Planning & Development Services

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Public Comments on 3rd draft Critical Areas Ordinance Update

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18.	Ellen Bynum	Friends of Skagit County PO Box 2632 Mount Vernon, WA 98273-2632	Email	11/14/2025	151
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Comment #1

Robby Eckroth

From: Victoria Hattersley <hattersv@gmail.com>
Sent: Thursday, October 30, 2025 9:01 PM
To: PDS comments
Subject: Skagit County 2025 Critical Areas Ordinance Update

Dear Commissioners,

I am surprised and perplexed that there has not been an acknowledgement of the issue of looking 1 mile downstream for the impact of stormwater discharge on critical area water quality. Please let those of us who are very concerned about this for Big Lake and other critical areas of your reasoning for not explaining your reluctance to address this issue, which has been recommended by the Department of Ecology, as repeatedly pointed out by Jan Edelstein:

Please protect Big Lake, and all critical areas, from stormwater pollution. Adopt the Department of Ecology's recommendation to require new project applicants to submit expert opinion on the impact of stormwater discharge on critical area water quality "up to one mile downstream." See 2024 Department of Ecology Stormwater Manual for Western Washington I-3.5.3 Off Site Analysis Report, page 149.--

Hopefully, my concern is misplaced, and it will be addressed in this 3rd revision of the ordinance, or you will help us understand why it is not.

Thank you.

Victoria Hattersley
Better Together America
I Chose Democracy!
Mount Vernon, WA
781-956-3354

Comment #2

Robby Eckroth

From: Rosann Wuebbels <rwuebbels@yahoo.com>
Sent: Friday, October 31, 2025 5:29 PM
To: PDS comments
Subject: Critical areas

Please protect Big Lake, and all critical areas, from stormwater pollution. Adopt the Department of Ecology's recommendation to require new project applicants to submit expert opinion on the impact of stormwater discharge on critical area water quality "up to one mile downstream."
sincerely , Rosann wuebbels
11134 O Ave
Anacortes, WA 98221

Comment #3

Robby Eckroth

From: Mark r <kier0055@outlook.com>
Sent: Tuesday, November 4, 2025 10:49 AM
To: PDS comments
Cc: Lisa Janicki; Peter Browning; Ron Wesen
Subject: Possible Spam: Skagit County 2025 Critical Areas Ordinance Update

Mark Reilly
17786 Walden Lane
Mt Vernon, WA 98274

Commissioners,

I am requesting the BOCC adopt the Department of Ecology recommendation of the 2024 Stormwater Manual (page 149) to look along the flow path from the project site to the receiving water, for a distance of up to one mile.

“In the best interests of the general public and environment,” Ecology recommends local governments require development projects that discharge stormwater off-site to submit an **off-site analysis report that assesses the potential off-site water quality,** erosion, slope stability, and drainage impacts associated with the project. **The review should look downstream for a distance of up to one-mile from the project site.**

Sincerely
Mark Reilly

Comment #4

Robby Eckroth

From: virginia reilly <virginia.m.reilly@gmail.com>
Sent: Tuesday, November 4, 2025 10:59 AM
To: PDS comments
Subject: Skagit County 2025 Critical Areas Ordinance Update

Virginia Reilly
17786 Walden Lane
Mt Vernon, WA 98274

Commissioners,

I am requesting the BOCC adopt the Department of Ecology recommendation of the 2024 Stormwater Manual (page 149) to look along the flow path from the project site to the receiving water, for a distance of up to one mile.

“In the best interests of the general public and environment,” Ecology recommends local governments require development projects that discharge stormwater off-site to submit an **off-site analysis report that assesses the potential off-site water quality,** erosion, slope stability, and drainage impacts associated with the project. **The review should look downstream for a distance of up to one-mile from the project site.**

Sincerely ,
Virginia Reilly

Comment #5

Robby Eckroth

From: Jann Barem <jlbarem1979@hotmail.com>
Sent: Tuesday, November 4, 2025 7:26 PM
To: PDS comments; commissioners@skagit.wa.us; Lisa Janicki; Peter Browning; Ron Wesen
Subject: Skagit County 2025 Critical Areas Ordinance Update

To: Skagit County Board of County Commissioners

Dear Sir or Madame,

Please consider amending the Critical Areas Ordinance to at least 1 mile. The entire watershed impacts the quality of any lake or river and a 200-foot limit does not make any sense. Contaminated water runs downhill and it magically does not stop at a 200-foot boundary from Big Lake.

Respectfully,

Leif & Jann Barem
17193 West Big Lake Blvd.
Mount Vernon, WA 98274

Comment #6

Robby Eckroth

From: James Brandt <jebrandt1913@gmail.com>
Sent: Wednesday, November 5, 2025 6:25 PM
To: PDS comments; Commissioners; Lisa Janicki; Peter Browning; Ron Wesen
Subject: Skagit County 2025 Critical Areas Ordinance Update

Dear County Commissioners and Planning Staff,

From living in Big Lake for over 20 years, and visiting Big Lake for over 50 years, these past couple years have been some of the worst water conditions I have ever seen. I cannot imagine adding more nutrients and contamination to the lake because of the development site, when we cannot deal with the amount that we have now.

I believe that the Department of Ecology is right in recommending local governments require development projects that discharge stormwater off-site to submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project. The review should look downstream for a distance of up to one-mile from the project site.

I truly believe that it is in the best interests of our community and the environment to make sure that the decisions that are being made don't have a negative impact further downstream including Big Lake, rather than the current proposition of only studying 200 ft from the development site.

Thank you for taking your time to read this.

Sincerely,
James Richard Brandt
17281 Lake View Blvd. Mt. Vernon, WA 98274

Comment #7

Robby Eckroth

From: Commissioners
Sent: Thursday, November 6, 2025 12:09 PM
To: PDS comments
Subject: FW: Skagit County 2025 Critical Areas Ordinance Update

Skagit County Commissioners' Office
1800 Continental Place, Suite 100
Mount Vernon, WA 98273
Telephone: (360) 416-1300

From: Susie Horan <SusieHoran@bhhsnwre.com>
Sent: Thursday, November 6, 2025 12:00 PM
To: Commissioners <commissioners@co.skagit.wa.us>
Subject: Skagit County 2025 Critical Areas Ordinance Update

Dear Commissioners:

Please amend the Critical Area Ordinance. It is time. I urge you to adopt the Department of Ecology recommendation in the 2024 Stormwater Manual (page 149) to look along the flow path from the project site to the receiving water, for a distance of up to One Mile. Now is the time.

The Department of Ecology guidelines are the gold standard in the State of Washington. Skagit County needs to rise up and meet those standards. We do not want to be left behind. There is more land development now than ever before. We have increased populations of people and increased contaminations. Skagit County needs to be seen as a leader in high standard guidelines. Please represent all of the property owners in the area and require development projects that discharge stormwater off-site to submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project. The review should look down stream for a distance of up to One Mile from the project.

Thank you for doing the right thing.

Susan Horan

19020 Sulfur Springs Rd

Mt Vernon, WA 98274

206-227-3900

Comment #8

Robby Eckroth

From: Commissioners
Sent: Friday, November 7, 2025 8:24 AM
To: PDS comments
Subject: FW: Possible Spam: Protect Big Lake

Skagit County Commissioners' Office
1800 Continental Place, Suite 100
Mount Vernon, WA 98273
Telephone: (360) 416-1300

-----Original Message-----
From: Celia Miller <celiarmiller@icloud.com>
Sent: Thursday, November 6, 2025 6:01 PM
To: Commissioners <commissioners@co.skagit.wa.us>
Subject: Possible Spam: Protect Big Lake

Please accept the Dept. of Ecology recommendation to look beyond the flow of water runoff up to 1 mile for the proposed site to protect Big Lake.
Thank you,
Celia Miller
Sent from my iPhone

Comment # 9

Robby Eckroth

From: Beth Rosenstiel <biglakex2@gmail.com>
Sent: Sunday, November 9, 2025 11:48 AM
To: PDS comments
Cc: Commissioners; Lisa Janicki; Peter Browning; Ron Wesen; John and Beth
Subject: Skagit County 2025 Critical Areas Ordinance Update

I urge the County Commissioners to protect water quality in our county by requiring development projects to look downstream beyond the current 200 feet requirement.

Department of Ecology recommendations from 2024 are for a distance of one mile. As a long term resident on the shore of Big Lake, I have observed an increase in harmful bacteria blooms in the lake with increasing development around the lake, beyond the current 200 feet.

Beth Rosenstiel
18870 Sulfer Springs Road
Big Lake
Mount Vernon, 98274

Skagit County Commissioners
Mount Vernon, WA. 98273

Nov.7, 2025

Comment #10

Comments on Skagit County Critical Areas Ord. (CAO)

Washington State Supreme Court has ruled.

References can be found on County's CAO 2nd. Draft Commentor #14.

Reference 1 - Early 2000's county agriculture associations, farmers, landowners and citizens combined to protect Skagit agriculture. By providing best available science (BAS) that meets all criteria of BAS listed in WAC 365-195-900-925 real true, field tested on the ground and replicable in development of Skagit County's Ongoing Agriculture (CAO).

Reference 2 - Reference 1 was essential in Washington State Supreme Court Ruling that Skagit County is adequately protecting On-going Agriculture Ordiance. Court case.

Reference 3 - Skagit County Cattlemen's found that EPA, DOE, WDFW's shade theory lacks proof that shade cools water. There methodology does not address natural backgrounds or local climate conditions as they rely on assumptions and political science and flawed data in computer modeling. 138 million dollars wasted on failed restoration projects with no proof any projects were successful. The Cattlemen provided a 96 page literature review manual. The shade theory can be debunked in a single season of monitoring using proper methods and a statistical analysis. Will take 65 years to grow a buffer that will have no influence on water temperature or water quality.

Reference 4 – Attached is requested full copy of Cattlemen 2001-2002 Stream Study and Data. Agriculture was being blamed but it's not the problem at all just the natural conditions of Skagit County.

Reference 5 – 2010 County GIS Study shows 80% forested natural buffer canopy at 75 feet on Ag/NRL zoned lands.

Reference 6 – Shows fecal loading output rate for one skunk is equal to 23 cows. Water fowl is the major pollution contributor.

Reference 7 – Ocean condition is reason for decline in fish numbers. Article by Bill Reinard member of Skagit Fisheries Enhancement's.

It's pass time to reevaluate these failed restoration projects that relied on assumptions, flawed computer modeling, and start using proper methodology for science investigations to assess natural background for local climate conditions to save our valuable farmland for food production.

Attachment- Full copy of Skagit County Cattlemen 2001-2002 Data Stream Study. By Pat Larson

Randy Good

Randy Good President Friends of Skagit County
Rep. Skagit County Cattlemen
35482 State Roue 20
Sedro Woolley Wa. 98284
360-856-1199

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Books 4a and 4b	06/25/02	Public Meeting Submittals (cont) ***Submittal 5) by Pat Larson is contained in Binders 4a and 4b of the Indexed material***	5) Pat Larson: Science and Natural Resource Advisor, Oregon Cattlemen's Association, June, 2002. Literature Review of *Best Available Science,* with subsections: a) Fundamentals of BAS Theory Statistics; 1. State of Washington's Growth Management Act Procedural Criteria For Adopting Comp Plans and Development Regs (April 2001) Part Nine-Best Available Science; 2. *Pseudoreplication and the Design of Ecological Field Experiments*, Stuart H. Hurlbert, Ecological Monographs, Vol. 54, No.2; 3. *Monographs in Physical Measurement-Temperature*, A.H. Cook, T.J. Quinn (1983); 4. *The Story of Physics*, Lloyd Motz and Jefferson Hane Weaver; 5. *Five Equations that Changed the World, The Power and Poetry of Mathematics*, Michael Guillen, Ph.D.; 6. *Prediction of Temperature in Rivers and Reservoirs, Journal of the Power Division* (July, 1962), Jerome M. Raphael, F. ASCE; 7. *Entropy and the Second Law of Thermodynamics*, Chapter 22, Fundamentals of Physics, Third Edition, David Halliday, Robert Resnick; 8. *Heat, Temperature, and Internal Energy*, Physics-A World View, Second Edition, Larry D. Kirkpatrick, Gerald F. Wheeler; 9. *Atmospheric Thermodynamics* (1998), Craig F. Bohren, Bruce A. Albrecht; 10. *Techniques of Trend Analysis for Monthly Water Quality Data*, Robert M. Hirsch, and others, Water Resources Research. Vol. 18, No. 1 (February 1982); b) River Systems: 1. *Fluvial Processes in Geomorphology*, Leopold, Luna B., M.G. Wolman, J.P. Miller (1964); 2. *Applied River Morphology*, Rosgen, D. (1996);

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Book 4	06/25/02	Public Meeting Submittals (cont)	8) Patricia A. Larson: Letter to Skagit County Commissioners, from Ecosystem Research and Analysis Science and Natural Resource Advisor, with attachments: a) A copy of Skagit County Cattlemen Stream Study Final Report 2001 Data; b) Science & Data Booklet, A Quick Reference Handbook for Landowners (1998), Distributed in Cooperation with the Oregon Cattlemen's Association; c) White Paper, *What is Science?* Oregon Cattlemen's Association; 9) Annie Lohman: Letter to Skagit County Public Works Dept from Skagit County Farm Bureau suggesting considerations and objectives in writing a new ordinance. Also submitted: a) *Watershed Agricultural Program for New York City's Water Supply Watershed* and *Whole Farm Planning and Management*; b) Watershed Agricultural Council, New York, *Watershed Protection: A Better Way*, Richard I. Coombe, Chair, October 21, 1994; c) A White Paper: *Skagit County Critical Area Ordinance Triggers State and Federal Constitutional Property Rights and Due Process Protection;* 10) William Porter: *A Farmer's Opinion of BUFFER ZONES;* 11) Bill Reinard: *The Responsible Alternative to Excessive Buffer Demands* and *Over Harvest Still Prevents Salmon Recovery*; 12) Tarn Mower: Web articles on global environment; 13) Thomas H. Solberg: Letter to Skagit County Commissioners re Rewrite of CAO on ongoing agriculture; 14) Randy Good: Letter to Skagit County Commissioners with comments for SCC 14.24.120 rewrite, with submittals: a) *Economic Farm Value Lost-Result of Skagit County's 75 Foot Buffers On Ag Lands*, compiled by Randy Good; b) Woody Debris Destructive Consequences, Roger A. Lowe; c) Pictures and statistics regarding Manser Creek; 15) Carol Ehlers: Public comment sought on 303(d) listing policy, May, 2002; 16) Tipton Hudson: Letter to Board of County Commissioners from Washington Cattlemen's Association;

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Exhibit Location	Date	Title / Type of Document	Description
Book 4	06/25/02	Public Meeting Submittals (cont)	17) Dana Jones Studebaker: Letter to Skagit County Commissioners from Woolly Prairie Buffalo Company; 18) Glenn Tenneson: Opinion re Skagit County's Flawed Buffer Plan; 19) Ruth Thomas: Comment sheet submitted at meeting; 20) Other: a) *Sherman Creek Implementation Project SCIP (September 2001);* b) Delisting Petition to D. Robert Lohn, Regional Administrator for Nation Marine Fisheries Service, from James L. Buchal, to remove two "species" of Pacific Northwest salmon from the "threatened" status under the ESA; c) Court's Memorandum Decision in Whatcom County Superior Court Case No. 99-2-00334-3, Island County and WEAN v. WWGMHB; d) Contract Documents Harvestable Salmon Carcasses and Eggs-Fall, (August 1997); e) Part nine, Best Available Science, WAC 365-195-900 21) Letter to Chal Martin, Public Works Department, from Sakuma Brothers Holding Company dated 6/16/02 with comments on Ag buffer Ordinance rewrite. Also includes e-mail comments from Dave Brookings and Chal Martin in response to letter.
Book 5	06/26/02	Letter and articles submitted by Bill Reinard (Updated version 6/26/02)	*The Responsible Alternative to Excessive Buffer Demands*, previously submitted on 6/25/02 by Bill Reinard **(see 6/25/02, Sub 11)** including the following attachments: 1) *Pacific Salmon and Wildlife, Ecological Context, Relationships, and Implications for Management*, Johnson and O'Neil 2000; 2) *The Responsible Alternative to Excessive Buffer Demands*, June, 2002, with bibliography; 3) "Works Not Cited"-listing newspaper and other articles of interest, with articles attached; 4) *Fish Habitat Rehabilitation Procedures*, Watershed Restoration Technical Circular No. 9; 5) *Fishes and the Forest, Expanding perspectives on fish-wildlife interactions*, Mary F. Willson and others;

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Exhibit Location	Date	Title / Type of Document	Description
Book 5	06/26/02	Letter and articles submitted by Bill Reinard (Updated version 6/26/02) (continued)	6) *An Estimation of Historic and Current Levels of Salmon production in the Northeast Pacific Ecosystem, Evidence of a Nutrient Deficit in the Freshwater Systems of the Pacific Northwest*, Ted Gresh, Jim Lichatowich and Peter Schoonmaker; 7) *Inverse Production Regimes: Alaska and West Coast Pacific Salmon,* Steven R. Hare, Nathan J. Mantua and Robert C. Francis; 8) *Impacts of Climatic Change and Fishing on Pacific Salmon Abundance Over the past 300 Years;* Bruce P. Finney, and others. 9) Other: Miscellaneous newspaper and other articles.
Book 5	06/26/02	Letter to "Interested Parties" from Lew Atkins, Assistant Director, Fish Program; Letter to "U.S. Fraser Panel convention Area Fishers" from Rich Lincoln, Fraser River Panel, WDFW	Re regulations applying to non-treaty Puget Sound commercial salmon fisheries, with attachments from 2002 Puget Sound All-citizen Commercial Salmon Fisheries
Book 5	07/2002	Riparian Zone Bibliography	*Vegetated Stream Riparian Zones: Their Effects on Stream Nutrients, Sediments, and Toxic Substances*, an Annotated and Indexed Bibliography of the world literature including buffer strips, and interact6ions with hyporheic zones and floodplains, by Dave Correll, July 2002
Book 5	07/02/02	Letter to Governor Gary Locke from Senator Mary Margaret Haugen, 10th Legislative District	Requesting Governor Locke to tour Skagit County, meet the farmers involved in county agriculture and assist by providing leadership in resolving the tide-gate and dike and drainage issues.
Ex 478 (0033c)	07/12/02	Letter to Matthew Ojennus, Asst Planner, Growth Mgt Program, from Chal Martin, Skagit County Public Works Director	Transmitting the 2nd quarter 2002 status report of activities under block grant agreement S01-63200-004, with request to extend termination date of contract to 12/31/03. (Copy of Status Report attached)
Ex 485 (0033c)	07/23/02	Interim Ordinance No. R20020263	An Interim Ordinance Repealing Skagit County Code (SCC) 14.24.130, Strategic Plan to Protect Wild Salmonids and Amending SCC 14.24.120 of the Critical Area Ordinance.

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Exhibit Location	Date	Title / Type of Document	Description
Book 6	09/11/02	Memo to Planning Commission Members from Patti Chamber, Planning and Permit Center	Re: Correspondence for Deliberations on September 24th; Invitation to September 17th BCC Agenda Item
Book 6	09/11/02	Skagit County Public Works News Release	*County Seeks Input For New Critical Areas Ordinance*, announcing public meeting on 9/23/02.
Book 6	09/13/02	Memo to Ric Boge, Public Works from Rod Hamilton, CREP Program Specialist, FSA	Response to inquiry on land eligibility under CREP
Book 6	09/17/02	Board of County Commissioners Agenda and Record of Proceedings	Planning and Permit Center – Discussion/Possible Approval-Issue a Request for Proposals for Development of a Programmatic Environmental Impact Statement for Skagit County's Critical Areas Ordinance.
Book 6	09/19/02	Letter to WWGMHB from Senator Mary Margaret Haugen, 10th Legislative District	Expressing concern of continuing litigation affecting Skagit County and the impact on agricultural land.
Book 6	09/19/02	BAS literature for Skagit County Cattlemen submitted by Randy Good	Best Available Science Index: Grazing and Livestock Management: 1) *Field evaluation of furrow irrigation performance, sediment loss, and bromide transport in a highly erosive silt loam soil*, Ashraf, M.S., et al, 1999; 2) *Grazing systems, pasture size, and cattle grazing behavior, distribution and gains*, Hart, R.H., et al, 1993; 3) *Upland erosion under a simulated most damaging storm*, Linse, S.J., et al, 2001; 4) *Influence of intensive rotational grazing on bank erosion, fish habitat quality, and fish communities in Southwestern Wisconsin trout streams*, Lyons, J., et al, 2001; 5) *Economic and environmental impacts of alternative practices on dairy farms in an agricultural watershed*, Osei, E., et al, 2000; 6) *Nitrogen fertilization, botanical composition and biomass production on mixed grass rangeland*, Samuel, Marilyn J., et al, 1998; 7) *Nitrate abatement practices, farm profits, and lake water quality: a central Illinois case study*, Shankar, B., et al, 2000; 8) *Seasonal grazing affects soil physical properties of a montane riparian community*, Wheeler, Melinda A., et al, 2002; 9) *Pasture management influences on soil properties in the northern Great Plans*, Wienhold, B.J., et al, 2001

REPORT 2001-2002 DATA
Skagit County Cattlemen Stream Study

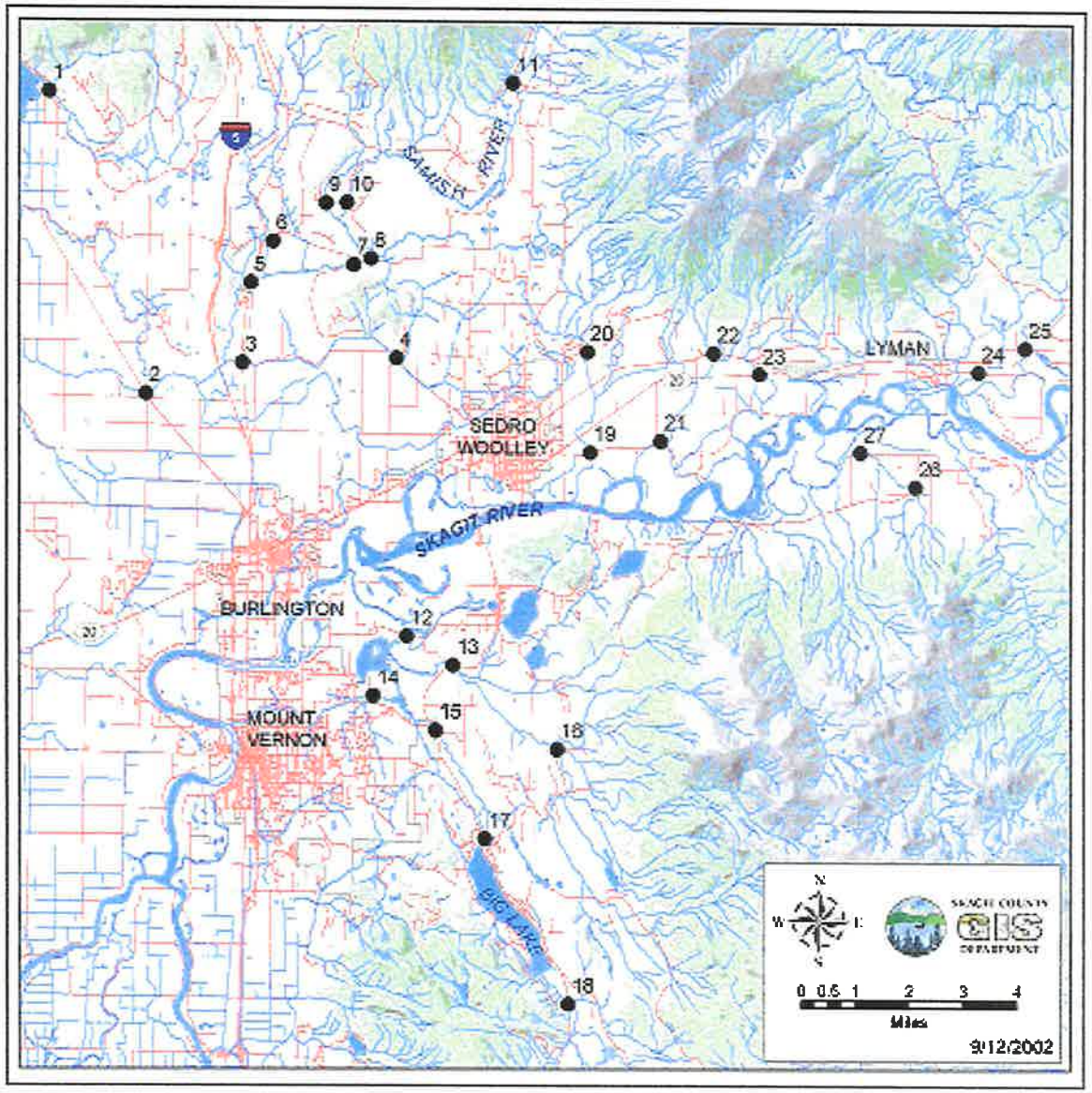
Prepared for the Skagit County Cattlemen

by

Pat Larson
Science and Natural Resource Advisor
Oregon Cattlemen's WESt program
Version: March, 2003

61931 Cottonwood Rd. La Grande, OR 97850 541-963-9387

Skagit County Public Works Sampling Stations



Skagit County Public Works Sampling Stations
(Read with map on previous page)

Colony Creek at Blanchard Road-	Buf1
Samish River at Chuckanut Drive-	Buf2
Thomas Creek at Highway 99	Buf3
Thomas Creekat F&S Grade Road	Buf4
Samish River at Highway 99	Buf5
Friday Creek at Prairie Road	Buf6
Samish Riverat F&S Grade Road	Buf7
Swede Creek at Grip Road	Buf8
Skarrup Creek at Double Creek Lane	Buf9
Samish River at Prairie Road	Buf10
Samish River at Highway 9	Buf11
Nookachamps Creek at Swan Road	Buf12
EastFork Nookachamps Creek at Highway 9	Buf13
College Way Creek at College Way	Buf14
Nookachamps Creek at Knapp Road	Buf15
East Fork Nookachamps Creek at Beaver Lake Road	Buf16
"Nookachamps Creek at Highway 9, Big Lake Outlet	Buf17
LakeCreek at Highway 9	Buf18
Hansen Creek at Hoehn Road	Buf19
Hansen Creek at Northern State	Buf20
Coal Creek at Hoehn Road	Buf21
Coal Creek at Highway 20	Buf22
Wiseman Creek at Minkler Road	Buf23
Mannser Creek at Lyman-Hamilton Road	Buf24
Red Cabin Creek at Hamilton Cemetery Road	Buf25
Morgan Creek at South Skagit Highway	Buf26
Morgan Creek at Walberg Road	Buf27

Version March, 2003

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Section 3

*** Version: March 2003 will be revised through requested edits.

Welcome to Planet Earth
Credit: Apollo 17 Crew, NASA

Introduction

Earth, third planet from the Sun is sphere shaped and composed mostly of rock. The Earth's surface (land and water) is 196,938,800 square miles and can roughly be divided into 1/3 land mass and 2/3 water. The planet receives energy from the Sun which is distributed through an atmosphere that maintains an energy balance that sustains all living systems.

The atmosphere has more than a minor influence on the surface temperature; it has a profound one. In the absence of an atmosphere the earth would average about 50 °F lower than it does at present. Life (as we now know it) could not exist. About 30% of the solar energy reaching Earth is reflected,; it never helps heat the Earth. Another 20 % is absorbed at various heights in the atmosphere and about 50% of the incoming solar radiation reaches the ground and oceans where it is absorbed as heat. The energy transfer down into the ground occurs through a slow process of heat conduction. During the day the ground absorbs solar radiation, is heated, and in turn heats the air in contact with it and at night as the ground cools the air closest to the surface cools also (Sellers, 1965).

The surface of the Earth receives it's energy from two sources: the sun and the atmosphere. The atmosphere emits radiation for the same reason the sun does: each has a finite temperature. Earth receives nearly twice as much energy from the atmosphere as it does from the sun. Even though the sun is much hotter, it does not cover nearly as much of the sky as does the atmosphere. A great deal of radiation coming from the direction of the sun does not add up to as much energy as the smaller amount of radiation coming from all over the sky (Bohren, 1988) .

Water is fundamental to life and Earth is the only planet in the Solar System where the present surface temperature and pressure allow the three forms of water, solid (ice), liquid (ocean), and gas (water vapor condensing in clouds) to exist simultaneously. Due to the abundance of water it has been used as a standard for a variety of units of measure. The Celsius temperature scale was developed using the triple point of water where all 3 phases of water (liquid, solid, and gas) exist. The calorie (a unit of heat) is based on the amount of energy it takes to heat 1 gram of water 1 °C which determines the specific heat of other elements such as air and soil. The specific heat of a material doesn't depend on the size or shape of the objects made from the material.

For example, the specific heat of water is 1 and air is 0.24; meaning it takes 0.24 the amount of energy to increase air temperatures 1 °C than it takes to increase 1 gram of water 1 °C which allows for consideration about the amount of time needed to heat and cool the two materials (Kirkpatrick and Wheeler, 1995). Water requires 4 times as much energy to increase temperatures 1° than is needed to increase the same volume of air 1 °. Water temperature increases do not occur instantaneously nor do temperature decreases.

Knowing these facts about the energy cycle and solar radiation (based on facts that meet the "best available science" criteria WAC-365-195-900 through 925) , energy exchanges between the atmosphere, land and water can be examined. Energy exchange is described by The First and Second Law of Thermodynamics. These laws tell us that we can transform but not create nor destroy energy and that energy exchange occurs from areas of high temperature toward areas of lower temperature. The laws also state: if a = b and b=c, then a = c. This equation is important for describing equilibrium in systems, which is basic in using thermometers as instruments that record the increase and decrease in energy of the substances being measured (Haliday and Resnick, 1988).

It is easy to demonstrate that when two objects are put in thermal contact, the object with the higher temperature cools while the cooler object becomes warmer until a point is reached after which no more change occurs. When the thermal changes have stopped, we say that the two systems are in thermal equilibrium. "If three or more systems are in thermal contact with each other and all in equilibrium together, then any two taken separately are in equilibrium with one another"(quote from T. J. Quinn's monograph Temperature).

A thermometer is an instrument that measures the temperature of a system when it is in thermal equilibrium with the system.

Over the years a lot of interest has developed about the temperatures of streams in watersheds due to the Endangered Species Act listing of salmon. Thermometers have been widely used to record daily temperature cycles to assess if the waters are thermally polluted and harmful to Salmonid life stages. Stream water exceeding a 7 day average of the maximum temperatures of 64 F has been used as an indicator for regulatory concerns and is often categorized as being thermally polluted.

Skagit County contracted to have a literature review written (NRC 2000) to identify the "best available science" regarding protection for salmon in the Skagit and Samish River basins. The NRC report cited a number of studies from which the County has concluded "ambient stream temperatures in a given stream reach primarily reflect the combined temperatures of the upstream waters as affected by solar radiation (seasonal and diurnal), ambient surface temperatures (runoff) and subsurface (groundwater) flows. The net rate of gain or loss of heat (thus temperature) as it moves through a landscape is determined by net solar radiation, evaporation, convection, conduction and advection (horizontal movement of a mass of fluid). The relative importance of each of these factors is determined by environmental factors such as cloud cover, ambient air temperature, the geometry of the stream (shallow/wide versus narrow/deep) and flow magnitudes" (Skagit County, 2003).

Of particular interest in these statements is "the net rate of gain or loss of heat (thus temperature) as it moves through a landscape is determined by net solar radiation, evaporation, convection, conduction and advection". The statement is in reference to a well known "energy balance" or "heat flux" equation: Energy = solar radiation + evaporation + convection + conduction + advection.

The "energy balance" equation could be applied to water studies conducted in a laboratory, but has not been used in field studies. To apply the equation on a flowing stream a number of instruments

would be needed to quantify the immediate area solar radiation, evaporation, convection etc. and more than one site would be needed to account for variations between places. The equation has most often been used as a component of numerous stream temperature modeling exercises. These computer models attempt to predict stream temperatures by simplifying the system and "fiddling" and manipulating the equation parts. Use of a "heat budget" equation for this type of work is appropriate because the models are intended to derive the final temperature of water at a specific time. To ensure that the model is "close" or reasonable to what is taking place in the stream being modeled, thermometer data is used for comparisons. At no time are instruments that measure solar radiation, convection, advection, conduction etc. ever taken to the stream to determine if the quantities inserted into the model are accurate.

The Skagit County Cattlemen's study used thermometers on streams to record the amount of energy present in streams, and relied on a different equation to assess the data. The equation is: change in temperature = temperature A(recorded at time 1) – temperature B (recorded at time 2). The equation result does not address how the energy arrived in the stream but quantifies whether the temperature increased or decreased and by how much. No part of the data describes the components of the heat budget equation.

The rise of average surface-air temperatures typically lag 4-8 weeks behind the period of maximum solar radiation (summer solstice), shifting the period of maximum summer heating from June into July and August (Trewartha, 1968). In the Pacific Northwest , an example of the redistribution of summer heat can be observed when pressure systems, originating in southern California, migrate northward, generating daytime high temperatures of 100°F as far north as British Columbia. Similarly, an "arctic express" during the winter can produce below 0°F temperatures as far south as New Mexico and Texas.

If all of Earth's water was represented in a quart jar, the oceans would take up 97% of the water in the jar. Freshwater would be 2 tablespoons of water remaining. Some of this water is in the form of ice and some is underground. The amount of water in the lakes and rivers out of the 2 tablespoons of freshwater would amount to 2 big drops of the water. 1 drop of the water would represent the amount of water in both the soil and air. Ocean water, covering 2/3 of the Earth affects the global air masses which bring a variety of weather changes as they move across land masses.

A river running through a watershed is very small compared to the area that a local climate event can cover. On a watershed scale, both air and soil serve as thermal reservoirs that are directly influenced by global patterns of heating and cooling. These reservoirs are large in comparison to flowing streams and one would anticipate that the temperature of the layer of water would be dependent upon, not independent of the air mass over the stream and the soil mass beneath it.

During late spring and summer, air typically warms during the day to temperatures that are greater than the temperature maintained beneath the soil surface. The water and soil, having a lower temperature receive energy mostly from atmospheric radiation as a day progresses. Air temperature can be used as an indicator of the thermal environment of the watershed and when water temperatures are compared to the air data, a number of tests can be conducted to determine if the water temperature increases are skewed due factors outside of the expected natural thermal profile.

The Laws of Thermodynamics explain that the flow of energy in a watershed is from the warmest reservoir of energy to coolest reservoir (Kirkpatrick and Wheeler, 1995). The laws describe the rate of energy transfer through determination of the "thermal gradient" that sets up between the warmest and coolest reservoir. This can be demonstrated using air temperature and water temperatures recorded on thermometers each hour of the day. In Figure 1 the "thermal gradient"

can be determined for each hour by subtracting the water temperature from the air temperature. When the difference between the air temperature and the water temperature is large the rate of water heating is more rapid than when the difference is small. When thermal gradients are averaged over 12 hour periods throughout the spring and summer seasons, streams located in different places will have similar average gradients and similar rates of heating (Larson and Larson , 2001).

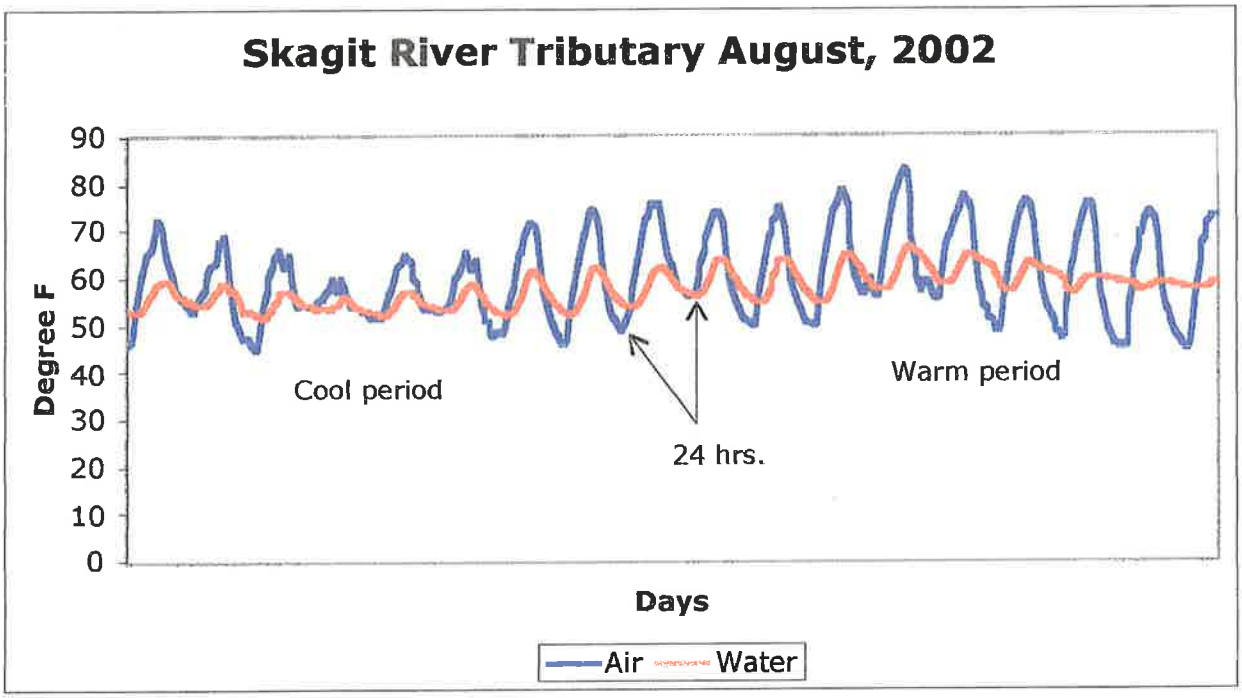


Figure 1. The Skagit River tributary thermal cycle is typical of other streams in the Skagit and Samish River basins. During a cool period water temperatures have less variation compared to warm periods. Water temperature patterns follow the heating and cooling patterns that reflect the natural background conditions for the area.

Temperature increases during the summer period have been used as an indicator of poor water conditions for fish and there have been accusations that agriculture practices contribute to high water temperatures: crops remove shade from streams during field preparations, livestock browse and trample vegetation thus limiting tree recruitment and tree growth. Studies have established the "natural" heating cycle for streams in the Pacific Northwest through statistical analyses of data collected using thermometers. Some published articles about stream heating and shade have concluded that shade is needed to prevent streams from heating, but the studies rarely collected data at a number of sites using air, water, and soil temperatures. Others failed to collect data and instead relied on computer simulations to express an outcome.

The Washington state standards are compared with stream temperatures using a 7 day average of the daily maximum temperature. The rest of the data is ignored resulting in a very limited view of the actual conditions in a watershed. The 7 day average is an exploratory statistical test performed on the data sets that lack a rigorous comparisons against the standard using statistical tests.

It is important to analyze stream temperatures throughout the day and during each month of the spring and summer season. If a stream is heating and cooling within the background conditions of a watershed a foundation of understanding about the system can be established. The data then becomes valuable in understanding many other parameters that are measured to determine water

quality. Some are sensitive to water temperatures and samples may vary during a day or over a period of time when the local climatic events take place.

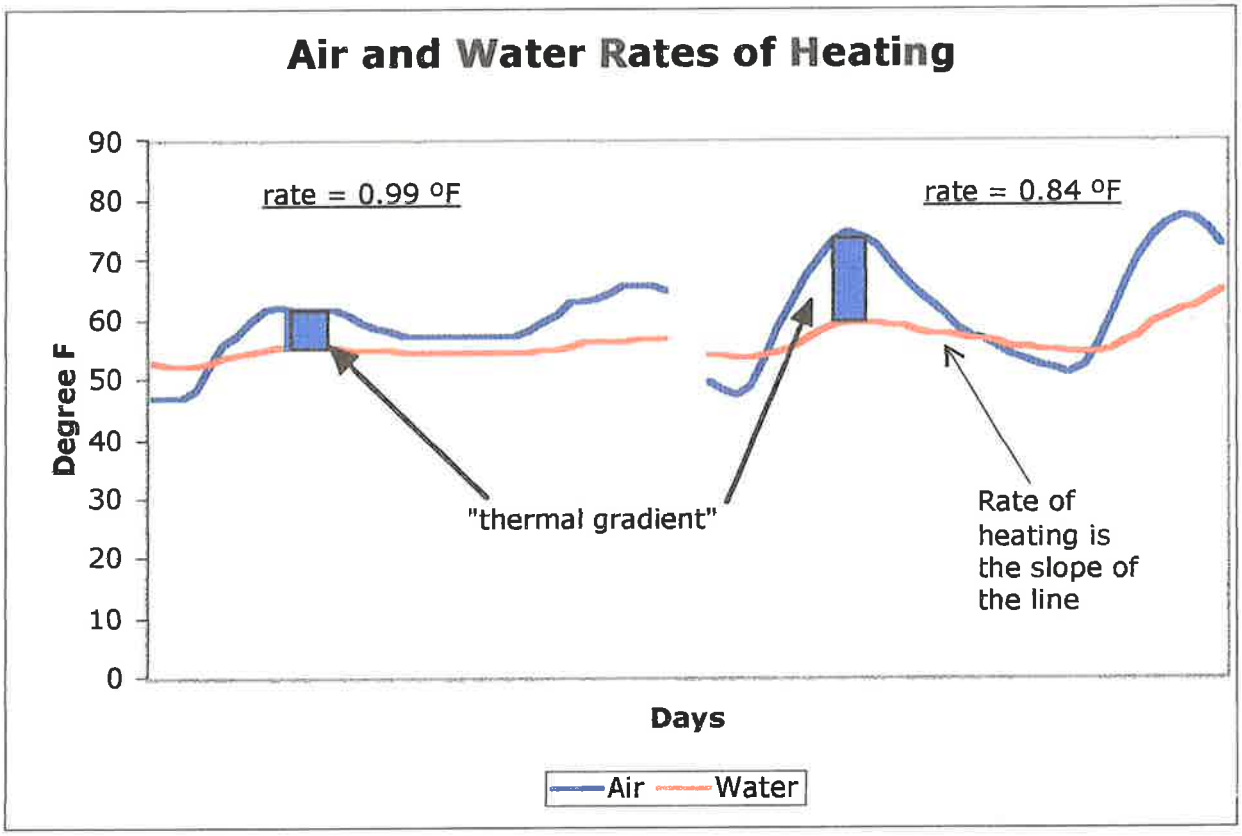


Figure 2. Rates of heating were calculated for each day on streams in both the Skagit and Samish River basins. The average "thermal gradient" was calculated for each day by subtracting the water temperature from the air temperature at each hour. Analysis of the testing periods using the rates of heating and/or thermal gradients provided an objective method to determine if the heating patterns on different days were different and if there were differences between streams.

In the figure above, 2 days during August 2001 are graphed to show that a cool day does not heat the same as a warm day. The slope of the lines are different between the days and the thermal gradients are different. The slopes of the lines are calculated by adding the degrees for each hour over a 12 hour period (5 am - 5 pm). A rate of 0.99 °F in terms of daily heating means that for each 1 °F that air temperatures increase, the water temperatures increase 0.2 °F and a rate of 0.86 °F means for each 1 °F air temperature increase water temperatures increase 0.25 °F.

The patterns of heating and cooling were calculated for streams in the Skagit and Samish River basins by days, weeks, and stream segments. Overall the analyses have shown that the streams and stream segments are heating according to the thermodynamic principles. The rates and "thermal gradients" are consistent throughout the basin and there is no indication that thermal pollution is a problem.

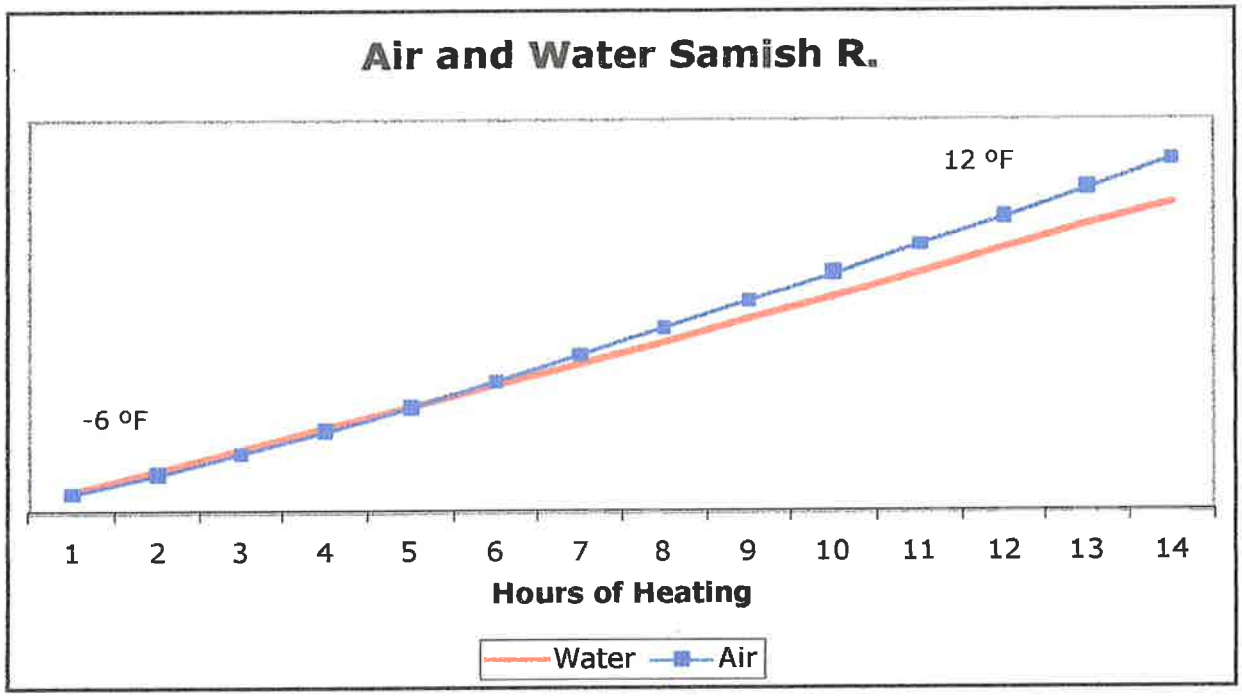


Figure 2a. The graphs an example of a day of heating on the Samish River. The thermal gradient between the air and water temperature changes over the heating period of a day. Between the 1st and 3rd hours, air temperatures are lower than the water temperatures and a negative gradient exists. During the 6th hour the air mass has accumulated enough energy to exceed the water temperatures and the gradients are then positive. During the rest of the day, water temperatures lag behind air temperatures, and increase at a fraction of the rate that air increases. The difference between air and water temperatures determines how fast water heating takes place. On the day represented in the graph, air temperatures increased 24 °F between 5 am and 5 pm and water increased 6 °F. Water temperature increases are not equal to the air temperature increases, but are proportional.

