pH 5.6, 5.86

temperature 2.4°C, 2.4°C

dissolved oxygen 4.75

total dissolved solids

Site # B-2 Latitude 45N 29`6"

Subbasin B Longitude 122W 30`85"

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 15 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? erosion

Water quality data: pH 4.25

temperature 4.6°C, 4.6°C

dissolved oxygen 10

total dissolved solids

Site # D-1 Latitude 45N 28'53"

Subbasin D Longitude 122W 30'19"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy open

Distance of water feature to nearest trail cross (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? fallen trees, brush, culvert

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-2 Latitude 45N 28'57"

Subbasin D Longitude 122W 30'31"

Which best describes the site? stream

Direction of water flow (drains to) southwest

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail cross (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? plants in stream

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-3 Latitude 45N 28`52"

Subbasin D Longitude 122W 30`32"

Which best describes the site? stream

Direction of water flow? (drains to) southwest

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail crosses (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? plantgrowth, brush

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # D-4 Latitude 45N 28`52"

Subbasin D Longitude 122W 30`37"

Which best describes the site? stream

Direction of water flow (drains to) southwest

What is the condition of the tree canopy? open

Distance of water feature to nearest trail crosses (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? brush, overgrowth

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # E-1 Latitude 45N 29`2"

Subbasin E Longitude 122W 30`13"

Which best describes the site? wetland

Direction of water flow? (drains to) southwest

What is the condition of the tree canopy none

Distance of water feature to nearest trail 35 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? litter, downward slope

Water quality data: pH 7.4/6.43/6.54

temperature 2.1°C

dissolved oxygen 11

total dissolved solids

Site # E-2 Latitude

Subbasin E Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site #

Latitude

Subbasin F

Longitude

Which best describes the site? wetland

Direction of water flow? (drains to) West

What is the condition of the tree canopy open

Distance of water feature to nearest trail 4½ (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? rocks, tracks

Water quality data: pH 6.8, 6.8

temperature 1

dissolved oxygen 9.9

total dissolved solids

Site # F-2

Latitude

Subbasin F

Longitude

Which best describes the site? wetland

Direction of water flow (drains to) West

What is the condition of the tree canopy? open

Distance of water feature to nearest trail 5 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? tracks

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # F-3 Latitude

Subbasin F Longitude

Which best describes the site? stream

Direction of water flow? (drains to) east

What is the condition of the tree canopy open

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? trail, tracks, rocks

Water quality data: pH 6.4, 6.4

temperature

dissolved oxygen 9,9

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

TRIP # 4
SPRING 2001

Site # A-2
Latitude
Subbasin
Longitude
Which best describes the site? seep
Direction of water flow? (drains to)
What is the condition of the tree canopy
Distance of water feature to nearest trail (meters)
Degree of disturbance in area of site? low
What signs of disturbance are present?
Water quality data: pH
temperature
dissolved oxygen
total dissolved solids

Site # A
Latitude 45N 29'51"
Subbasin 1
Longitude 122W 30'14"
Which best describes the site?
Direction of water flow (drains to)
What is the condition of the tree canopy? open
Distance of water feature to nearest trail (meters)
Degree of disturbance in area of site? low
What signs of disturbance are present?
Water quality data: pH
temperature
dissolved oxygen
total dissolved solids

Site # A
Latitude 45N 29'45"

Subbasin 3
Longitude 122W 30'75"

Which best describes the site? stream

Direction of water flow? (drains to) northeast

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? trail, erosion

Water quality data:

pH 7.2, 7.1

temperature 9°C, 9°C

dissolved oxygen 9, 9

total dissolved solids

Site # A
Latitude 45N 29'38"

Subbasin 4
Longitude 122W 31'8"

Which best describes the site? stream

Direction of water flow (drains to) northeast

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail on (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? trail, debris, rocks

Water quality data:

pH 7.51, 7.47

temperature 10.2°C, 10.1°C

dissolved oxygen 11, 11

total dissolved solids

Site # A

Latitude 45N 29'44"

Subbasin 5

Longitude 122W 31'7"

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy open

Distance of water feature to nearest trail 4 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? garbage, mild

Water quality data: pH 7.45

temperature 11.8°C

dissolved oxygen 5

total dissolved solids

Site #

Latitude

Subbasin

Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # 2 Latitude 45N 29' 1"

Subbasin B Longitude 122W 30' 50"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy closed

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? mud, sticks

Water quality data: pH 6.76, 6.78

temperature 8.7°C

dissolved oxygen 7.7

total dissolved solids

Site # 1 Latitude 45N 28' 49"

Subbasin B Longitude 122 W 30' 46"

Which best describes the site? stream

Direction of water flow (drains to) south

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? mud, sod

Water quality data: pH 5.96

temperature 8.7°C

dissolved oxygen 6

total dissolved solids

Site # 4 Latitude 45N 29` 17"

Subbasin B Longitude 122W 30`24"

Which best describes the site? wetland

Direction of water flow? (drains to)

What is the condition of the tree canopy open

Distance of water feature to nearest trail 7 (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present? foot prints

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # 5

Latitude 45N 29`14"

Subbasin B

Longitude 122W 30`41"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail .2 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? mud

Water quality data:

pH 6.76, 6.78

temperature 8.7°C, 8.7°C

dissolved oxygen 7.7

total dissolved solids

Site # 3

Latitude 45N 29`5"

Subbasin B

Longitude 122W 30`47"

Which best describes the site? stream

Direction of water flow (drains to) west

What is the condition of the tree canopy? intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? cans

Water quality data:

pH

temperature

dissolved oxygen

total dissolved solids

Site # C-1 Latitude 45N 28`85"

Subbasin Longitude 122W 30`70"