The Skagit County Cattlemen's Study

A literature review was conducted for the Skagit County Cattlemen's project to locate studies that describe scientific principles used to determine the best methods for: conducting agriculture activities (Best Management Practices), protection of land resources, vegetation management near streams, management and use of riparian areas, and grazing practices used for maximum production in riparian areas. Criteria for "best available science" described in WAC-365-195-900 through 925 .

Temperature data was collected on the Skagit and Samish Rivers during 2001, and 2002 by the Skagit County Cattlemen. Phosphate, nitrate, pH, streambed substrate, and riparian vegetation measurements were also assessed to provide as complete a description as possible for a baseline inventory of the water quality and contributions of non point source runoff.

Temperature

Data loggers that record continuous water temperatures during the summer months were used in the Skagit and Samish River River Basin to document the thermal cycles of the mainstem as well as tributaries. Air and water data were collected during 2001, and 2002.

For this report two types of analyses were used to describe the natural heating cycles at each site using topographic elevation, degree accumulations, and water temperature increases during 3 periods of the day: 5 am -9 am, 9 am - 1 pm, 1 pm -5 pm.

A total of twenty-one permanent sites were evaluated to determine the natural heating cycle and increases in water temperatures that occur above the expected natural thermal cycle. Thermal gradients were calculated for sites based on topographic elevation and rates of thermal increase and decrease. Differences between sites and years were determined based on the local climate patterns, using analysis of variance. Other statistical evaluations used were regression equations and Chi square analysis.

Nutrients

During 2001-2002 Skagit County Public Works field data for water quality samples were made available to the public. The data was collected as a "grab" sample which is recommended protocol for lab analysis by Washington Department of Ecology. "Grab" samples are taken at sites on a specific day, at a specific moment in time, and represent the quality of the water column. These samples are generally made using small collecting containers compared to the volume of water in a river or stream, and are taken in a matter of seconds out of the total seconds available during a 24 hour period.

For many water quality parameters such as phosphates, nitrates, fecal coliform, and dissolved oxygen, "grab" samples taken once a month have limitations for statistical analyses. In this report the Skagit County field data was tested to determine if enough samples had been taken for monthly, yearly, or site comparisons. Some samples had very high values, some had low values and too few samples were taken to adequately represent a normal distribution within the water column over the time period when sampling was conducted. The test to determine this indicated that the data set had too few samples and further analyses could not be performed.

Nutrient information was graphed to show that some samples for fecal coliform were high, others were low, and a pattern could not be identified to indicate if there was pollution at a site, during a period of a year, or other time period.

For future testing, a new sampling strategy should be used that more closely compares to the quality assurance of the laboratory testing results. It would be best if nutrient and chemistry samples were taken at 3 times during a day and repeated over 3 days. This strategy would provide a better picture about the water quality because the samples would likely capture daily influences due to temperature change as well as periodic changes over the 3 days due to a local weather changes. This type of sampling would provide data sets that over time would meet the test for sample adequacy, could be statistically evaluated, and could be conducted at fewer sites.

Sediments

Samples of the substrate have not been collected in the Skagit and Samish River Basin in the past making documented annual sedimentation events are unavailable. Substrate material during 2001-2002 were measured in this study to initiate a database of bed materials and how they change over time. Sediment in the Skagit and Samish River Basin should be measured each year to reflect whether "fines" (silt and clay size soil particles) are present at levels that are harmful to aquatic life, document if there are changes in the size and amounts of sediment, as well as provide a description of the substrate consistent with the family of soils in the basin. (See Materials and Methods.

Riparian Vegetation and pH

Streamside vegetation was measured using standard vegetation measurement practices. Species were documented as well as tree dbh and height within a variable plot radius. All data were calculated to determine trees/acre by size class and stratified by soil series or type where changes in species composition are expected to be different. pH was monitored at the sites to associate site soils, plant communities and water quality during the study years.

KEY FINDINGS

The term "pollution" is used in this report, to mean water quality that has been impaired by temperature, sediments, or nutrients above what is expected for that site due to "natural" thermal cycles, erosion, and nutrient additions. Data were tested to determine if there were significant differences between sites, periods (June - September), or years.

1. Sampling results of phosphate, fecal coliform, and turbidity are provided in graphs of the Skagit and Samish River data sets collected by Skagit County Public Works and Skagit County Cattlemen during 2001 and 2002. Some of the data are inconclusive at this time about the cause of fecal coliform, turbidity and other water quality tests. Skagit County Public Works data set offers no information to determine the background levels expected in the Skagit and Samish River basin at this time. More testing will have to be conducted (possibly using a different strategy) in order to gain an adequate number of samples for statistical comparisons.

- The 2 year Skagit County records were examined to determine if the samples could be tested using statistical methods such as t-tests or analysis of variance. The data did not contain an adequate number of samples to account for the variable lab results. Graphs of the data indicate the variability and this report provides no conclusive remarks regarding the water quality presented in their baseline inventory.

- The data should be viewed with caution, because the methods employed to create a water quality index assessment at the sites mentioned above are open to sampling bias and subjective interpretive errors. A more robust approach to the data analyses is needed to objectively determine if the sampling is representative of the system.

2. Sediments in the Skagit and Samish River streams were measured during 2001-2001 to determine if the streambed materials are consistent with soil types and geologic formations found at the monitoring sites and between monitoring sites. At sites located within agriculture lands comparisons of silt and clay particles deposited were made in the streambed gravels and did not accumulate during the study period. Erosion due to runoff is within the "natural " background rates. Riparian areas within the study area are protecting salmon habitats. Soil types and plant community descriptions are provided.

3. Temperature data for all areas were tested during each year, by site, and periods. Graphs of the data and testing results are in Section 1 of this report. None of the streams segments displayed thermal cycles that were outside of the expected natural heating and cooling cycles for the area.

- Water temperature patterns followed the natural cycles of air temperature patterns in the Skagit and Samish River watersheds.

- Water temperature increases are not equal to the air temperature increases, but are proportional.

- Local climate fronts entered the area, the environment of the watershed cooled or warmed depending on the type of front that was present. Cool periods display lower water temperatures and warming trends display water temperatures increasing as the air mass temperature increases which is consistent with the physical laws. The patterns of heating and cooling at each site varied from year to year due to climate differences. During each year of the study, sites had similar degree accumulations as well as rates of heating and cooling that conformed to location, velocity and elevation.

- Thermodynamic principles were consistent at each site during all years. Rates of heating at each site were similar and consistent with thermal gradients. A summary of the expected rates and gradients for the Skagit and Samish River basins were calculated using a mathematical analysis of the physical attributes and illustrates a pattern of thermal cycles due to natural background conditions. Other factors affecting water temperatures were not detected.

- Heating and cooling rates at sites in the study were accounted for due to Thermodynamic principles. Thermal pollution is not evident in the Samish or Skagit River Basins.

- Restoration and/or protection measures implemented to control stream temperatures should first examine temperature data using standard statistical methods in order to verify the natural thermal cycle has been exceeded in the watershed.

- Restoration of riparian vegetation in the Skagit and Samish River basins intended to affect the thermal cycles of the streams should be redirected to focus on maintaining riparian vegetation for other objectives. Protection of the habitat is at a maximum level regarding erosion from runoff, thermal cycles, and riparian vegetation.

- A reference list of science, published studies on the topic of stream water temperature cycles and associated physical laws, used in this report is included.

5. The Skagit and Samish River basins water temperatures were tested for differences in rates of heating and cooling between years (2001, and 2002), sites, elevation differences, as well as daily 4 hour periods of 5am-9am, 9am-1pm, and 1pm-5pm Borman and Larson (2003). Thermal gradients were tested for association with rates of heating as reported in Larson and Larson (2002).

- Figure 3 (page 12) is a summary of the temperature analyses conducted during 2001, and 2002. Sites, located by elevation and velocity will have a similar rate of heating or cooling when the thermal gradient established between the air temperature and water temperatures are similar through the daily cycles.

- The rates of heating and cooling when converted to °F as recorded on a temperature logger indicate that for each 1 °F increase in air temperature, water temperatures will increase at a rate of 0.30, 0.25 or 0.20 °F when located by velocity and/or elevation.

7. The ultimate goal of water quality investigation is to understand how physical laws within the watershed environment can be correlated with direct temperature sensor data, well designed nutrient sampling, and substrate sampling for sedimentation. The Skagit and Samish River basins during both study years were found to be heating according to the expected natural heating and cooling cycles.

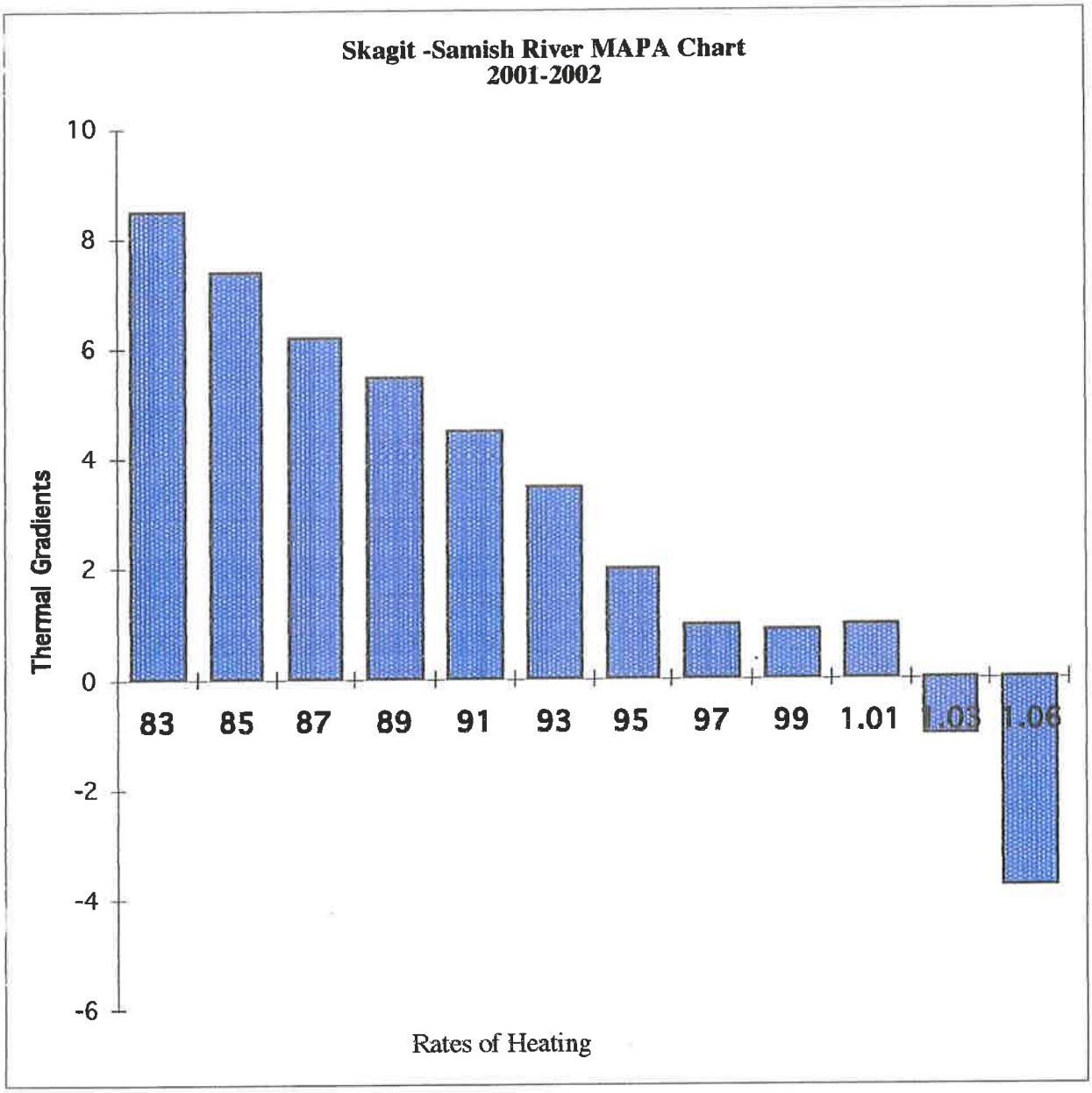


Figure 3: Rates of heating and cooling can be summarized based on the physical attributes of the Skagit and Samish watersheds. For each 1 °F change in air temperature, water temperature changes according to the associated thermal gradient that is present at a site. The Skagit and Samish Rivers and their tributaries heat and cool at rates associated with the thermal gradients provided in this graph. The rates and thermal gradients were tested using analysis of variance and the differences between rates are represented by the bars ($p \leq 0.05$) which indicate that the basin streams are within the natural pattern expected for the local area.

Issues:

1973 Federal Clean Water Act established a law for water pollution control.
The Clean Water Act defines two ways for pollution to enter a water body. The first is a point source discharge and the second type of pollution is non point source pollution. These are defined in federal law as:

1. 33 USC 1362 (6) The term "pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.

2. 33 USC 1362(14). The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

3. 33 USC 1362(19) The term "pollution" means the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

State Identified Water Quality limited streams are placed on a list known as the 303(d) list which is a reference to the Clean Water Act section 303 subsection (d). Listings on the 303(d) list triggers state programs to set a total maximum daily load (TMDL) to control point source discharges into streams that even after the best available technology is applied will not achieve the state standards.

In 1987 the federal CWA was amended for nonpoint pollution. The amendment created a system for the control of nonpoint sources of water pollution through the imposition of Best Management Practices. The Clean Water Act section 319 describes how states can develop incentive based programs for non point source contributions by encouraging pollution control through best management practice (BMP) incentives.

Throughout the Pacific Northwest a number of salmon, steelhead, and bull trout populations have been designated as threatened or endangered under the federal Endangered Species Act (ESA). In an effort to have regulatory programs that are compatible between the ESA and CWA clean water issues have been linked to protection of the salmon and aquatic life.

Agriculture industries in Washington are faced with compliance in both the federal and state law to control non point source contributions from agriculture land. The task of determining compliance with water quality regulations incorporates 3 major steps: identification of water quality problems in the watersheds, identification of soil types prone to erosion events that contribute to sedimentation of streams, and identification of the remedies available to solve water quality problems.

This report assessed the water quality data available to Skagit County and the Skagit County Cattlemen and other private landowners. The information in this report used statistical methods (Snedcor and Cochran) to make a comparative analysis of existing inventories collected during 2001 and 2002 by Skagit County Cattlemen and Skagit County Public Works.

Three types of parameters were examined: thermal pollution, sedimentation, and nutrient contributions. The analysis examined each of the parameters from a statistical perspective and did not assume any stream segment identified on the Washington 303(d) list as a water quality limited

stream was limited. Instead, each stream segment and sampling station was assumed to be equal and pollution free. The term "pollution" is used in this report, to mean water quality that has been impaired by temperature, sediments, or nutrients above what is expected for that site due to "natural" thermal cycles, erosion, and nutrient additions. Data were tested to determine if there were significant differences between sites, periods during the June - September season, or years.

Natural Heating and Cooling of Water

Thermodynamics is the science of heat which addresses the question: When a hot body is in contact with a cool body, why does heat always flow from hot to cold and never the other way around? In thermodynamics science has also established the theories of universal gravitation and general relativity and also explains why heat flows downhill (von Baeyer, 1999).

Halliday and Resnick (1988) state that it is not possible for heat to flow from one body to another body at a higher temperature, with no other change taking place. The directions in which natural events happen is governed by the Second Law of Thermodynamics.

When all stream thermal cycle processes are combined (elevation and stream velocity, rates of heating and cooling, and the difference between air temperature and water temperature) the framework of the thermal environment in which a stream is flowing can be described. However, modification of one or more of the thermal sources will result in a different rate of heating or cooling (Larson and Larson,1997).

Zwieniecki and Newton (1999) reported in a study of comparisons between different levels of buffering that there was no basis for a cumulative effect on temperature from multiple harvest units interspersed with forested stream sections. The warming trend signature occurring within a natural forest cover is a product of the sum of radiant energy inputs and exposure to air warmer than water. Stoneman and Jones (1996) studied the relationship between instream water temperature and ambient air temperature at 6 stream sites and found two sites had maximum summer water temperatures that never exceeded 17°C (62.6 °F); at two others, temperatures remained below 23°C (73.4 °F); and at the remaining two, temperatures reached 28°C (82.4 °F). The relationship that best distinguished the three pairs of sites was the regression of water temperature measured at 1600 hours on maximum air temperature.

The difference between the air temperature and the water temperature influences the rate at which the water will warm or cool. The smaller the differences are between air and water temperature the longer it will take for the water to heat or cool. Generally water at higher elevations accumulates energy at a different rate than those at lower elevations. Higher elevations have lower water temperatures at sunrise and greater average gradients during the day (Larson and Larson, 2002). The lower elevations have warmer water, but they have warmer air temperatures on a daily basis. Two measurements are required at a minimum to estimate the thermal evolution of a stream: 1) the flow rate and, 2) the gradient between air and water temperature. The rate of flow determines how long the water is exposed to a particular air mass (at a specific temperature). The gradient determines the rate at which heat energy is transferred between the air and water (Larson and Larson, 1997).

From a global perspective the Earth's atmosphere gains energy from the ocean and land masses. Differential heating of these surfaces by the Sun creates pressure systems, climatic patterns, and ocean currents that circulate over the globe redistributing energy and water. As a result, the rise of average surface-air temperatures typically lag 4-8 weeks behind the period of maximum solar radiation (summer solstice), shifting the period of maximum summer heating from June into July and August (Trewartha 1968).

The daily temperature range of a stream is influenced by the environment through which it flows. As a stream decreases in elevation the water flows through areas of warming temperatures. This is commonly described as the adiabatic rate of heating. Adiabatic cooling refers to the rate of air mass cooling associated with increasing elevation. This rate of air temperature change typically ranges between 3.5°F and 5.5°F per 1000 feet of elevation (Satterlund and Adams 1992).

The rate of flow of a stream must be determined to understand the entire process of how a stream heats and cools. In early spring a river can flow fast enough to travel 12 miles in 4 hours. In late summer its flow might only travel that same 12 miles every 12 hours. Flow determines how long a body of water is influenced by a particular air temperature. Downstream air temperatures are warmer than upstream because of lower elevations. Flow rates must be monitored during each sample period, between each monitoring site to establish how long the water is exposed to a thermal environment.

Two measurements are required to determine the thermal evolution of a stream: 1) the flow rate and, 2) the gradient between air and water temperature. The rate of flow determines how long the water is exposed to a particular air mass (at a specific temperature). The gradient determines the rate at which heat energy is transferred between the air and water.

The temperature study in the Skagit and Samish River basins for the years indicated were analyzed for stream temperature degree accumulations on a daily basis. The method of systematically computing stream rates of heating through degree accumulations establishes the basis for site comparisons using regression equations and analysis of variance (ANOVA).

Data and Analysis

Data were collected using a designed monitoring program that allowed separation of natural background conditions and undesirable parameters of concern within the water column.

Scientific protocols were used with an adequate sampling design to collect data suitable for statistical analyses. The design allowed us to objectively determine if undesirable thermal pollution levels and sedimentation exceeded the natural background conditions for the Skagit and Samish River Basins, that were due to inadequate riparian vegetation within the area perpendicular to the streams at bank full to 100 feet on either side of the streams.

Water-monitoring sites were randomly selected. Testing was conducted to determine the existence of conditions in the water column that fail to meet CWA parameters as described by the state and that are important to the function and habitat requirement of anadromous species. A hierarchical design that focused on waters of the state for parameters of concern described by the Washington State DOE standards was used to separate data based on soil types and elevation above the mouth of the streams.

Monitoring Materials and Methods

Temperature
Stowaway temperature loggers (Onset Computer Corp., Pocasset, MA) were used to measure water and air temperature. Stowaway temperature loggers have a manufacturer specified accuracy of ± 0.2 °C (0.4 °F) and were used to monitor temperatures at 1-hour intervals.

Temperature logger data were primarily collected to determine if streams categorized as cool or warm water were different when compared based on (i) changes in the rates of water temperature increases at different topographic elevations, (ii) changes in air and water temperatures during 4 h

periods, (iii) high or low velocity, and (iv) diurnal fluctuation in water temperatures during a 12 hour cycle.

The daily pattern of temperature change (4 hr. periods between 5 am and 5 pm) in both air and water was evaluated using chi square tests. The tests identified periods of greatest temperature change and were compared across sites.

Air temperature was used as an index of the thermal environment of the watershed for years 2001 and 2002. Accumulated degree hours (Richardson and Leonard 1980, Miller and Donahue 1990) were calculated for both air and water temperature data sets and rates of heating (regression analysis) were calculated for each day between 5 am and 5 pm Standard time (Larson and Larson 2001).

Sediment Studies

Five line-intercept transects per site were randomly selected to measure the exposed surface of the channel substrate (bank to bank) during 2001 and 2002. Transects were placed perpendicular to the channel and the substrate was measured to the nearest inch. Substrate less than 2.54 cm was classified as fragments.

Fragment samples (150 ml) were collected in 3 locations along each transect. Each sample was dried and screened to separate the materials into categories of >1.3 cm, 0.6 cm-1.3 cm, 0.2 - 0.6 cm, and < 0.2 cm Separated material was measured by water displacement (ml of volume). The category of < 0.2 cm is further divided by separating sand, silt and clay size particles using standard soil procedures based upon Stokes Settling Law (Miller and Donahue 1990). Transect data was summarized to yield the percentage of transect length occupied by substrate size classes including the fragment category.

Water Quality Nutrient Samples

The Skagit County Public Works inventory contains sample results from data collected randomly over 2 years for phosphates, nitrates, turbidity, fecal coliform and other attributes. The records contain extreme values, because samples were collected on a single day, grabbed at a moment in time on that day, and were included in the data collection without notations describing why the results were high or low compared to other samples taken at the same site during other months and other years. A statistical test (sample adequacy) was performed to determine whether enough samples were collected to sufficiently represent the population. The data set fails to meet the required number of samples needed to draw valid conclusions regarding water pollution at the testing sites.

A statistical test for sample adequacy (Snedecor and Cochran) was conducted on the nitrate, phosphate, turbidity and fecal coliform data to determine if it would be useful for a comparison between months, seasons, or years. The tests indicated that little confidence could be placed in the results. To be 90% certain that the samples collected between 2001 and 2002 were representative of the fecal coliform the number of samples needed at most sites exceed 1000. Examples of problems in the data collection were graphed to indicate the variability between samples, and are located in Section 3.

Riparian Vegetation

Streamside vegetation was measured using standard vegetation measurement practices. Species were documented as well as tree dbh and height using variable plots based on basal area. All data

were calculated to determine trees/acre by size class and stratified by soil series or type where changes in species composition are expected to be different.

pH

Throughout the study pH sampling of the water column fell within the range of pH of the soil series in which the streambed was formed. The Skagit River system ranged from 6.9 to 7.3 which was consistent with the soil types for the area. The Samish River system pH ranged from 6.7 to 7.2 which was the expected pH for each soil series at the sties within the study area. All pH samples were within the range defined by the Washington State water quality standards.

SECTION 1

2001 Temperature Data Samish River Basin

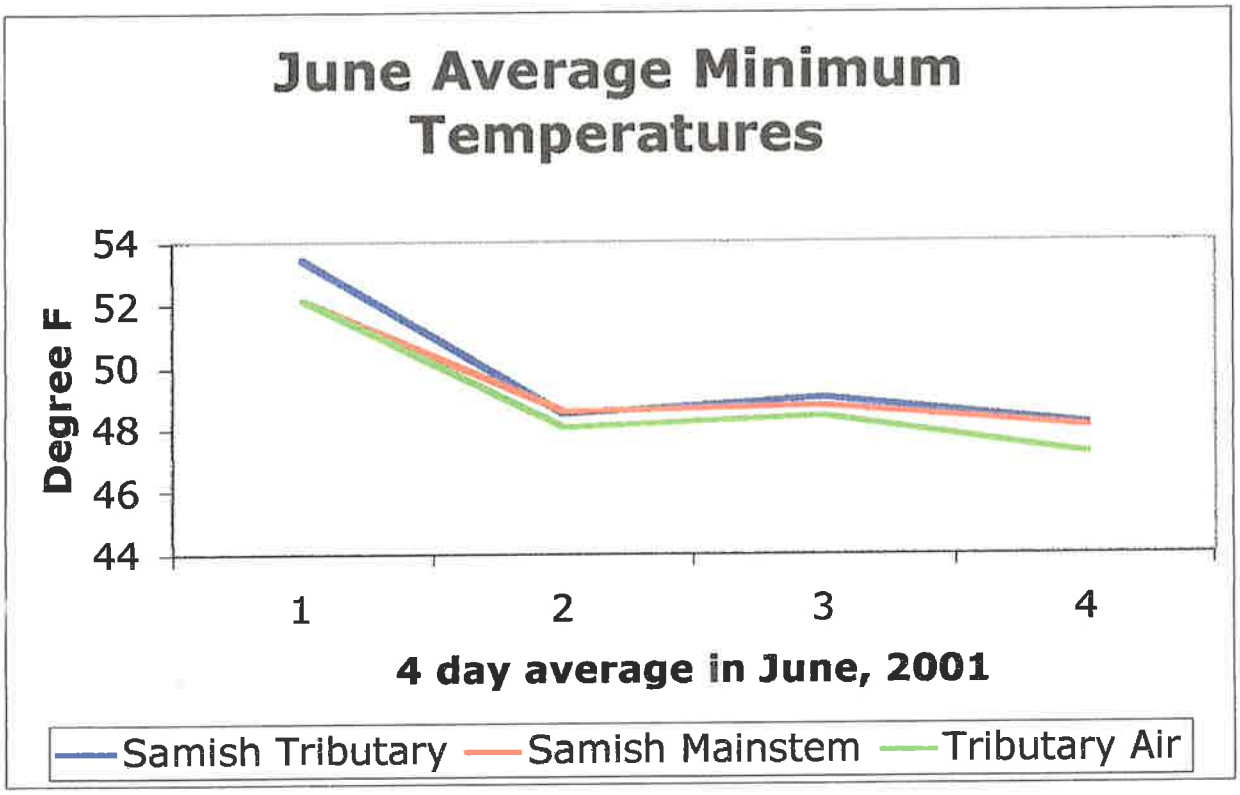


Figure 4. The minimum water temperatures for 4 days were averaged in June, 2001. The graph displays the low temperature averages for 2 sites in the Samish basin. The minimum overnight water temperatures governs the amount of increase during the hours 5 am to 5 pm. If the 5 am water temperatures are above 64 °F, it is not possible for the daily maximum to cool and drop below 64 °F during the day. Overnight temperatures are governed by the air temperatures over the area during the 5 pm to 5 am period.

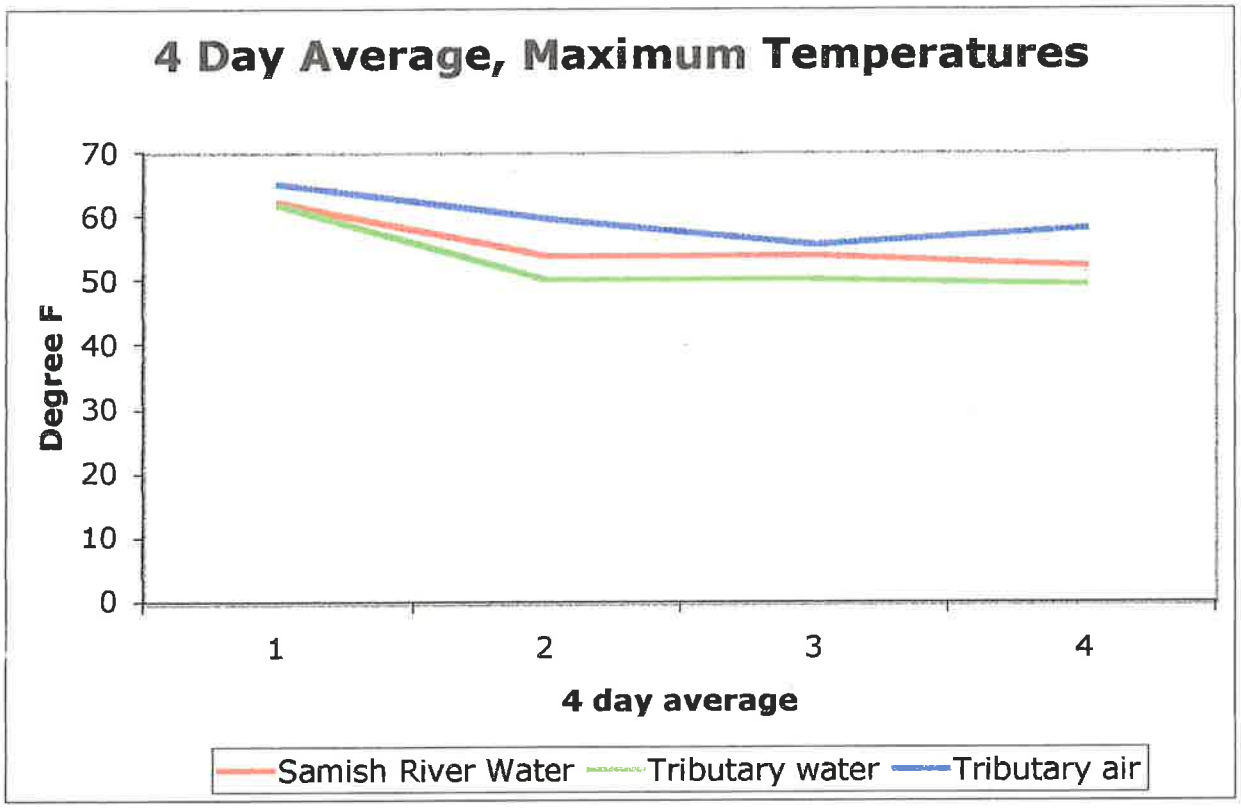


Figure 5. The maximum water temperatures for 4 days were averaged during June, 2001. The graph displays the maximum temperature averages for 2 sites in the Samish River basin.

Air and water are at the lowest temperatures of the day at dawn and maximum temperatures occur between 3 pm and 6 pm. The "equilibrium" temperatures are an important factor in the heating and cooling cycle. For many types of streams, air and water temperatures reach equilibrium in the morning hours as the air mass heats due to the solar angle increases. Air temperatures continue to increase until the afternoon or early evening when the solar angle decreases and the air mass begins to cool. Air temperatures and water temperatures reach equilibrium again for a short time as the air temperatures drop below the water temperatures.

Average surface-air temperatures typically lag 4-8 weeks behind maximum solar radiation, reflecting the annual pattern of energy accumulation in the earth's thermal environment and subsequent redistribution by climatic patterns (Trewartha 1968). The heating of a natural body of water is governed by two primary radiation sources: the sun, and the ambient radiation emitted by the atmosphere and the earth (Larson and Larson 1996). Whether there is net radiative cooling or warming depends on the balance between emission and absorption. Infrared radiation is emitted continuously, and emission rates are usually greater during the day than at night (Bohren 1987).

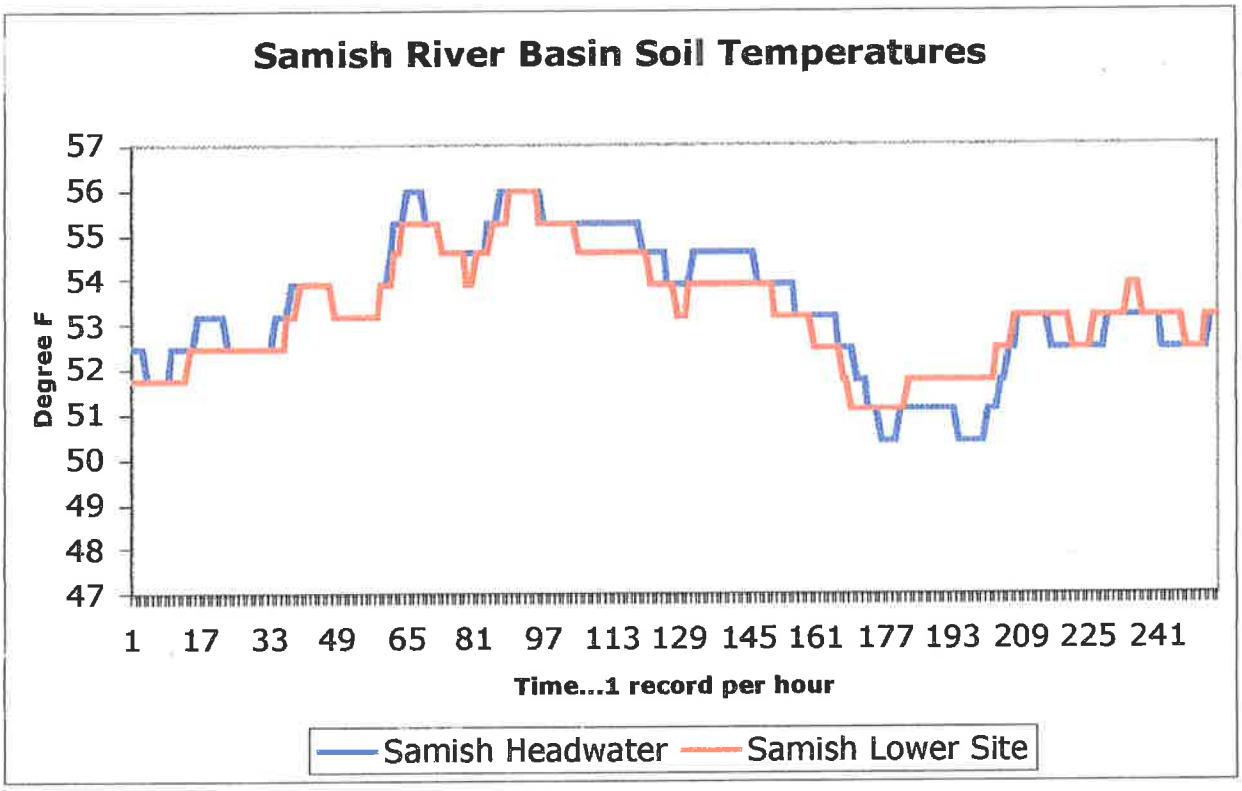
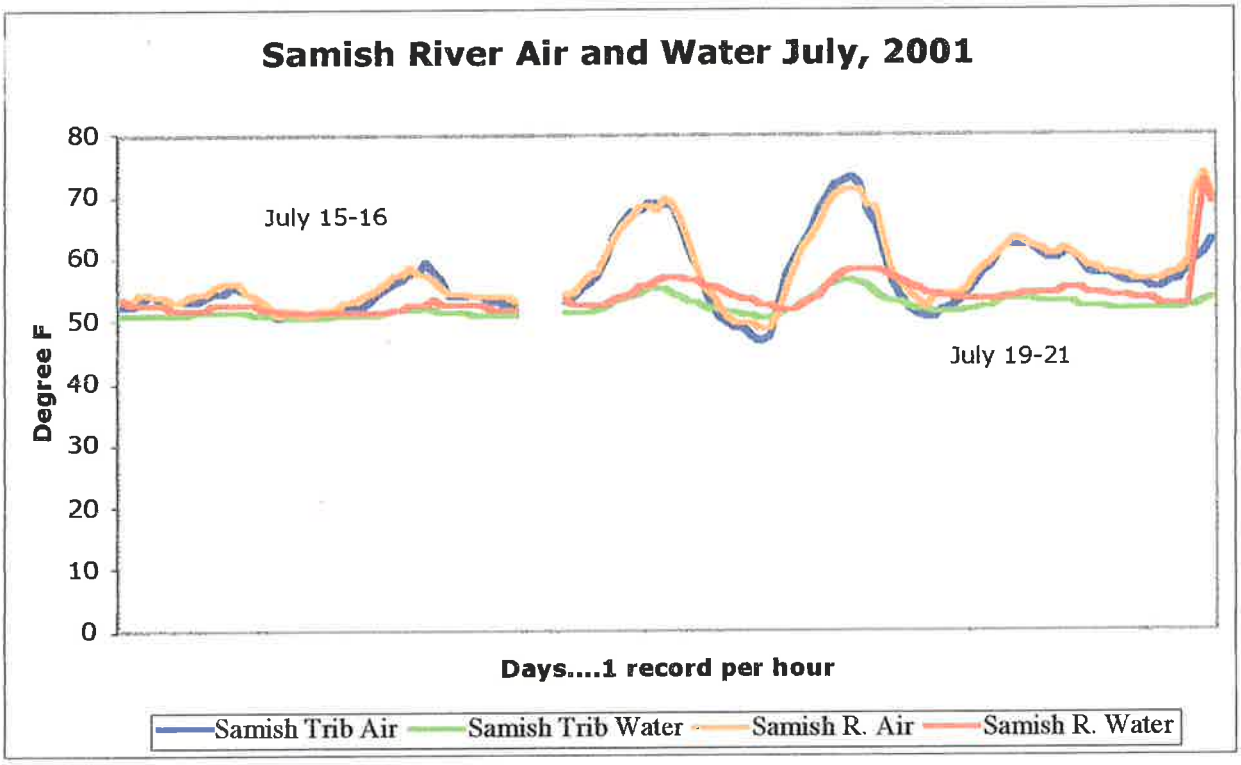


Figure 6. Soil temperatures along the Samish River were measured during June 2001. Little differences were found on a daily basis between the headwater soil temperatures and temperatures recorded 20 miles downstream.

Many stream studies have not estimated changes in the thermal environment of a watershed when reporting study results. Soil temperatures averages during a year are within a few degrees of the annual air and water temperature averages. Differences between periods suggests an association between air, water, and soil temperatures with weather which influences the surrounding environment (ie air and water temperatures).

Suggestions that the thermal patterns in parts of a watershed can be changed by increasing or decreasing riparian vegetation widths have likely been made without regard to how heating takes place on Earth. Air masses enter and leave the Skagit Valley area throughout the summer months brining cool and warm periods which are reflected in the air temperatures and soil temperatures. Water temperatures increase and decrease according to the thermal environment surrounding the stream. Soil temperatures in the graph above increased 4 °F during the warmer period and 2 °F when it was cool. It is important to study the thermal patterns throughout the watershed and avoid examining one component without reference to other factors that may be driving the system. Air and soil temperatures are good indicators of the possible temperature ranges that can be expected in a watershed.



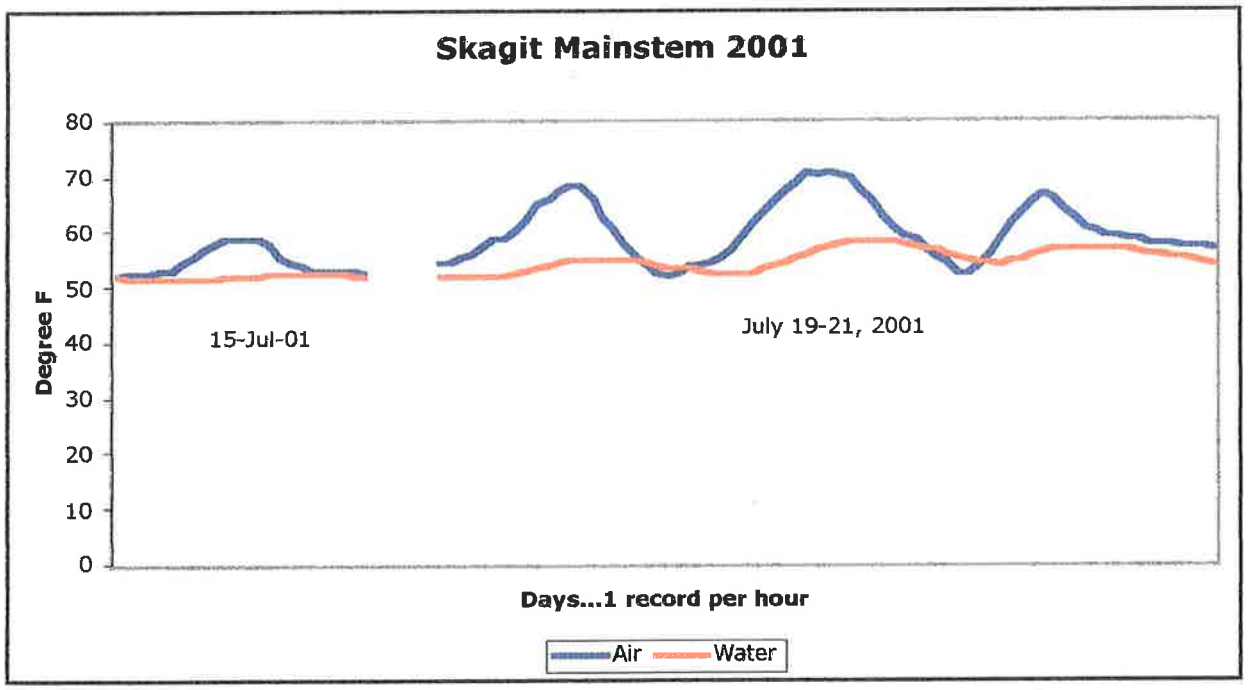


Figure 7. The mainstem water temperatures on the Samish and Skagit Rivers reflect the influence of local climate changes displayed by the air temperatures. The patterns of heating are similar during warm and cool period in both basins and are typical of the natural stream cycles described for the Pacific Northwest. Water temperatures fluctuate depending on the local climate and the velocity of the stream at the time of the measurements.

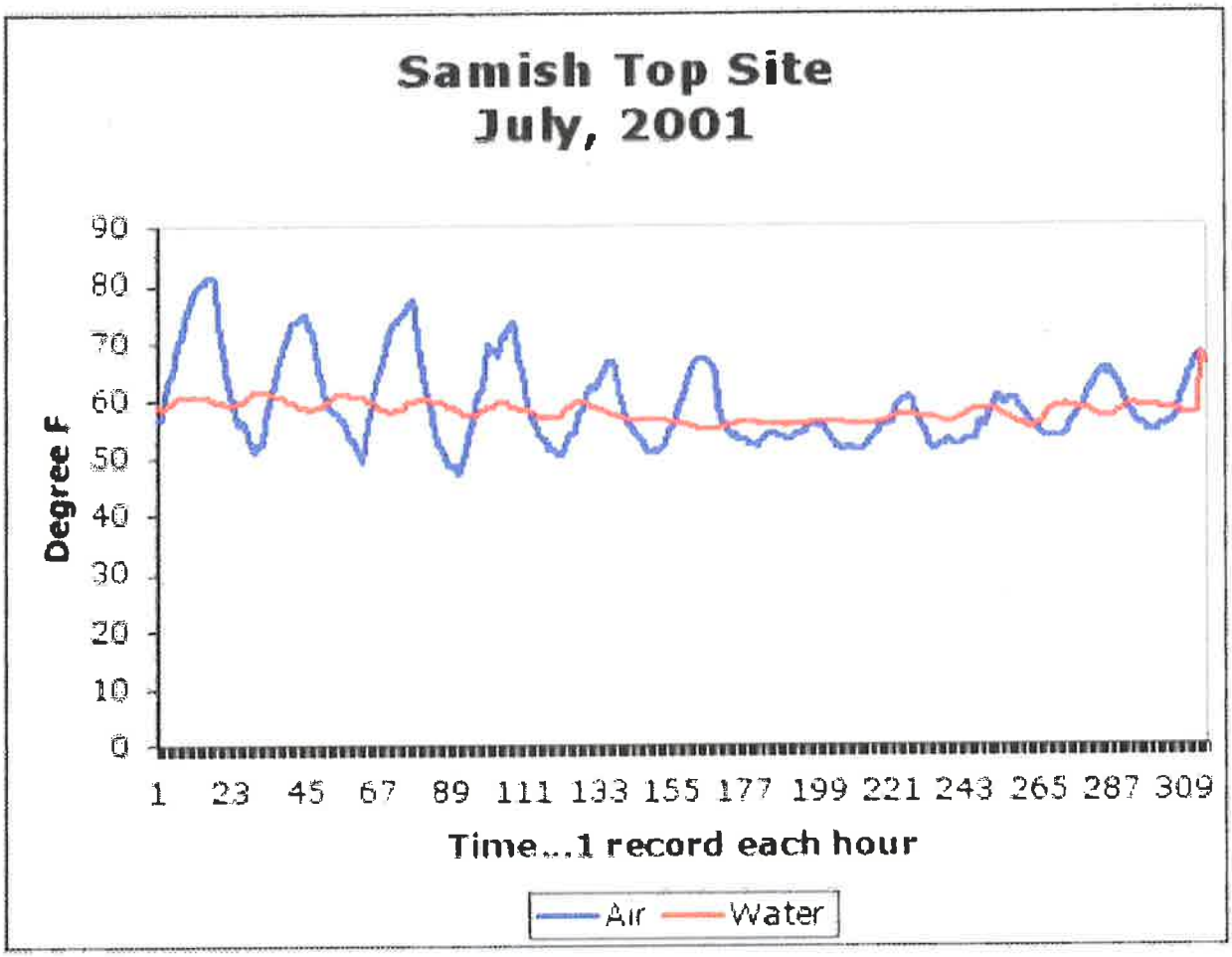


Figure 8. The Samish River water and air temperatures were measured during July, 2001 at the top site which was located below the Samish River headwaters.

The Samish River at this site had an average air temperature of 59 °F and average water temperature of 58°F for the July period displayed above. In June the average air and water temperatures were 53 °F and 51 °F respectively. The rate of heating at the site in June was 0.95 °F when the average gradient was 2 °F. The rate of heating was 0.94 °F in July with an average thermal gradient of 3 °F. During both months water heated 0.2 °F for each 1 °F that air temperatures increased.

The Samish upper site streambed meanders through flat terrain and maintains a fairly consistent elevation for several miles. The stream velocity is low which exposes the water to a similar thermal air mass throughout the day. Compared to stream segments located in the lower reaches, this Samish upper site reflects a slower heating rate than sites downstream. Water temperatures at the site have a limited fluctuation in temperatures from 5 am to 5 pm on a daily basis. On average daily water temperature increases are not significantly different: increases of 1.2 °F occurred between 9 am and 1 pm and 1.8 °F between 1 pm and 5 pm (Chi square analysis). During the July period air temperatures increased an average of 20 °F.

The heating rates and thermal gradient are consistent with other streams in the Samish and Skagit River basins. Days with similar gradients had similar rates when compared with other mainstem and tributary stream segments.

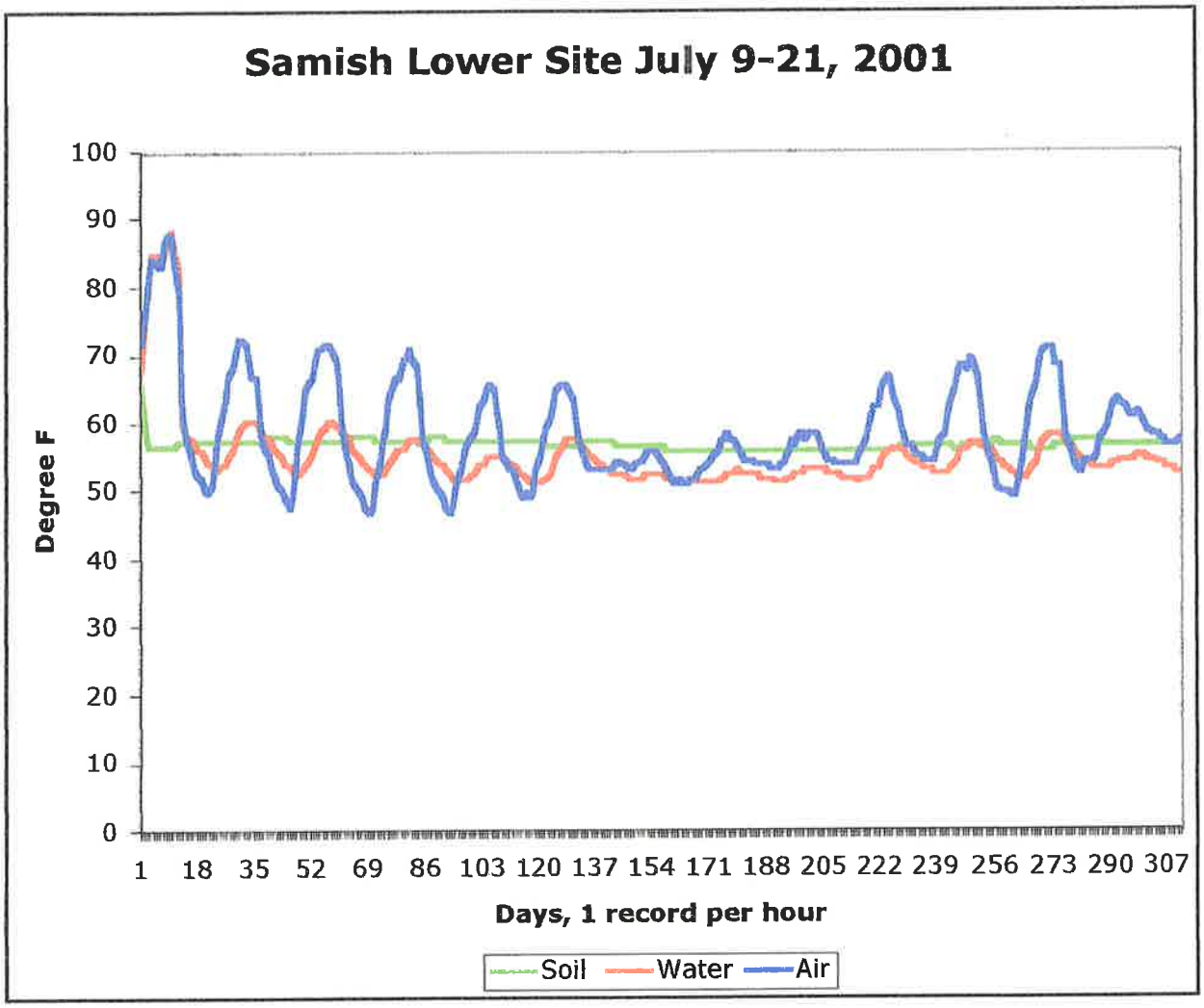


Figure 9. The Samish River lower site, July, 2001 heated and cooled in response to the local climate. During this period the average soil temperature was 57 °F, air temperature was 59 °F, and water was 55 °F. The average thermal gradient (the difference between air and water temperatures) was 5.4 °F which produced a 0.90 °F rate of heating based on accumulated degrees during the testing period.

During July daily air temperature increases were 15 °F and water temperature increases were 4 °F. Air temperature increases between 5 am and 9 am were 6 °F, and between 9 am and 1 pm. were 6 °F also. Water temperature increases during the first period were 0 °F which is significantly different than the 2nd and 3rd periods. Average water temperature increases in the 2nd period were 2 °F and 2 °F during the 3rd period.

The data and analysis indicates there are no heating patterns that are outside of the expected natural heating cycle for the area. Water temperature changes are observed when air temperatures change due to local weather conditions. These results are consistent with results reported in Borman and Larson (2003) and Larson and Larson (2001) and are consistent with the thermodynamic laws.

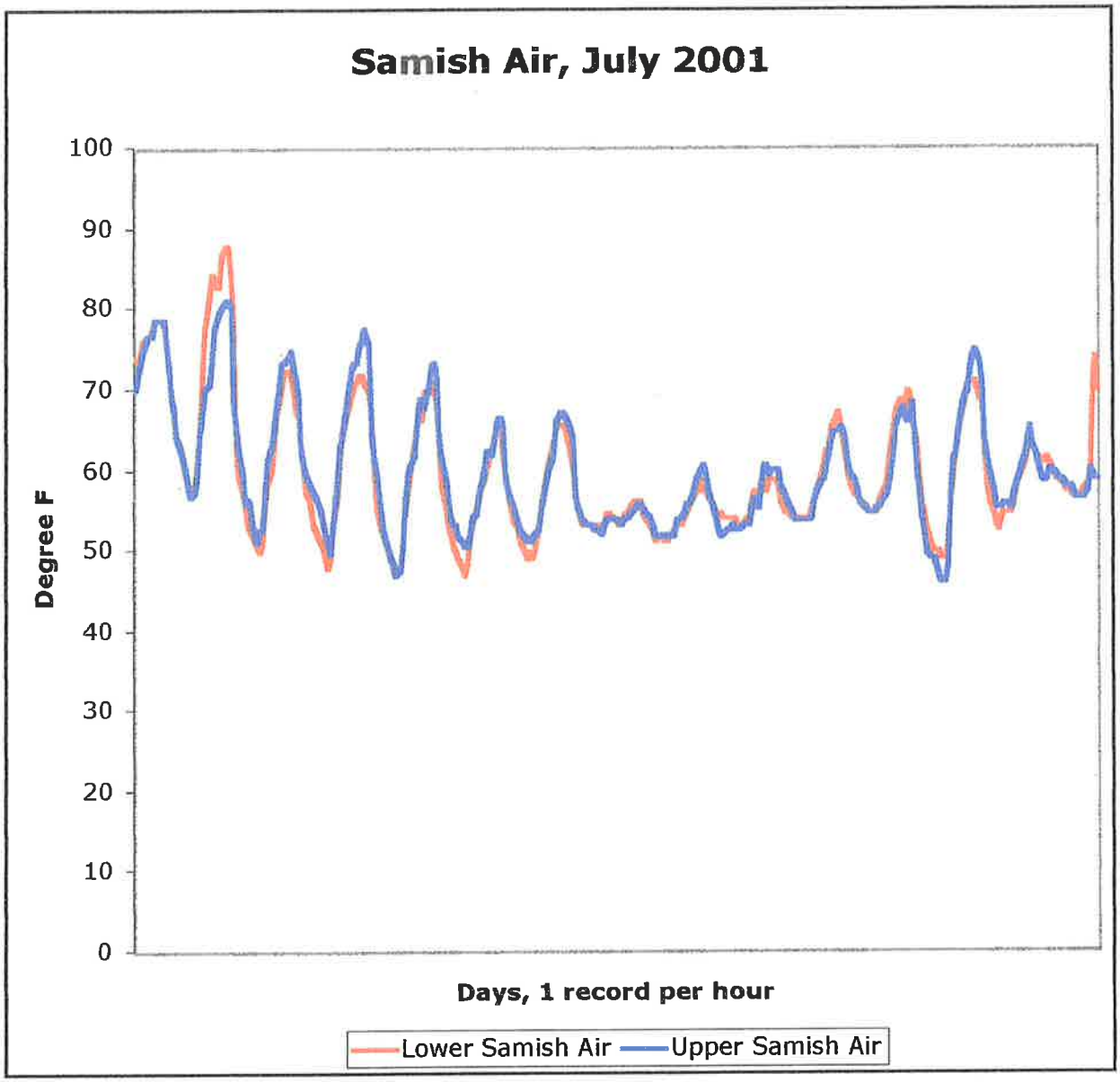


Figure 10. Air temperatures in the Samish River Basin generally reach similar maximums and minimum temperatures during different periods June-August. Similar air mass temperatures over the basin suggests that velocity of the stream and the topographic elevation changes are major factors to consider when examining the water temperatures.

On a watershed scale, both air and soil serve as a large thermal reservoir that are directly influenced by global patterns of heating and cooling. Watershed attributes such as air mass characteristics, elevation adiabatic rates, and stream velocity influence stream temperatures (Larson and Larson,1996, 2002).

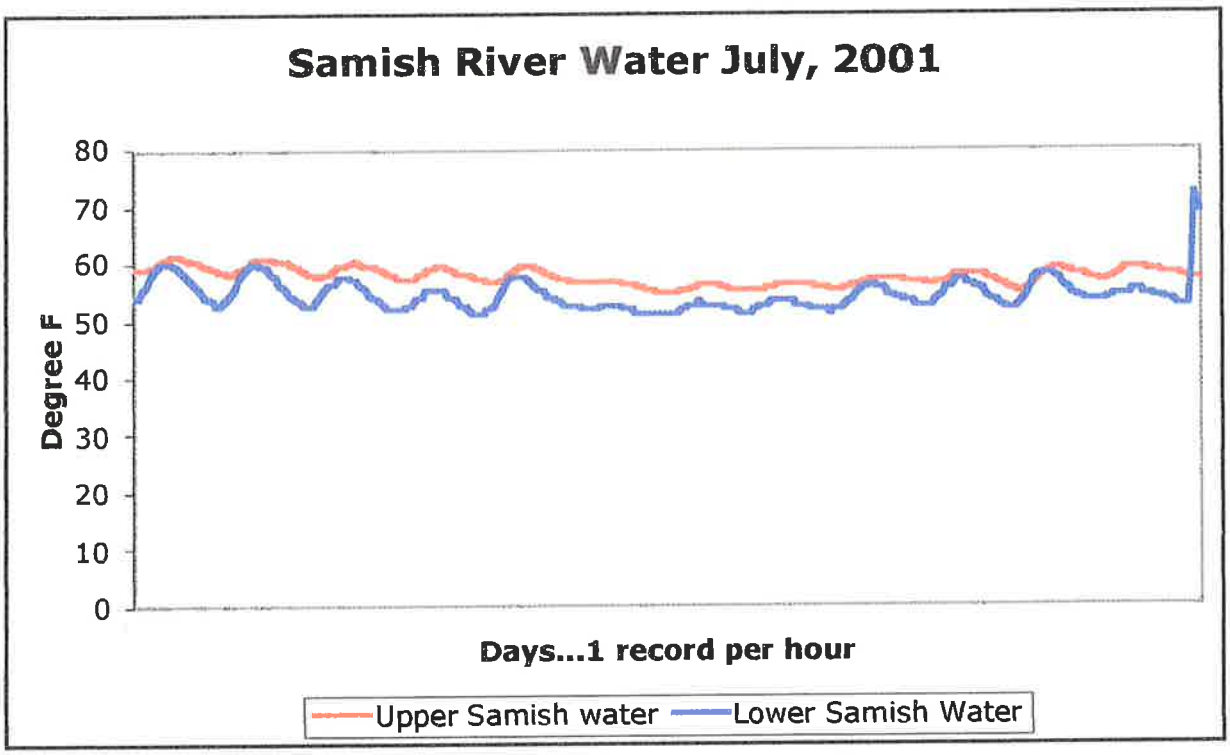


Figure 11. The Samish River headwaters are located at an elevation above 250 feet. Within the first 3-4 miles a marsh area occurs where several small tributaries empty into the river. The area is very flat, the river pools and becomes very wide. During part of the summer period, the velocity is very low through this section of the river. Below this area the river flows downstream to an elevation of approximately 100 feet near Prairie and then to 50 feet in the next 2.5 miles where it flows through Warner Prairie. The sinuosity of the mainstem increases between Warner Prairie and Friday Ck. and the velocity decreases through this section. The longer water is exposed to a mass of air, more time is available for equilibrium to be reached. As the water continues to flow through areas, time passes, and unless the water is slowed and exposed to warmer air beyond the 1pm-5pm period, the solar angle is too low for continued heating and it is time that prevents equilibrium from occurring before sunset.

The graph displays water temperatures that are reflective of the site where the data was collected and indicates that the daily fluctuations at the headwater area and the Lower Samish site are slightly different. The rates of heating and cooling were tested using analysis of variance and compared to other sites located in the basin. The Upper Samish and Lower Samish rates of heating were significantly different when the thermal gradients were different. Days with similar thermal gradients heated at rates that were not significantly different. Overall throughout this period of testing, the average rate of heating were consistent with the results in Figure 3 (page 12).

The water temperatures appear to cool at downstream monitoring sites and the cooling can be accounted for by categorizing streams based on high and low velocities. The Samish River heating and cooling is occurring according to the thermodynamic principles and the analyses indicates that the mainstem is not being thermally impacted by the land activities in the area.

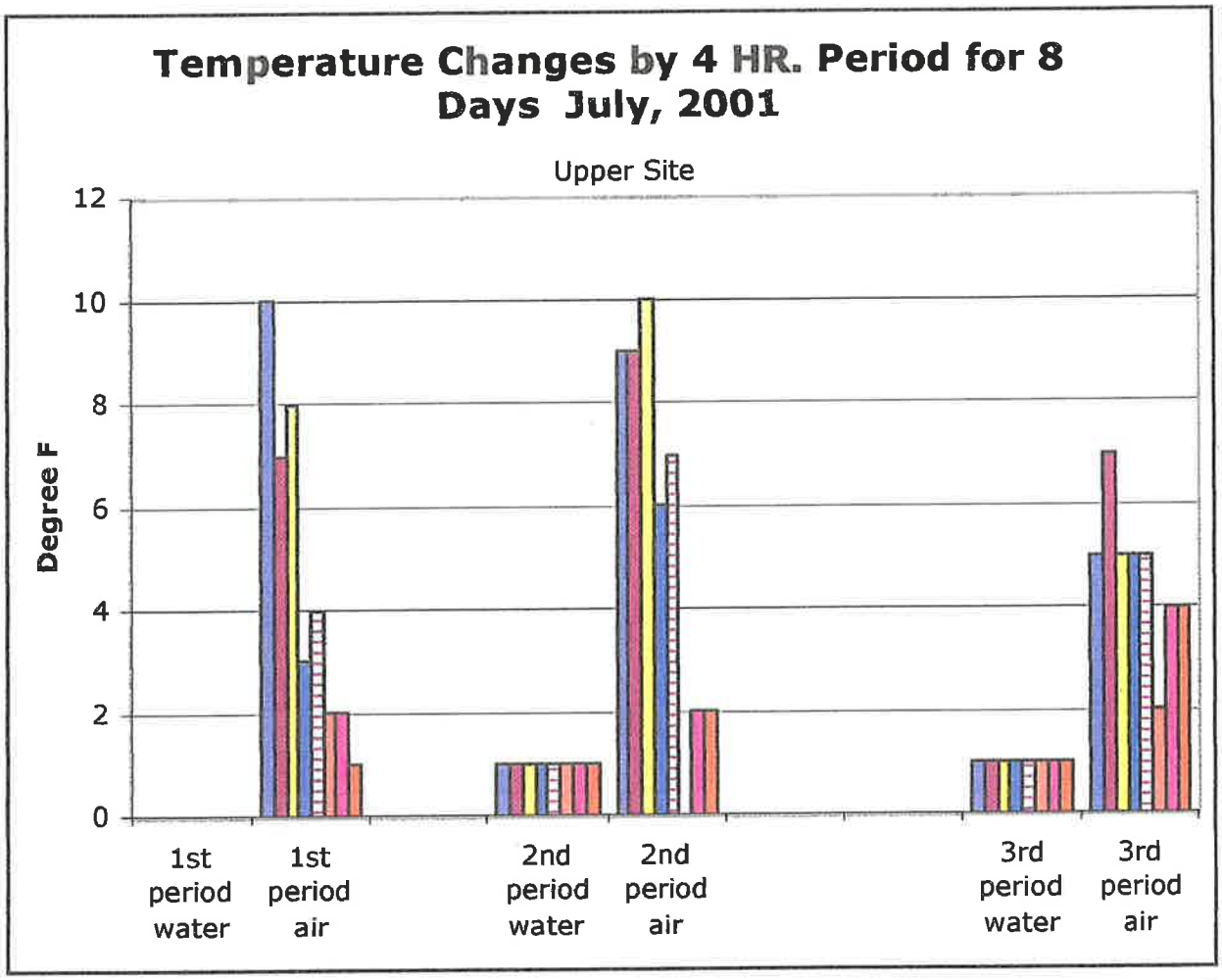


Figure 12. The Upper Samish Site air temperature increased significantly more between 9 am and 1 pm than between 1-5pm during July, 2001. Bars in the graph represent days and show the changes in air and water temperature for each day measured. Water temperature increases between 9 am -1 pm were 0 °F each day. The average daily increases for air and water temperatures during this 8 day period were 14 °F and 2 °F respectively.

An observation during data analysis suggests that on low gradient streams approximately 8 °F increase in air temperature occurs before the first water temperature increase occurs while on steeper gradient reaches with higher velocities, water temperatures increase 1 °F after 12 °F increase in air temperatures. The Samish River at the Upper Site is a low gradient, slow moving body of water The average thermal gradient is 3 °F which indicates that the water is under the influence of the local air mass for a long period during the day and is within 3°F of attaining equilibrium with the air temperature.

Typically a steep gradient stream increases in stream velocity and the average temperature changes fluctuate more than the Upper site demonstrated in this graph. Low velocity, low gradient streams where monitoring sites are located within a 12 hour flow period, reflect water temperatures crossing the point of measurement that have been influenced by air temperatures upstream during the previous 12 hours. Steep gradient streams with higher velocities receive water at measurement sites that reflect the influence of water exposed to cooler air, in some cases this can be more than 5 °F when a stream originates in a mountainous terrain at elevations above 1000 ft.

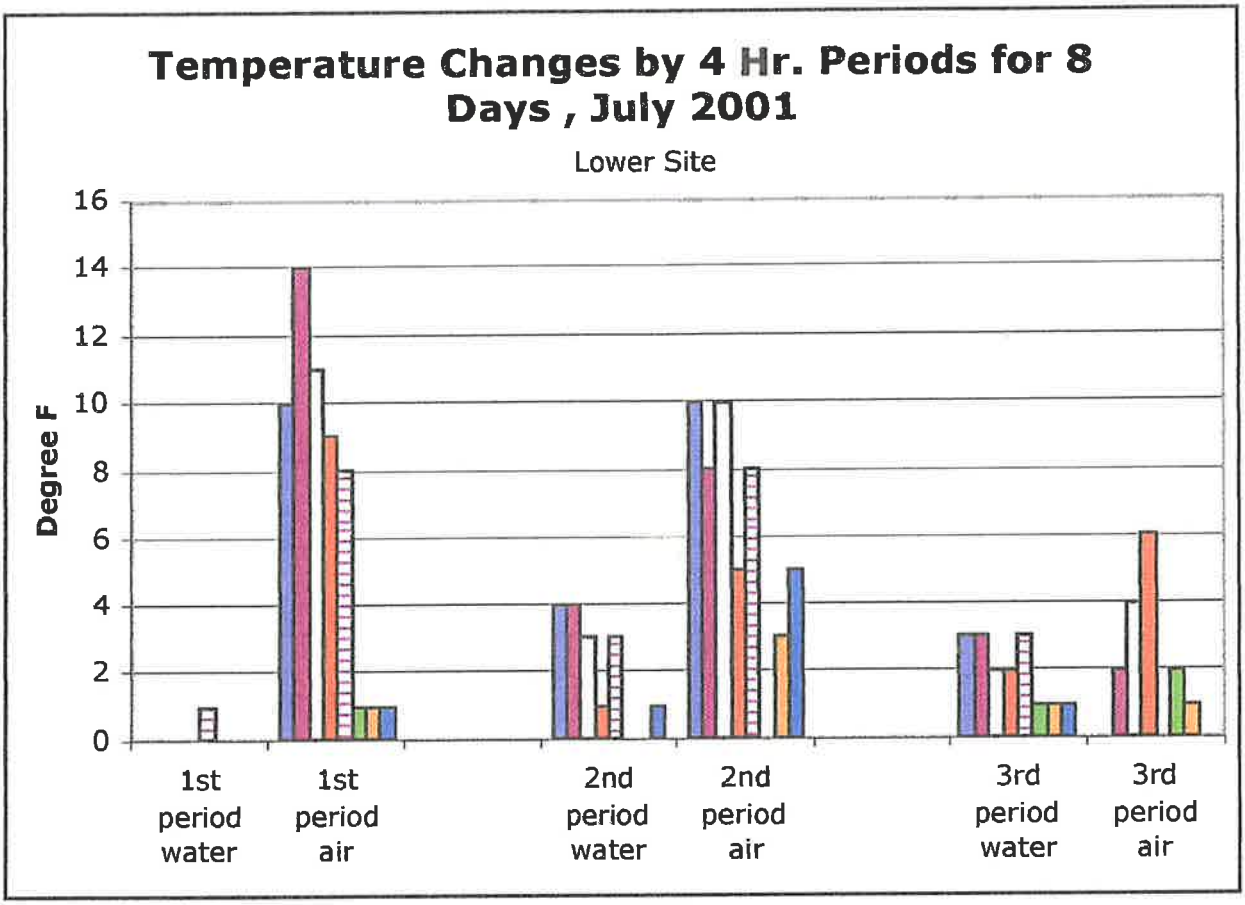


Figure 13. The Lower Samish Site air temperatures heat more between 5-9 am than between 1-5pm (Chi square test). Bars in the graph represent days and show the changes in air and water temperature for each day measured. Water temperatures increases between 9 am -1 pm are not different from temperature increases between 1 pm and 5 pm. The average daily increases for air and water temperatures during this 8 day period were 15 °F and 4 °F respectively. The time of day when the air and water temperatures increase at the Lower Samish site are different than what is seen at the Upper Samish site.

Overall, the Samish River data over the 2 year study did not display thermal cycles outside of what is expected for the watershed as a natural heating and cooling pattern. Protection for fish and aquatic life is at the highest level possible. The water temperatures cannot become cooler, because they are heating and cooling according to the natural background conditions of the watershed.

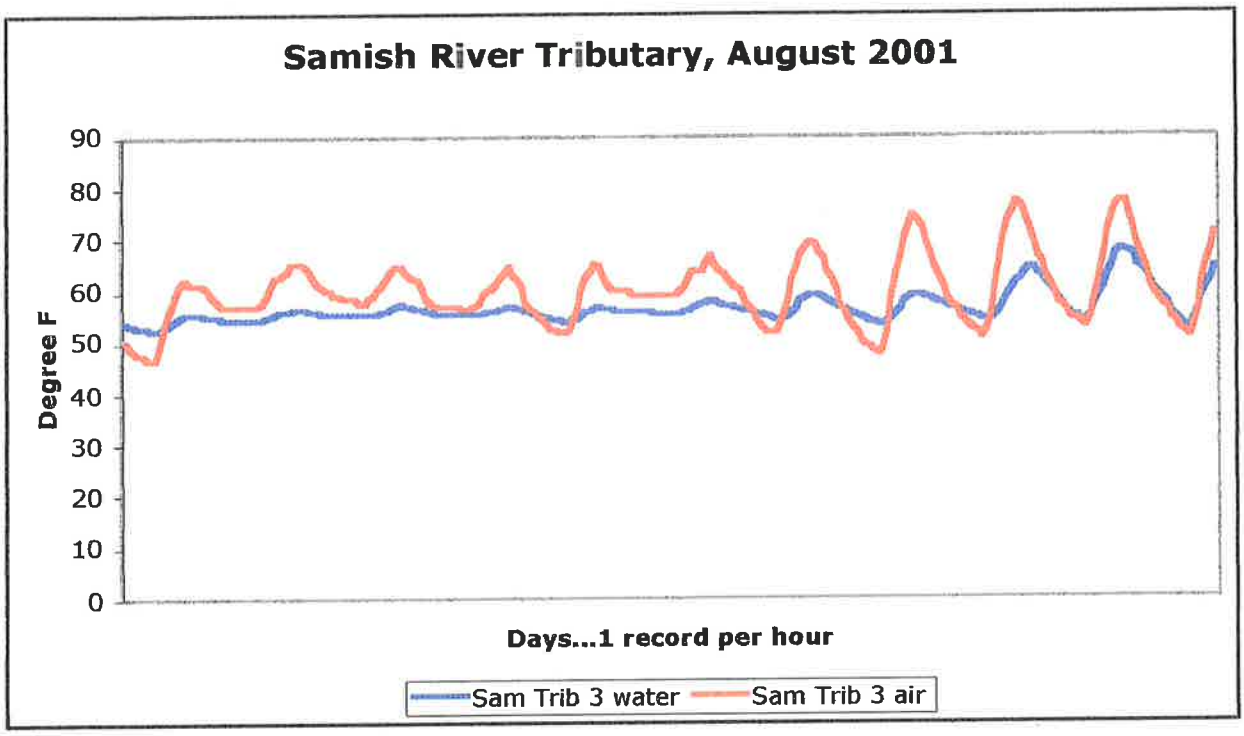


Figure 14. The Samish River tributary (Sam Trib 3) during August, 2001 had a heating rate of 0.87 in July and 0.90 °F in August. Average surface-air temperatures typically lag 4-8 weeks behind maximum solar radiation, reflecting the annual pattern of energy accumulation in the earth's thermal environment and subsequent redistribution by climatic patterns (Trewartha 1968). We expect the rates of heating to change during the summer and the Sam Trib 3 site is typical of the streams throughout both the Samish and Skagit River basins.

The rate of heating between the first 4 days (0.87) and the last 4 days (0.90) shown on the graph are different (ANOVA) and are typical of other streams during the same period. When cool air moves through a watershed the thermal gradient between the air and water temperatures is less than when warm fronts are present.

The data was analyzed using analysis of variance (ANOVA) and Chi square tests to assess differences between days and stream segment heating cycles expected for the area based on the thermodynamic principles for water temperature increases.

Protection for fish and aquatic life is at the highest level possible on the Samish River tributaries. The water temperatures cannot become cooler, because they are heating and cooling according to the natural background conditions of the watershed. Each of the tributaries monitored during the 2 year study responded the same as Sam Trib 3. Streams with similar heating rates had similar average thermal gradients. Samish streams were compared to Skagit River streams and segments and there were no differences between streams when tested during the same periods.

2001 Temperature Data
Nookachamps Sub Basin

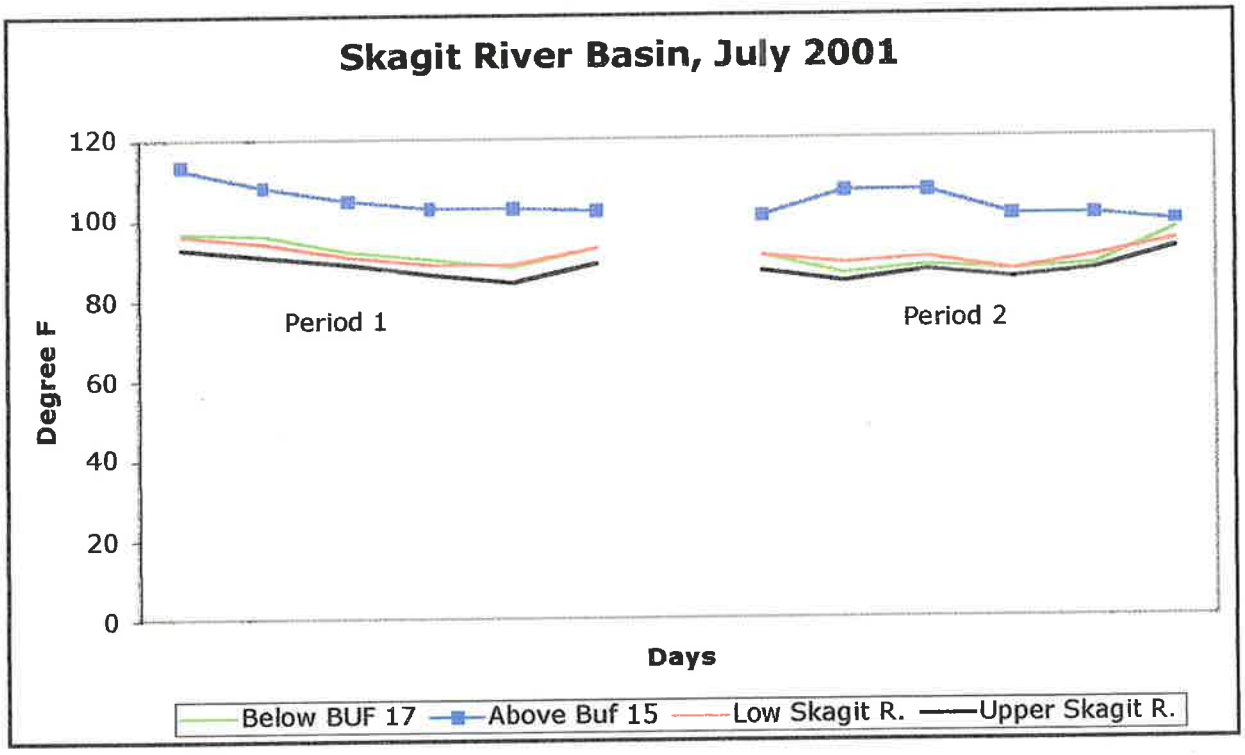


Figure 15. This figure demonstrates 4 sites in the Skagit River Basin selected for testing: 2 sites on the Skagit River and 2 sites on Nookachamps Ck. Daily rates of heating were calculated for 2 periods (6 days each) during July 2001 and then compared using analysis of variance. The site Above BUF 15 was different than the other sites. The average rate of heating at the site was 1.04 °F compared to 0.87-0.90 °F at the other sites.

A Chi square analysis of temperature changes between 5am-9am, 9am-1pm, and 1pm-5pm for air and water increases on the Skagit River at both sites. The results showed there were no significant differences between periods for water temperatures at Low Skagit R. site and the Upper Skagit R. Both sites had 0°F average temperature change between 5 am and 9 am. There was no difference between the 2nd and 3rd periods and the sites averaged 4 °F temperature increase during July, 2001.

Air temperature changes at the Lower and Upper Skagit River sites were 19 and 14 °F respectively.

The site above BUF 15 is strongly influenced by Big Lake. Sites above and below Big Lake were tested using Chi square analysis for temperature changes in air and water data during three 5 hour periods 5 am - 9 am, 9 am - 1 pm, and 1 pm - 5 pm. At the site Below BUF 15 air temperature increases were 5, 8, and 5 °F during each of the respective periods. Water temperatures increased on average 3, 4, and 2 °F during the 1st, 2nd, and 3rd periods. On average the daily temperature increase throughout the 12 hours for air and water were 17 °F and 9 °F.

The average temperature change during the 12 hour period at the site Below BUF 17 was 21 °F and 3 °F for water temperature increases. Water temperatures at the site above Big Lake increased 0 °F in the first period and 1 °F during the 2nd and 3rd periods. Air temperature increases during the 1st, 2nd and 3rd periods were: 4, 14, and 3 °F.

Big Lake has a major influence on the stream temperatures below the lake. The lake is about 1.5 miles long, has a very large surface area, and is thermally stratified as most lakes, reservoirs and contained bodies of water. Temperature data collected in Nookachamps Ck. below the lake are reflective of the surface temperature of Big Lake. The lake water is fed at the upper end, and the surface water leaves the lake about 1.5 miles downstream where it flows into Nookachamps Ck., below Big Lake.

Due to the different heating cycle of Big Lake, the temperature of Nookachamps Ck. below the lake is dominated by the lake water. This influence is continued downstream for at least a distance that the water flows during a 24-25 hour period. Early in the season the point where the water has moved far enough from the mouth of the lake to no longer be dominated by Big Lake heating, is approximately 15-25 miles downstream when the velocity of the stream is 1-1.5 ft/second. Late in the season, this distance is shortened to 10 miles when the average velocity changes to less than 1 ft/sec.

Analysis of the data has been conducted and indicates that Nookachamps at this location is responding as expected due to the local environment. The heating in the stream at this location is in equilibrium with the air temperatures.

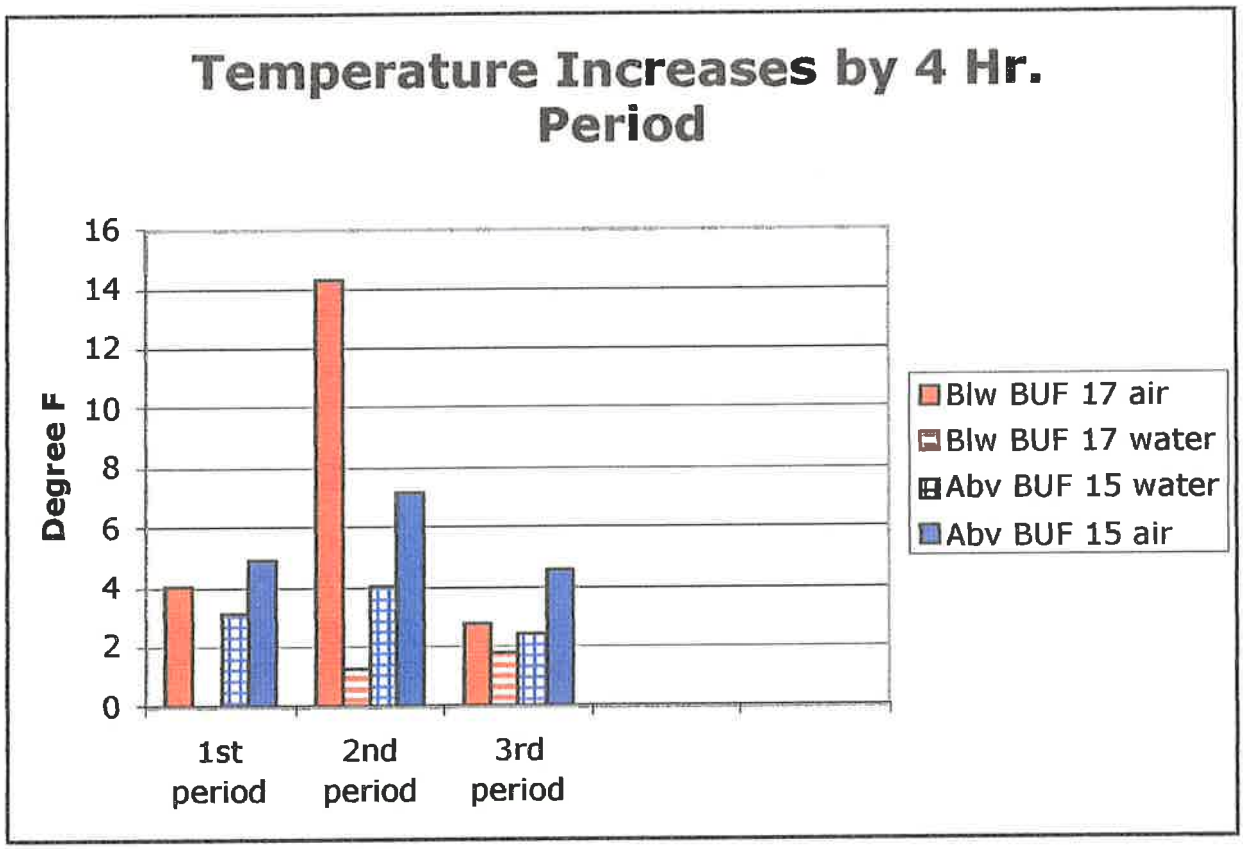


Figure 16. Sites on Nookachamps Ck. above and below Big Lake were tested in a Chi square analysis. The bars represent temperature at monitoring sites. The Above BUF 15 site reaches or nearly reaches equilibrium with the air temperatures when enough heat units are available over enough time and air temperatures are above 70 °F. At the site Blw BUF 17 the water temperatures reflect Nookachamps Ck. temperature cycles typical for what is expected based on stream location, velocity and air mass. The site Blw BUF 17 heating rates were not significantly different than the Skagit River sites located above Sedro-Woolley during the same period.

It is important to note that at both sites, daily water temperature increases averaged 2-4 °F which is similar to other sites in the study area.

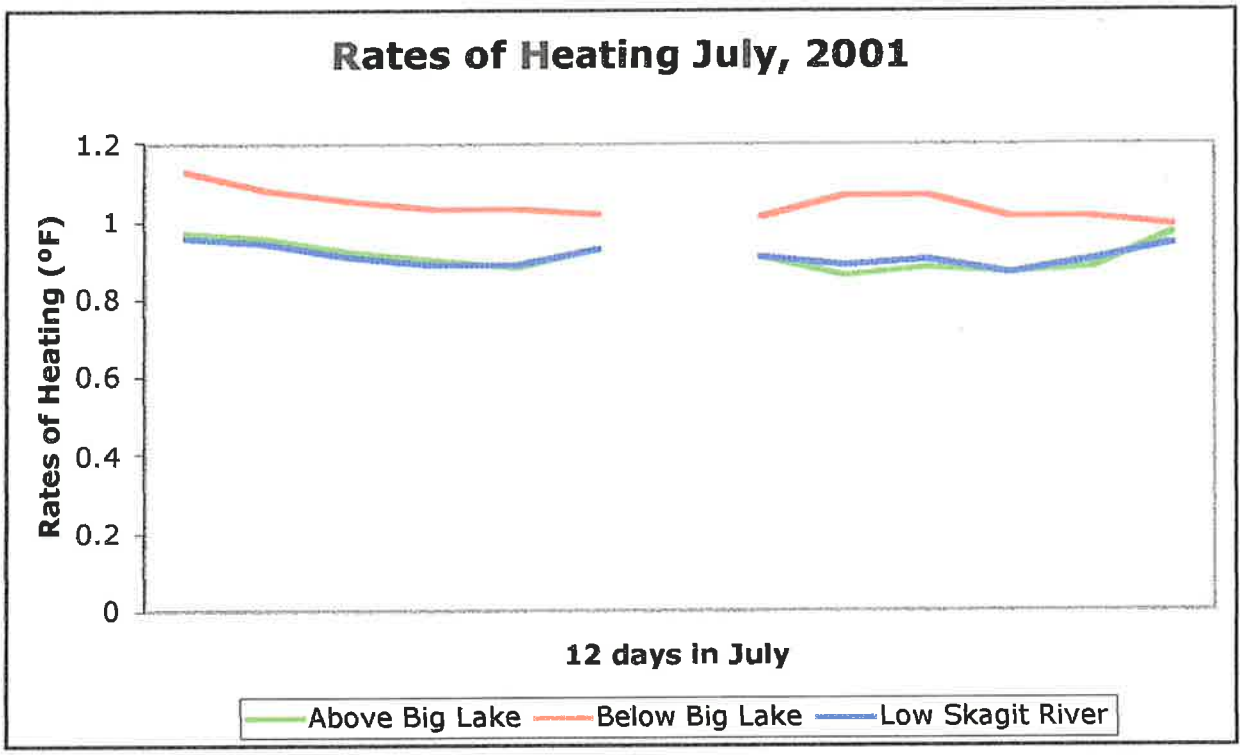


Figure 17. Nookachamps Ck. above and below Big Lake were compared to the Low Skagit River site during July 2001. The site Below Big Lake average rate of heating was significantly different (1.04) than Above Big Lake (0.91) and Low Skagit River (.91) when compared across the 12 days.

The days were identified as 1-6 and 7-12 and the rates were compared between weeks. The weeks were different. The overall rate of heating during the first period was 0.97 and 0.94 during the 2nd week. The test indicates that the streams in the Skagit River basin are heating and cooling according to the natural background conditions for summer months. The streamside vegetation at all 3 sites are very different, the types of streams at each site are different, and the source of water at each site is different.

When air is used as an index of the thermal environment specific testing can be conducted using regression analysis to describe how and when streams heat and cool. The changes in water temperature during days and weeks when assessed (using a12 hour daily basis) provides a way to treat each stream the same regardless of the many other factors that are not being measured at that time.

The comparison of the different stream segments during 2001 through the June, July, and August periods reflected changes in the periods of testing but the patterns of heating by stream when compared one against others maintained the same patterns. If land activities were affecting the temperature patterns at any time (as shown in the 2001 and 2002 data sets) the rate of heating on that stream would exceed the expected results as shown in Figure 3 (page 12).

In this study, streams with similar differences between air and water temperatures had similar rates of heating. The 2001 analyses found no differences between stream segments on days with similar rates of heating using thermodynamic principles for comparisons of the Skagit River basin and Samish River basin mainstem and tributaries

2001 Temperature Data
Skagit River Basin

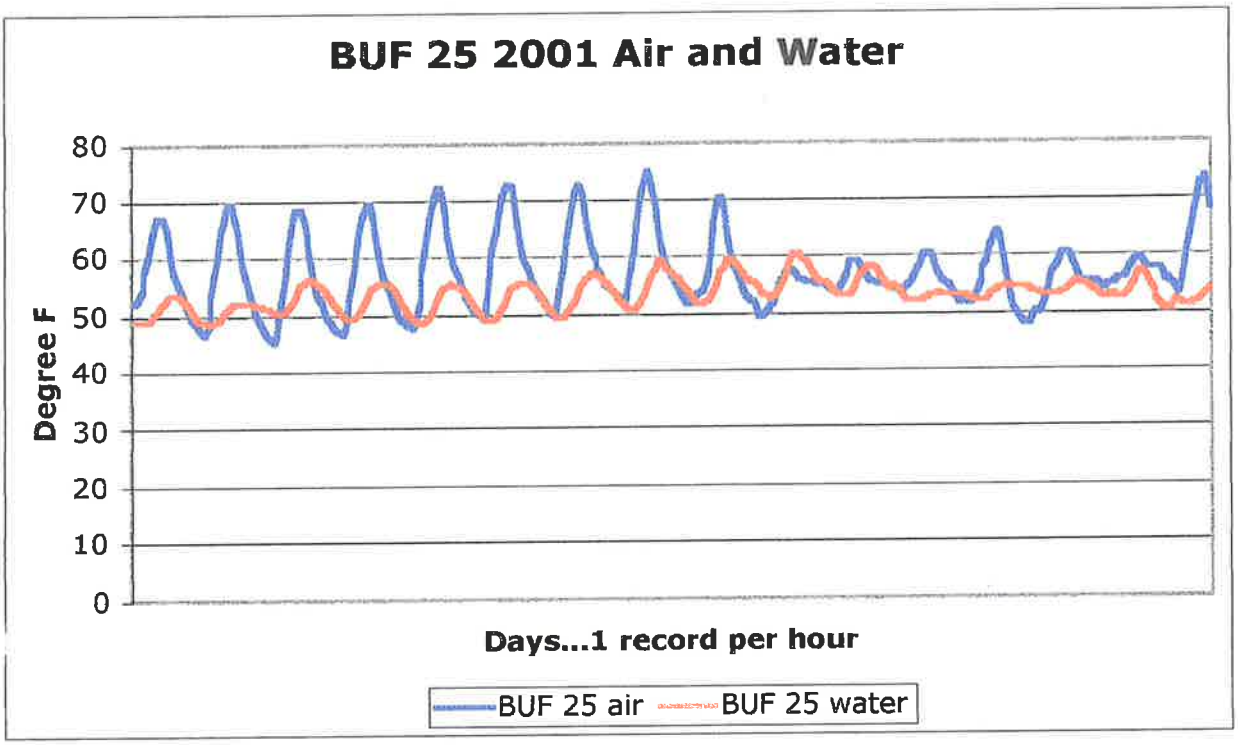


Figure 18. Buf 25 air and water display the same pattern of heating and cooling that is typical for streams in the Skagit and Samish River basins. During the cooler period (right side of the graph) water temperatures decreased over a 2 day period. Water temperature decreased as air temperature decreased and remained low until a warm period returned to the area.

Buf 25 is located at Red Cabin Ck . Skagit County Cattlemen located a site during the study period in the Hamilton area (see Figure 19) and calculated rates of heating and thermal gradients for both sites. The rate of heating between the sites were significantly different.

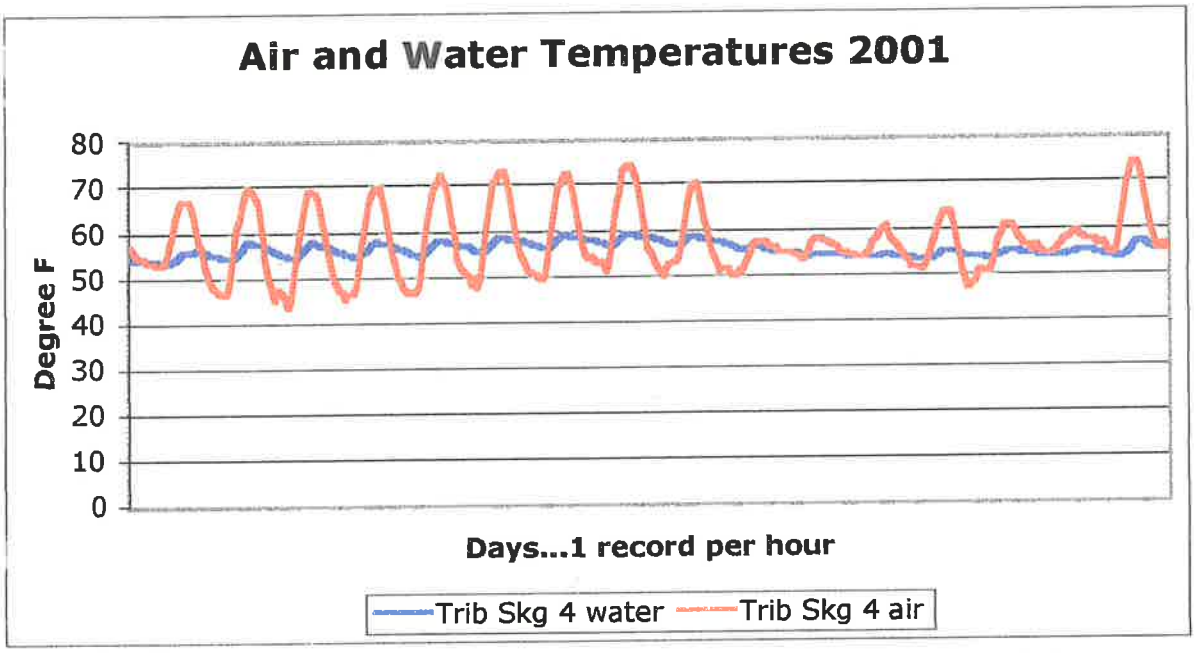


Figure 19. Figure 18 and Figure 19 graphs display air and water temperatures during the same late summer period on 2 different Skagit River tributaries located near Hamilton, WA. BUF 25 air temperatures increased on average 20 °F each day and water temperatures increased 4 °F. At the Trib Skg 4 site the increases were 16 °F for air and 2 °F for water. At both sites air temperature increases were greatest during the 9 am to 1 pm time period (Chi square) and water temperature increases were the same during all periods between 5am-5pm.

Rates of heating were tested (ANOVA) between the two sites during a late summer 2001. Trib Skg 4 heated at a significantly different rate (0.94 °F) compared to BUF 25 (0.87 °F). The BUF 25 water temperatures as graphed above show greater changes during the daily cycle than the water temperatures at the Trib Skg 4 site. BUF 25 site receives water from upstream throughout the day that have been influenced by a cooler environment found at higher elevations than the Trib Skg 4 stream which receives waters from lower elevation headwaters.

BUF 25 and BUF 24 rates of heating during this period were the same when compared using analysis of variance (0.87 and 0.89 °F respectively). Trib Skg 1, 2, and 3 were not significantly different than BUF 24 during August 2001.