Which best describes the site? erosion channel

Direction of water flow? (drains to) south

What is the condition of the tree canopy closed

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? people, trail, erosion

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-4 Latitude 45N 28`80"

Subbasin Longitude 122W 30`79"

Which best describes the site? wetland

Direction of water flow (drains to) south

What is the condition of the tree canopy? none

Distance of water feature to nearest trail 3 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? concrete path, phone poles, wood fenc

Water quality data: pH 6.42, 6.46

temperature 10.1°C

dissolved oxygen 3.5

total dissolved solids

Site # C-2 Latitude 45N 28'54"

Subbasin Longitude 122W 30'20"

Which best describes the site? stream

Direction of water flow? (drains to) southeast

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? trail, people, erosion

Water quality data: pH 6.7, 6.35

temperature 9.6, 9

dissolved oxygen 10

total dissolved solids

Site # Latitude

Subbasin Longitude

Which best describes the site?

Direction of water flow (drains to)

What is the condition of the tree canopy?

Distance of water feature to nearest trail (meters)

Degree of disturbance in area of site?

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-3

Latitude 45N 28`83"

Subbasin

Longitude 122W 30`59"

Which best describes the site? erosion channel

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? erosion, trail, roots

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-2a

Latitude 45N 28`84"

Subbasin

Longitude 122W 30`66"

Which best describes the site? erosion channel

Direction of water flow (drains to) south

What is the condition of the tree canopy? open

Distance of water feature to nearest trail 0 (meters)

Degree of disturbance in area of site? med

What signs of disturbance are present? people, trail

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

Site # C-5 Latitude 45N 28`77"

Subbasin Longitude 122W 30`60"

Which best describes the site? wetland

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 3 (meters)

Degree of disturbance in area of site? med.

What signs of disturbance are present? concrete trail, telephone pole

Water quality data: pH 6.46, 6.67

temperature 11.5°C

dissolved oxygen 6

total dissolved solids

Site # C-6 Latitude 45N 28`47"

Subbasin Longitude 122W 30`47"

Which best describes the site? wetland

Direction of water flow (drains to) south

What is the condition of the tree canopy? open

Distance of water feature to nearest trail 6 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? fence, pasture, ducks, path

Water quality data: pH 6.74, 6.78

temperature 13.9°C, 14.3°C

dissolved oxygen 10

total dissolved solids

Site # D-1 Latitude 45N 28`54"

Subbasin Longitude 122W 30`18"

Which best describes the site? stream

Direction of water flow? (drains to) south

What is the condition of the tree canopy intermediate

Distance of water feature to nearest trail 1 (meters)

Degree of disturbance in area of site? high

What signs of disturbance are present? erosion

Water quality data: pH 6.88-7.02, 7.02-7.04

temperature 8.65°C, 8.65°C

dissolved oxygen 10, 10

total dissolved solids

Site # D-2 Latitude 45N 28`52"

Subbasin Longitude 122W 30`31"

Which best describes the site? erosion channel

Direction of water flow (drains to) south

What is the condition of the tree canopy? closed

Distance of water feature to nearest trail ⅓ (meters)

Degree of disturbance in area of site? low

What signs of disturbance are present?

Water quality data: pH

temperature

dissolved oxygen

total dissolved solids

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METRO

December 9, 1999

Dan Vasen
Central Catholic High School
2401 SE Stark
Portland, OR 97214

Dear Mr. Vasen and Environmental Science Class;

I want to take a moment to thank you for a wonderful morning on Powell Butte the other day. It was a pleasure to watch such conscientious students at work. Even though it was windy, rainy and cold ever student was engaged and I don't think I heard one discouraging word. Your students were professional and courteous and made me feel like part of the team. I appreciate that in young adults.

As a former high school biology teacher, I commend you on your organization and pre trip planning and study. When your students got off the bus I could see they were focused, ready to go and excited about what they were doing. As a veteran of many less than optimal weather days in the field, I can truly say your students attacked their project with positive high energy.

Due to lack of time I wasn't able to visit with all the groups at their stations but if they were anything like the wetlands group I watched they were doing good problem solving and were 100% on task. My group consisted of three young women and a young man and I want to say I applaud the number of young women you have in your class. However, all of your students were exceptional.

I would enjoy other invitations to participate in your field studies and when you analyze your data in class. I would be most interested in how your students process this information. I find this study of a very good application of science in a practical manner. If there is anyway I can help, please do not hesitate to let me know.

Again thank you for the opportunity.

Sincerely,

Lynn Wilson
Restoration and Education Grants Coordinator

CITY OF
PORTLAND, OREGON
OFFICE OF PUBLIC UTILITIES

Jim Francesconi, Commissioner
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Portland, Oregon 97204-1994
(503) 823-3008
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August 20, 1999

Dan Vasen
Central Catholic High School
2401 SE Stark Street
Portland, OR 97214

Dear Dan:

I enjoyed visiting with you and the Friends of Powell Butte last month. I was especially pleased to hear about Central Catholic's involvement at the Butte and about the work that has been done monitoring the tall bugbane population. Jim Sjulin again confirmed with me how pleased he has been with the quality of the work that your students have brought to this project.

Naturally I am very pleased to support your continuing involvement at Powell Butte. I think that the work that you intend to do in the area of measuring and monitoring water quality impacts from Powell Butte is very important. The City of Portland is trying very hard to better understand how its activities impact the health of the Johnson Creek watershed and, in particular, how salmon habitat might be affected.

Since I have been Commissioner of Parks & Recreation, I have been encouraging schools and Parks & Recreation to work together in as many ways as possible. Your involvement with our Natural Resources Program is exactly what I want to see happening everywhere.

Best regards,

Jim Francesconi
City Commissioner