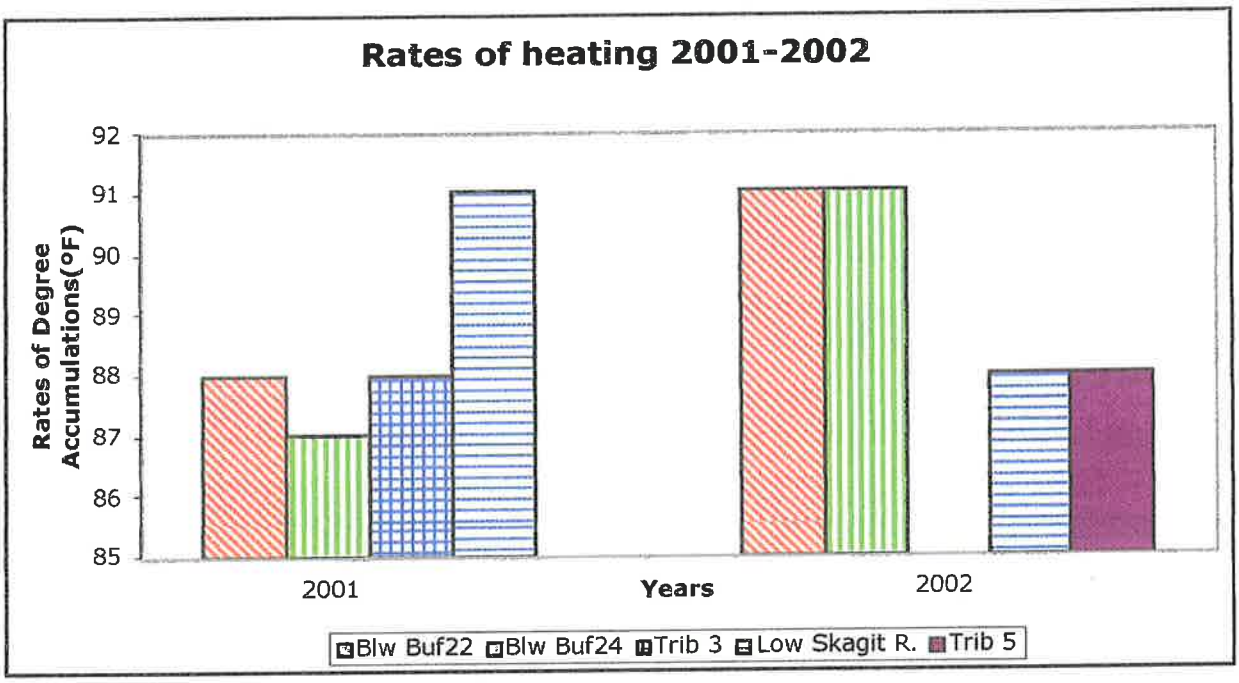


Figure 20. Analysis of variance results indicated that Blw Buf 22, Blw Buf 24, and Trib 3 heated at the same rate during 2001. The rates of heating during 2001 were different than the 2002 rates, but the sites Blw Buf 22 and 24 were not different. Low Skagit River site rates of heating were different during 2001 and 2002.

Differences between years are due to the variability in weather conditions between seasons in different years. Years are expected to be different during a specific period. Trib 5 wasn't monitored during 2001 but in 2002 the rate of heating was the same as the Low Skagit site.

Considering the varied landscapes that each of the stream segments flow through there is strong evidence in the temperature data that activities are not influencing the thermal cycle. The natural cycles are reflected in the analysis results. Air temperatures used as an index of the thermal environment is effective in accounting for weather changes inherent in data collected in a watershed. The streams all "appear" very different when viewed from the streambank. Manser Ck. is very different looking than Coal Ck. and is much smaller than the Skagit River. This test provides a way to make an objective analysis without the influence of a stream's physical appearances.

2002 Temperature Data
Samish River Basins

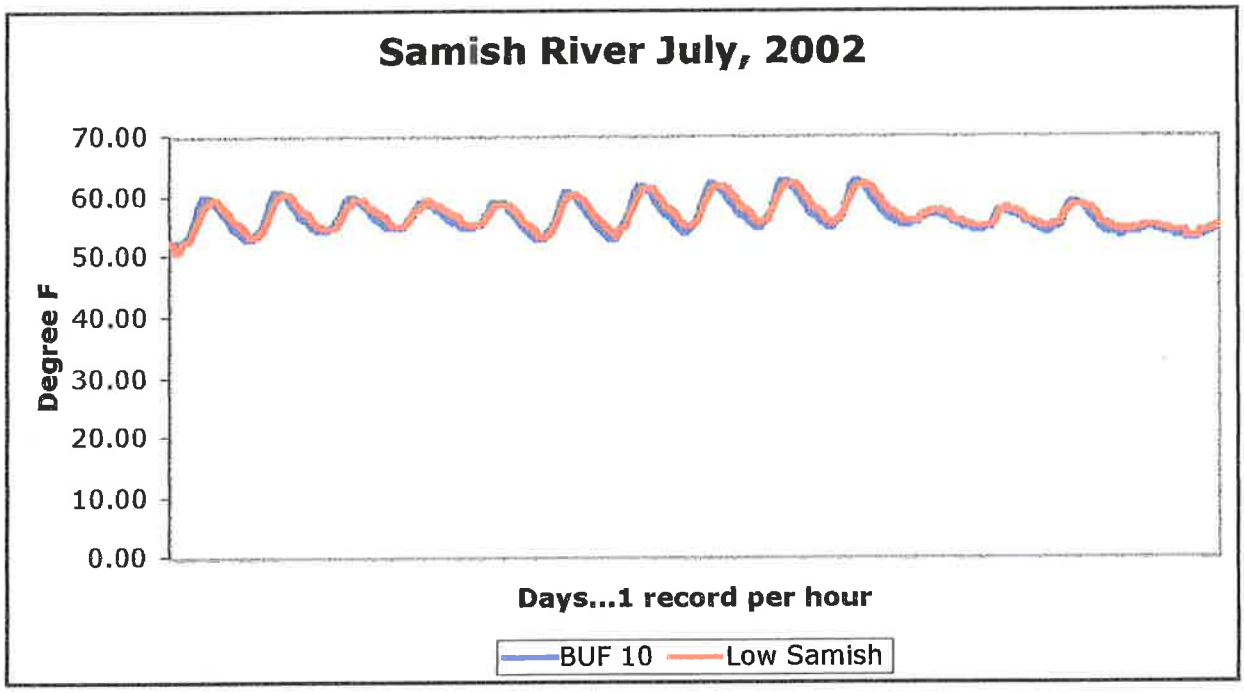


Figure 21. Data was collected on the Samish River during July, 2002. Water temperature data collected at the Lower Samish site was graphed with Skagit County data collected at the BUF 10 site which is located on the Samish River at Prairie Rd.

If land activities were taking place between BUF 10 and the Low Samish site that influenced the water temperatures, the increase would be reflected in the data at the lower site. There were no observations during 2001 and 2002 that indicated the Low Samish site recorded water temperatures outside of the expected natural heating rates for the area.

The two water temperature records displayed in Figure 18 are the same. The sites were compared using Chi Square analyses and accumulated degrees. There were no significant differences between the total daily accumulations during the testing period.

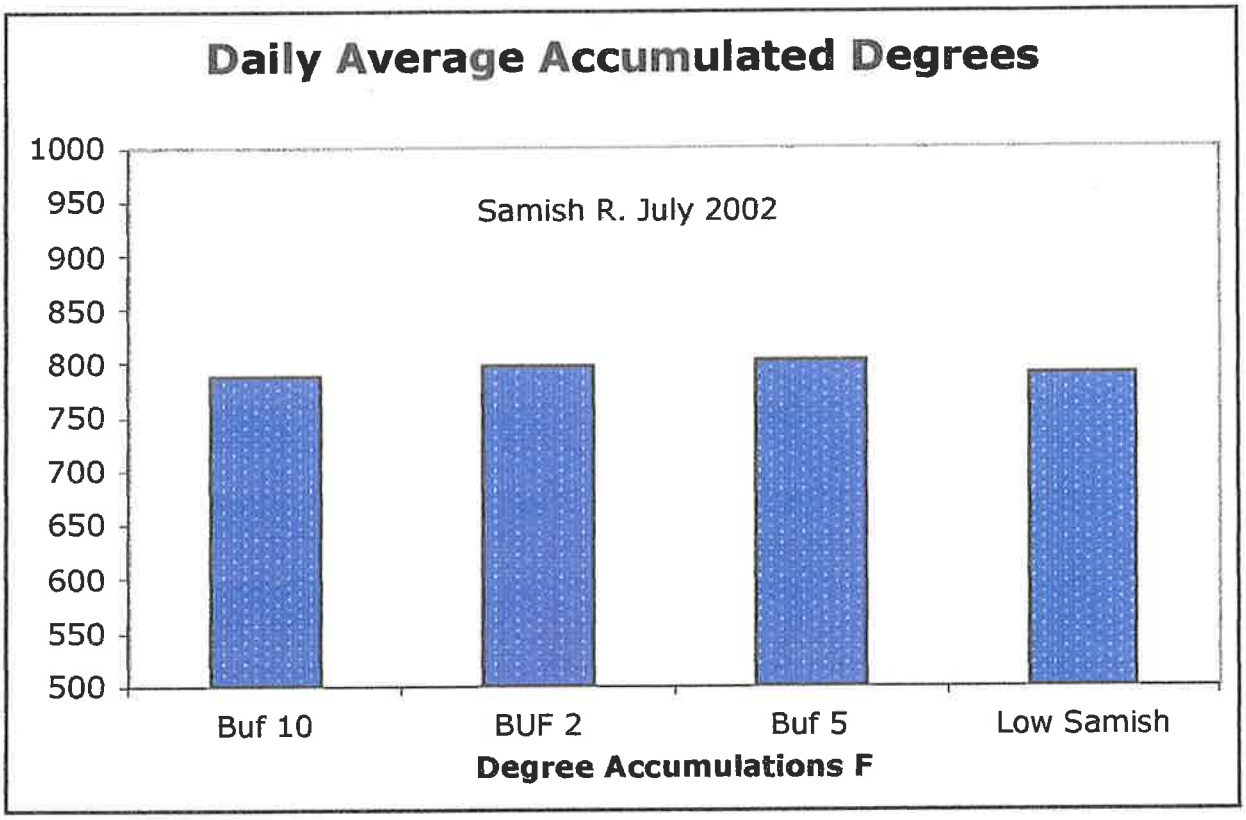


Figure 22. Degree accumulations were calculated for each day on all streams and compared using analysis of variance. There were no significant differences between the sites for total accumulated degrees during the July, 2002 period.

These results are consistent with the results during 2001.

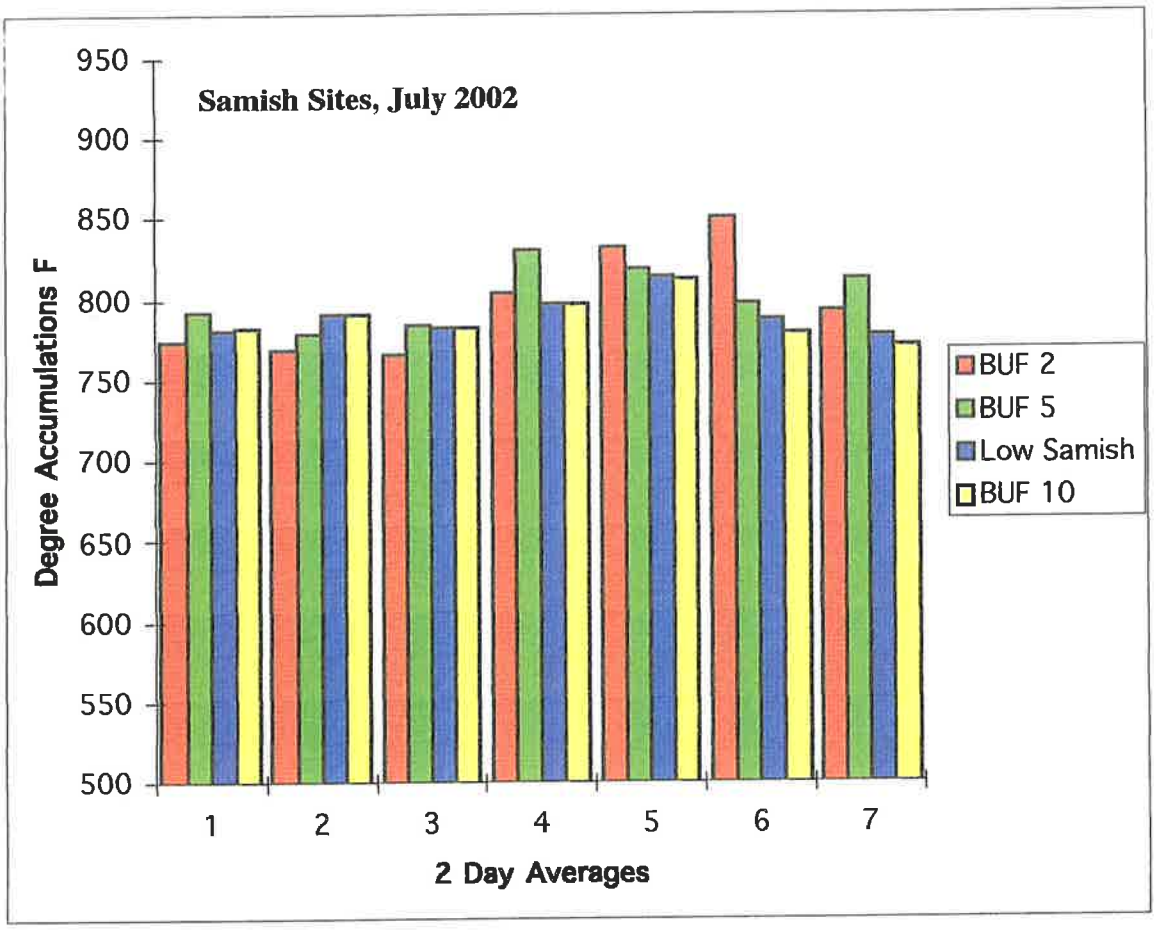


Figure 23. Skagit County Public Works and Cattlemen's data were combined and tested using the Low Samish site on the mainstem near the BUF 6 area. BUF 5 is located below the fish hatchery and BUF 2 is located downstream on the West side of I-5. The topographic elevation change between BUF 10 and the Low Samish / BUF 6 area is approximately 50 feet. The graph displays the daily degree accumulations at the sites shown in the previous figure.

Examination of the degrees that accumulate during a day provides a way to compare streams day to day while accounting for the local climate at the time of the data collection. Site degree accumulations vary from day to day and are dependent on the weather systems passing through the watershed, thus it would be expected to have degree accumulations increase when the weather is warm and decrease when it is cool.

There were no differences between the sites which suggests that each site is responding naturally to the thermal conditions in the watershed from the Samish at Prairie Rd. to the site located at Samish River at Chuckanut Dr. (BUF 2). Assertions that an addition of riparian vegetation to facilitate shading on the Samish River in order to prevent stream water warming is not supported by the testing results. From all observations and analyses during the 2 year study, the Samish River mainstem and tributaries have excellent water temperature profiles and there is no evidence that thermal pollution is occurring. Protection for the fish and other aquatic life is excellent and is consistent with the natural background conditions for the watershed.

2002 Temperature Data
Nookachamps Sub Basins

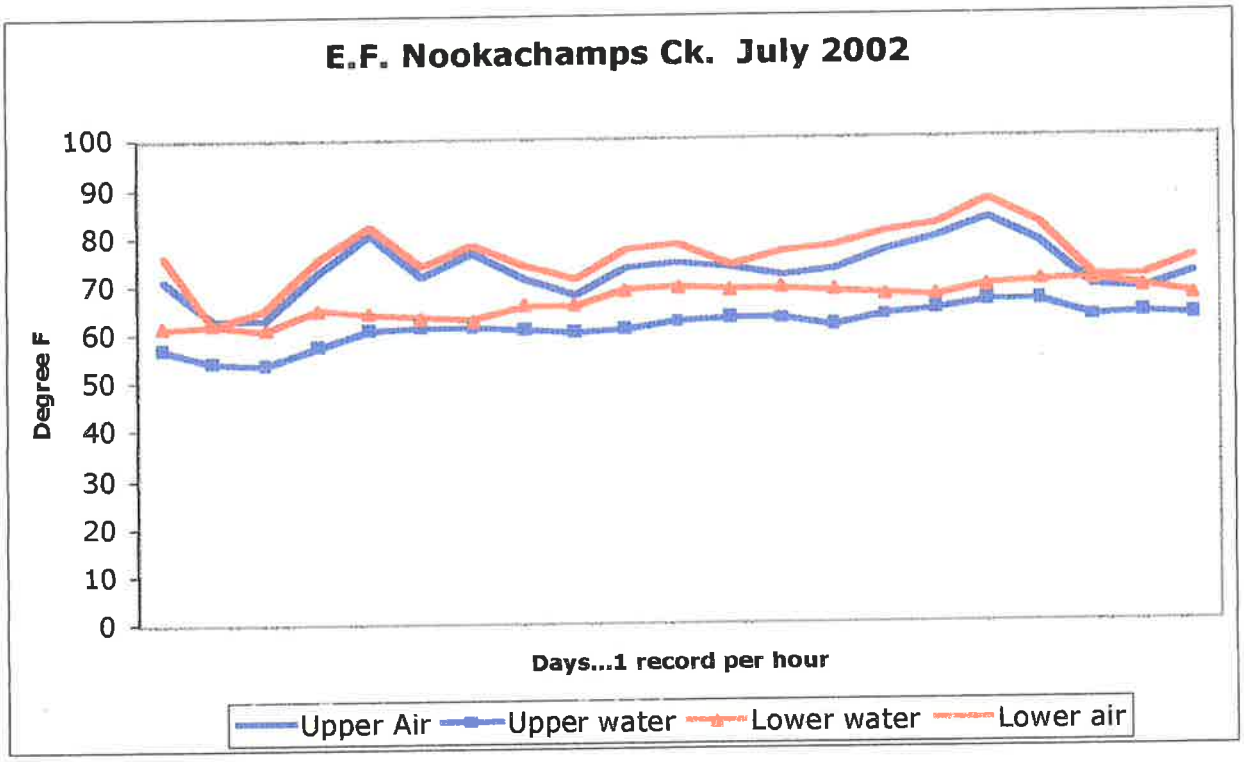


Figure 24. Upper E.F. Nookachamps Ck. and lower Nookachamps Ck. was monitored for temperature during 2001 and 2002. The distance in stream miles between the upper site and lower site below the confluence of E.F Nookachamps as shown on the graph is more than 8 stream miles with little change in elevation. The stream velocity at the upper site varies depending on rainfall. After heavy rains the velocity might be 2 ft/sec and during dry spells the velocity decreases to as low as 0.3 ft/sec. The lower Nookachamps site is similar. By late summer 0.3 ft/sec. is typical at both sites due to the flat terrain between sites.

The influence of elevation change and velocity is an important factor when observing water temperature data collected between two points (Larson and Larson, 1996). Water temperatures lag behind air temperatures on a daily and seasonal basis which is reflected in the two year record at these sites. The thermal gradient established between air temperature and water temperature each hour determines how fast the water temperature will increase during the day. Chi square tests were performed to determine if there were significant differences between temperature changes during 4 hour periods of 5 am to 9 am, 9 am to 1 pm, and 1 pm to 5 pm.

In August 2001 the lower Nookachamps air temperatures increased 8 °F during the first period 5 am to 9 am and 9 °F during the second period 9am-1pm. Water temperatures did not increase until the second period 9 am to 1 pm and the average increase was 5 °F. Both air and water temperatures increased an average of 2.5 °F in the third period (1 pm to 5 pm).

In late July, 2002 the same site displayed air temperature changes during the first 4 hour period of 8°F and 7°F during the second period. Water temperature increases during the 2002 testing period

did not increase on average until the 3rd period 1 pm to 5 pm. The thermal gradient during this period of 2002 wasn't large enough until late in the day for the stream water temperatures to increase. The average change was less than 1 °F. On 2 consecutive days in early July the air temperatures reached 82 and 74 °F. Water temperatures on these days were 64 °F and 63°F with temperature increases of 3°F and 0 °F. Water temperatures increased very little compared to the air temperature increases. Due to the high heat capacity of water the thermal gradient established at this site slows the heating rate.

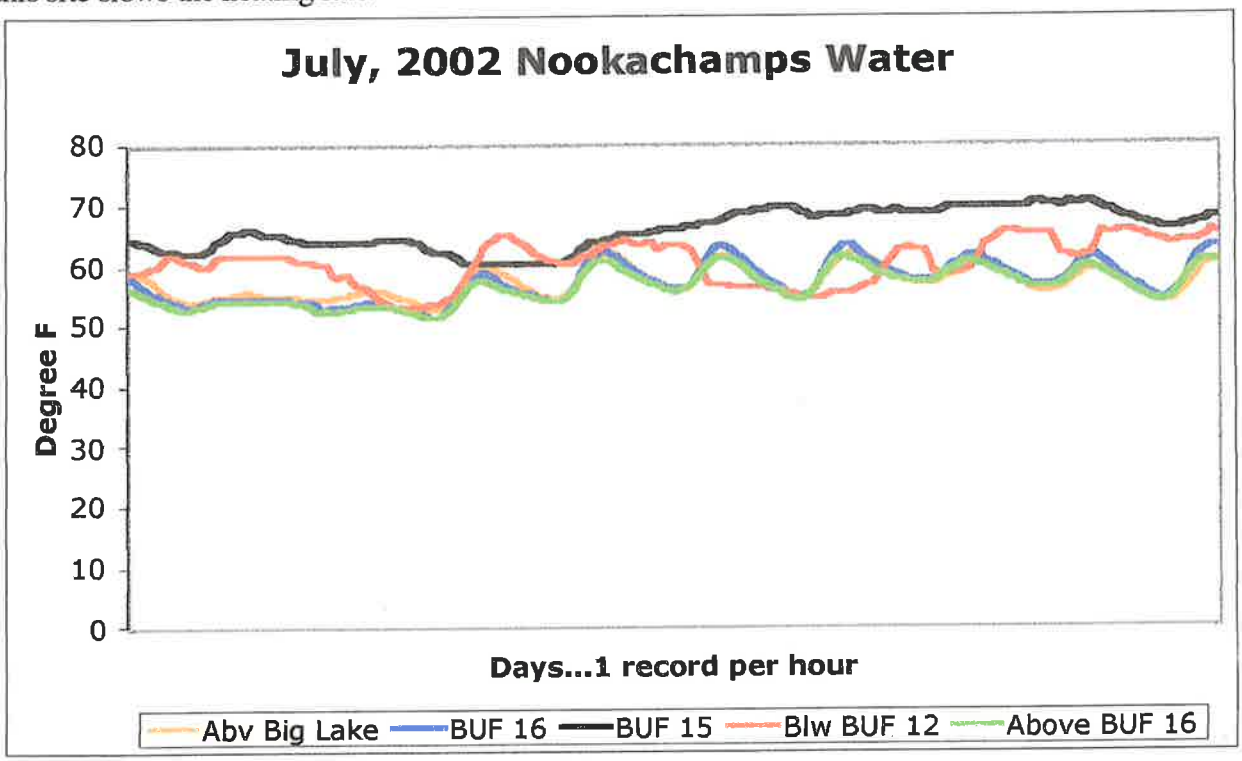


Figure 25. Nookachamps and E.F. Nookachamps mainstem sites in 2002 reflected a similar pattern to data collected during 2001. Stream temperatures rates of heating during the July period were tested using analysis of variance. The rate of heating for Upper Nookachamps was significantly different than the lower Nookachamps sites. The rates of heating at the Skagit County site BUF 16 were the same as the Cattlemen's site above BUF 16 as well as the site above Big Lake.

Of particular interest are the water temperatures at sites located below BUF 15 . As stream velocity decreases across low gradient topography, the water is exposed to a similar air mass for an extended period of time. The BUF 15 site and the lower Nookachamps sites display a typical pattern of temperature lag in response to changing air masses between days as well as between nighttime and daytime air fluctuations.

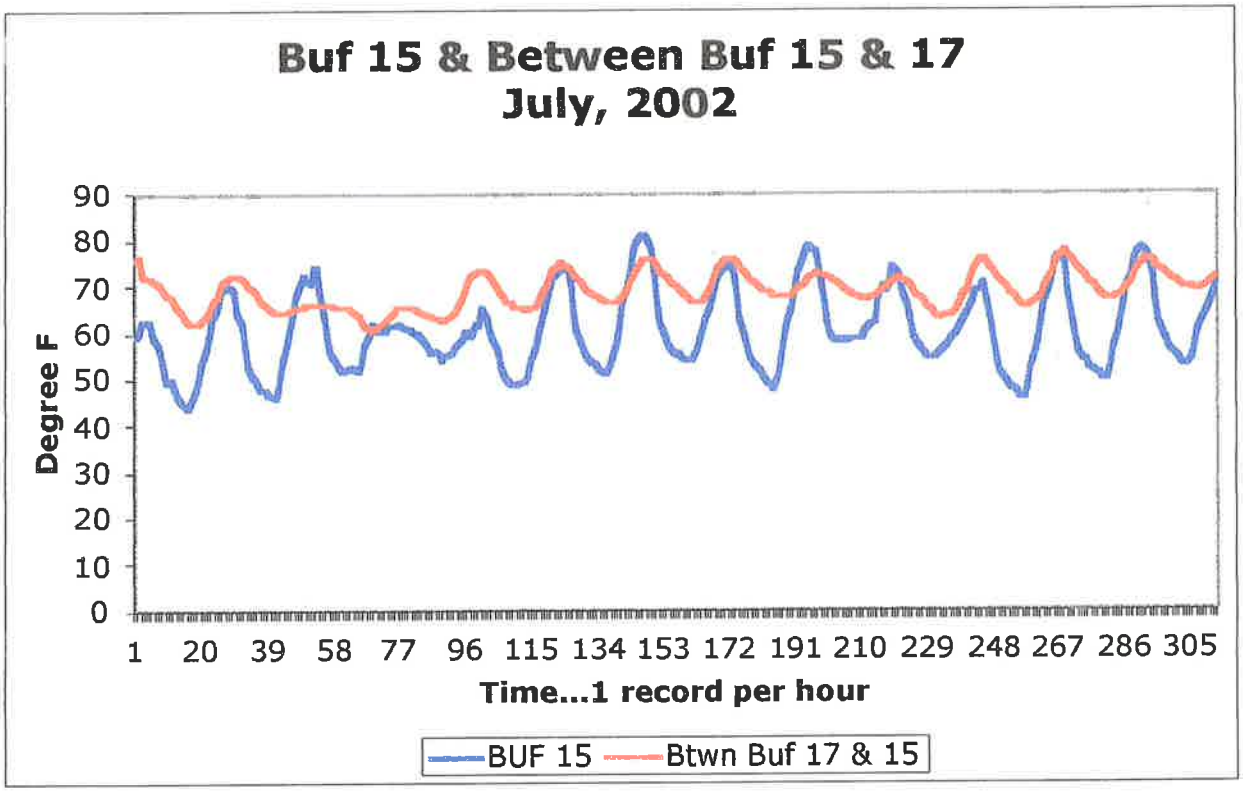


Figure 26. The influences of Big Lake are captured at sites located at Buf 17 and the Cattlemen's sites between Buf 17 and Buf 15. At Buf 15 the water temperatures appear to have responded to the air mass downstream and is once again reflecting the environment of the site.

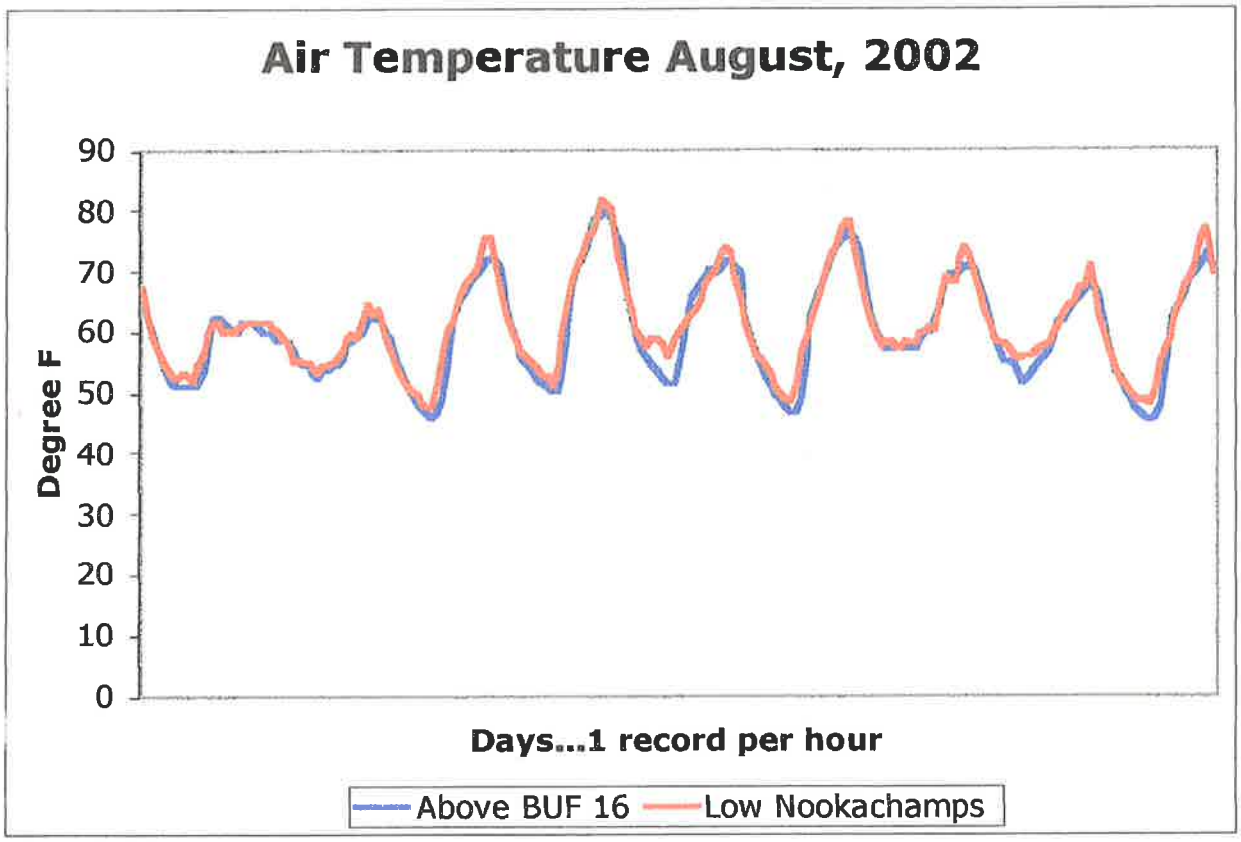


Figure 27. Air temperatures are similar throughout the Nookachamps Ck. sub basin. The lower Nookachamps sites have slightly higher air temperatures on warm days and do not reach as low a minimum temperature overnight. The water temperatures recorded at the upper BUF 16 site generally reflect cooler water temperatures than the lower sites due to upstream conditions captured in the data set by stream water flowing across the BUF 16 site from higher elevations and different overnight temperatures. The water may be flowing from as far as 12 miles up stream when the velocity is 1 ft/sec or 6 miles when the velocity is near 0.5 ft/sec.

ANOVA testing results for the Nookachamps during 2002.

Nookachamps and E.F. Nookachamps, Skagit County and Cattlemen sites compared (2 weeks)

Site	Rates					
1. Cattlemen ABV 16	0.87	x				
2. BUF 18 Abv Big Lake	0.87	x				
3. Cattlemen Abv Big Lake	0.88	x				
4. BUF 16	0.88	x				
5. Cattlemen Btwn 13& 16	0.90	x				
6. BUF 15			1.00	x		
7. Btwn Buf 17 & 15					1.06	x
8. BUF 13					1.08	x

Significant differences are noted by "x" which are lined up to indicate no differences and separated to indicate differences.

Overall, the upper sites heat at a different rate than the lower sites. The gradient between air and water temperatures is greater at the upper sites than the lower sites and velocity is slower at the lower sites. A two week period was tested. The overall rate of heating in the sub basin for each of the weeks was the same, but comparison between sites produced significant differences. These results are consistent with the graph in Figure 3 (page 12). Stream segments heat at similar rates when they have similar thermal gradients.

By testing how fast stream segments heat over a period time, an assessment of the influence of cool and warm weather cycles. Observations are made well about whether activities between segments have changed the natural thermal cycle for the area. Statistical testing performed for each site and compiled to examine the sub watershed indicates that the natural heating cycle has been undisturbed between the upper reaches and the lower reaches. These results are similar to those reported by Borman and Larson (2003), Larson and Larson (2001), and Stoneman and Jones (1996).

Heating slows in the lower segments as evidenced by the rates at Buf 15 and Buf 13 rate. Water temperature increases of 4 °F or 5 °F when air temperatures increase 20 °F or more during a 12 hour period can be expected according to the physical laws of heating and cooling. The rates are typical of other streams in the Pacific Northwest where water flows through flat terrain and have low velocities.

2002 Temperature Data
Skagit River Basin

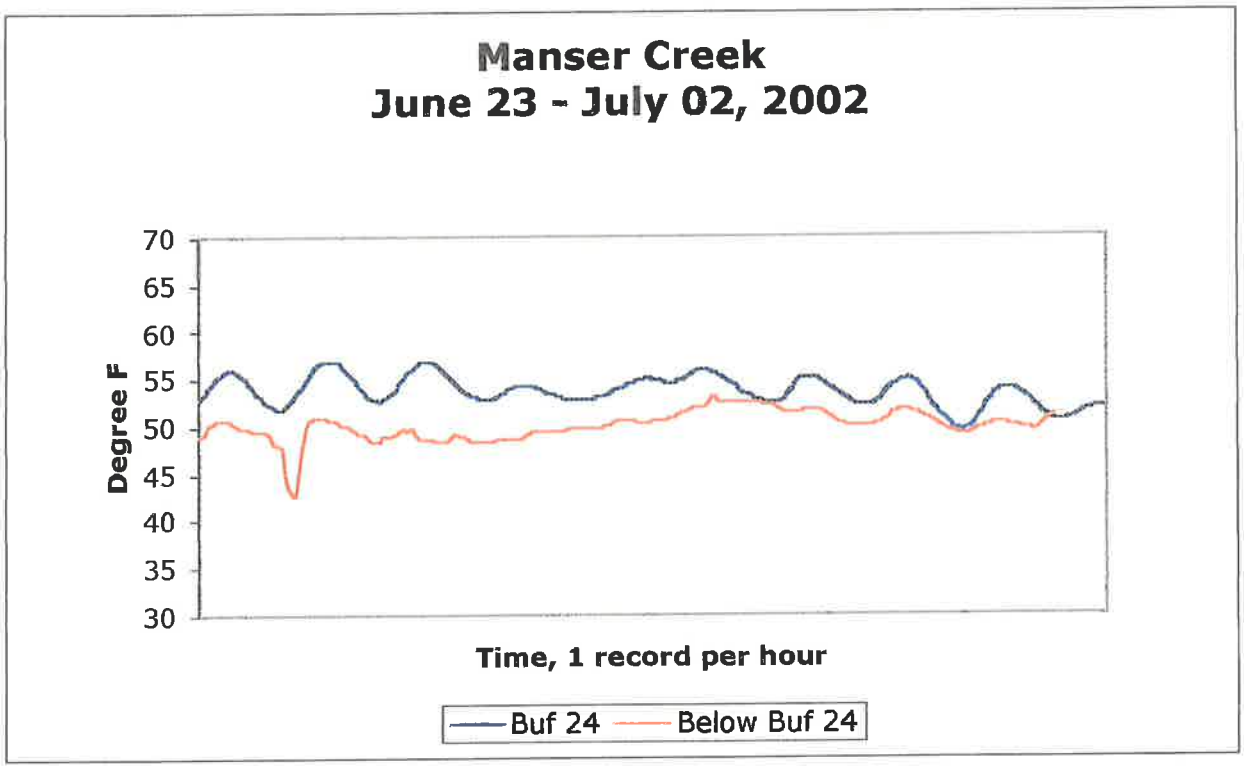


Figure 28. Skagit County Public Works located a site on Manser and the Skagit County Cattlemen's site was located below BUF 24. The two sites display a similar trend over the testing period but the site Below Buf 24 displays less fluctuation than the upper site during the testing period. Manser Ck. data water temperatures increased on a daily average 1 °F in 2001 and 2 °F in 2002.

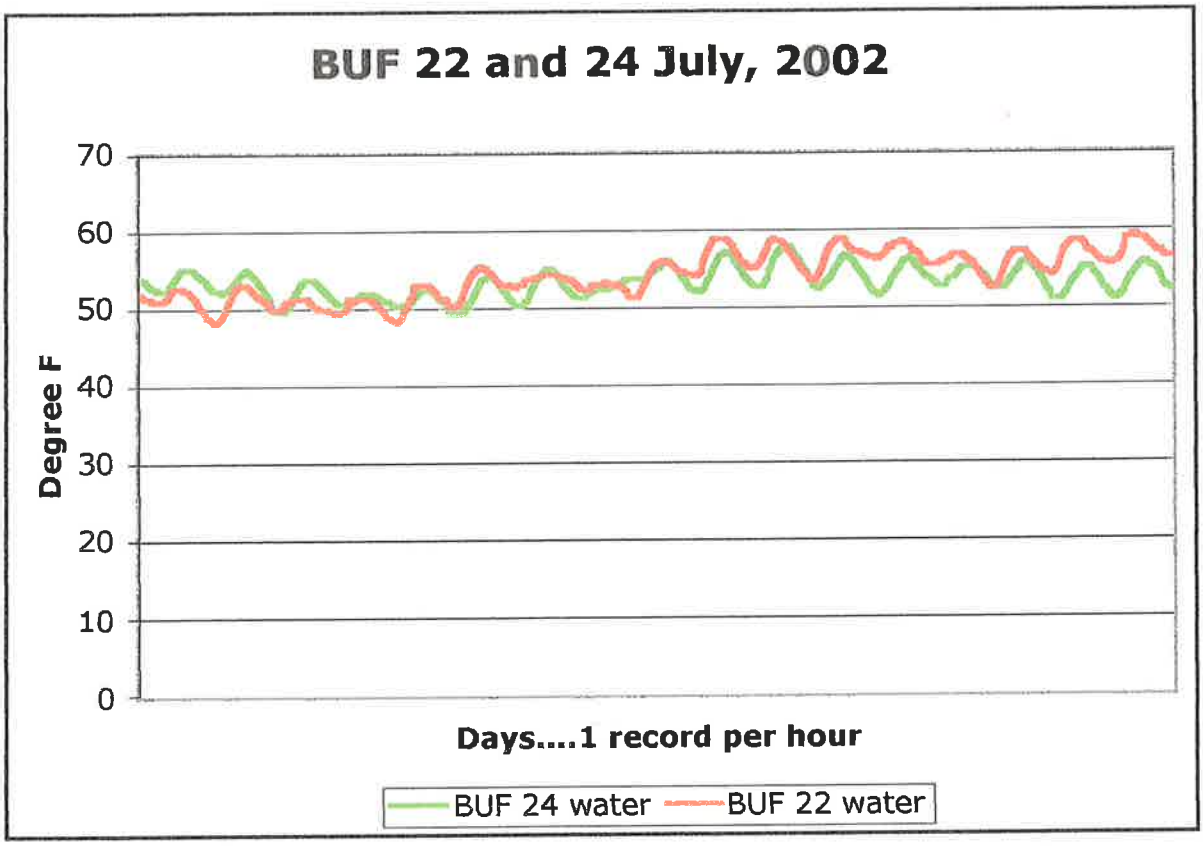


Figure 29. BUF 22 is located on Coal Ck. and BUF 24 is located on Manser Ck. The data was recorded in July, 2002 by Skagit County Public Works. Skagit County Cattlemen located testing sites on both streams and maintained records for 2 years. When the data were combined with Skagit County, the rates of heating were compared between sites to determine if significant changes in heating occurred between the sites. BUF 22 and the Cattlemen's site on Coal Creek heated at the same rate (0.91). BUF 24 heated at a significantly different rate (0.77 °F) when compared to the Cattlemen's site located below BUF 24 (0.86 °F).

Manser Ck. has been documented as being a very good salmon stream. It doesn't exhibit all of the habitat qualities generally described for salmon habitat, but salmon are there in good numbers. Manser is a low gradient stream compared to others in the area. Velocities are generally low compared to Coal Ck. and demonstrates a low number of riffle areas. Skagit County Public Works measured velocity in May, 2002 and found Manser Ck. velocity to be 0.2 ft/sec and Coal Ck. on the same day was 1.1 ft/sec. The differences between rates of heating at Buf 24 and below Buf 24 suggests that the velocity of Manser Ck. between the 2 sites is low enough that the water takes more than a day to move from the upper to the lower site.

Manser Ck. is a very low gradient stream with low velocities throughout the drainage area below Highway 20. It has a very wide flood plain compared to other streams. Rivers are runoff areas that have formed over time and Manser Ck. temperature data reflects cycles that are similar to soil temperatures during the summer periods.

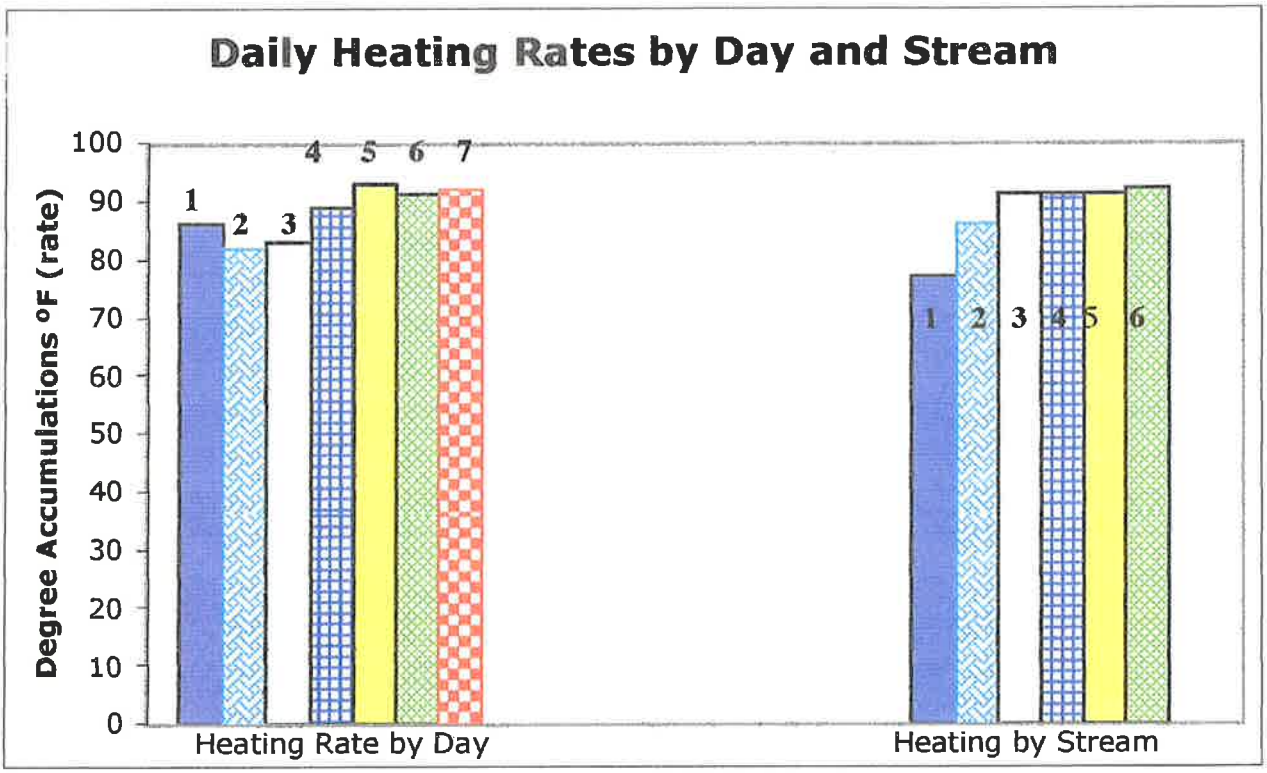


Figure 30. Degree hour accumulations were calculated for all Upper Skagit River tributary sites and regressions were performed to determine the daily rates of heating for each site. The graph displays the rates of heating averaged across all tributaries for each of 7 days (bars on the left). The rates of heating for each stream (bars on the right) are the result of analysis of variance ($p \leq 0.05$) conducted to determine if the rates of heating were different between streams.

The heating rates by stream (bars on the left) are numbered as:
1= Manser below Buf 24,
2= Buf 24
3 = Coal below Buf 22
4= Hansen below Buf 19
5 = Buf 22
6 = Trib 4

Buf 24, Coal below Buf 22, Hansen below Buf 19, and Buf 22 are not significantly different. Trib 4 is significantly different than Buf 24 and Manser below Buf 24.

Days (left columns) 1,2, and 3 are the same but are significantly different than days 4, 5,6, and 7.

This series of tests indicates that even though rates of heating are different on different days, stream heating rates vary based on thermal gradients associated with the rates as displayed in Fig. 3 on page 12. Daily rates of heating tested across streams by days provides an understanding of how the local climate changes within a basin. Examining the rates by stream, describes how streams with rates that can change by day over a testing period, yields an overall rate which can be tested seasonally or annually.

The Skagit River basin displays typical rates associated with natural background conditions.

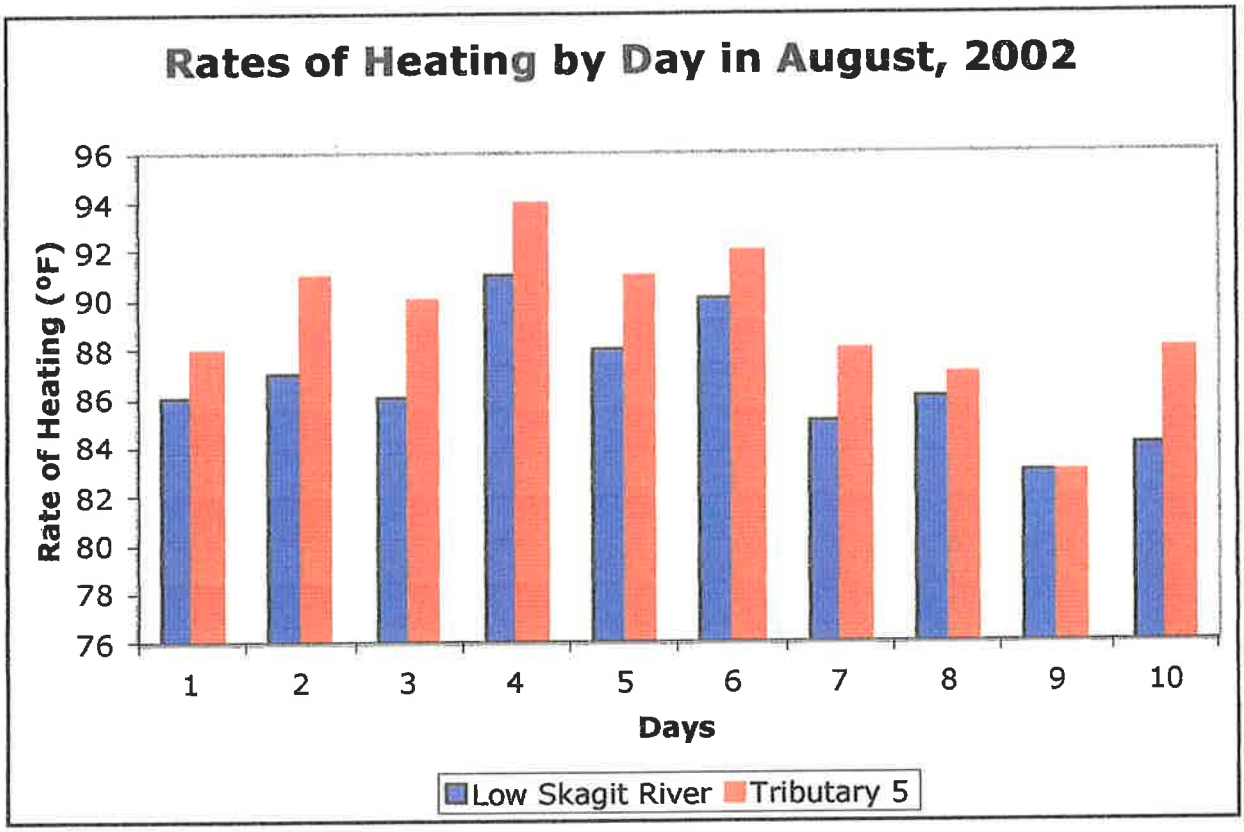


Figure 31. The Low Skagit River site and Tributary 5 (located west of Buf 24 Manser Ck.) are displayed over 10 days in early August, 2002. Degree accumulations were calculated for each stream and each day and a regression was performed to determine the rates of heating.

Rates of heating by days when the stream rates are combined yields a daily rate for a local area which reflects the local climate conditions. The graph above shows the daily rates calculated for each stream by each day. Between day 1 and day 4 a warm period occurred followed by a cooling trend until day 9. On day 9 both the Skagit River and Tributary 5 heated at the same rate. Days with similar thermal gradients (difference between the air temperature and water temperature averaged over a 12 hour period) have similar rates of heating. These results are consistent with Figure 3 (page 12).

A Chi square analysis was performed to determine which period air and water temperatures increased: Air temperatures changed the least during the 1pm-5pm period. The daily average temperature change was 14 °F.

Water temperatures at the Low Skagit River site did not heat during the 1st period 5am-9am but increased and average of 1°F during the 2nd period 9am-1pm. The 3rd period, 1pm-5pm average temperature increase was 1.2 °F.

In August, 2001 water and air temperatures averaged 56 °F and 61 °F respectively. The average rate of heating was 0.96 °F. In August 2002 average water and air temperatures during the same period were 55 °F and 61 °F respectively. The average rate of heating was 0.96 °F.

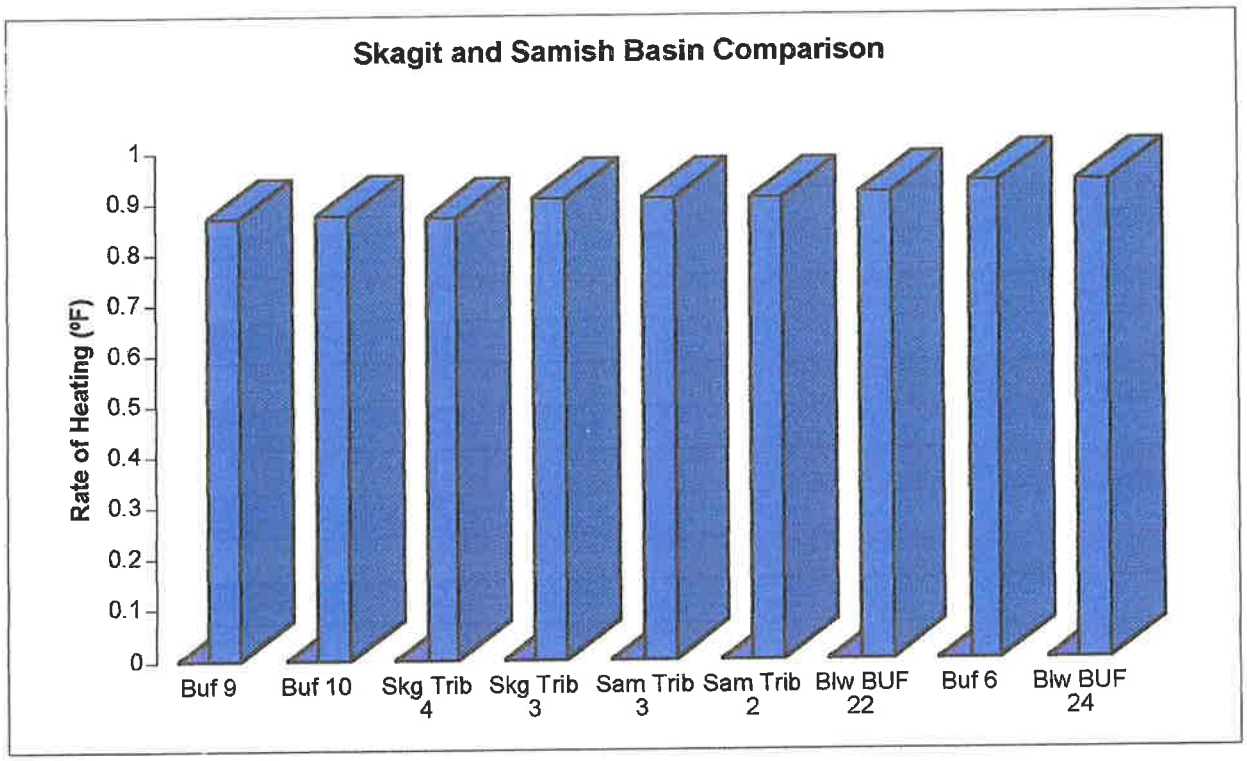


Figure 32. The streams in the Skagit River basin and streams in the Samish River basin were compared using rates of heating and thermal gradients. Overall there are no significant differences between the basins.

Section 2

2001-2002 Sediment Data and Streamside Vegetation Measurements

Skagit and Samish River Basins

Soils in the Study Area

There are 5 major soil series that are found in the riparian areas within the Skagit County Cattlemen's study area. Soils have an important function in assessing watershed attributes and help guide expectations for areas regarding sediment accumulation, nutrient inputs, and riparian vegetation.

Pilchuck soils are on floodplains at elevations of about 10 to 800 feet. The soils formed in alluvium. Slopes are 0 to 8 percent. These soils occur in a climate having an average annual precipitation of 35 to 60 inches. Average January temperature is 37 degrees F, average July temperature is 62 degrees F, and average annual temperature is about 50 degrees F. The frost-free season is about 160 to 210 days. The soils in agriculture areas are mostly managed as pasture or woodland. Native vegetation is Douglas-fir, western hemlock, western redcedar, bigleaf maple, black cottonwood, and red alder with an understory of vine maple, western swordfern, salmonberry, common snowberry, trillium, stinging nettle, bedstraw, Oregon oxalis, western brackenfern, and false-Solomon's-seal.

Minkler soils are on terraces slightly above the normal flood plain at elevations of 50 to 80 feet. They formed in stratified medium and coarse textured alluvium and lacustrine material with a mantle of volcanic ash. Slopes are 0 to 2 percent. Average annual precipitation is 45 to 55 inches. The mean January temperature is about 36 degrees F., and the mean July temperature is about 64 degrees F., and the mean annual temperature is about 50 degrees F. The average frost-free season is 190 days. The soils in agriculture areas are mostly used for pasture and cropland. Native vegetation is Douglas-fir, red alder and western redcedar with an understory of blackberry, red elderberry, vine maple, western swordfern, and lady fern.

Larush soils formed in alluvium on flood plains and on low terraces above the present flood plain at elevations of 100 to 500 feet. Slopes are 0 to 5 percent. The average annual precipitation is 60 to 80 inches. Average January temperature is about 37 degrees F, average July temperature is about 65 degrees F, and the mean annual temperature is 49 to 53 degrees F. The frost-free season is 180 to 220 days. Soils are used for cropland. Corn, wheat, and pasture are common crops. Native vegetation includes Douglas-fir, western hemlock, western redcedar, red alder and bigleaf maple, with an undergrowth of western brackenfern, geranium, vine maple, trailing blackberry, northern twinflower, and western swordfern.

Samish soils are on flood plain terraces of narrow stream valleys at elevations of 45 to 400 feet. These soils formed in alluvium derived from talc over mixed alluvium from adjacent mountain slopes. Average annual precipitation is 35 to 60 inches. Average January temperature is about 38 degrees F and average July temperature is about 62 degrees F. Average frost-free season is 160 to 200 days. Samish soils in agriculture areas are cleared and drained and used for cropland. Major crops are hay and pasture. Native vegetation is western redcedar, western hemlock, Douglas-fir, and western swordfern.

Wickersham soils are on alluvial fans and terraces at elevations of 150 to 400 feet. Slopes are 0 to 8 percent. The soils formed in alluvium from phyllite. The average annual precipitation ranges from 55 to 75 inches. The mean annual temperature ranges from 48 to 53 degrees F., mean January temperature is about 37 degrees F., and mean July temperature is about 62 degrees F. The frost-free season is 150 to 200 days. The soils in agriculture areas are mainly used for pasture use.

Sediment Sampling

Five line-intercept transects per site were randomly selected to measure the surface of the channel substrate from bank to bank. Transects (5 ft length) were placed across the channel and the substrate was measured to the nearest inch. Substrate less than 2.54 cm was classified as fragments.

Fragment samples (150 ml) were collected in 3 locations along each transect. Each sample was dried and screened to separate the materials into categories of >1.3 cm, 0.6 cm-1.3 cm, 0.2 - 0.6 cm, and < 0.2 cm Separated material was measured by water displacement (ml of volume). The category of < 0.2 cm is further divided by separating sand, silt and clay size particles using standard soil procedures based upon Stokes Settling Law (Miller and Donahue 1990). Transect data was summarized to yield the percentage of transect length occupied by substrate size classes including the fragment category.

One site on a Skagit River tributary, substrate sampling during 2001 indicated that sands are the primary material (98%) found in the substrate of the stream. 1.5% of the substrate material is composed of silt size material. The soil type at the site is a silt loam and the banks are vegetated with reed grass, blackberries, and alder. The site is used for haying and grazing. 75% of the pastures are grass species and 25% are forb species.

A second site on a Skagit River tributary, substrate sampling during 2001 indicated that sediments occurred at a rate of 0.02% when measured perpendicular to the stream. There were no "fines" (silt and clay size particles) during 2001 and 2002 which could be detrimental to young salmonids. The site is grazed on a rotational system throughout the year. 60% of the pastures are grass species and 40% are forb species.

The Samish River mainstem flows through Samish silt loam soil series. The upper sites have streambeds composed of mainly bolder and cobble sized material ranging in sizes of 3-12 inches. Lower sites have more gravel and samples during 2001 and 2002 indicate that the streambeds are composed of material (80%) between 1.0 inches and 0.01 inches and 19% of the material is sand size (less than 0.01 inches). Samples containing silt sized material were recorded as traces and the frequency of this size deposit was less than 0.01 % during 2001 and 2002.

Erosion is at natural background levels for the Skagit and Samish basins. Problems with "sedimentation" of fishery habitat due to agriculture land non point source contributions could not be found within the mainstems or tributaries of either basin. Replicated samples were consistent throughout the basins with known geologic channel depositions and the absence of "fines" in the testing results.

The general assumptions about the role of riparian areas providing a trap for sediments, their usefulness in creating pools and riffles, and their contribution to placing woody debris in streams are concepts that have not been documented in the literature that meets the "best available science" criteria WAC-365-195-900 through 925. From replicated studies conducted over time and place the evidence is that fluvial processes are affected by many factors and the role of riparian vegetation is limited and not supported by research that meets "best available science" criteria. Trapping sediment with vegetation cannot be estimated by a casual site visit to determine if banks are bare or vegetated to the bank full level. Hydraulics are a factor that must be considered before conclusions of this nature can be made.

Also, human activity influences cannot be incorporated into the equations until geologic formation, geologic time, soil morphology, and climatic events are accounted for in studies which are aimed at

addressing the links. To consider the impact of agriculture activities on water pollution research results suggests that the soil types, ground litter and size of the event are factors that control the amount of sediment reaching a stream rather than the management style.

No supporting evidence was found that met the WAC-365-195-900 through 925 criteria including data collections and quantitative analysis that justified the concept of needing a specific riparian area size a for protection of salmon habitat. The concept that a buffer area of a specific width and species composition is critical for fish protection appears to have been formed without sufficient study to link fish survival or population size to the presence or absence of a buffer. Many studies expressed various viewpoints about the use or no use of riparian areas by livestock, that did not produce measurements, quantitative analysis, nor appeals to authority which support "no livestock".

The Skagit County Cattlemen's study collected streambed substrate data to measure the amount of "fines" being deposited in the Skagit and Samish River basins. All sites were identified by soil type and riparian vegetation was categorized by basal area. There were no significant differences between the sites over the 2 year study period. The amount and kind of riparian vegetation varied but regardless of the size and structure of the streamside area, sedimentation due to agriculture runoff is not a concern in the basins.

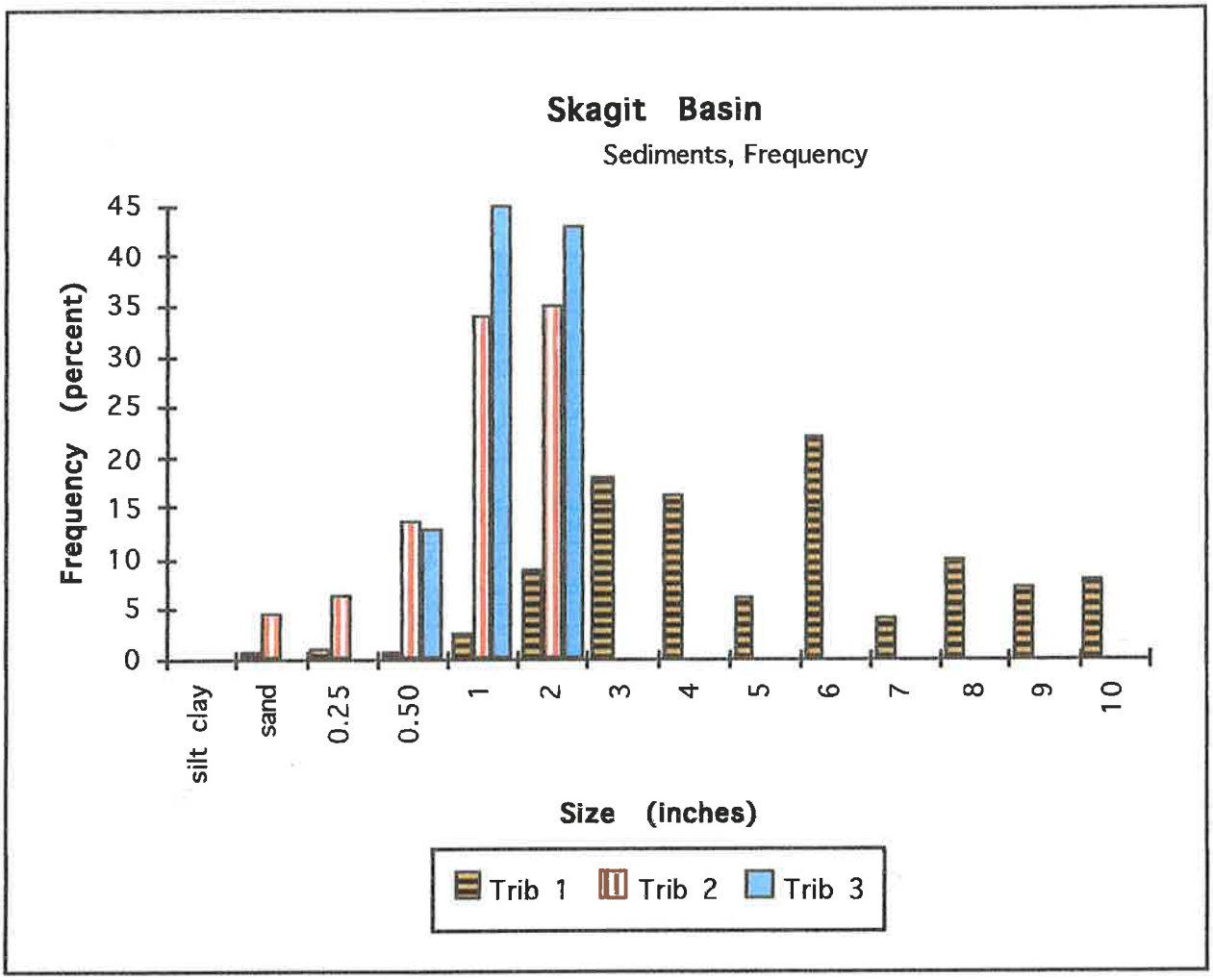


Figure 33. Skagit Basin streambed screening results and frequency measurements for bolder, cobble, gravel, and "fines" in the study area. There were no changes in the 2002 sampling results when compared to the 2001 results. The Skagit Basin streams have not been impacted from land activities that cause stream sedimentation. Erosion due to runoff did not take place at a rate that nor in an amount that was detected through sampling. Protection of aquatic species that are impacted by streambed "fines" is taking place under the current management practices. There is no evidence that erosion from agriculture activities is occurring at a rate that is significant for water quality concerns.

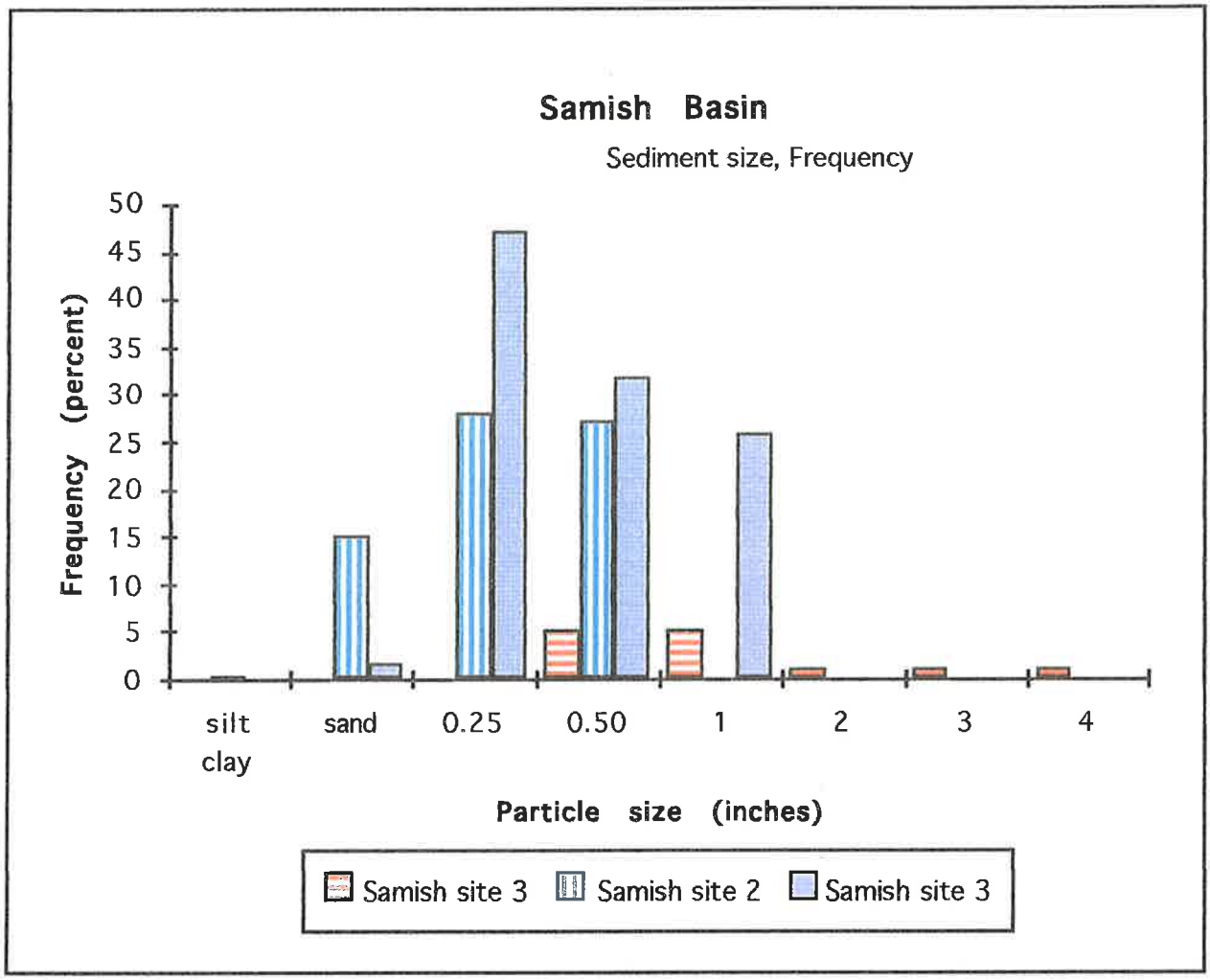


Figure 34. Samish Basin streambed screening results and frequency measurements of bolder, cobble, gravel, and "fines" in the study area. There were no changes in the 2002 sampling results. The Samish Basin streams do not demonstrate there have been impacts from land activities that cause stream sedimentation. Protection of aquatic species that are impacted by streambed "fines" is taking place under the current management practices. There is no evidence that erosion from agriculture activities is occurring at a rate that is significant for water quality concerns.

Ongoing agriculture activities appear to have a minimal impact on the streambed substrate because the fish habitat is protected from silt and clay sized material that is harmful to salmonid eggs. Statements have been made in the past that erosion from agriculture runoff is a problem in Skagit and Samish River Basins, but there is no evidence that deposits are occurring in frequency nor volumes that verify the claims.

Riparian Vegetation

During the 2 year study a literature review examined best available information regarding growth and production of the grasses and riparian vegetation and the use of vegetation while protecting water quality and fish habitat. Fundamentals of "grass species" biology and physiology were

reviewed and incorporated which are the basis for prescription methods of grazing use by livestock. Many of the studies examined grazing as a tool to maintain vigorous grass and riparian communities to avoid decadent grass stands and deterioration of areas used by wildlife.

Pasture species landward of the riparian areas were examined for species composition and productivity which ranged from 1500-4000 lbs per acre.

Riparian Vegetation Measurements

Based on soil series random sites were selected to estimate the size and structure of the riparian tree and shrub community. Height and diameter were measured, species were noted, and the field data was used to calculate the distribution of trees on a per acre basis.

Figure 35 and 36 demonstrate the dbh size classes of sites having 36 trees/A, 71 trees/A, 125 trees/A and 150 trees/A. The riparian area widths were variable by site and ranged between 35-100 feet. Stream widths ranged between 30 and 80 feet with 3-10 ft. bank heights measured from the streambed throughout the Skagit and Samish River basin study area.

Tree species covered a broad range and were typical of vegetation noted as occurring on different soil types for the area. Alder and maple were dominant with abundant leaf litter, ferns, horsetail and various small forbs. Western red cedar dominated some sites which produced little ground cover in the way of grasses, forbs, or litter other than needle drop. Cottonwood and alder sites were included which produced an open canopy allowing small alder clumps to become established with horsetails, juncus spp. and reed grasses. Blackberry shrubs were a common barricade between pastures and the stream banks.

Tree diameters throughout the basins ranged from 3 inches to 44 inches and had heights of 40-80 feet. Sites on soil types that support trees and shrubs were generally fully stocked with a variety of size and species of plants. Sites without a tree component were fully stocked with grass species and shrubs.

Measurements were calculated to determine basal area at each site. Basal area in the Skagit Basin was generally at 140 square feet or greater and the Samish Basin sites were 100-150 square feet. These figures are consistent with the expected basal area based on soil types (Skagit County Soil Survey, 1986).

A properly functioning landscape should contain the full range of plant species composition and structure. The existing vegetation management is yielding a desired mosaic of vegetation with the expected composition and structure on each soil type. These conditions are present in the Skagit and Samish basins.

The temperature, soil, and rainfall patterns of the Skagit and Samish River Basins are 3 components considered major factors limiting management options to increase shade and riparian vegetation when thermal pollution is detected. The existing vegetative components in the area are not limiting the water quality regarding non point thermal pollution at this time. Riparian shade is at a maximum level at all sites measured and the analysis indicates that riparian shade is not a factor that is contributing to the stream temperatures. The maximum amount of sediment filtering is also occurring and as indicated by streambed sampling, there are no "fines" present that are contributing to that pollution parameter.

The local distribution of plants and of plant communities is determined chiefly by the nature of the soil, either directly, or in its relation to other factors. Soil types coupled with the geologic features

are factors that influence the species growing in the area, the streambed characteristics, and the effective land management techniques used by landowners.

The type of vegetation (life-form) in the tropical and temperate zones is determined by the amount and seasonal distribution of the rainfall and by the humidity of the air. The high precipitation during the water year in the area is an important factor that contributes to the existing basal area measured in the Skagit and Samish River Basins.

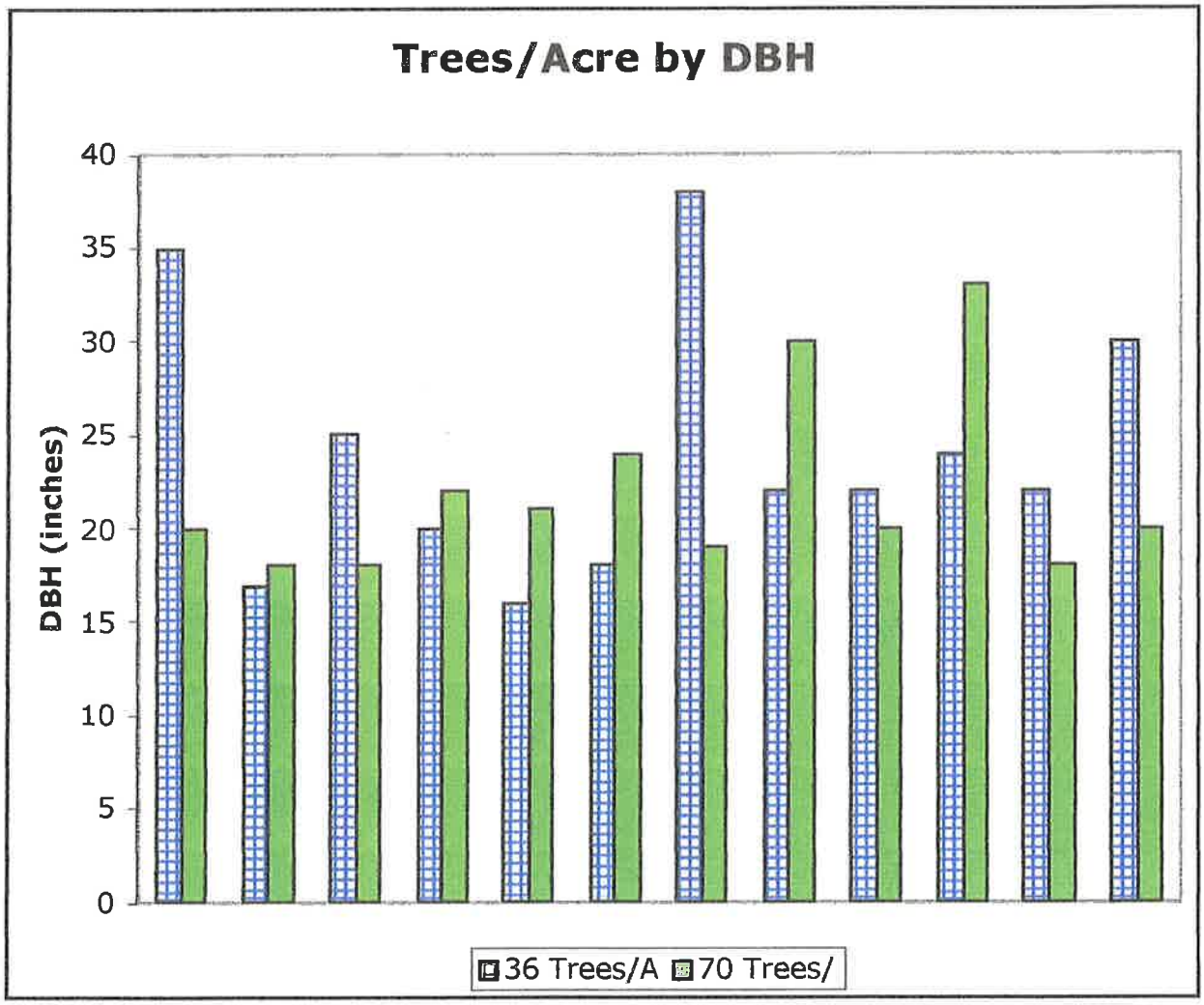


Figure 35. The size of trees in plots with 36 trees/acre and 70 trees/ acre are generally above 15 inches dbh. Sites with fewer trees per acre are in a lower size class than sites with a higher density.

Streamside vegetation (trees and shrubs) were measured during the study period to establish a baseline inventory of the current number of trees per acre, size class, and distribution based on soil types. Sites were assessed to consider if enough vegetation was present to provide protection to the sites for temperature control, erosion, and runoff contributions. Based on soil types and the results of the analysis during this study, the basin riparian areas are in good condition.

Protection of aquatic species is taking place under the current management practices used for

riparian areas. Sediment samples over two years have not produced "fines" which indicates that erosion due to runoff is minimal. Recognizing that under the current management practices the water quality is excellent when examined for temperature and sedimentation there is little evidence to suggest the size class and vegetation density within the study site is inadequate to protect aquatic species and other wildlife. Agriculture practices within the study area are generally based on best available science recommendations and implemented using best management practices. Protection of salmonid habitat is high based on measurements during 2001-2002.

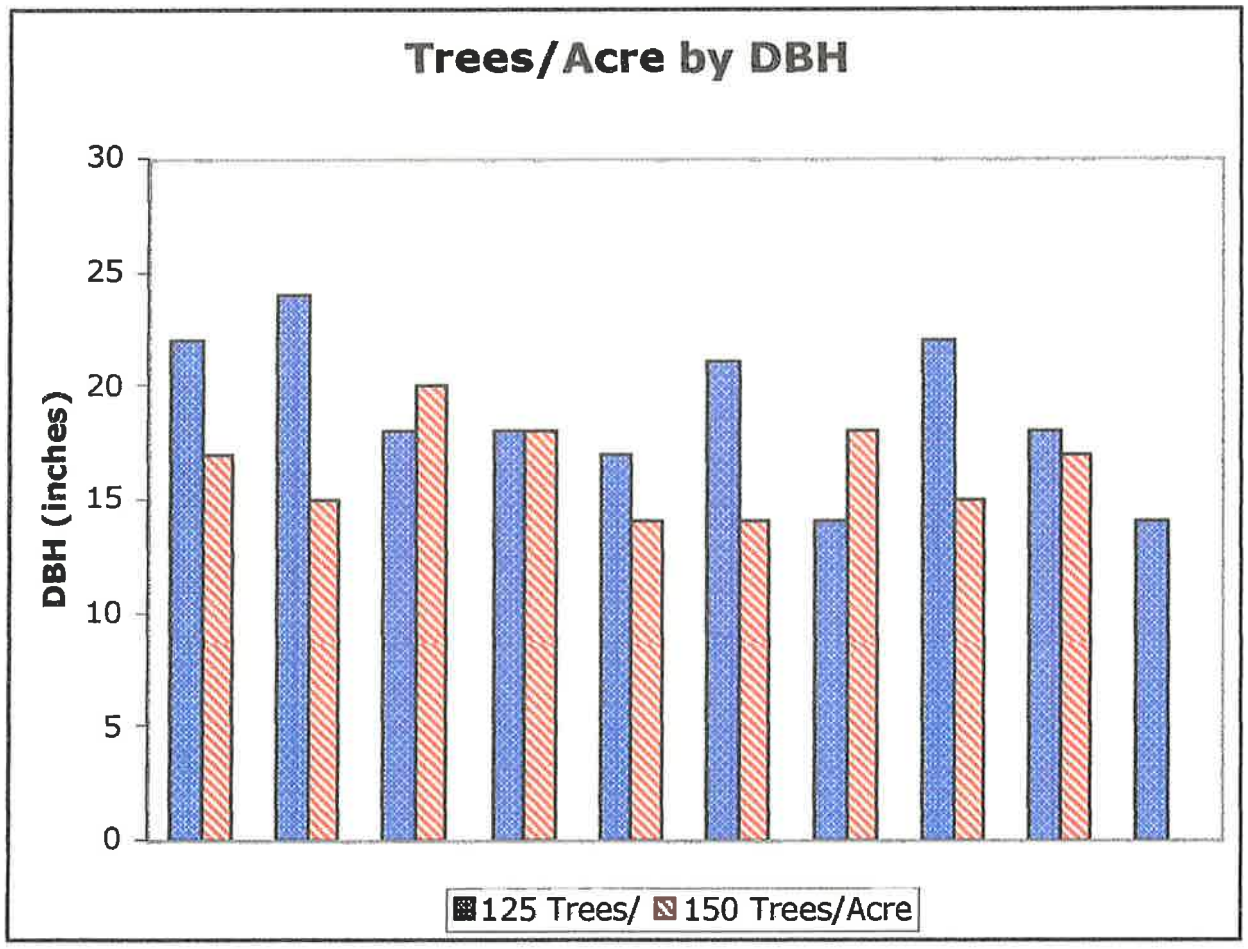


Figure 36. When tree spacing is between 125 and 150 trees / acre the size class of the trees range between 14-20 inch dbh. Sites were identified by soil type and variable plots were used to identify species and size of trees by dbh and height to establish whether sites lacked riparian vegetation and site capability was not being met.

Based soil types, the sites monitored in the Skagit County Cattlemen's study during 2001 and 2002 are fully stocked. The riparian areas vary in width but there is no evidence that from the temperature and sediment monitoring that width of the riparian vegetation nor the number of trees per acre

Section 3

Water Sampling for Phosphates, Fecal Coliform, and Turbidity

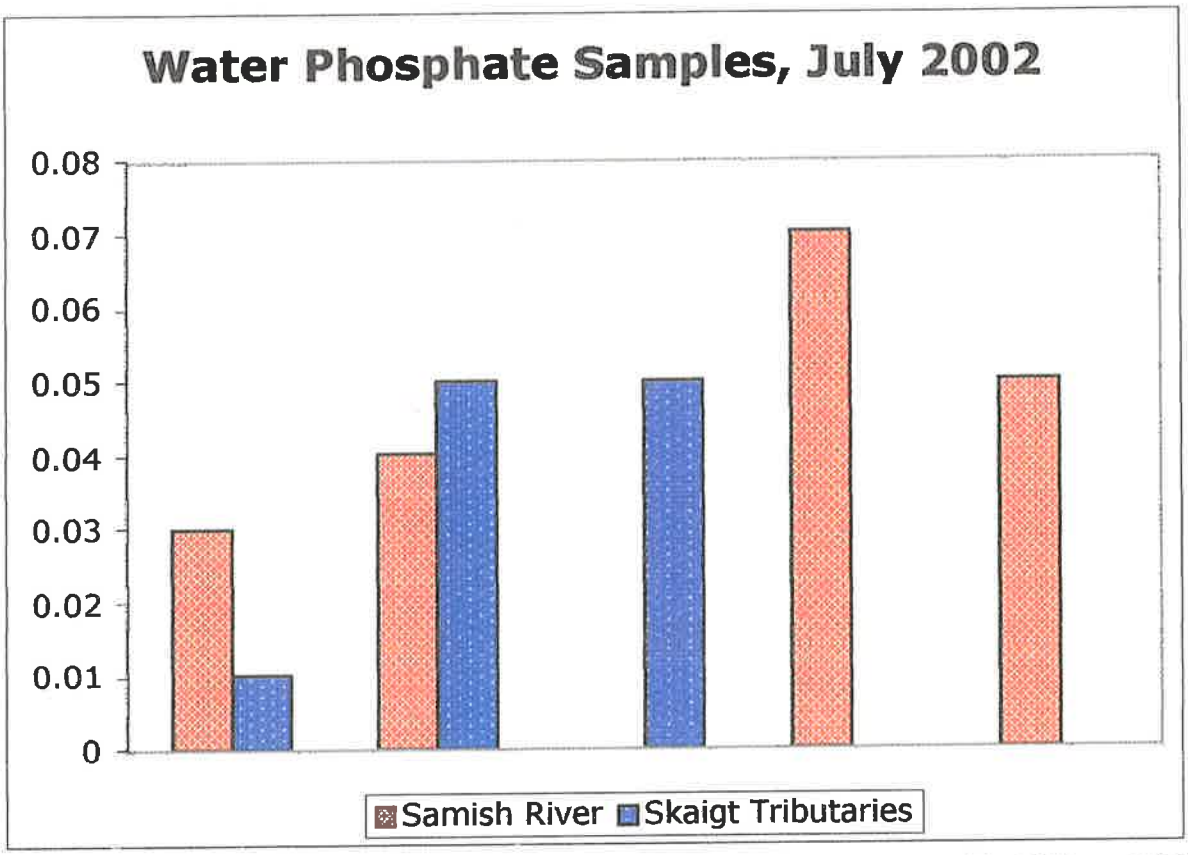


Figure 37. For this study the Skagit and Samish monitoring sites were used in 2001 and 2002 as permanent sites for water quality sampling. During 2001 a typical "grab" sample was made according to the sampling protocols described for water quality sampling. The 2001 results were limited considering the amount of time between sampling periods, but the samples were all within an acceptable range for nitrates (federal standard is 10 mg/liter) and phosphates (samples were less than 1 mg/liter). There is little that can be said about the results except that there is no indication that these nutrients are being added to the water from non point source contributions. Samples were collected and tested at a parts per million (ppm) accuracy. All samples were below 1 ppm for nitrates and phosphates throughout both years.

Currently Washington water quality standards (WAC 173-201A) do not regulate nitrate or phosphate. The samples were collected to provide an indication about erosion levels at the sites. If erosion were taking place due to agriculture activities, the phosphate and nitrate levels would likely be apparent in the water at the monitoring sites.

During the period May-October 2002 soil samples were collected at sites located by soil type. Soil samples were taken from the top 4 inches of the surface on sites with grazing and with no grazing. The soil samples were used to provide an indication of the available contributions from the

agriculture land if erosion due to runoff was taking place. Some sites were used for hay production rather than grazing and these areas were stratified by hay and no hay. 12 samples were measured in each graze/hay and no graze/hay category and were replicated during each monthly visit. A slurry of soil and water was prepared in a ratio of 1 part soil to 2 parts water. The slurry was then tested to determine the amount of phosphate available in the soil that could be transported to the stream during a runoff event. The first year results are graphed in Figure 38.

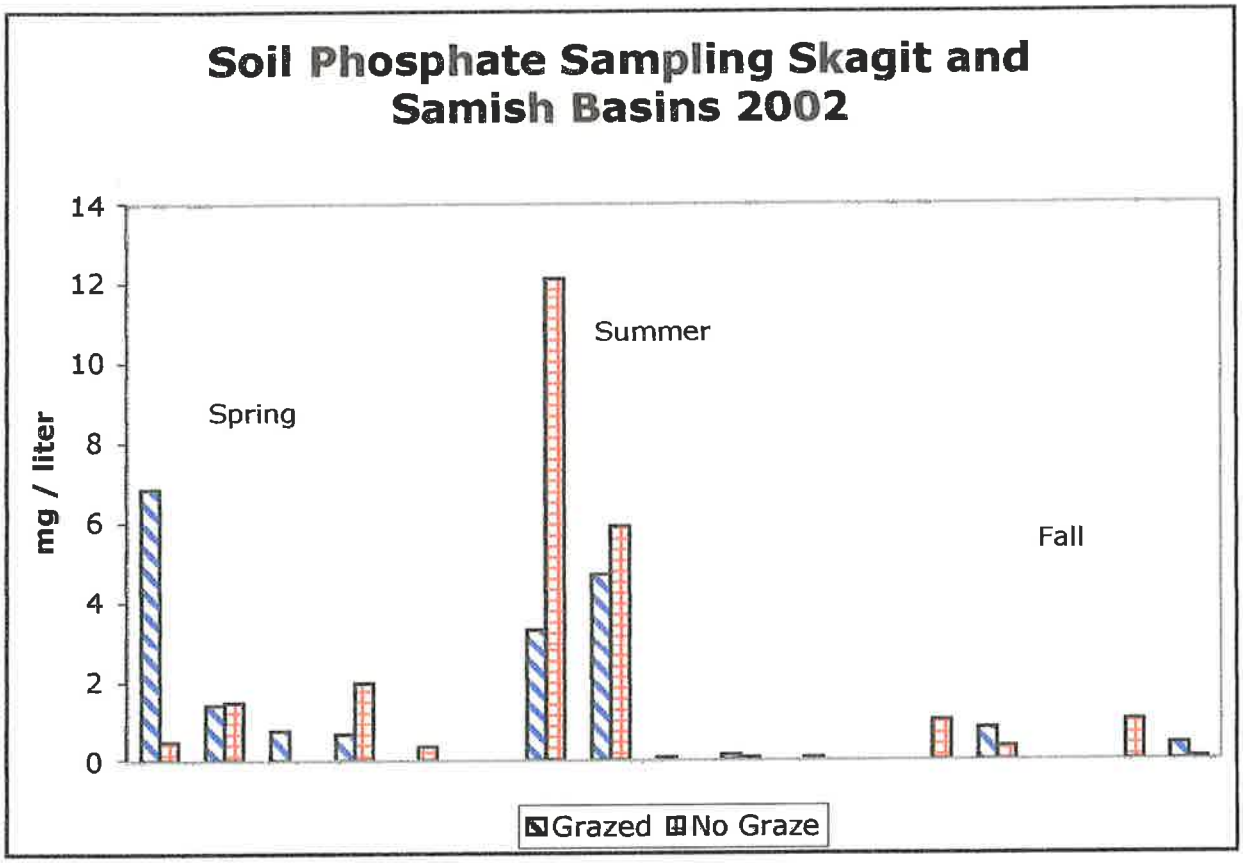


Figure 38. The graph is an example of the 1 year sampling results designed to examine the amount of phosphate in the top 4 inches of soils that could be transported to streams during a runoff event. During the summer, areas that were not grazed contained phosphate levels of about 6 mg/liter which is 6 parts per million (ppm). During May one pasture had phosphate levels that averaged more than 6 ppm and field observations at that time indicated that the grazing impact was likely due to the amounts of grass leaves and stems that had been left behind after the grazing took place.

The summer period results indicated that "no graze/hay" sites were higher than the grazed/hay sites. Observations during the first year suggested that this may be due to the abundance of plant material available on the site that had reached maturity and due to plant material breakdown and microbial activity at the base of the plants, the phosphate levels were high.

Due to known microbial activities in plant materials and soil organic matter phosphate contributions might be expected to be greater in ungrazed areas than grazed areas over a longer period. These studies may continue for several years in order to establish erosion contributions to streams when runoff occurs.

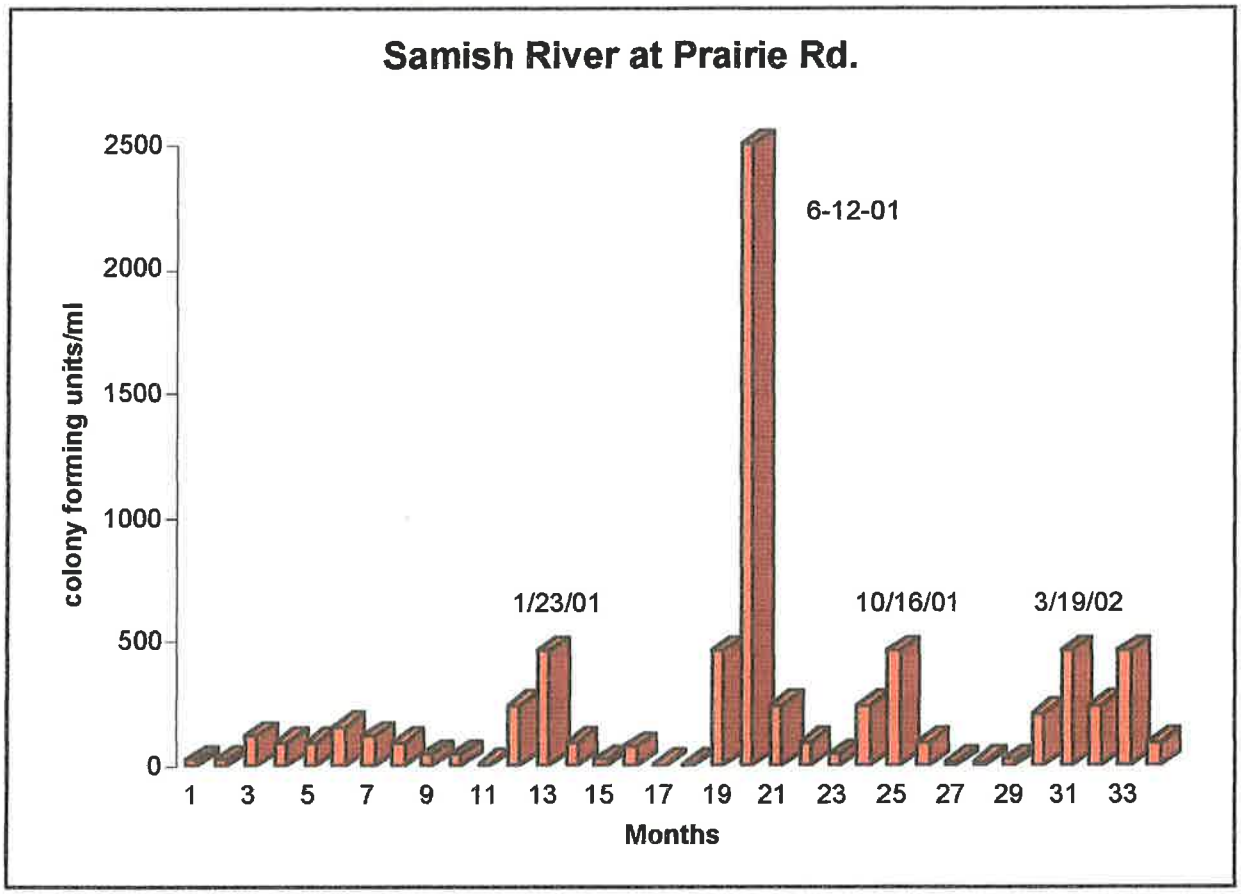


Figure 39. Skagit County Public Works established a number of permanent sampling sites on the Samish River and tributaries. A variety of tests were performed at a lab from the water samples collected in the field. Grab samples were collected at most sites 1 time per month and some sites were sampled 2 times in a month.

The graph above demonstrates the high variability in the data for fecal coliform. In a watershed there are many factors that can affect the measured samples collected for the lab tests. The lab is being asked to verify the population of a component found in a water sample that is suppose to represent the entire stream population. If a stream has 400 cfs at the time of a grab, how likely is it that a single sample put into a small container is truly representative of the water that will cross the same point later in the day or into the next day? The grab sample data set collected by Skagit County Public Works project presents many questions of this type. Samples are generally taken once a month, usually morning, and only one result is recorded for that period. There are no replicated samples and there are no references to determine if the samples are out of the population or are intended to represent a population during a specific time period.

The fecal coliform data set does not contain an adequate number of samples for analysès. It is not possible to draw any conclusions about the quality of the water at this site.

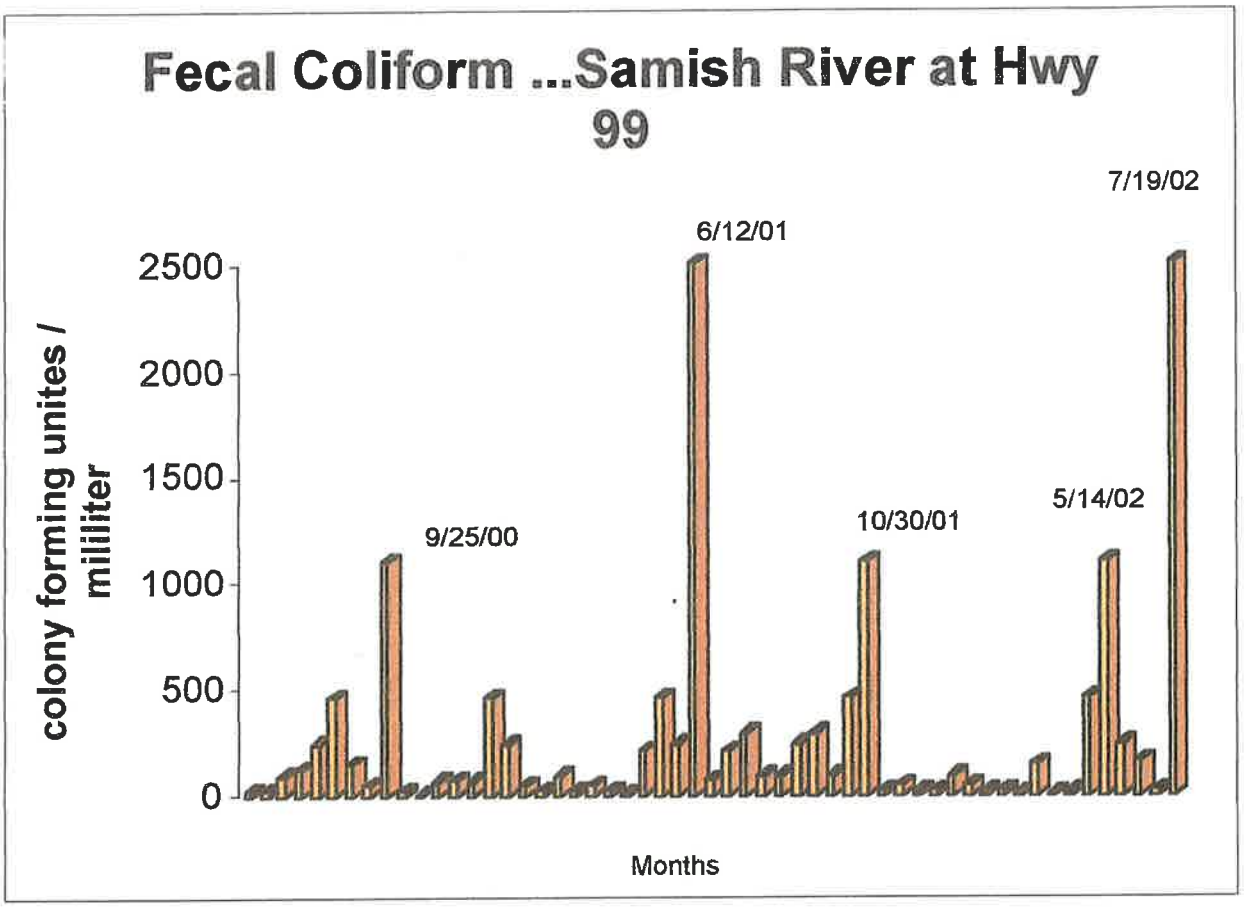


Figure 40. Fecal coliform testing results were highest in June, 2001 and in July 2002 (2500 cfu) at the Samish River Hwy 99 site. Fecal coliform was the same at the upper Samish River Prairie Rd. site in July 2001 but wasn't sampled during July 2002.

Friday Creek in June, 2001 was 468 cfu but was not sampled for fecal coliform in July, 2002. It "appears" Friday Ck. may have contributed to the FC results at the Hwy 99 site during the July 2001 period. However, in December, 2001 Friday Ck. levels were 600 cfu and the Hwy 99 level was 23 cfu. which suggests that Friday Creek fecal coliform levels don't always influence the Samish River downstream from the confluence.

In December, 2000 the upstream Samish River site at Prairie Rd. had a fecal coliform level of 240 cfu and the downstream site at Hwy 99 was 460 cfu. and it "appears" that perhaps fecal coliform was being added to the system between the sites. However, this does not hold up in the samples taken during the following month.

In January 2001 Samish River site at Prairie Rd. had a fecal coliform level of 460 cfu and downstream at Hwy 99 the level was 43 cfu. These numbers "appear" to suggest that the area between the two sites might be removing fecal coliform from the stream.

In April, 2001 the Samish River Prairie Rd. site had a fecal coliform level of 7 cfu and downstream at Hwy 99 the level was 7 cfu. The discharge at the sites was not recorded and it is unknown if the low fecal coliform counts were associated with river conditions or climate at the time of the sampling. In July 2001 fecal coliform samplings showed 240 cfu at Prairie Rd. and 210 cfu at Highway 99.

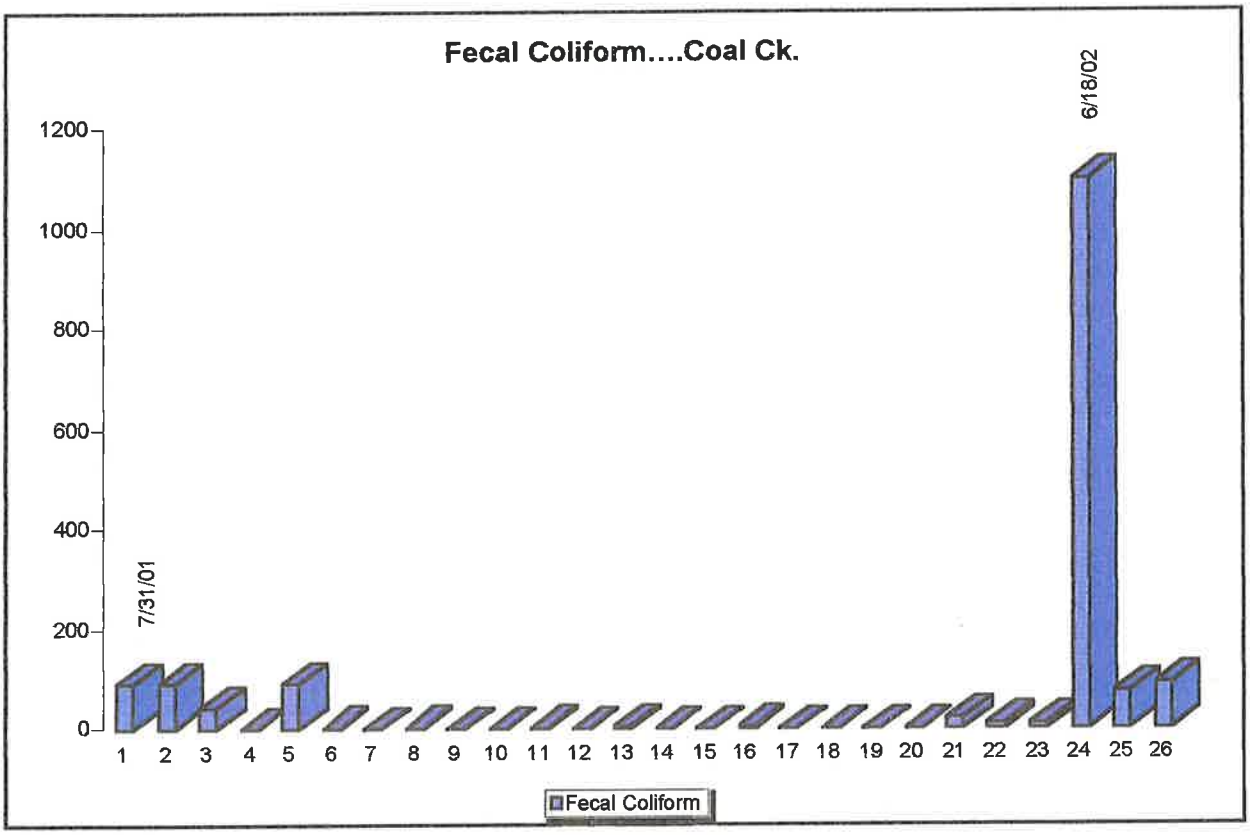


Figure 41. The average fecal coliform level for Coal Ck. during 2001 and 2002 is 110 cfu. For an average to be meaningful it must provide a close representation of the samples that were used to establish the average. The highest level in the data set was 1100 (it occurred 1 time) and the lowest was 3 (it occurred 3 times). An average of 110 is confounded by the 1100 cfu and in order to have enough samples to proceed with analyses, thousands of samples are needed to account for the variability in this data set.

The same problem exists for all sites where fecal coliform testing was performed. The data is inconclusive.

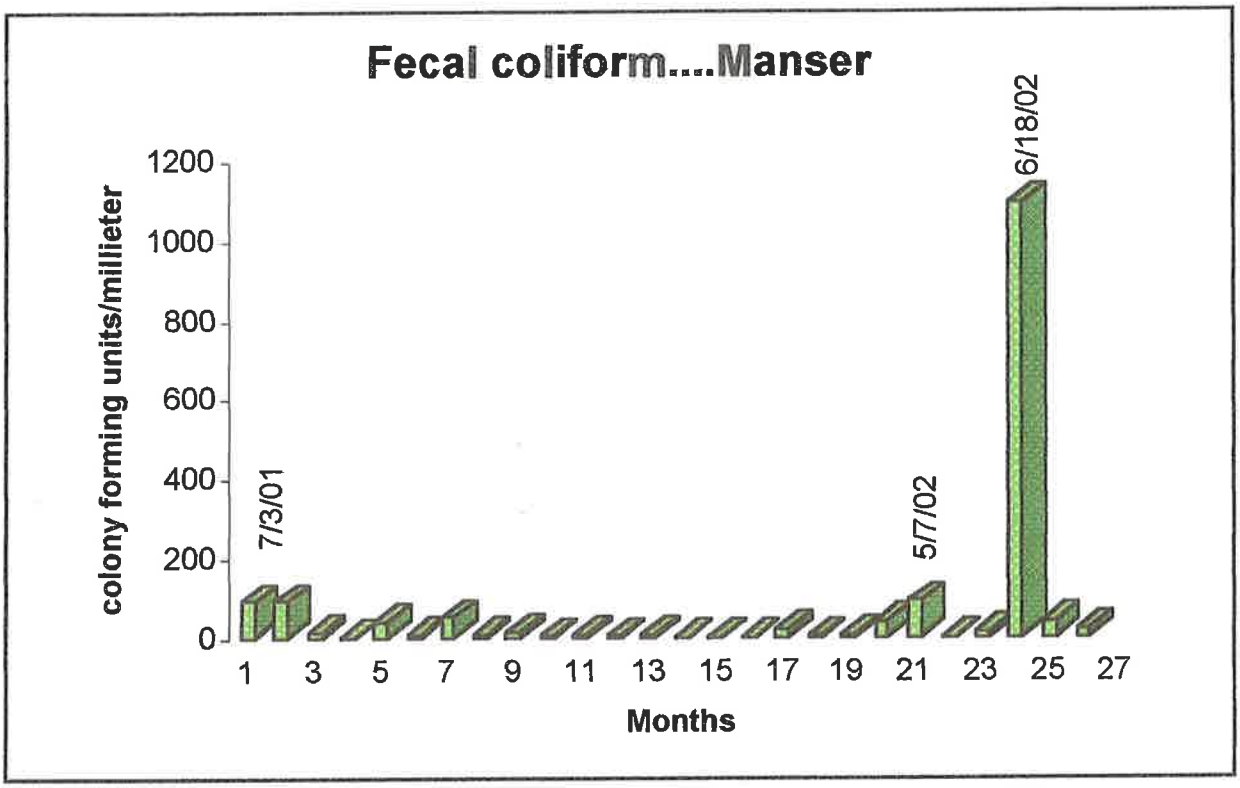


Figure 42. The average fecal coliform level for Manser Ck. during 2001 and 2002 is 78 cfu. For an average to be meaningful it must provide a close representation of the samples that were used to establish the average. The highest level in the data set was 1100 (it occurred 1 time) and the lowest was 3 (it occurred 1 time). Many more samples are needed to account for the variability in this data set.

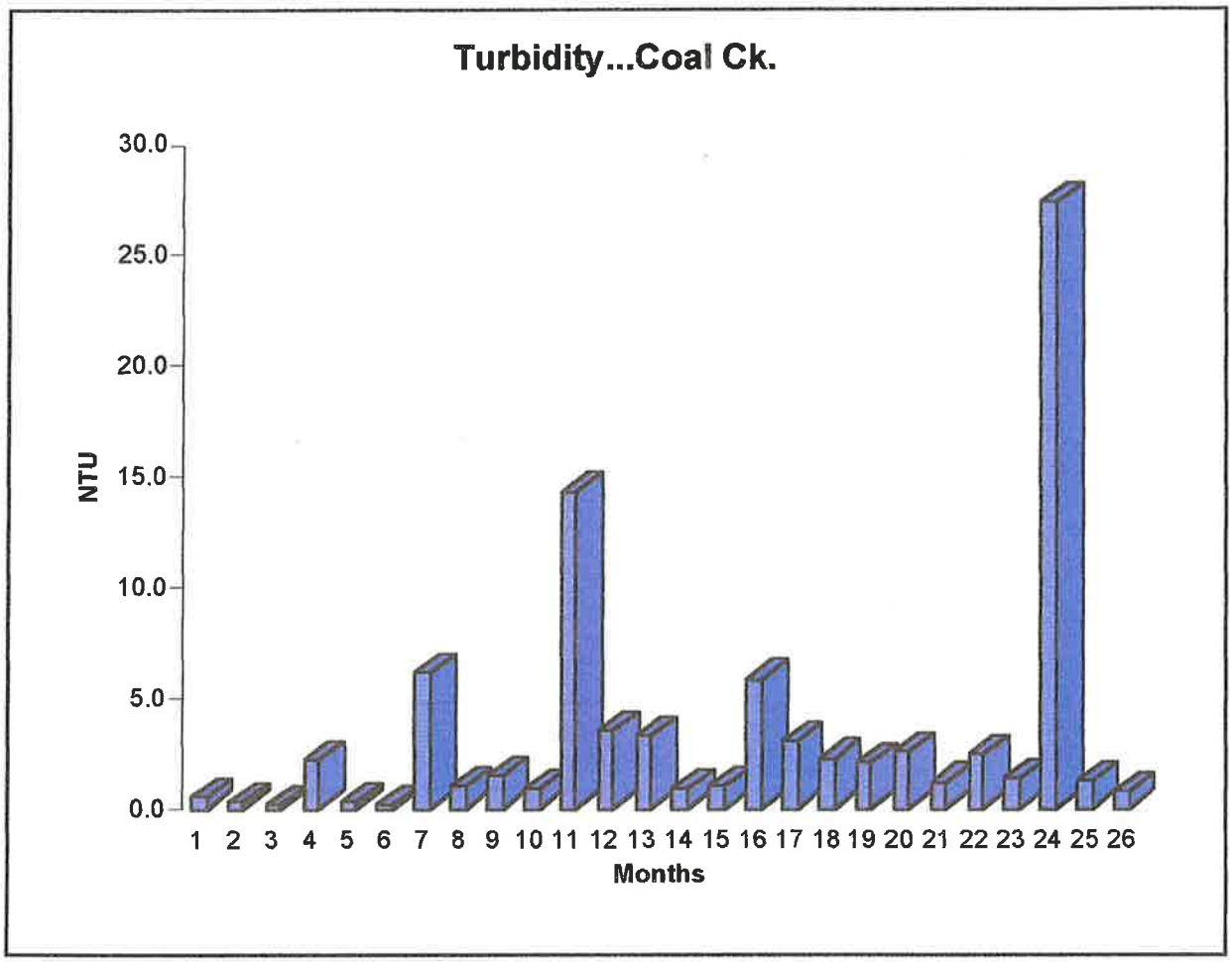


Figure 43. Coal Ck. turbidity was measured during 2001 and 2001 and the average for the sample set is 3.3 NTU. The lowest sample record was 0.1 NTU and the highest was 27.3 NTU. Hundreds of samples are needed to establish with confidence a mean that is representative of the stream. Turbidity is a test for clarity of the water and none of these readings are a concern as far as the state standards. However, some water quality programs attempt to associate turbidity with sediments and other pollution and if the data set doesn't represent the stream, misinterpretations may occur.

Summary and Conclusions

1. The Samish River and tributaries above the fish hatchery are not on the Washington 303(d) list for water quality impaired streams. In the Skagit River system some streams are listed for temperature, but none are listed as being impaired due to excessive nutrients, pH, dissolved oxygen, or sediments. The results of the data analysis for water and air temperatures collected during this study period conflict with the 303(d) list designation. Through statistical comparisons of data we found no differences between streams on days with similar thermal gradients. The stream temperature patterns followed very closely the patterns of air temperature which were influenced by the local climate over the area during the testing. Water temperatures were determined to be within the range expected under natural thermal cycles as described by Halliday and Resnick (1988) and applied in Larson and Larson, 2001. The observations were similar to those identified by Stoneman, C.L. and Michael L. Jones.(1996) and Zwieniecki, M.A. and M. Newton (1999).

Air temperatures are lower than water temperatures during the overnight periods. A negative thermal gradient exists between the air temperature and water temperature at 5 am. The Chi Square tests provide a means to assess if water temperatures are influenced by solar radiation between dawn and 9 am when heating of the environment begins. If solar radiation was a significant influence on water temperature we would expect to see water temperature increase at rate nearly equal to air temperatures. We did not detect this trend. On many segments water temperatures remained constant until after 9 am each day. Overall water temperatures during 12 hour periods increased 2-5 °F on a daily basis.

We found that no water temperature increases were measured until the air temperatures exceeded an average of 12-15°F. Once the air temperatures had increased this amount, the thermal gradient was large enough to affect the water temperatures which is consistent with the Thermodynamic Laws.

- Application of thermodynamic principles produced results that were consistent at each site during all years. Rates of heating at each site were similar and consistent with thermal gradients. A summary of the expected rates and gradients for the Skagit and Samish River basins were calculated using a mathematical analysis of the physical attributes and illustrates a pattern of thermal cycles due to natural background conditions. The method provides a way to examine stream temperatures in a consistent way regardless of the location. The chart in Figure 3 has been replicated in many other watersheds in Oregon and Washington and demonstrates the ubiquity of the Thermodynamic Laws. (Larson and Larson, 2002, 2001). Other factors affecting water temperatures were not detected.

2. Screened material from the stream beds sorted by size gave no indication that sediment was entering the stream due to land activities. Generally the smallest grain sizes found in substrate samples in both the Skagit and Samish basin streams were in the sand size category. Erosion due to runoff from agriculture lands was not detected at any of the sample sites during 2001 or 2002.

Soil types were identified using the Skagit County Soil Survey published by the USDA Natural Resource Conservation Service. Major soil series were identified as Cokedale, Larush, Pilchuck, Samish, and Wickersham within the study area that are located near the basin streams. Runoff from these soils due to erosion above the expected background erosion rates would likely be found in the streambed containing silt and clay particles in amounts exceeding that found in the soil types.

Skagit County Cattlemen are familiar with the many references that suggest erosion from agriculture land is a problem on most streams in the Pacific Northwest. However, these reports do not address actual measurements of the stream bottom material. Either the authors speculated that the erosion and runoff are occurring or they based their statements on ocular survey summaries that

failed to make any site specific measurements. Agriculture lands in the study area are being managed with best management practices suitable for the local areas and production goals. Statements that agriculture activities in the study area do not protect fish and/or habitat are in error. The lack of sediment in the streams is evidence that full protection is taking place.

3. Nitrogen can enter the water is from an excessive source of nitrate in the soil. Most forms of Nitrogen are tied up by clay particles in the soil and cannot become soluble. Nitrate is a water soluble form of nitrogen. If nitrates are present in the soil and runoff is excessive the nitrates can be picked up in the runoff and eventually reach a steam in sufficient quantities and concentration to be detected.
4. Crops cannot use phosphorus from one season to the next because it is unavailable and so little can be retrieved from the soil. Phosphorus applications are made to land in many areas each year and if applied in excessive amounts that can't be used by the plants on site, it can become soluble. When the form of phosphorus is soluble, phosphate, it is nearly always due to a natural background source or it is a sewer or septic system that is the source. Ag lands are the least likely to be contributing to a phosphate contamination because fertilization with phosphorus is usually done at a rate that meets the needs of the plants on the site which use it for growth. Phosphorus is easily tied up by soil particles so the time period between application and plant use if short.

5. When urine, feces, and vegetation are present in water, microbes and insects use them as nitrogen and phosphorus sources for their bodies and excrete excess as waste. In general none of the above processes is a problem for fish except under certain conditions. Fish protection from nitrate or phosphate contributions from agriculture lands in the Skagit and Samish River basins is taking place because there are no concerns about "pollution" from these sources.

The 2001-2002 data collection and analyses did not find N or P at levels that indicated runoff is taking place in frequency or volume that would be needed to be considered a non point source contribution. The levels found in this study indicate that stream water is not polluted due to the agriculture activities in the study area. There were no differences found in the water samples when examined between years. Levels of nitrate and phosphate present in the streams appear from all information gathered for the study to be at a natural background level. Protection of salmon habitat is taking place regarding this type of pollution. None of the testing sites were noted as having an algae problem which would be another indicator of nutrient input concerns.

6. Tree species covered a broad range and were typical of vegetation noted as occurring on the different soil types for the area. Alder and maple were dominant with abundant leaf litter, ferns, horsetail and various small forbs. Western red cedar dominated some sites which produced little ground cover in the way of grasses, forbs, or litter other than needle drop. Cottonwood and alder sites were included which produced an open canopy allowing small alder clumps to become established with horsetails, juncus spp. and reed grasses. Blackberry shrubs were a common barricade between pastures and the stream banks.

Tree diameters throughout the basins ranged from 3 inches to 44 inches and had heights of 40-80 feet. Sites on soil types that support trees and shrubs were generally fully stocked with a variety of size and species of plants. Sites without a tree component were fully stocked with grass species and shrubs.

A properly functioning landscape should contain the full range of plant species composition and structure. The existing vegetation management is yielding a desired mosaic of vegetation with the expected composition and structure for each soil type. These conditions are present in the Skagit and Samish basins.

7. Focus on individual stream reaches has limited the accuracy of many studies. Study designs have underestimated sampling error and have not addressed the comparative importance of different parts of a basin. This study examined two basins in Skagit County and did not find pollution to be a concern in the mainstem Skagit or Samish Rivers or the tributaries. The study incorporated the standard methods of sampling and statistical analyses of the data sets collected over 2 years. There were no differences between years when temperature, streambed substrates, nitrates and phosphates, and riparian vegetation areas were examined.

8. Assertions that an addition of riparian vegetation to facilitate shading on the Samish River in order to prevent stream water warming is not supported by the testing results and is not supported by the Laws of Thermodynamics. From all observations and analyses during the 2 year study, the Skagit and Samish River mainstems and tributaries have excellent water temperature profiles and there is no evidence that thermal pollution is occurring. Water temperature increases are not equal to the air temperature increases, but are proportional. Thermal gradients established between air temperature and water temperatures throughout the day determine how fast stream water heats. Calculation of the rates of heating indicate that over the 2 years study period, the streams are heating and cooling within the natural background thermal cycles found in the Skagit and Samish basins.

9. Protection for the fish and other aquatic life is excellent and is consistent with the natural background conditions for the watershed. Best management practices (BMPs) used by the agriculture landowners are preventing water quality problems. BMPs are varied throughout the area and have been put in placed to meet the production needs while observing the site conditions.

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Comment #11

Robby Eckroth

From: John and Beth <verose@usa.net>
Sent: Tuesday, November 11, 2025 3:38 PM
To: PDS comments
Cc: Commissioners; Lisa Janicki; Peter Browning; Ron Wesen
Subject: Skagit County 2025 Critical Area Ordinance Update

I urge the County Commissioners to protect water quality in our county by requiring development projects to look downstream beyond the current 200 feet requirement.

Department of Ecology recommendations from 2024 are for a distance of one mile. As a long term resident on the shore of Big Lake, I have observed an increase in harmful bacteria blooms in the lake with increasing development around the lake, beyond the current 200 feet.

John P. Verdoes
18870 Sulfer Springs Road
Mount Vernon 98274

Comment #12

Robby Eckroth

From: Molly Doran <mollyd@skagitlandtrust.org>
Sent: Wednesday, November 12, 2025 9:31 PM
To: PDS comments
Subject: Skagit County 2025 Critical Areas Ordinance Update

November 12, 2025

Re: 3rd Draft of Skagit County 2025 Critical Areas Ordinance Update

Skagit Land Trust Comments

Dear Skagit County Board of County Commissioners and Planning and Development Services Staff,

Skagit Land Trust has 1700 households and businesses as members. Together, we have protected more than 11,800 acres in Skagit County, including more than 51 miles of shoreline, conserving wildlife habitat, working agricultural and forest lands, scenic open space, wetlands, and shorelines. Thank you for providing this opportunity for us to comment on the third draft of the Critical Areas Ordinance (CAO) Update.

We appreciate the time and thought you put into considering the public's comments and best available science as you revised and amended this third draft of the CAO to better protect the environment and critical areas of Skagit County. However, the third draft does not alleviate the following major concerns we believe need your attention. We have previously submitted comments on these areas and will articulate why we believe the areas need attention.

14.24.230(7) Wetland Protection Standards.

14.24.230(7)(b) applies to wetlands less than 1000 sq ft. These *may* be exempted from [all] buffer provisions if the criteria in 14.24.230(7)(a) are met.

Smaller wetlands often provide critical habitat and function alone or in tandem with other habitats and wetlands. Thus, clear guidance must be given on how they are treated. Subsection (7)(b) fails to provide that needed clarity. It does not explain how decisions will be made or what science-based criteria will be used to guide decisions. The county must ensure clear rules governing possible exemptions so that any exemptions do not appear arbitrary.

For example, "May be exempted" raises questions. Who exempts? The Director? The Commissioners? Based on what criteria? The difference in language from section (7)(a) which reads "are exempt" makes it clear that this is not an automatic exemption.

Does this provision, once triggered, exempt wetlands less than 1000 sq ft from all buffer provisions in the Chapter or only those determined by the Director on a case-by-case basis?

The word 'buffer' appears 273 times in the draft CAO update including where it was deleted from the previous draft. Nonetheless, the latest draft allows the elimination of buffer protection for small local wetlands if certain conditions are met. Because some of those conditions are subject to human judgment rather than objective science, this provision could result in eliminating buffer protection for all small local wetlands, which function as an important element of habitat even when not directly connected to a riparian corridor or larger wetland mosaic.

This would be contrary to the reason for having a critical areas ordinance, which among other things, is to protect wetlands and their vital ecological function.

Removing buffer protections for these small but important wetlands could lead to unintended consequences. The current provisions in 14.24.240(2) allow for flexibility, such as buffer averaging, which can balance wetland protection and reasonable use. Replacing this approach with a blanket buffer exemption is overly simplistic and could have negative effects. For instance, 14.24.240(2)(b) allows low-impact uses that support the purpose of the buffer. If this rule were removed, would those uses still be allowed if they directly affect the wetland once the buffer is gone?

We also see planning and permitting problems with these exemptions. Removing all buffer rules, including 14.24.220, would affect the requirement that wetland reports include a site plan showing both the wetland and its buffer. Without buffers on the site plan, it's unclear how anyone could determine whether a wetland qualifies for exemption. This shows that a blanket exemption would not work under the proposed code. The alternative — having the Director make regulatory determinations — would require detailed rules and standards, which are not yet provided in the proposed code.

Given the potential impacts on wetland values and functions of a blanket exemption of buffers for these wetlands and the lack of criteria on which to base individual exemptions, Skagit Land Trust opposes the language of 14.24.230(7)(b). We suggest that the subsection be eliminated and the provisions and criteria in 14.230(7)(a) be applied to all wetlands under 4000 sq ft.

- **14.24.410 Geologically hazardous areas known or suspected risk.**

As in our comment letters of May 8, 2025, and July 28, 2025, **we again urge inclusion of wording that gives more direction to geologists or other professionals assessing plans for potential development on alluvial fans. The county should give a standard – such as a conservative time period and/or level of event - on which the professional's study and recommendations should be based.** This is done for potential development in flood areas and for such things as coastal bluff geologic hazards, but not for active alluvial fans. While the exact timing of such an event is impossible to predict, understanding the worst-case scenario enables a proactive, rather than reactive, approach to alluvial fan disaster management and ensures that the landowner, community and county are as prepared as possible for extreme events and/or avoid areas where extreme events will happen at an unknown time.

We recommend adding the following bolded language to 14.24.410:

- "Permanent residential structures and commercial developments shall be allowed in alluvial fan hazard areas only if the fan has undergone a county-approved study to assess potential hazards, determine risks, and identify mitigation measures and is deemed suitable for development. **The technical administrator shall make this determination based on a detailed assessment by a qualified professional that identifies the risks associated with a 500-year return period debris flow or the maximum credible event that could impact the alluvial fan."**

- **14.24.500 Fish and wildlife habitat conservation area designations.**

Skagit Land Trust protects approximately 85% of the March Point Heronry nesting site, the largest heronry and primary breeding center for Great Blue Herons in the Salish Sea. The sheer number of herons breeding, nesting, and rearing their young at March Point, provides the genetic diversity necessary to sustain a thriving population of

Great Blue Herons in the Salish Sea. For herons to successfully reproduce they need forest with trees strong enough and tall enough to support their large nests 50 feet or more above the ground and proximity to an abundant number of forage fish to feed their growing young. The March Point heronry is ideally located in mature coastal forest next to the eel grass beds of Padilla Bay. Such forest habitat with close by foraging has become increasingly rare and must be protected.

To better protect the March Point Heronry, we repeat the request of our May 8, 2025, and July 28, 2025, comment letters:

Align the protection for the March Point Heronry in the CAO with that provided in the Anacortes Critical Area Regulations (CAR) as portions of the heronry lie in each jurisdiction. The Anacortes CAR follows WDFW's recommendations for management of Great Blue Heron heronries more closely than Skagit County's CAO.

Following are links to sections of the Anacortes CAR that address the March Point Heronry and Great Blue Heron Nesting and Breeding Area.

https://anacortes.municipal.codes/AMC/19.70.315(A)(9)(b)
https://anacortes.municipal.codes/AMC/19.70.335(C)(2)
https://anacortes.municipal.codes/AMC/19.70.335(D)(2)(c)

To best protect the March Point Heronry, we recommend that Skagit County, at a minimum, incorporate into the CAO the following buffer language from the Anacortes CAR based on WDFW's recommendations:

"D.2.c.iv For the March Point colony, given the observed and documented sensitivity of this mega-colony to human intrusion and the fact that the colony is in a rare, isolated, but tight location, a year-round buffer of 984 feet."

- **14.24.530 Fish and wildlife habitat conservation area protection standards**

We appreciate the increased buffer widths and structure setbacks for Type F and N streams, together with the wildlife corridor provisions in 14.24.530.

- **14.24.540 Fish and wildlife habitat conservation area performance-based buffer alternatives and mitigation standards.**

The improved riparian buffer widths and wildlife corridor provisions in 14.24.530 are severely compromised in 14.24.540(4)(g), by the continued allowance for timber harvest within these very same riparian buffers. We are disappointed and concerned that this draft does not reflect the comments submitted by WDFW, as well as community members, environmental and habitat restoration organizations, and tribes, regarding the incompatibility of commercial timber harvest activities within riparian areas. As has been stated previously, this provision will not protect the ecological function of these areas, including protection and restoration of endangered species. It is, instead, a loophole big enough for logging trucks.

Again, we remind staff and commissioners of the comments submitted by Washington Department of Fish and Wildlife in its May 8, 2025, comment letter (#27):

> "Allowing timber harvest within riparian buffers, regardless of conditions or proposed performance standards, compromises the critical ecological functions and values these areas are intended to protect.... For these reasons, we strongly recommend eliminating this provision and reinforcing protections for intact riparian vegetation to maintain water quality, fish habitat, and the long-term resilience of riparian ecosystems." (p.9)

And again, we note that WDFW's *Skagit County Riparian Buffer Evaluation* (Whittaker & Fuchs, July 1, 2025) found that county's 2006 buffers have resulted in the loss of thousands of acres of riparian tree cover and consequently have not been ensuring no net loss of ecological functions (pgs. 16 & 17). It is inappropriate to then allow reducing forest cover in riparian areas.

We strongly recommend that timber harvest be prohibited in critical area buffers.

Thank you for considering our comments.

Molly Doran, executive director

Skagit Land Trust

1020 S 3rd Street

Mount Vernon, WA 98273

Robby Eckroth

Comment #13

From: Tammie Grobschmit <tsgrob3@gmail.com>
Sent: Thursday, November 13, 2025 3:21 PM
To: PDS comments; Commissioners
Cc: Lisa Janicki; Peter Browning; Ron Wesen
Subject: Skagit County 2025 Critical Areas Ordinance Update

Commissioner Lisa Janicki
Commissioner Peter Browning
Commissioner Ron Wesen

Commissioners:

I have lived on Big Lake for 24 years. For 21 of those years, I have actively participated on the advisory committee in Big Lake's Lake Management District #1, collaborating with the Skagit County Noxious Weed Coordinator and the Skagit County Natural Resources Division to maintain the lake's health. This hands-on involvement has shown me how profoundly our entire watershed influences the lake's condition.

As you know, Big Lake is Skagit County's largest lake at 540 acres, fed by an exceptionally large 14,336-acre watershed that channels stormwater runoff and drainage into it. We are now witnessing direct consequences: this drainage is fueling toxic algae blooms, to what degree we do not yet know and may not know for several years. The Natural Resources Division office (led by Jenn Johnson), along with our lake treatment contractor (Aquatechnex-Terry McNabb), is sampling water and soil while coordinating with the Stormwater Team—led by Jason Quigley—to test for phosphorus and other pollutants.

For context, Lake Stevens, the largest lake in neighboring Snohomish County, covers over 1,000 acres—nearly double Big Lake's size (540 acres)—yet its watershed is only 4,536 acres, roughly one-third of ours.

Speaking not as an expert but as a longtime resident with decades of observation, I urge you to do what you can to safeguard our vulnerable lake. As development expands within our watershed, it is only logical to assess each project's downstream effects on Big Lake.

Please amend the Critical Areas Ordinance to protect water quality by extending safeguards beyond the current 200 feet from new developments to up to one-mile downstream from the project site as is the Department of Ecology recommendation of the 2024 Stormwater Manual (page 149) to look along the flow path from the project site to the receiving water.

Respectfully,

Tammie Grobschmit

24186 N. West View Road

Mount Vernon, WA 98274

360-840-6422

Robby Eckroth

Comment #14

From: Andrea Xaver <dancer@fidalgo.net>
Sent: Thursday, November 13, 2025 4:29 PM
To: PDS comments
Cc: Lisa Janicki; Peter Browning; Ron Wesen
Subject: Skagit County 2025 Critical Areas Ordinanace Update

I'm chiming in with similar/same comments from other Big Lake area residents. And, **I've added my own comments**, as well.

"In the best interests of the general public and environment, Ecology recommends local governments require development projects that discharge stormwater off-site to submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project. The review should look downstream for a distance of up to one-mile from the project site."

I'm adding that impacts should be assessed upstream, also. Flooding on my farm property from "extra water" comes to mind, along with any pollution that could be in water overtopping Lake Creek's banks due to water backing up from the adjacent swamp at the south end of the lake, and the lake itself. (AX)

"Please adopt the Department of Ecology (DOE) recommendation of the 2024 Stormwater Manual (page 149) to look along the flow path from the project site to the receiving water, for a distance of up to one mile."

I'm adding that based on flooding issues, areas connected to Big Lake and the inflow to it from Lake Creek and the outflow into Nookachamps, should also be considered regarding any potential harm, even though areas could be more than a mile away. Everything in this area is connected, and damage could be far-reaching. (AX)

Thank you for your consideration.

Andrea Xaver
19814 State Route 9
Mount Vernon, Wa 98274
(360-202-9533)

Comment #15

Robby Eckroth

From: Tim Trohimovich <Tim@futurewise.org>
Sent: Thursday, November 13, 2025 5:15 PM
To: PDS comments
Subject: Skagit County 2025 Critical Areas Ordinance Update October 14, 2025 3rd Draft

Dear Staff and the Board of County Commissioners:

Thank you for the opportunity to comment on the Third Draft Critical Areas Ordinance Update. Futurewise supports the update, the ordinance, and the recommended improvements. We do have some additional recommendations set out below.

Futurewise works throughout Washington State to support land-use policies that encourage healthy, equitable and opportunity-rich communities, and that protect our most valuable farmlands, forests, and water resources. Futurewise has members and supporters throughout Washington State including Skagit County. Our recommendations follow.

Please clarify when critical areas review is required in Skagit County Code Section 14.24.080 consistent with the requirements of SCC 14.24.080(1)(d)(i) on pages 11 – 14 of 78.

Skagit County Code Section (SCC) 14.24.080(1)(d)(i) is proposed to be amended to provide that standard critical areas review is required if (with the deletions omitted):

> (i) Critical areas or their buffers are present if either is within 300 feet, or a distance otherwise specified in this Chapter, from the proposed activity or may be affected by the proposed activity.

We support this amendment because it recognizes that some fish and wildlife buffers are wider than 300 feet and it also recognizes that activities can have other adverse effects on critical areas such as discharging storm water into downstream wetlands, rivers or lakes.[1] For example, "[b]uilding within 150 m (492 ft) of a loon nest should be avoided year-round to maintain a permanent buffer around nests."[2] The common loon is a sensitive species found in Skagit County.[3]

Unfortunately, the amendments to SCC 14.24.080(3) and (4) only require review within 300 feet for wetlands, 250 feet for water courses in the Special Flood Hazard Area, and 200 feet for other critical areas. They also omitted the standard of whether a critical area may be affected by the proposed activities. These changes significantly weaken the protections in the critical areas regulations and can adversely impact critical areas functions and values. The Growth Management Act (GMA) "requires that the regulations for critical areas must protect the 'functions and values' of those designated areas. [RCW 36.70A.172(1).] This means all functions and values."[4]

To address this problem we recommend that SCC 14.24.080(3) and (4) use the same language as SCC 14.24.080(1)(d)(i) as proposed to be amended. This will help protect critical area functions and values.

Please require an Off-Site Analysis Report development projects that discharge storm water off-site in Skagit County Code Section 14.24.080 on pages 11 – 14 of 78.

The *2024 Stormwater Management Manual for Western Washington* provides:

> Ecology recommends that local governments require development projects that discharge storm water off-site to submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project, and proposes appropriate mitigation for

> those impacts. The report should also assess the amount of off-site run-on from upstream off-site areas that may affect the site design.
>
> The initial qualitative analysis shall extend along the flow path from the project site to the receiving water, for a distance up to one mile. If the receiving water is within one-quarter mile from the project site, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream from the project site to a point where there are no backwater effects created by the project, and the designer can determine all areas contributing run-on to the project.[5]

"The objective of the off-site analysis report is to identify, evaluate, and determine measures to prevent off-site water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by a proposed project."[6] This analysis is needed to protect the functions and values of aquatic fish and wildlife habitats as the Growth Management Act requires.[7]

SCC 14.24.230(5) which allows the use of a previous buffer should require the current buffer widths if additional uses or more intensive uses are being permitted. See page 36 of 78.

Current wetland science supports the buffers in SCC 14.24.230.[8] SCC 14.24.230(5) allows the use of existing buffers that do not meet the current buffer requirements for new or expanded uses. We appreciate and support the additional limits being proposed. However, this accommodation should not apply where more intensive uses or additional uses that will adversely impact the wetland are being allowed. If SCC 14.24.230(5) applies in this circumstance the critical areas regulations will violate the Growth Management Act requirement that critical areas regulations must also at least "protect[s] critical areas by maintaining existing conditions."[9]

Futurewise supports SCC 14.24.350, the Instream Flow Rules, and recommends they be updated to comply with RCW 36.70A.590 and RCW 90.44.050. See pages 51 – 56 of 78

Futurewise supports SCC 14.24.350 Instream Flow Rules. RCW 36.70A.070(1) provides that "[t]he land use element shall provide for protection of the quality and quantity of groundwater used for public water supplies." RCW 36.70A.070(5)(c)(iv) provides that "[t]he rural element shall include measures that apply to rural development and protect the rural character of the area, as established by the county, by: … Protecting surface water and groundwater resources." The Growth Management Act (GMA) in RCW 36.70A.590 also provides that:

> For the purposes of complying with the requirements of this chapter [the GMA] relating to surface and groundwater resources, a county or city may rely on or refer to applicable minimum instream flow rules adopted by the department of ecology under chapters 90.22 and 90.54 RCW. Development regulations must ensure that proposed water uses are consistent with RCW 90.44.050 and with applicable rules adopted pursuant to chapters 90.22 and 90.54 RCW when making decisions under RCW 19.27.097 and 58.17.110.

Development regulations must comply with the GMA including the critical areas regulations.[10] These development regulations are required because overuse of surface or ground water often harms senior water rights holders and fish and wildlife habitat. For example:

> Although domestic water use in rural areas uses a small amount of water, the cumulative impact of many domestic water users can together impair streamflows, especially in tributaries. Hydrogeologic studies and computer models show that domestic wells impact streamflows in the Skagit Basin.[11]

To comply with RCW 36.70A.070(1), RCW 36.70A.070(5)(c)(iv), and RCW 36.70A.590, the critical areas regulations should adopt regulations to ensure development complies with the water codes and the applicable instream flow rules.

RCW 36.70A.590 requires the development regulations to ensure that proposed water uses are consistent with RCW 90.44.050. To comply with RCW 90.44.050 for residential permit exempt wells, the policies and development regulations must require that the County when determining if a development, land division, or use qualifies for a permit exempt well under RCW 90.44.050 ensure that the water used by the parent parcel that existed in 2002, any lots created from the parent parcel, and any development built on or after 2002 on those lots does not in total exceed the 5,000 gallons a day allowed by RCW 90.44.050. Under the State Supreme Court's *Campbell and Gwinn* decision, each lot is entitled to one 5,000 gallon per day permit exempt withdrawal for single or group domestic uses under RCW 90.44.050.[12] A "developer may not claim multiple exemptions for the homeowners."[13] So each lot that existed in 2002, the year the *Campbell and Gwinn* decision was decided, is entitled to one permit-exempt withdrawal under RCW 90.44.050.

As lots are subdivided or developed over time, part or all of the permit exempt withdrawals are used by the lots created or the development authorized. To qualify for a permit-exempt groundwater withdrawal authorized under RCW 90.44.050, the lot must have some remaining water from the parent parcel's single 5,000 gallon per day permit exempt withdrawal for single or group domestic uses.

Therefore, the required development regulations can only authorize the use of a permit exempt-well or well system for single or group domestic uses if the water use does not exceed the 5,000 gallons a day allowed by RCW 90.44.050 including the parent parcel that existed in 2002, any lots created from the parent parcel, and any development built on or after 2002. To comply with RCW 36.70A.590, SCC 14.24.350 must include this important limitation. Therefore, we recommend SCC 14.24.350 limit each lot that existed in 2002 to one permit-exempt withdrawal under RCW 90.44.050 including the water used by any land divisions or developments and also comply with RCW 36.70A.590.

This regulation also helps to protect families that buy lots and houses that rely on permit exempt wells. Developments that are approved in violation of RCW 36.70A.590 and RCW 90.44.050 do not have a legal water right. Their current and future water use is not legal.

Futurewise strongly supports the improved seawater intrusion areas regulations in SCC 14.24.380 on pages 57 – 61 of 78.

Salt water intrusion is a serious problem for the islands and coastal shorelines in Skagit County.[14] We strongly support the improved seawater intrusion areas regulations in SCC 14.24.380 to address this serious problem.

Adopt stream, lake, and marine buffer widths that consistent with the current best available sciences and that protect the functions and values of salmon habitat. Please see SCC 14.24.530(1) on pages 69 — 72 of 78

The southern resident orcas depend on the chinook salmon to live and recover their numbers.[15] The *2022 State of Salmon in Watersheds* report rated the Puget Sound Chinook salmon as "in crisis," the Governor's Salmon Recovery Office's worst rating.[16] The Puget Sound Steelhead are also "in crisis."[17] Other salmon and steelhead are also declining.[18] The key factors causing the decline in salmon and steelhead include habitat degradation.[19] An analysis by the National Oceanic and Atmospheric Administration and the State of Washington Department of Fish and Wildlife ranked the Northern Puget Sound Fall Chinook salmon from the Nooksack, Elwha, Dungeness, Skagit, Stillaguamish, and Snohomish Rivers as the highest in importance as food sources for the southern resident orcas.[20] New Year Eve saw the death of another orca calf and once again the calf's mother is carrying her around Puget Sound for all of us to see.[21] The Washington State Academy of Sciences concluded that **"[c]learly, there have been net losses of species and habitats in Washington. The committee is reasonably confident that without policy changes, these types of losses will continue** and will contribute to the disappearance of distinct habitats and ecosystem types from Washington's terrestrial and aquatic landscapes."[22] For the sake of the chinook salmon and the southern resident orcas we can and must better protect their habitat.

"Preserving habitat is far less expensive than restoring degraded habitat."[23] We are not achieving no net loss of riparian vegetation that is necessary to protect salmon habitat. This is in part because the critical areas regulation buffers for rivers, streams, and shorelines are too narrow.

The State of Washington Department of Fish and Wildlife has developed new recommendations for protecting riparian areas. "Under WAC 365-190-130(4)(b), the [State of Washington] Department [of Fish and Wildlife]'s priority species habitat information is considered best available science."[24] The updated management recommendations document that fish and wildlife depend on protecting riparian vegetation and the functions this vegetation performs such as maintaining a complex food web that supports salmon and maintaining temperature regimes to name just a few of the functions.[25]

The updated *Riparian Ecosystems, Volume 1: Science synthesis and management implications* scientific report concludes that the "[p]rotection and restoration of riparian ecosystems continues to be critically important because: a) they are disproportionately important, relative to area, for aquatic species, e.g., salmon, and terrestrial wildlife, b) they provide ecosystem services such as water purification and fisheries (Naiman and Bilby 2001; NRC 2002; Richardson et al. 2012), and c) by interacting with watershed-scale processes, they contribute to the creation and maintenance of aquatic habitats."[26] The report states that "[t]he width of the riparian ecosystem is estimated by one 200-year site-potential tree height (SPTH) measured from the edge of the active channel or active floodplain. Protecting functions within at least one 200-year SPTH is a scientifically supported approach if the goal is to protect and maintain full function of the riparian ecosystem."[27] The buffers should be updated to include these buffers.

The State of Washington Department of Fish and Wildlife's recent analysis shows that not adopting the one 200-year SPTH will result in loss of riparian vegetation functions and values.[28] This violates the Growth Management Act.[29]

SCC 14.24.600, SCC 14.24.610, and SCC 14.24.630 should be updated to protect people and property from sea level rise. Please see page 76 – 77 of 78

Sea level rise is a real problem that is happening now. Sea level is rising and floods and erosion are increasing. In 2012 the National Research Council concluded that global sea level had risen by about seven inches in the 20th Century.[30] A recent analysis of sea-level measurements for tide-gage stations, including the Seattle, Washington tide-gauge, shows that sea level rise is accelerating.[31]

The report *Projected Sea Level Rise for Washington State – A 2018 Assessment* projects that for a low greenhouse gas emission scenario there is a 50 percent probability that sea level rise will reach or exceed 1.6 feet by 2100 in Skagit County at Latitude 48.3 degrees north and Longitude -122.4 degrees west.[32] *Projected Sea Level Rise for Washington State – A 2018 Assessment* projects that for a higher emission scenario there is a 50 percent probability that sea level rise will reach or exceed 2.1 feet by 2100 in Skagit County at Latitude 48.3 degrees north and Longitude -122.4 degrees west.[33] Projections are available for all of the marine shorelines in Skagit County.[34]

The extent of the sea level rise currently projected for Skagit County can be seen on the NOAA Office for Coastal Management Digitalcoast Sea Level Rise Viewer available at: https://coast.noaa.gov/digitalcoast/tools/slr.html. A copy of the map from the viewer showing two feet of sea level rise was enclosed with Futurewise's May 8, 2025, emails with the filename: "Skagit Cty 2 ft Sea Level Rise.pdf."

Projected sea level rise will substantially increase flooding. As Ecology writes, "[s]ea level rise and storm surge[s] will increase the frequency and severity of flooding, erosion, and seawater intrusion—thus increasing risks to vulnerable communities, infrastructure, and coastal ecosystems."[35] Not only our marine shorelines will be impacted, as Ecology writes "[m]ore frequent extreme storms are likely to cause river and coastal flooding, leading to increased injuries and loss of life."[36]

Zillow recently estimated that 31,235 homes in Washington State may be underwater by 2100, 1.32 percent of the state's total housing stock. The value of the submerged homes is an estimated $13.7 billon.[37] Zillow wrote:

> It's important to note that 2100 is a long way off, and it's certainly possible that communities [may] take steps to mitigate these risks. Then again, given the enduring popularity of living near the sea despite its many dangers and drawbacks, it may be that even more homes will be located closer to the water in a century's time, and these estimates could turn out to be very conservative. Either way, left unchecked, it is clear the threats posed by climate change and rising sea levels have the potential to destroy housing values on an enormous scale.[38]

Sea level rise will have an impact beyond rising seas, floods, and storm surges. The National Research Council wrote that:

> Rising sea levels and increasing wave heights will exacerbate coastal erosion and shoreline retreat in all geomorphic environments along the west coast. Projections of future cliff and bluff retreat are limited by sparse data in Oregon and Washington and by a high degree of geomorphic variability along the coast. Projections using only historic rates of cliff erosion predict 10–30 meters [33 to 98 feet] or more of retreat along the west coast by 2100. An increase in the rate of sea-level rise combined with larger waves could significantly increase these rates. Future retreat of beaches will depend on the rate of sea-level rise and, to a lesser extent, the amount of sediment input and loss.[39]

These impacts are why the Washington State Department of Ecology recommends "[l]imiting new development in highly vulnerable areas."[40]

Unless wetlands and shoreline vegetation can migrate landward, their area and ecological functions will decline.[41] If development regulations are not updated to address the need for vegetation to migrate landward in feasible locations, wetlands and shoreline vegetation will decline. According to Ecology "[d]evelopment of coastal areas and shoreline armoring (e.g., bulkheads, seawalls) prevent habitat areas from reestablishing inland" in response to sea level rise.[42] Ecology provides more detailed documentation of these adverse impacts:

> The prospect of more flooding, erosion, and storm damage may lead communities and property owners to seek to build seawalls, dikes, and tidal barriers. The construction and placement of these structures will have a direct and immediate impact on natural shoreline environments. These structures will also lead to the progressive loss of beach and marsh habitat as those areas are squeezed between the rising sea and a more intensively engineered shoreline. Predicted decreases in size or transitions in tidal marshes, salt marshes, and tidal flats will affect the species these habitats support. It is predicted that while some species may be able to locate alternate habitats or food sources, others will not (Glick, 2007).
>
> Shellfish, forage fish, shorebirds, and salmon are among those identified as examples of species at risk (Glick, 2007). Sea level rise will also lead to other changes in coastal ecosystems, such as shifting of stream mouths and tidal inlets, reconfigured estuaries and wetlands, and more frequently disturbed riparian zones.[43]

"Loss of salt marsh and related habitats may be significant in systems constrained by surrounding development."[44] This loss of shoreline vegetation will harm the environment. It will also deprive marine shorelines of the vegetation that protects property from erosion and storm damage by modifying soils and accreting sediment.[45] This will increase damage to upland properties. Enclosed with this letter are maps showing the extent of wetlands at mean higher high water and at two feet of sea level rise in western Skagit County.[46] A comparison of these maps shows that there will be migration of wetlands in Skagit County if the wetlands are not blocked by development.

Flood plain regulations are not enough to address sea level rise for three reasons. *Projected Sea Level Rise for Washington State – A 2018 Assessment* explains two of them:

> Finally, it is worth emphasizing that sea level rise projections are different from Federal Emergency Management Agency (FEMA) flood insurance studies, because (1) FEMA studies only consider past events, and (2) flood insurance studies only consider the 100-year event, whereas sea level rise affects coastal water elevations at all times.[47]

The third reason is that flood plain regulations allow fills and piling to elevate structures and also allow commercial buildings to be flood proofed in certain areas. While this affords some protection to the structure, it does not protect the marshes and wetlands that need to migrate.

Because of these significant impacts on people, property, and the environment, "[n]early six in ten Americans supported prohibiting development in flood-prone areas (57%)."[48] It is time for Washington state and local governments to follow the lead of the American people and adopt policies and regulations to protect people, property, and the environment from sea level rise. This is why RCW 36.70A.070(9)(e)(i)(C) requires county and city comprehensive plans to "[a]ddress natural hazards created or aggravated by climate change, including sea level rise, landslides, flooding, drought, heat, smoke, wildfire, and other effects of changes to temperature and precipitation patterns." RCW 36.70A.040(3) requires counties and cities development regulations that are consistent with and implement the comprehensive plan and to address these natural hazards. We recommend the addition of the following regulations as part of the critical areas update:

X. New lots shall be designed and located so that the buildable area is outside the area likely to be inundated by sea level rise in 2100 and outside of the area in which wetlands and aquatic vegetation will likely migrate during that time.

X2. Where lots are large enough, new structures and buildings shall be located so that they are outside the area likely to be inundated by sea level rise in 2100 and outside of the area in which wetlands and aquatic vegetation will likely migrate during that time.

X3. New and substantially improved structures shall be elevated above the likely sea level rise elevation in 2100 or for the life of the building, whichever is less.

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[1] *Best Available Science Review Skagit County Critical Areas Ordinance Update* p. 29, p. 34, pp. 39 – 42 (Feb. 24, 2025) last accessed on Nov. 13, 2025, at: https://www.skagitcounty.net/PlanningAndPermit/Documents/compplan2025/Skagit%20County%20BAS%202.24.2025%20-%20FINAL.pdf#page=40.24.

[2] Jeffrey C. Lewis, Ruth Milner, and Morie Whalen, *Common Loon* p. 1-2 in E. Larsen, J. M. Azerrad, N. Nordstrom editors, *Management Recommendations for Washington's Priority Species, Volume IV: Birds* (Washington Department of Fish and Wildlife, Olympia, Washington, USA: 2004) last accessed on Nov. 13, 2025 at: https://wdfw.wa.gov/publications/00026 and enclosed in Futurewise's July 28, 2025, email to pdscomments@co.skagit.wa.us with the filename: "wdfw00026.pdf."

[3] *Best Available Science Review Skagit County Critical Areas Ordinance Update* p. 48 (Feb. 24, 2025).

[4] *Whidbey Env't Action Network v. Island Cnty.*, 122 Wn. App. 156, 174–75, 93 P.3d 885, 894 (2004).

[5] Washington State Department of Ecology, Water Quality Program *Stormwater Management Manual for Western Washington* Volume I-Chapter 3 p. 149 – 50 (July 2024, Publication Number 24-10-013) last accessed on Nov. 13, 2025, at: https://apps.ecology.wa.gov/publications/SummaryPages/2410013.html and cited pages enclosed in a separate email with the filename: "2410013 pp 149-52.pdf."

[6] *Id*. p. 150.

[7] *Whidbey Env't Action Network v. Island Cnty.*, 122 Wn. App. 156, 174–75, 93 P.3d 885, 894 (2004).

[8] Washington State Department of Ecology Shorelands and Environmental Assistance Program, *Wetland Guidance for Critical Areas Ordinance (CAO) Updates: Western and Eastern Washington* pp. 20 – 25 (Olympia, Wash.: Oct. 2022, Publication #22-06-014) last accessed on Nov. 11, 2025, at: https://apps.ecology.wa.gov/publications/SummaryPages/2206014.html and enclosed with Futurewise's May 8, 2025, emails with the filename: "2206014.pdf."

[9] *Swinomish Indian Tribal Cmty. v. W. Washington Growth Mgmt. Hearings Bd.*, 161 Wn.2d 415, 430, 166 P.3d 1198, 1206 (2007), as corrected (Nov. 28, 2007), as corrected (Apr. 3, 2008).

[10] *Kittitas Cnty. v. E. Washington Growth Mgmt. Hearings Bd.*, 172 Wn.2d 144, 164, 256 P.3d 1193, 1203 (2011) *citing* RCW 36.70A.130(1); *accord* RCW 36.70A.290(2).

[11] State of Washington Department of Ecology Water Resources Program, *Water Availability for Skagit Basin Landowners: Frequently asked questions* p. *3 (Publication 13-11-006 | Revised Aug. 2023) last accessed on Nov. 13, 2025, at: https://apps.ecology.wa.gov/publications/documents/1311006.pdf and enclosed in a separate email with the filename: "1311006.pdf."

[12] *State Dep't of Ecology v. Campbell & Gwinn, L.L.C.*, 146 Wn.2d 1, 14, 43 P.3d 4, 110 (2002).

[13] *Id*.

[14] See for example Washington Water Science Center, *Aquifer Recharge Area Study of Guemes Island* webpage (Oct. 13, 2021), last accessed on Nov. 13, 2025, at: https://www.usgs.gov/centers/washington-water-science-center/science/aquifer-recharge-area-study-guemes-island.

[15] NOAA Fisheries, *Southern Resident Killer Whale Priority Chinook Salmon Stocks - Questions and Answers* webpage last accessed on Nov. 13, 2025, at: https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/southern-resident-killer-whale-priority-chinook-salmon and enclosed with Futurewise's May 8, 2025, emails with the filename: "Southern Resident Killer Whale Priority Chinook Stocks Q and A.pdf."

[16] Washington State Recreation and Conservation Office, Governor's Salmon Recovery Office, *2022 State of Salmon in Watersheds Executive Summary* p. 7 (Feb. 2023) last accessed on) last accessed on Nov. 13, 2025, at: https://stateofsalmon.wa.gov/wp-content/uploads/2023/02/SOS-ExecSummary-2022.pdf.

[17] *Id*.

[18] *Id*. p. 6.

[19] *Id*. pp. 14 – 15.

[20] National Oceanic and Atmospheric Administration and the State of Washington Department of Fish and Wildlife, *Southern Resident Killer Whale Priority Chinook Stocks* p. 6 (June 22, 2018) last accessed on Nov. 13, 2025, at: https://media.fisheries.noaa.gov/dam-migration/srkw_priority_chinook_stocks_conceptual_model_report___list_22june2018.pdf and enclosed in Futurewise's May 8, 2025, emails with the filename: "srkw_priority_chinook_stocks_conceptual_model_report___list_22june2018.pdf."

[21] Lynda V. Mapes, *Mother orca Tahlequah once again carrying her dead calf* The Seattle Times (Jan. 1, 2025 at 6:41 pm) last accessed on Nov. 13, 2025, at: https://www.seattletimes.com/seattle-news/climate-lab/mother-orca-tahlequah-once-again-carrying-her-dead-calf/.

[22] Washington State Academy of Sciences, *Assessment of No Net Loss and Recommendations for Net Ecological Gain Metrics, Indicators, and Monitoring: Prepared for the Washington State Department of Fish and Wildlife* p. 4 (June 2022) in Washington Department of Fish and Wildlife (WDFW), *Net Ecological Gain Standard Proviso Summary Report* (Dec. 2022) bold in the original last accessed on Nov. 13, 2025, at: https://wdfw.wa.gov/sites/default/files/publications/02357/wdfw02357.pdf and enclosed with Futurewise's May 8, 2025, emails with the filename: "wdfw02357.pdf."

[23] Washington State Recreation and Conservation Office Governor's Salmon Recovery Office, *2022 State of Salmon in Watersheds Executive Summary* p. 15 (Feb. 2023).

[24] *Whidbey Env't Action Network v. Growth Mgmt. Hearings Bd.*, 14 Wn. App. 2d 514, 526, 471 P.3d 960, 968 (2020).

[25] Timothy Quinn, George F. Wilhere, and Kirk L. Krueger, technical editors, *Riparian Ecosystems, Volume 1: Science Synthesis and Management Implications* pp. 265 – 68 & p. 270 (A Priority Habitat and Species Document of the Washington Department of Fish and Wildlife, Olympia, WA: Updated July 2020) last accessed on Nov. 13, 2025, at: https://wdfw.wa.gov/publications/01987/ and enclosed with Futurewise's May 8, 2025, emails with the filename: "wdfw01987.pdf." This report was peer-reviewed. *Id.* at pp. 11 – 12. *See also* Terra Rentz, Amy Windrope, Keith Folkerts, and Jeff Azerrad, technical editors, *Riparian Ecosystems, Volume 2: Management Recommendations* (A Priority Habitat and Species Document of the Washington Department of Fish and Wildlife, Olympia, WA: Dec. 2020) last accessed on Nov. 11, 2025, at: https://wdfw.wa.gov/sites/default/files/publications/01988/wdfw01988.pdf and enclosed with Futurewise's May 8, 2025, emails with the filename: "wdfw01988.pdf."

[26] Timothy Quinn, George F. Wilhere, and Kirk L. Krueger, technical editors, *Riparian Ecosystems, Volume 1: Science Synthesis and Management Implications* p. 270 (A Priority Habitat and Species Document of the Washington Department of Fish and Wildlife, Olympia, WA: Updated July 2020).

[27] *Id.* at p. 271.

[28] Kara Whittaker, PhD & Kevin Fuchs, MS, *Skagit County Riparian Buffer Evaluation* pp. 15 – 17 (Washington Department of Fish and Wildlife: July 1, 2025) enclosed in a separate email with the filename: "7-1-2025 WDFW Skagit County Riparian Buffer Evaluation – FINAL.pdf."

[29] *Whidbey Env't Action Network v. Island Cnty.*, 122 Wn. App. 156, 174–75, 93 P.3d 885, 894 (2004).

[30] National Research Council, *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future* p. 23, p. 156, p. 96, p. 102 (2012) last accessed on Nov. 13, 2025, at: https://www.nap.edu/download/13389.

[31] William and Mary Virginia Institute of Marine Science, U.S. West Coast Sea-Level Trends & Processes Trend Values for 2024 last accessed on Nov. 13, 2025, at: https://www.vims.edu/research/products/slrc/compare/west_coast/index.php.

[32] University of Washington Climate Impacts Group, *Visualization #1: Projected sea level change by year for Projected sea level change by year Lat 48.3 Long 122.4 Skagit County*, accessed on April 1, 2022, at: https://cig.uw.edu/our-work/applied-research/wcrp/sea-level-rise-data-visualization/ and enclosed with Futurewise's May 8, 2025, emails with the filename: "Projected sea level change by year Lat 48.3 Long -122.4 Skagit Cty.pdf." The methodology used for these projections is available in Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E, *Projected Sea Level Rise for Washington State – A 2018 Assessment* (A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, Oregon State University, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project: updated 07/2019) last accessed on Nov. 13, 2025, at: https://cig.uw.edu/wp-

content/uploads/sites/2/2019/07/SLR-Report-Miller-et-al-2018-updated-07_2019.pdf and enclosed with Futurewise's May 8, 2025, emails with the filename: "SLR-Report-Miller-et-al-2018-updated-07_2019.pdf."

[33] University of Washington Climate Impacts Group, *Visualization #1: Projected sea level change by year for Projected sea level change by year Lat 48.3 Long 122.4 Skagit County*.

[34] Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E, *Projected Sea Level Rise for Washington State – A 2018 Assessment* p. 6 & p. 9 of 24 (A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, Oregon State University, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project: updated 07/2019).

[35] State of Washington Department of Ecology, *Preparing for a Changing Climate Washington State's Integrated Climate Response Strategy* p. 90 (Publication No. 12-01-004: April 2012) last accessed on Nov. 13, 2025, at: https://fortress.wa.gov/ecy/publications/publications/1201004.pdf.

[36] *Id*. p. 17.

[37] Krishna Rao, *Climate Change and Housing: Will a Rising Tide Sink all Homes?* Zillow webpage (Jun. 2, 2017) last accessed on Nov. 13, 2025, at: http://www.zillow.com/research/climate-change-underwater-homes-12890/.

[38] *Id*.

[39] National Research Council, *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future* p. 135 (2012).

[40] State of Washington Department of Ecology, *Preparing for a Changing Climate Washington State's Integrated Climate Response Strategy* p. 90 (Publication No. 12-01-004: April 2012).

[41] Christopher Craft, Jonathan Clough, Jeff Ehman, Samantha Joye, Richard Park, Steve Pennings, Hongyu Guo, and Megan Machmuller, *Forecasting the effects of accelerated sea-level rise on tidal marsh ecosystem services* Front Ecol Environ 2009; 7, doi:10.1890/070219 p. *6 last accessed on May 6, 2025, at: https://www2.clark.wa.gov/files/dept/community-planning/shoreline-master-program/proposal-comments-received/futurewise-data-cd/craft-et-al-2009.pdf#page=1.00&gsr=0. Frontiers in Ecology and the Environment is a peer-reviewed scientific journal. Frontiers in Ecology and the Environment Journal Overview webpage last accessed on May 6, 2025 at: https://esajournals.onlinelibrary.wiley.com/hub/journal/15409309/aims-and-scope/read-full-aims-and-scope. Both enclosed with Futurewise's May 8, 2025, emails with the filenames: "Craft et al 2009.pdf" and "Frontiers in Ecology and the Environment - Journal Overview" respectively.

[42] Washington State Department of Ecology, *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy* p. 68 (Publication No. 12-01-004: April 2012).

[43] State of Washington Department of Ecology, *Shoreline Master Program Handbook Appendix A: Addressing Sea Level Rise in Shoreline Master Programs* pp. 3 – 4 (Publication Number 11-06-010: rev. 12/17).

[44] *Id*. p. 4.

[45] R. A. Feagin, S. M. Lozada-Bernard, T. M. Ravens, I. Möller, K. M. Yeagei, A. H. Baird and David H. Thomas, *Does Vegetation Prevent Wave Erosion of Salt Marsh Edges?* 106 Proceedings of the National Academy of Sciences of the United States of America pp. 10110-10111 (Jun. 23, 2009) last accessed on May 6, 2025, at: http://www.pnas.org/content/106/25/10109.full and in a separate email with the filename: "10109.full.pdf." This journal is peer-reviewed. *Id*. p. 10113.

[46] Enclosed with Futurewise's May 8, 2025, emails with the filenames: "Marsh Skagit Cty MHHW.pdf" and "Marsh Migration Skagit Cty 2 ft Sea Level Rise.pdf." Three maps of the same view are needed to show the three parts of the legend, so that is why there are three pages in the Marsh Migration Skagit Cty 2 ft Sea Level Rise.pdf.

[47] Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E., *Projected Sea Level Rise for Washington State – A 2018 Assessment* p. 8 of 24 (A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, Oregon State University, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project: updated 07/2019).

[48] Bo MacInnis and Jon A. Krosnick, *Climate Insights 2020: Surveying American Public Opinion on Climate Change and the Environment Report: Natural Disasters* p. 8 (Washington, DC: Resources for the Future, 2020) last accessed on Nov. 13, 2025, at: https://www.rff.org/publications/reports/climateinsights2020-natural-disasters/.

Thank you for considering our comments. If you need anything else, please contact me at 206-343-0681 or tim@futurewise.org. The referenced enclosures will be included in an additional email.

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Water Availability for Skagit Basin Landowners

Frequently asked questions

The Skagit River Instream Flow Rule (chapter 173-503 WAC) went into effect April 14, 2001. The rule established instream flows to protect flow levels in the Skagit River and its tributaries. The rule was amended in 2006 to establish 25 surface and groundwater "reservations," to allow future uninterruptible out-of-stream water uses.

On October 3, 2013, the Washington Supreme Court overturned the 2006 amendment, ruling that the Department of Ecology (Ecology) cannot establish water reservations through rulemaking where water was previously set aside to support streamflows for fish. (Swinomish Indian Tribal Community v. Department of Ecology). Without water reservations, water uses established after the adoption of the April 14, 2001 rule, including future uses, can be interrupted when dry spells impact protected streamflows.

To address current and future water resource needs, Ecology worked with local governments, Tribes, water utilities, and landowners to develop sustainable water supply solutions in limited areas of the Skagit basin.

Q: How can I find out if my property falls within the Skagit River Instream Flow Rule management area?

A: The Skagit River Instream Flow Rule applies to land within the Skagit River watershed, *excluding* the Samish River subbasin and Fidalgo Island. Refer to the map on the last page of this document, or contact Ecology staff directly.

Q: What does it mean to say a water right is "interruptible?"

A: An interruptible water right is one is junior in priority to other water rights, including instream flow levels. Since senior water rights must be satisfied first, junior rights may be limited at certain times of the year and cannot reliably be counted on for regular use.

When the Skagit River falls below the established instream flow, all water rights junior to the instream flow are subject to being turned off (interrupted) until the Skagit River meets the regulatory flow levels. The Skagit River has not met the flow levels prescribed in the rule an average of 95 days in each of the past 28 years. These low flow days are mostly concentrated in the late summer and early fall months, and are expected to increase in frequency and duration due to climate change.

Q: Does the Rule affect me if I started using water before April 14, 2001?

A: No. All water right permits, certificates, and statements of claims with priority dates earlier than April 14, 2001 – including permit-exempt water rights for wells put to use before April 14, 2001 – are senior in priority to the Skagit Instream Flow Rule. Senior water rights, for the quantity and type of use established before 2001, are not subject to the rule provisions. Changed or expanded uses developed after the rule's adoption date are likely subject to the rule provisions.

Q: I started using water after April 14, 2001, but before the October 3, 2013 Supreme Court decision. What is the status of my water supply?

A: Ecology estimates that 475 homes and 8 businesses started using water between April 14, 2001 and October 3, 2013. In recent years, Ecology adopted the Skagit River Basin Mitigation Plan, which provides a legal source of water for those who began using water during this time. Property

owners in this category should have received a Proof of Mitigated Water Supply document from Ecology as proof of a legal water source.

Q: I drilled a well before April 14, 2001, but have not used the water. Am I subject to the Instream Flow Rule?

A: Likely, yes. A water right for a permit-exempt well established under RCW 90.44.050 is established when water is first put to use. For domestic water use, Ecology generally uses the date a building permit was approved to estimate the date of first use. If you began using water after April 14, 2001, or have not yet used your well, your water use is considered to be junior in priority to the Skagit Instream Flow Rule. It is, therefore, subject to the instream flows.

Junior water users are subject to interruption when the Skagit River does not meet the instream flow levels set in the rule, unless mitigation is in place to compensate for the impacts of well pumping on stream flow levels.

Q: Can an interruptible water right be used for domestic water supply?

A: Generally, no. Domestic water supply requires a continuous supply of clean water. Department of Health officials are concerned about the reliability of water systems that use storage to save well water and then release it when the well cannot be used. The period of time a well could be interrupted is hard to predict, as stream flow levels fluctuate greatly and groundwater impacts to surface water lag several weeks after the water use. As a result, planning adequate and safe storage is challenging.

Alternative water systems, like a roof-top rainwater catchment system or a water system using trucked water, may be ways to provide sufficient water to meet domestic water needs.

Q: Will my water supply be impacted if I am served by a public water system like the Skagit Public Utility District (PUD)?

A: No. Properties served by public water systems, like the Skagit PUD, are not affected by the Skagit Instream Flow Rule. This rule applies to privately-owned groundwater wells, for water uses that were not established prior to the effective date of the rule, April 14, 2001.

Q: I am interested in mitigation. What is the process for mitigation project approval?

A: "Mitigation" means compensating for water use so that withdrawing from a well does not interfere with the instream flows. In coordination with local governments, water utilities, Tribes, and the public, Ecology adopted two mitigation programs that provide water for future domestic development in limited areas of the Skagit Watershed. These programs are limited to certain areas close to the Skagit River and near Big Lake.

To find out if a particular property may benefit from these mitigation programs, please visit Ecology's Skagit River Basin webpage at https://ecology.wa.gov/Water-Shorelines/Water-supply/Protecting-stream-flows/Instream-flow-implementation/Skagit-River-basin.

Ecology also evaluates proposals for mitigation projects submitted by individual landowners. State law requires water resource mitigation occur "in-kind," "in-time," and "in-place." This means that mitigation should offset adverse effects by releasing an equal or greater quantity of suitable water into the same water system at the same time as the adverse impact.

If you are interested in a site-specific mitigation proposal, contact Ecology staff to discuss your project. Ecology can provide mitigation guidance and identify the likely timeline for review, as well as challenges that need to be addressed in the proposal.

Q: Isn't domestic groundwater use exempt from regulation?

A: Domestic groundwater use is only exempt from needing a water right permit. Under Washington water law, permit-exempt groundwater uses are still water rights subject to the same restrictions as water right permits and certificates, including the priority system for water rights. The Supreme Court made clear in its decision[1] that all water rights established after April 14, 2001 are junior in priority to the instream flows established in the

[1] https://www.courts.wa.gov/opinions/pdf/876720.pdf

Skagit Instream Flow Rule. This is now the law of the state of Washington that Ecology is bound to follow.

Q: Why is the state concerned about domestic water use? Doesn't most of the domestic water get recharged through a septic system?

A: Although domestic water use in rural areas uses a small amount of water, the cumulative impact of many domestic water users can together impair streamflows, especially in tributaries. Hydrogeologic studies and computer models show that domestic wells impact streamflows in the Skagit Basin.

The Washington Supreme Court has ruled in several cases that, even if the impairments to regulatory streamflows are small, senior instream flows are entitled to protection from the cumulative impact of later-established users, including domestic wells. Ecology recognizes much of indoor domestic water use is recharged back to the watershed through septic systems, and takes this into consideration when calculating credit for the recharge water when developing mitigation. Domestic water used for lawns and gardens does not recharge through septic systems and is mostly lost through evaporation and lawn and plant growth.

Q: What options exist for Skagit landowners affected by the Rule?

A: Skagit basin landowners who wish to use a well but did not establish use of a well before the April 14, 2001 Skagit Instream Flow Rule, have several options they can pursue. The feasibility of the following options will vary based on location and other factors:

- Hook up to the Skagit PUD or another local public water system.
- Develop a water system through one of Ecology's Mitigation Programs mentioned above.
- Acquire and transfer a senior water right within the same basin as your proposed project.
- Develop a rainwater catchment system or obtain a trucked water supply to serve your domestic or commercial needs.
- Submit an individual mitigation proposal to Ecology.

Q: Please provide an overall context and timeline for the Skagit Rule.

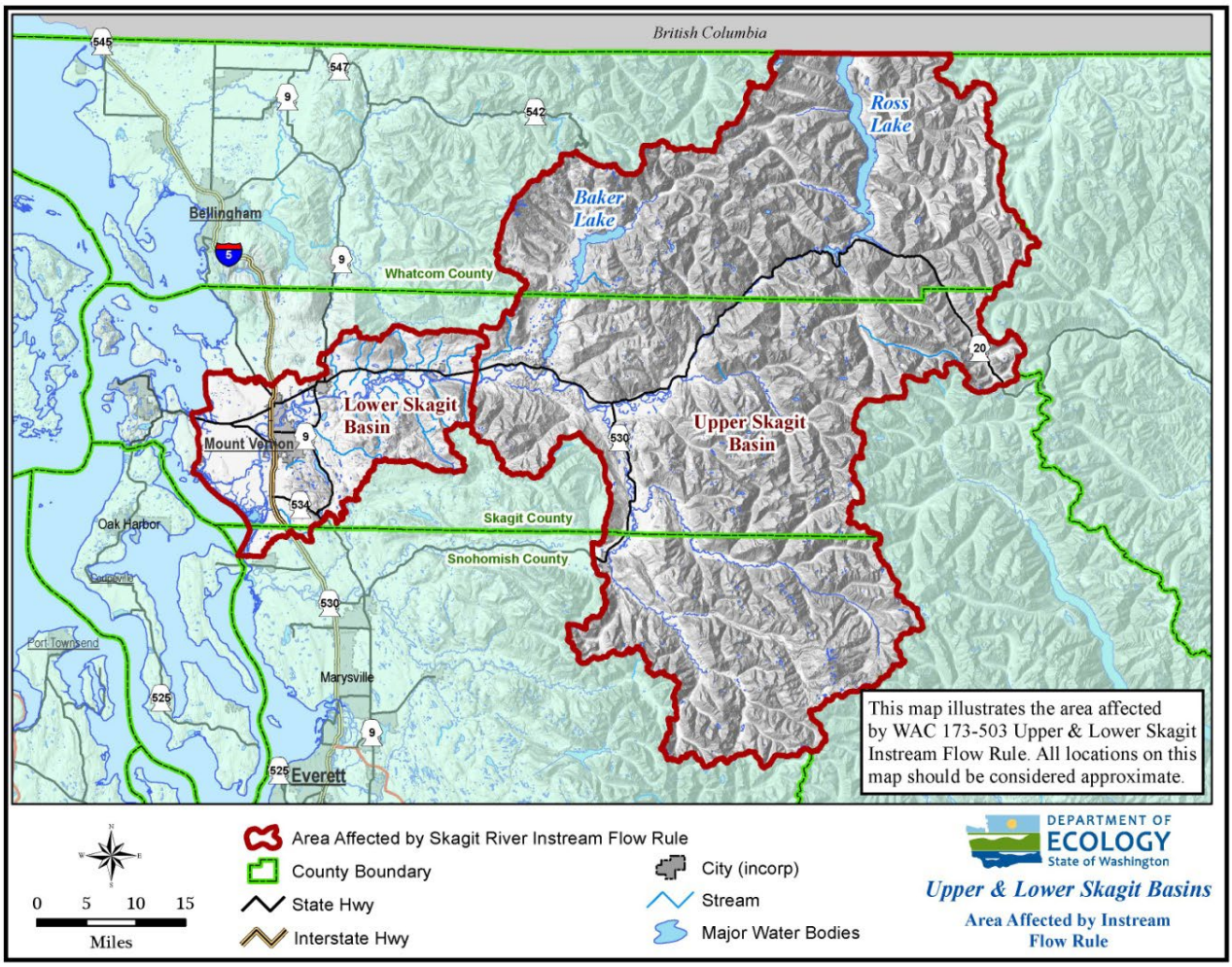
A: Water use in Washington is regulated through a permit and certificate system, with exceptions for certain uses such as domestic supply from wells. Our water law is based on "first in time, first in right," known as the prior appropriation doctrine. Under this system, water users that receive water rights first have priority over water rights established later. The priority system applies to all water rights, including permit-exempt groundwater uses.

The Skagit Instream Flow Rule was adopted in law on April 14, 2001. This rule functions like a water right for the Skagit River, with an April 14, 2001 priority date. Water uses established after April 14, 2001 are "junior" to the rule and therefore are subject to being interrupted when instream flow levels are not met.

Skagit Instream Flow Rule Timeline

- *December 1996*: Stakeholders sign Memorandum of Understanding committing to establish Skagit River instream flows.
- *April 14, 2001*: Skagit Instream Flow Rule adopted in law.
- *April 2003*: Skagit County challenges the 2001 Rule and requests Ecology to provide water supply for rural wells that could be used even when senior instream flows are not met.
- *May 2006*: Amendments to Skagit Instream Flow Rule adopted in law; reservations of water for future uses that provide uninterruptible water supply for well users throughout the watershed established.
- *June 2008*: Swinomish Tribe challenges the validity of the 2006 Rule amendments.
- *October 3, 2013*: Washington Supreme Court overturns the 2006 Skagit Instream Flow amendments.

Figure 1Upper and Lower Skagit Basins: Area affected by the instream flow rule



More detailed maps are available on-line. For specific questions, contact Ecology's Northwest Regional Office.

Related Information

- Skagit website[2]
- Skagit basin water availability[3]

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To request an ADA accommodation, contact Ecology by phone at 360-407-6872 or email at WRpubs@ecy.wa.gov, or visit https://ecology.wa.gov/accessibility. For Relay Service or TTY call 711 or 877-833-6341.

[2] https://ecology.wa.gov/water-shorelines/water-supply/protecting-stream-flows/instream-flow-implementation/skagit-river-basin
[3] https://ecology.wa.gov/Water-Shorelines/Water-supply/Protecting-stream-flows/Instream-flow-implementation/Skagit-River-basin/Water-supply

I-3.5.1 What Are Additional Protective Measures (APMs)?

Additional Protective Measures (APMs) are measures above and beyond the Minimum Requirements (MRs) that Ecology recommends for local governments to consider in their stormwater program. Ecology considers their use to be in the best interest of the general public and the environment, but will not make their implementation a requirement for manual equivalency or permit compliance.

Project proponents must check with the local jurisdiction to determine what local requirements apply beyond the Minimum Requirements (MRs) (see I-3.5.4 APM3: Local Requirements).

I-3.5.2 APM1: Financial Liability

Ecology recommends that local governments require performance bonding or other appropriate financial guarantees for all projects to ensure construction of Stormwater Management BMPs in compliance with these standards. In addition, Ecology recommends that local governments require a project applicant post a minimum two-year financial guarantee of the satisfactory performance and maintenance of any Stormwater Management BMPs that are scheduled to be assumed by the local government for operation and maintenance.

Local governments may choose to require longer performance bonds for certain project types, such as those that use the demonstrative approach (see I-1.7 Presumptive versus Demonstrative Approaches to Protecting Water Quality).

Objective

The objective of this APM is to ensure that development projects have adequate financial resources to fully implement their stormwater management requirements and that liability is not unduly incurred by local governments.

Supplemental Guidelines

The type of financial instrument required is less important than ensuring that there are adequate funds available in the event that non-compliance occurs.

I-3.5.3 APM2: Off-Site Analysis Report

Ecology recommends that local governments require development projects that discharge stormwater off-site to submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project, and proposes appropriate mitigation for those impacts. The report should also assess the amount of off-site run-on from upstream off-site areas that may affect the site design.

The initial qualitative analysis shall extend along the flow path from the project site to the receiving water, for a distance up to one mile. If the receiving water is within one-quarter mile from the

project site, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream from the project site to a point where there are no backwater effects created by the project, and the designer can determine all areas contributing run-on to the project.

The existing or potential impacts to be evaluated and mitigated should include:

- Conveyance system capacity problems;
- Localized flooding;
- Erosion, including landslide hazards and erosion along streambanks and at the outfall location;
- Violations of surface water quality standards as identified in a Basin Plan or a TMDL; or violations of groundwater quality standards in a wellhead protection area.

Objective

The objective of the off-site analysis report is to identify, evaluate, and determine measures to prevent off-site water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by a proposed project. "Aggravated" shall mean increasing the frequency of occurrence and/or severity of a problem.

Supplemental Guidelines

Some of the most common and potentially destructive impacts of land development are erosion of downgradient properties, localized flooding, and slope failures. These are caused by increased surface water volumes and changed runoff patterns. Because these problems frequently do not have a related water quality impact, Ecology is not listing off-site analysis as a Minimum Requirement. However, taking the precautions of off-site analysis could prevent substantial property damage and public safety risks.

The existing or potential impacts to be evaluated and mitigated should include the following:

- Conveyance system capacity problems
- Localized flooding
- Upland erosion impacts, including landslide hazards
- Downstream impacts to protective designations, including special resource waters, sole source aquifers, and recharge areas
- Stream channel erosion at the outfall location
- Violations of surface water quality standards as identified in a basin plan or a Total Maximum Daily Load (water cleanup plan); or violations of groundwater standards in a wellhead protection area

Projects should be required to initially submit, with the permit application, a qualitative off-site analysis report of each downstream system leaving a site. Upon review of the qualitative analysis, the local project reviewer may require that a quantitative analysis be performed. A quantitative off-site analysis report should contain the following:

1. **Define and map the study area**

   The off-site analysis report should include a map of the study area to show:

   - the study area's boundaries;
   - the study area's topography (at a minimum a USGS 1:24000 Quadrangle Topographic map);
   - the site's property lines;
   - the boundaries of proposed land disturbance;
   - the downstream flow path(s);
   - the tributary drainage areas to the downstream flow path(s); and
   - existing and/or potential problems.

2. **Review all available information on the study area**

   The designer should review, and the off-site analysis report should summarize all available basin plans, groundwater management area plans, geotechnical reports, drainage studies, floodplain/floodway FEMA maps, wetlands inventory maps, Critical Areas maps, stream habitat reports, salmon distribution reports, etc. within the study area. Contact the local jurisdiction for assistance in locating these and other relevant or historical data.

3. **Field inspect the study area**

   The designer should physically inspect the existing on- and off-site drainage systems within the study area for existing or potential problems and drainage features. An initial inspection and investigation should include:

   - Investigate problems reported or observed during the resource review;
   - Locate existing/potential constrictions or capacity deficiencies in the drainage system;
   - Identify existing/potential flooding problems;
   - Identify existing/potential overtopping, scouring, bank sloughing, or sedimentation;
   - Identify significant destruction of aquatic habitat (e.g. siltation, stream incision);
   - Collect qualitative data on features such as land use, impervious surface, topography, geological hazards, soils, and presence of streams and/or wetlands;
   - Collect information on pipe sizes, channel characteristics, and drainage structures;
   - Verify contributing drainage areas identified in the mapped study area;

- Contact the local government office with drainage review authority, neighboring property owners, and residents about drainage problems;
- Note date and weather at time of inspection.

The results of this inspection should be detailed in the off-site analysis report.

4. **Describe the drainage system, and its existing and predicted problems**

   For each drainage system component (e.g. pipe, culvert, bridges, outfalls, ponds, vaults) the following should be covered in the off-site analysis report: location, physical description, problems, and field observations.

   All existing or potential problems (e.g. ponding water, erosion) identified from the field inspection and information review should be described. The descriptions should be used to determine whether adequate mitigation can be identified, or whether a more detailed quantitative analysis is necessary. The following information should be provided for each existing or potential problem:

   - Magnitude of or damage caused by the problem
   - General frequency and duration
   - Return frequency of storm or flow when the problem occurs (may require quantitative analysis)
   - Water elevation when the problem occurs
   - Names and concerns of parties involved
   - Current mitigation of the problem
   - Possible cause of the problem
   - Whether the project is likely to aggravate the problem or create a new one.

Upon review of this analysis, the local jurisdiction may require mitigation measures to address the problems, or a quantitative analysis, depending on the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed design of the Stormwater Management BMPs.

If required, the quantitative analysis should repeat Tasks 3 and 4 (above), using quantitative field data including profiles and cross sections. The quantitative analysis should provide information on the severity and frequency of an existing problem or the likelihood of creating a new problem. It should also evaluate proposed mitigation intended to avoid aggravation of the existing problem and to avoid creation of a new problem.

Skagit County Riparian Buffer Evaluation

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Washington Department of Fish and Wildlife

July 1, 2025

Introduction

Reducing riparian canopy cover impairs ecological function and ecosystem integrity (Quinn et al. 2020). The Washington Department of Fish and Wildlife has adopted a set of science-based management recommendations for riparian buffer widths in land use planning that are intended to minimize this impairment (Rentz et al. 2020). Specifically, a lateral distance set by "site potential tree height" (SPTH) at age 200 can provide "full riparian function" (i.e., the height of the tallest mature trees defines the buffer width). Riparian functions include bank stabilization, shade, pollution removal, large wood delivery, nutrient inputs, climate mitigation, stormwater attenuation, and wildlife habitat (among others). These functions help ameliorate the impacts of upland land uses and management practices on aquatic systems.

The goal of this technical analysis is to demonstrate the spatial implications of the buffer width framework proposed by Skagit County as a part of the county's periodic update to its critical areas ordinance (CAO) under Washington State's Growth Management Act. We evaluated three alternative buffer scenarios: the site potential tree height at age 200 (SPTH), the current Skagit County proposed amendments (SKA2025), and the current Skagit County buffer requirements (SKA2006, Table 1). Within each of these three scenarios we report the raw acreages as well as the area of past riparian tree loss and existing riparian forest using land cover change detection data and land cover, respectively. We also examine these forest cover metrics across different stream types and land use designations.

Our focus is on relevant relative differences at the scale of countywide jurisdiction, not site-scale geospatial precision. This analysis was scripted from publicly available datasets released by Skagit County and other state and federal agencies, emphasizing transparency and reproducibility. While this is not a regulatory document and should not be read or interpreted as bearing on any particular parcel land use considerations, it does provide a new source of best available science for the county to include in its CAO update.[3] While type S waterbodies, by definition, fall within shoreline jurisdiction, they are currently covered under the county's CAO until its Shoreline Master Program update is complete.

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Methods

The analysis area of interest was where the county's stream buffers apply. We defined this as the county's jurisdictional area by excluding tribal, federal, state, and other non-county land use regimes (Figure 1) from further analysis. We also used the zoning designations in the Skagit County "Comprehensive Plan and Zoning Districts" GIS dataset to further constrain the analysis to the relevant jurisdictional area.[4] Specifically, "Incorporated Areas," "Secondary Forest," "Industrial Forest," and "Public Open Space of Regional/Statewide Importance" were excluded.

Table 1. Areas and parameters of the three riparian buffer width scenarios evaluated. Two scenarios (SKA2006 and SKA2025) were based on stream type, and one scenario was based on site potential tree height at age 200 (SPTH).

Buffer Scenario	Acres	Percent SPTH	Type S Width	Type F Width	Type Np/Ns Width
SKA2006	20,993	75.78%	200	150	50
SKA2025	22,823	82.39%	200	150	100
SPTH	27,701	100.00%	Site potential tree height		

The DNR Watercourses[5] and Water Bodies[6] datasets were used as the primary hydrography for this analysis because they are used by the county. Water types S (Shorelines of the State), F (Fish Habitat), and N (Non-fish Habitat) were included. Type U (Unknown) was treated as type N, and type X (Non-typed) was excluded. Because the scope of this analysis is limited to stream buffers and not lakes or wetlands, only water bodies labeled as stream were included, and watercourse streamlines within lakes and channel migration zones (i.e., around riverine islands) were removed. Watercourse ditches were also excluded. To further refine the accuracy of the mapped river boundaries, the Extent of Observed Water polygons from WDFW's Riparian Management Zone dataset[7] were incorporated wherever they overlapped the selected DNR water bodies, and the DNR water type attribute was transferred to them.

[4] https://www.skagitcounty.net/Departments/GIS/Digital/compplan.htm

[5] https://data-wadnr.opendata.arcgis.com/datasets/wadnr::dnr-hydrography-watercourses-forest-practices-regulation/about

[6] https://data-wadnr.opendata.arcgis.com/datasets/wadnr::dnr-hydrography-water-bodies-forest-practices-regulation/about

[7] https://fortress.wa.gov/dfw/public/PublicDownload/Habitat/PHSRMZInformation/index.htm

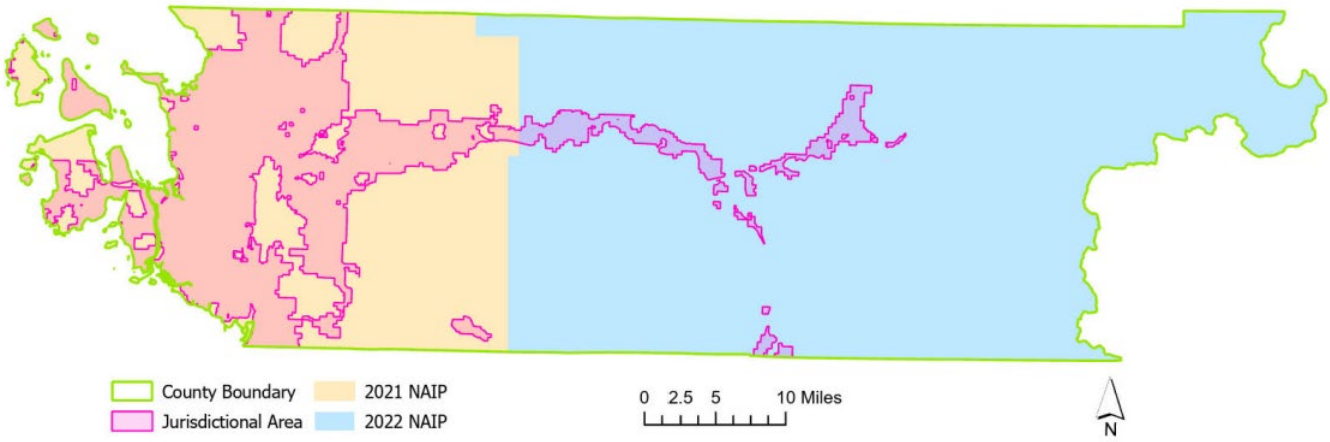

Figure 1. Most of the county's jurisdictional area (pink) is covered by 2021 National Agriculture Imagery Program (NAIP) imagery[8] (tan), but some was not flown until 2022 (blue). These are also the dates of the Ecopia land cover dataset.

We generated buffers for SKA2006 and SKA2025 based on DNR water type according to the widths in Table 1. For the SPTH scenario, we intersected WDFW's 200-year SPTH dataset[7] with the DNR hydrography to generate the buffer widths and applied a minimum 100-foot width where the SPTH was less than 100 or missing data, consistent with WDFW recommendations (stream length-weighted mean = 175 feet; stream length-weighted median = 204 feet). For each scenario, buffers were dissolved by water type, erased from within water bodies, and clipped to the jurisdictional area. In terms of the raw acreage, the SKA2006 buffers captured >75% of the area of SPTH buffers, and the SKA2025 buffers captured ~82% of the area of SPTH buffers (Table 1).

We then intersected the buffers with the comprehensive plan zoning dataset after filling gaps in the non-zone areas along rivers with the closest zone (i.e., where buffers meandered). We used the same four comprehensive plan zoning designation categories of "Natural Resource Lands," "Rural Lands," "Commercial/Industrial Lands," and "Urban Growth Areas (UGA)"; ("Public Open Space of Regional/Statewide Importance" was excluded).[9] Within "Natural Resource Lands" we only included "Agricultural" in this analysis for comparison purposes acknowledging the county's participation in the Voluntary Stewardship Program (VSP) as an alternative to regulation under the CAO. An additional "no-data" category represents a trace amount of acreage and was not shown in results.

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[8] https://naip-usdaonline.hub.arcgis.com/

[9] https://www.skagitcounty.net/PlanningAndPermit/Documents/CompPlan2016/comp-plan-2016-adopted-text-only.pdf (see Table 1)

Next, we evaluated land cover data within the buffer scenario features as an indicator of riparian function (Figure 2). First, we estimated past riparian tree loss from the WDFW High Resolution Change Detection (HRCD) dataset.[10] Then, we estimated existing riparian forest from the Ecopia high resolution land cover vector dataset (the most recent data available).[11] As a result, each feature contains information about the type and acres of land cover change that occurred within two- or three-year intervals between 2006 and 2019 (HRCD) and the total number of acres by land cover class in 2021-2022 (Ecopia).

HRCD data exists for the full jurisdictional area for the timeframe of 2006-2019 (Figure 2). Because HRCD changes are detected using NAIP imagery, data are available for the six intervals of 2006-2009, 2009-2011, 2011-2013, 2013-2015, 2015-2017, and 2017-2019. Land cover change acres were calculated by multiplying the change percentage for a polygon by the acres of that polygon that fall within the given buffer. Annualized change acres were calculated for each interval by dividing the total change acres by three for the 2006-2009 interval or by two for the other intervals. HRCD records tree loss, impervious surface increase, semipervious surface increase, and total change, and assigns a change agent attribute to each change. We limited our evaluation to human caused, or anthropogenic, change agents which include "Development," "Forestry," "Other Anthropogenic," "Redevelopment," "Retention Pond," and "Tree Removal" and did not evaluate the natural change agents ("Stream" and "Other Natural"). Because we excluded forestry-related land use categories from the county's jurisdiction area, we assume the land cover change our analysis attributed to Forestry was for tree harvest permitted under the CAO (i.e., conversion to development) as opposed to tree harvest permitted under the Forest Practices Rules (Class III, non-conversion).

Please note that HRCD data are an estimate, not an exact measurement, of land cover change. While analyst review of predicted change polygons eliminates commission error, some changes are missed; therefore, change acres predicted by HRCD can be considered an approximate *lower* bound estimate of the true acres of change. There also may be spatial uncertainty about the exact location of a change whenever less than 100% of a polygon has changed.[12]

The Ecopia land cover dataset includes two forest classes: "forest," which is a more conservative (lower) estimate of the ground area occupied by forest and "forest_canopy_overlap," which includes the area mapped as "forest" plus areas where the tree canopy overlaps other land classes such as "grass" or "pavement." Both are included in this report because they provide a range for assessing riparian ecological functions. The Ecopia dataset was created using NAIP imagery, which for this jurisdictional area was flown mostly in 2021, but there is a portion (~12%) in the eastern part of the area that was not flown until 2022 (Figure 1).

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[10] https://hrcd-wdfw.hub.arcgis.com

[11] https://www.ecopiatech.com/products/3d-nationwide-landcover

[12] https://hrcd-wdfw.hub.arcgis.com/pages/tutorials

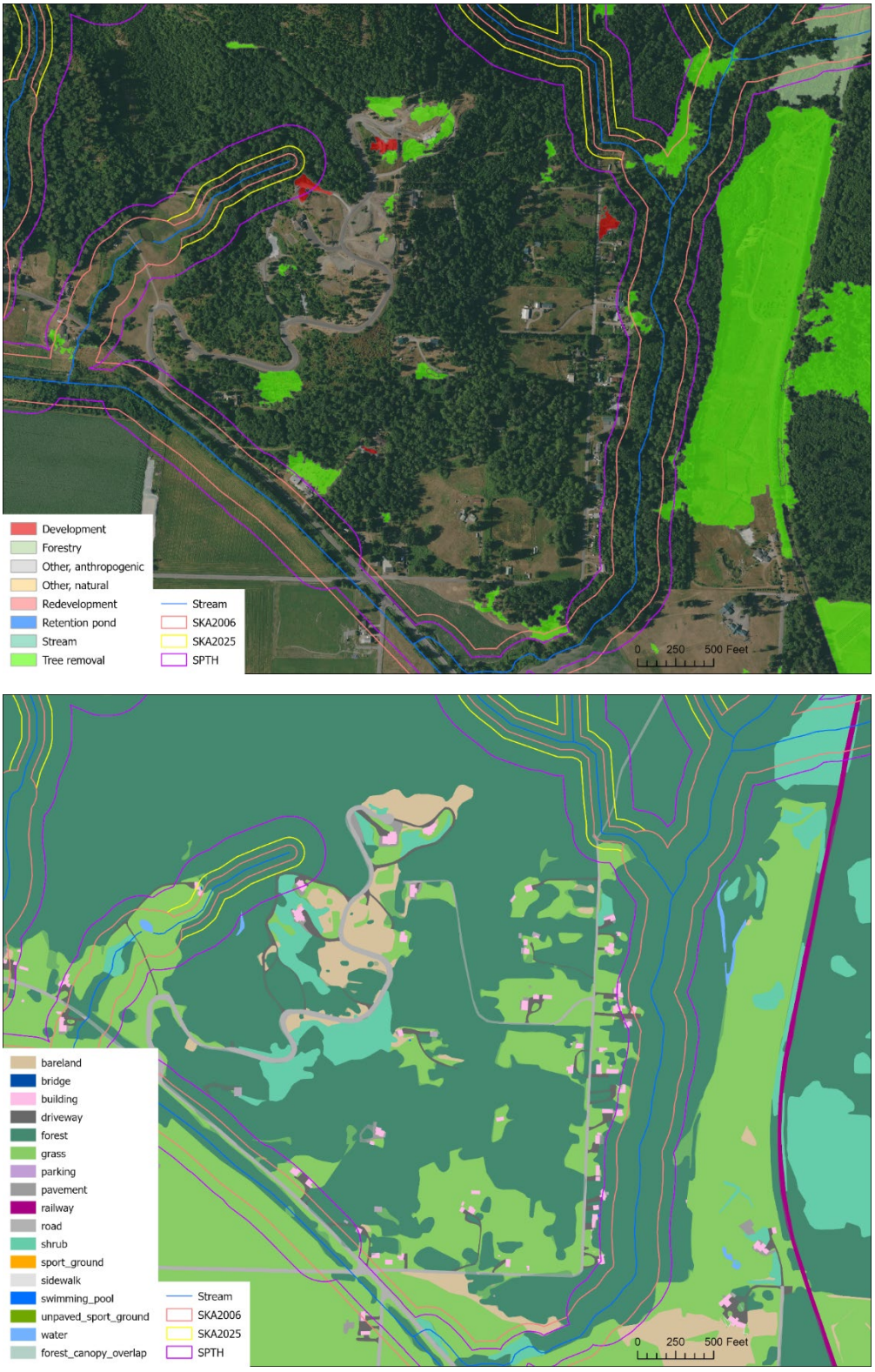

Figure 2. The three fully dissolved buffer scenarios shown with the 2006-2019 HRCD dataset (top) and the 2021-2022 Ecopia land cover classes (bottom) in the Rural Lands land use category. SKA2006 is the same as (i.e., lines overlap) SKA2025 for stream types F & S.

Results

Past Riparian Tree Loss

Most riparian tree loss in the riparian buffer scenarios was due to Tree Removal and Forestry, which both fall in the anthropogenic category (Figure 3). "Tree Removal" is a catch-all for any trees that are removed by humans but that are not part of forestry operations or development/redevelopment and often includes small-scale clearing of land on established properties. A lesser amount of tree loss also occurred due to stream movement, but this along with Other Natural were not included in sums of anthropogenic tree loss.

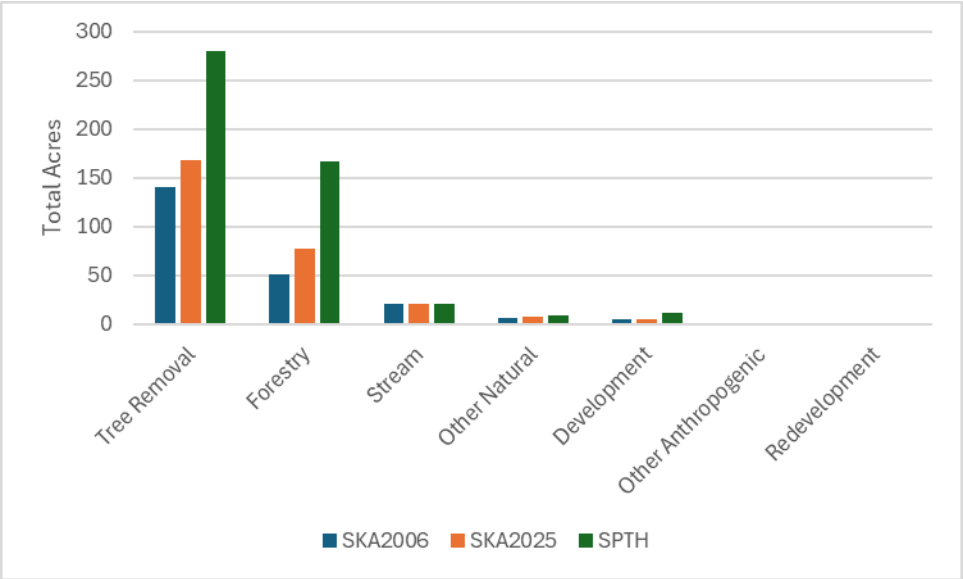

Figure 3. Total acres of riparian tree loss by change agent from 2006 to 2019.

The area and rate of anthropogenic tree loss between 2006 and 2019 was greater in wider buffer scenarios (Table 2). This pattern may be due to the buffer rules in place during this time period that only protected areas closest to streams (SKA2006 buffers). SPTH buffers had the greatest loss of forest (460 acres), and SKA2006 buffers had the least loss of forest (197 acres). Similarly, SPTH buffers had the greatest rate of forest loss (35 acres/year), and SKA2006 buffers had the lowest rate of forest loss (15 acres/year).

Table 2. Acres of anthropogenic riparian tree loss between 2006 and 2019 and percent of the buffer affected by that loss, across all water types and land use categories. Total acres are the sum across the 13-year timespan, and annualized acres are the per-year averages.

Buffer Scenario	Total Acres	Total Tree Loss Acres	Total Tree Loss Percent	Annualized Tree Loss Acres	Annualized Tree Loss Percent
SKA2006	20,993	197	0.94%	15	0.07%
SKA2025	22,823	252	1.10%	19	0.08%
SPTH	27,701	460	1.66%	35	0.13%

Anthropogenic tree loss occurred at variable rates over time within all buffer scenarios (Figure 4). The county's CAO (SCC 14.24) was last updated in 2006, coinciding with the year of the earliest available HRCD data, so there were no changes in the CAO's riparian buffer widths (SKA2006) during this period of analysis. The area of anthropogenic tree loss per year in the buffer scenarios declined sharply between 2009/2011 and 2011/2013 and then rebounded partially between 2011/2013 and beyond. Outside of SKA2006, the wider the buffer scenario, the greater the area of anthropogenic tree loss per year.

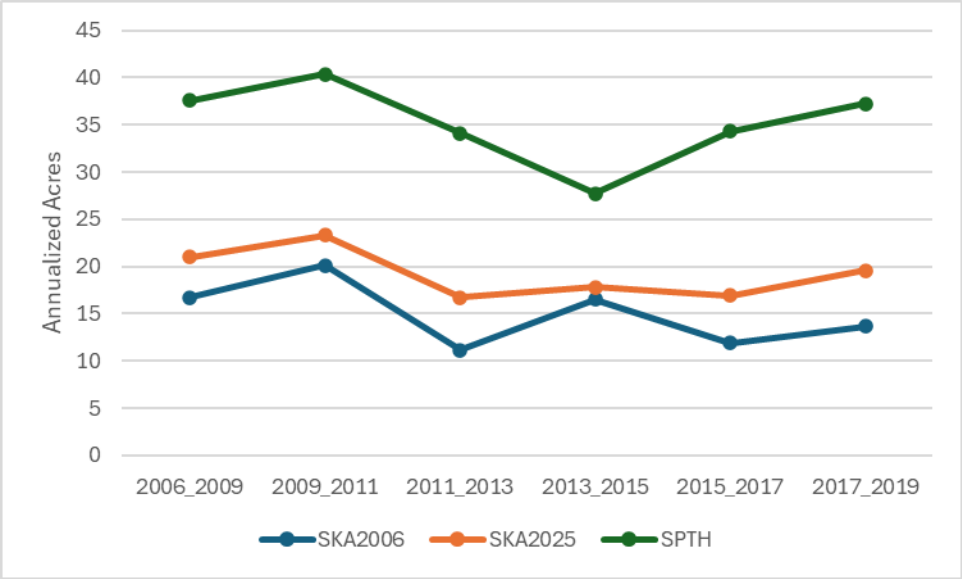

Figure 4. Annualized acres of anthropogenic tree loss for each HRCD interval.

Across *water types*, the average annual riparian tree loss by *percentage* of buffer area was lowest for shorelines (type S) and highest for non-fish bearing (type N) streams (Figure 5). The percent loss was greatest for SPTH buffers across all water types. Non-fish bearing stream

buffers showed substantially higher rates of tree loss than fish bearing (type S and F) stream buffers across all buffer scenarios. When interpreting any *percent*-based results, please note that they can be misleading without also considering the associated raw values, in this case, the *acres* of tree loss.

The average annual *acres* of tree loss in riparian buffers by *water type* was lowest for type S across all buffer scenarios (Figure 6). The acres of tree loss per year was considerably higher for types F and N streams, especially within SPTH buffers. The highest rates of anthropogenic riparian tree loss occurred within SPTH buffers of type N streams at more than 19 acres per year (Table 3).

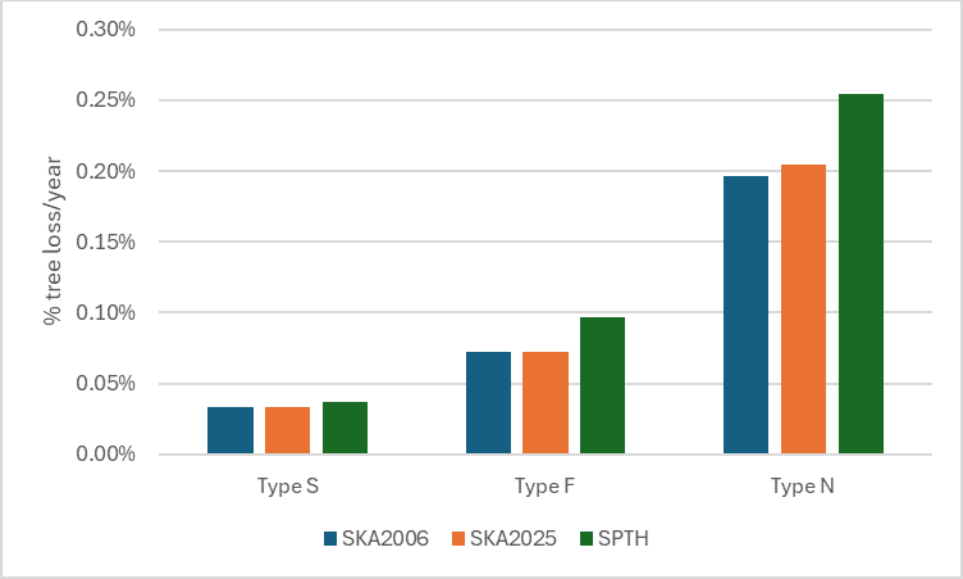

Figure 5. Average annual anthropogenic tree loss as a percentage of buffer area between 2006 and 2019 by water type and riparian buffer scenario.

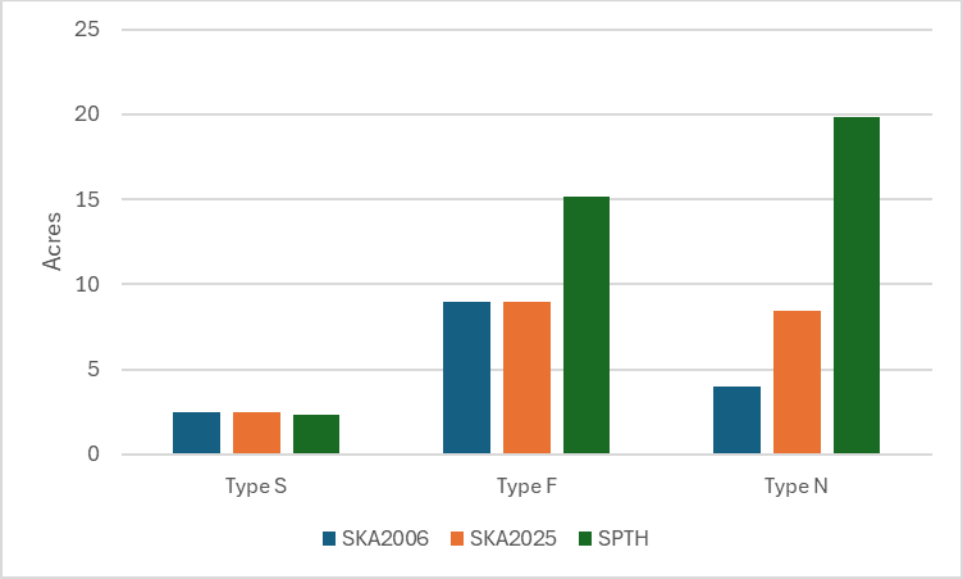

Figure 6. Average annual acres of anthropogenic tree loss between 2006 and 2019 by water type and riparian buffer scenario.

The average annual riparian tree loss by *percentage* of buffer area and *land use category* was lowest within UGA, intermediate within Agricultural and Commercial/Industrial Lands, and highest within Rural Lands (Figure 7). Within each land use category except UGA, the percent tree loss per year increased with buffer scenario width.

Similarly, the average annual *acres* of riparian tree loss in buffers by *land use category* was highest in Rural Lands followed closely by Agricultural Lands (Figure 8). Within these two land use categories, the annual acres of tree loss increased with stream buffer scenario width, with Rural Lands losing >19 acres of riparian trees per year and Agricultural Lands losing ~17 acres of riparian trees per year (Table 3).

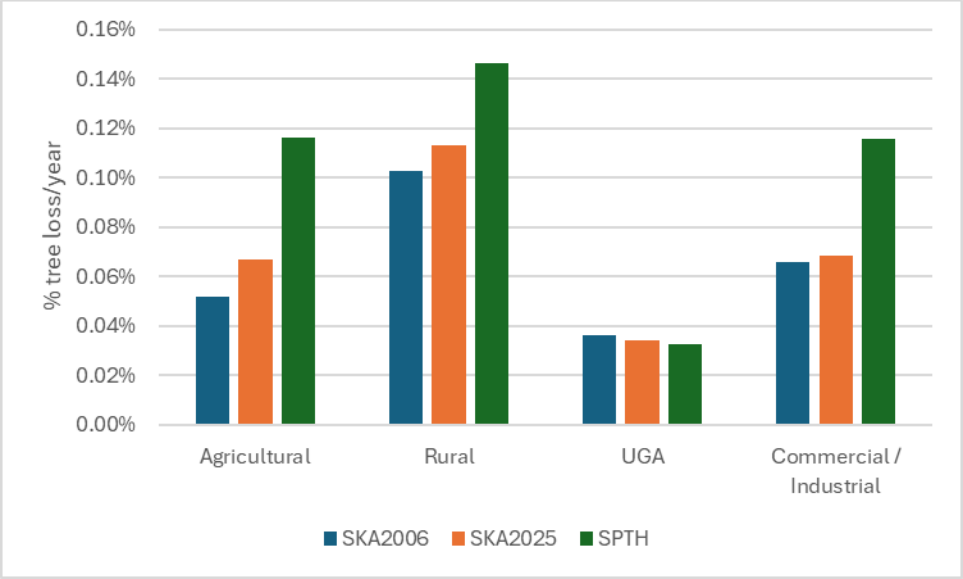

Figure 7. Average annual anthropogenic riparian tree loss as a percentage of buffer area between 2006 and 2019 by land use category and buffer scenario.

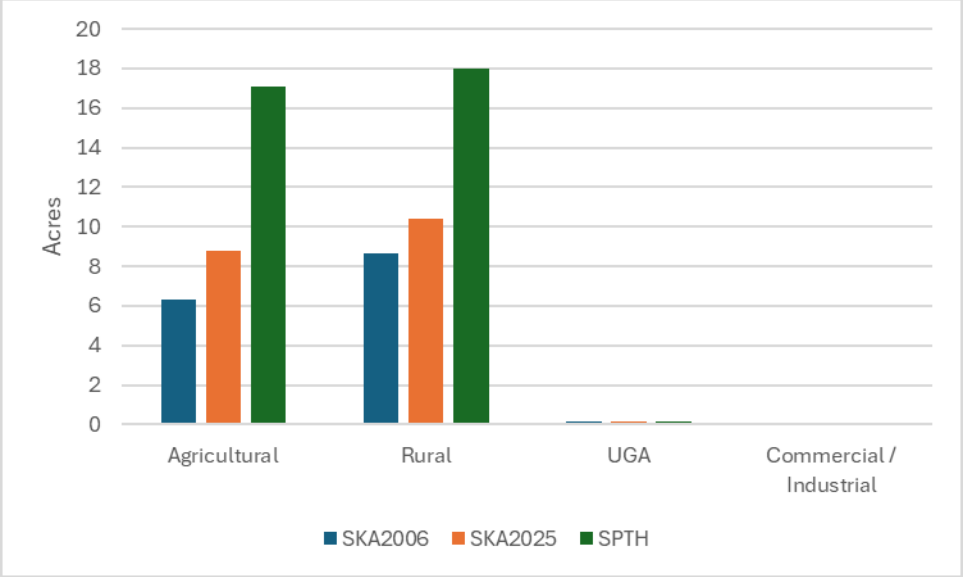

Figure 8. Average annual acres of anthropogenic riparian tree loss between 2006 and 2019 by land use category and buffer scenario.

Among stream types *and* land use categories, SPTH buffers on type N streams in Agriculture had the highest tree loss *proportionally* (0.29%/year) and the highest total *area* of tree loss at ~11 acres/year (Table 3). SPTH buffers of type F streams in Rural Lands showed the next highest rate of tree loss at ~9 acres/year.

Table 3. Average annual acres of anthropogenic riparian tree loss between 2006 and 2019 by water type and zoning category.

	SKA2006		SKA2025		SPTH	
	Tree Loss Acres	Tree Loss Percent	Tree Loss Acres	Tree Loss Percent	Tree Loss Acres	Tree Loss Percent
Type S						
Agricultural	1.31	0.03%	1.31	0.03%	0.97	0.02%
Rural	1.15	0.05%	1.15	0.05%	1.31	0.06%
UGA	0.03	0.13%	0.03	0.13%	0.03	0.11%
Commercial/Industrial	0.00	0.00%	0.00	0.00%	0.00	0.03%
Type F						
Agricultural	2.92	0.04%	2.92	0.04%	5.47	0.07%
Rural	5.88	0.11%	5.88	0.11%	9.40	0.13%
UGA	0.11	0.03%	0.11	0.03%	0.17	0.03%
Commercial/Industrial	0.04	0.10%	0.04	0.10%	0.09	0.14%
Type N						
Agricultural	2.12	0.19%	4.64	0.20%	11.04	0.29%
Rural	1.84	0.21%	3.78	0.21%	8.79	0.23%
UGA	0.00	0.00%	0.00	0.00%	0.00	0.00%
Commercial/Industrial	0.00	0.10%	0.01	0.10%	0.02	0.08%

Existing Riparian Forest

More than half of the area in each of the riparian buffer scenarios was forested in 2021-2022 (Table 4). On average the "forest_canopy_overlap" class covers 2.5% more buffer acreage than the "forest" class. The difference between the most forested buffer scenario (SPTH) and the least forested buffer scenario (SKA2006) was 4,074 acres of forest or 4,221 acres of forest canopy. For simplicity, we report only the "forest" class for the remainder of this report.

Table 4. Acres of forest and percent of the buffer that is forested for the three buffer scenarios across all water types and land uses.

Buffer Scenario	Total Acres	Forest Acres	Forest Canopy Overlap Acres	Forest Percent	Forest Canopy Overlap Percent
SKA2006	20,993	11,950	12,486	56.92%	59.48%
SKA2025	22,823	12,851	13,418	56.31%	58.79%
SPTH	27,701	16,024	16,707	57.85%	60.31%

Among *stream types*, type N buffers have the least *percent* of existing riparian forest (Figure 9). The SPTH buffer scenario has the highest percentage of forest on type S streams. When

interpreting any *percent*-based results, please note that they can be misleading without also considering the associated raw values, in this case, the *acres* of riparian forest.

Among *stream types* and by *acres*, type F riparian buffers have considerably greater forested area than the other stream types under all buffer scenarios (Figure 10). SPTH buffers have the most acres of existing forest for type F streams (9,092 ac), and SKA2006 buffers have the least acres of existing forest for type N streams (1,077 ac; Table 5). There is a notable difference (6,247 acres) in the area of riparian forest between type F and type N buffers under SKA2006.

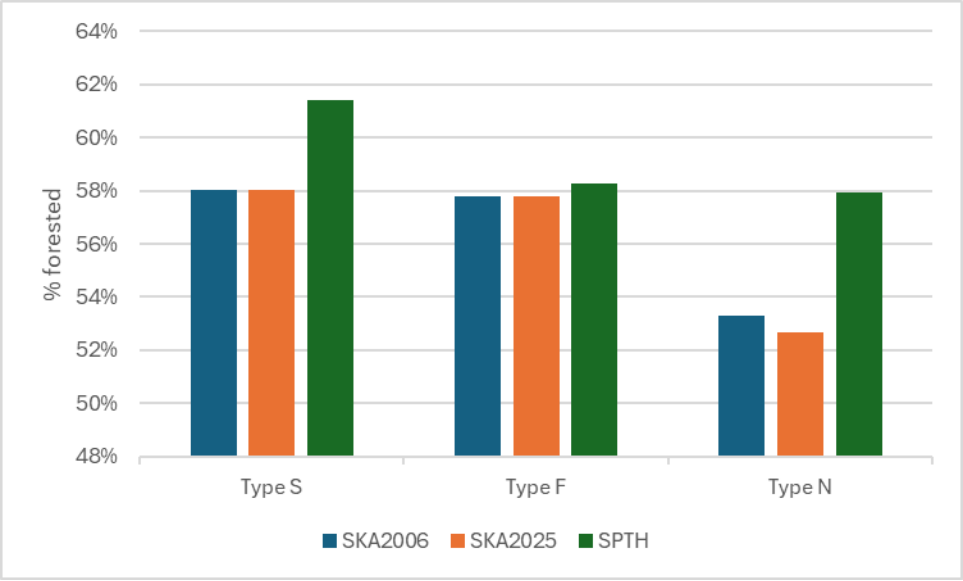

Figure 9. Percent of riparian buffer that is forested ("forest" class) by water type and buffer scenario.

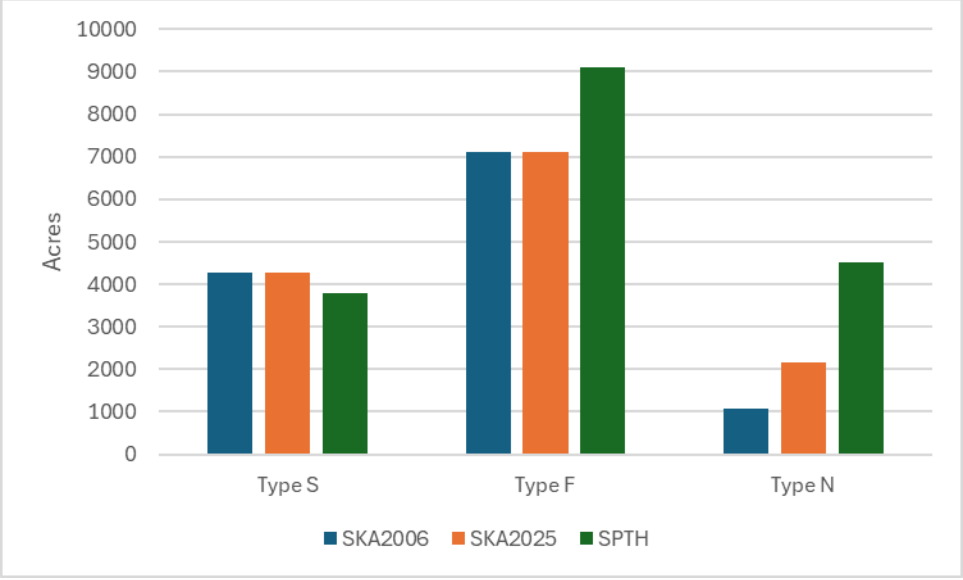

Figure 10. Acres of forest ("forest" class) by water type and buffer scenario.

Among *land use categories*, riparian buffers in Agriculture have the lowest *percent* forest, and Rural Lands have the highest percent forest (Figure 11). The percent of existing riparian forest is roughly equal among buffer scenarios except for SPTH buffers in the commercial/industrial land use category.

Among *land use categories,* the existing *acres* of riparian forest was highest in Rural Lands followed closely by Agricultural Lands (Figure 12). Within these two land use categories, the acres of riparian forest increased with stream buffer scenario width, with Rural Lands having 9,413 acres of riparian forest and Agricultural Lands having 7,599 acres of riparian forest under the SPTH buffer scenario (Table 5). The total acres of existing riparian forest varies the most within Rural Lands, from 6,358 acres in SKA2006 buffers to 9,413 acres in SPTH buffers, a 3,055 acre difference in riparian function (across all stream types).

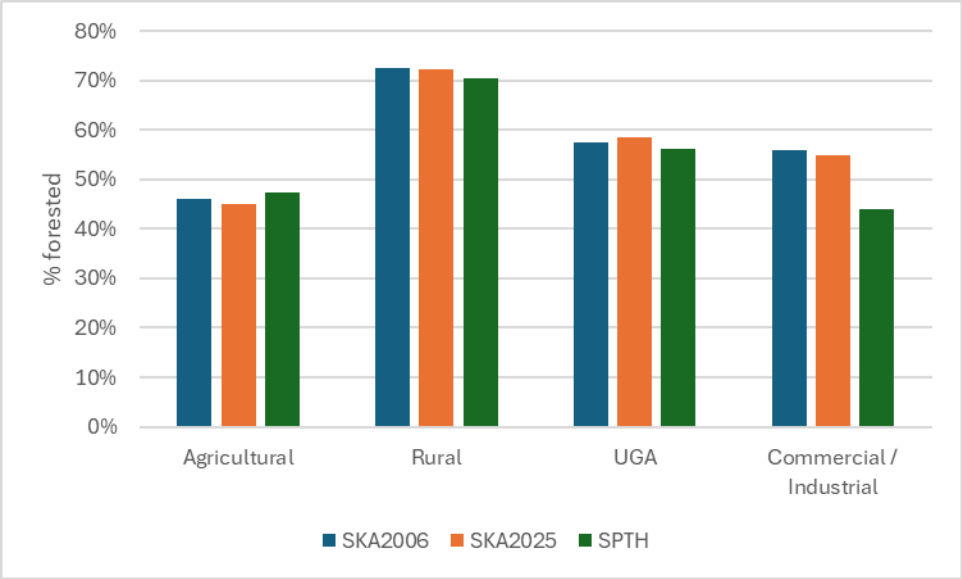

Figure 11. Percent of buffer that is forested ("forest" class) by land use category and buffer scenario.

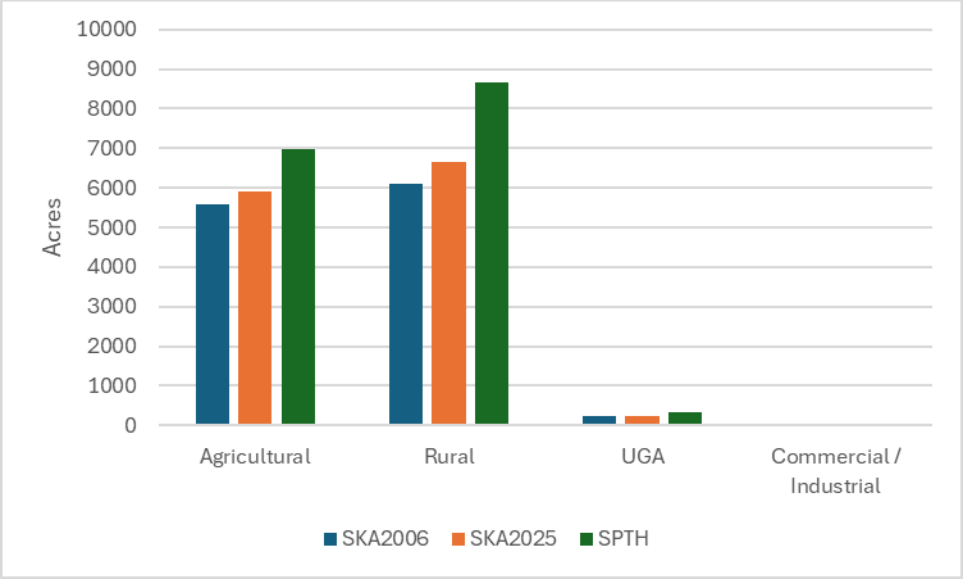

Figure 12. Acres of forest ("forest" class) by land use category and buffer scenario.

Among all combinations of stream type *and* land use, the percent of existing riparian forest ranges widely from 19% for type S SPTH buffers in UGA to >79% for type N SKA2006 buffers in UGA (Table 5). However, both of these combinations have far fewer forested acres than most other combinations. The highest single combination was in SPTH buffers on type F streams in Rural Lands (5,033 acres), and the second highest combination was in SKA 2006 and SKA2025 buffers on type F streams in Rural Lands (3,832 acres).

Table 5. Forested acres and percent of buffer that is forested ("forest" class) by water type and land use category.

	SKA2006		SKA2025		SPTH	
	Forest Acres	Forest Percent	Forest Acres	Forest Percent	Forest Acres	Forest Percent
Type S						
Agricultural	2,380	49.11%	2,380	49.11%	2,083	53.25%
Rural	1,883	75.53%	1,883	75.53%	1,695	76.13%
UGA	5	19.84%	5	19.84%	5	19.52%
Commercial/Industrial	22	79.09%	22	79.09%	13	76.10%
Type F						
Agricultural	3,066	46.77%	3,066	46.77%	3,775	47.88%
Rural	3,832	71.30%	3,832	71.30%	5,033	70.08%
UGA	207	58.66%	207	58.66%	260	54.72%
Commercial/Industrial	19	43.44%	19	43.44%	24	36.72%
Type N						
Agricultural	413	37.02%	833	36.82%	1,741	45.79%
Rural	643	73.47%	1,297	71.83%	2,685	69.56%
UGA	19	79.75%	40	77.50%	85	73.11%
Commercial/Industrial	2	40.19%	3	38.30%	7	35.81%

Discussion

Past Riparian Tree Loss

We evaluated past trends in riparian tree cover as potential indicators of future trends in riparian tree cover in Skagit County with a focus on anthropogenic/human causes of change. The county's current riparian buffer regulations (SKA2006) date back to at least 2006, roughly equal to the earliest HRCD Change Detection data available to analyze. Between 2006 and 2019, we found SPTH buffers had 2.34 times the area of loss and 1.77 times the rate of loss of riparian forest than SKA2006 buffers. While these patterns are not unexpected based on the regulatory buffer protections in place during this period that only protected areas closest to streams (SKA2006), they also illustrate the full extent and range of loss of riparian function within the county's jurisdiction over this 13-year period (SPTH) under this regulatory framework.

Comparing trends among *stream types*, the average annual acres of riparian tree loss per year was considerably higher for types F and N streams (compared with type S streams), with the highest rates of loss within SPTH buffers of type N streams (>19 acres per year). Across *land use categories,* the average annual acres of riparian tree loss was highest in Rural Lands (>19 acres/year) followed by Agricultural Lands (~17 acres/year). Among stream types *and* land use categories, SPTH buffers on type N streams in Agriculture had the highest rate and area of riparian tree loss (~11 acres/year), and SPTH buffers of type F streams in Rural Lands showed

the next highest rate of tree riparian tree loss (~9 acres/year). These findings underscore the important role the county's CAO can play in minimizing future losses of riparian forest within lands with Rural land use designations. These findings also illustrate the important role the county's VSP workplan implementation plays in minimizing future losses of riparian forest within Agricultural Lands.

Existing Riparian Forest

We estimated the area of existing riparian forest within the county's jurisdictional area to illustrate the extent of riparian function that may be at risk of loss under different buffer scenarios. There was >4,000-acre difference between the most forested buffer scenario (SPTH) and the least forested buffer scenario (SKA2006), and SKA2025 buffers have an intermediate amount of riparian forest. Type F buffers have considerably more riparian forest than the other stream types under all buffer scenarios, with the most existing forest occurring within SPTH buffers. The sizeable difference (>6,000 acres) in the area of riparian forest between type F and type N buffers under SKA2006 likely reflects their relative levels of protection under the CAO since at least 2006.

Among *land use categories*, the most riparian forest exists on Rural Lands and Agricultural Lands under the SPTH buffer scenario. Similarly, the two highest combinations of stream type *and* land use were in SPTH buffers on type F streams in Rural Lands and Agricultural Lands. Within Rural Lands, there is a >3,000-acre difference in the area of riparian forest between SKA2006 buffers and SPTH buffers (across all stream types).

Conclusions

This analysis examined the extents of past riparian tree losses and existing riparian forest between alternative buffer scenarios, with past trends serving as potential indicators of future risks to existing riparian functions. We found the greatest riparian tree losses occurred in type F stream buffers within Rural Lands and type N streams within Agricultural Lands. We also found that type F stream buffers in Rural Lands have the most existing acres of riparian forest, especially in the SPTH buffer scenario. We estimate a total of ~4,000 acres of existing forest providing riparian functions within SPTH buffers could be at risk of loss if the county's future CAO retains SKA2006 buffers. Most (~3,000 acres) of this existing riparian function occurs on lands with Rural land use designations.

The county is responsible for achieving no net loss of critical area functions and values, including within its Fish and Wildlife Habitat Conservation Areas.[13] The results presented here document consistent losses of riparian function both within the regulated buffers (SKA2006)

[13] WAC 365-196-830(4)

and outside of them (SPTH) as well as key opportunities for the county to better protect riparian functions in greater alignment with best available science. As land use pressures continue to grow, the health and resilience of the county's rivers and streams and communities will depend in part on the extent that riparian forest is protected and restored now and into the future.

Appendix

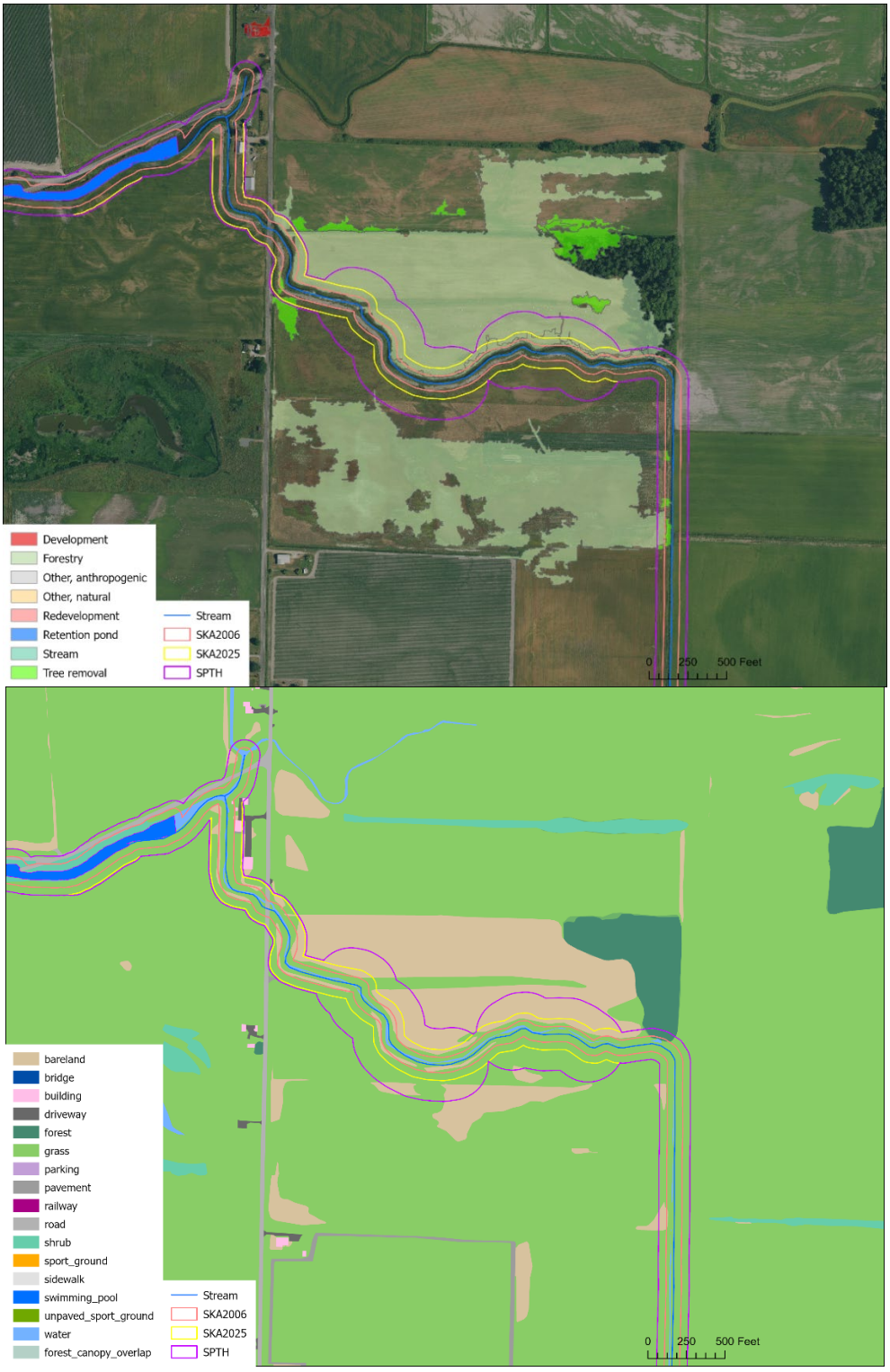

Figure 13. Agricultural land use category: the three fully dissolved buffer scenarios shown with the 2006-2019 HRCD dataset (top) and the 2021-2022 Ecopia land cover classes (bottom). SKA2006 is the same as (i.e., lines overlap) SKA2025 for stream types F & S.

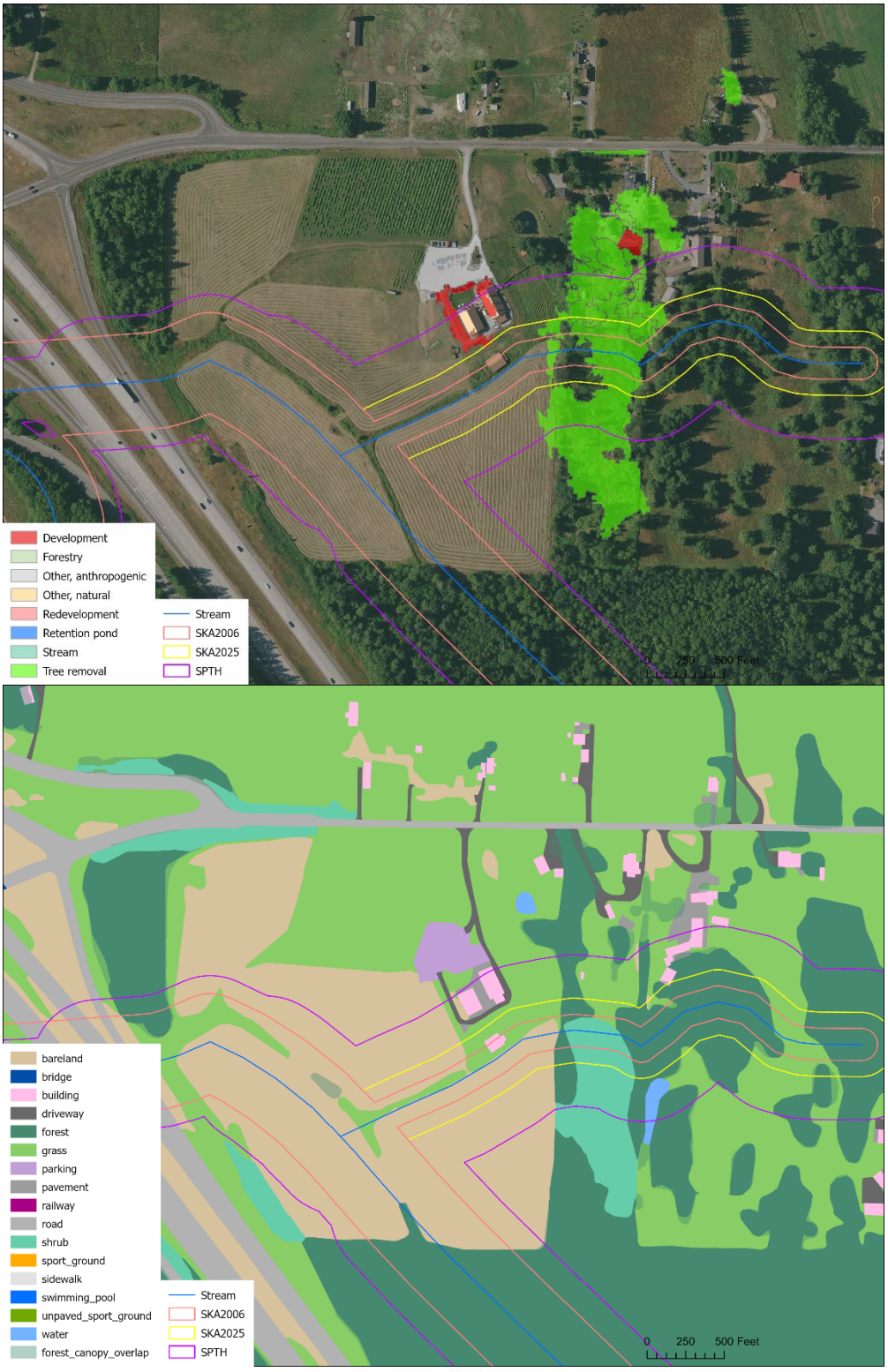

Figure 14. Commercial/Industrial land use category: the three fully dissolved buffer scenarios shown with the 2006-2019 HRCD dataset (top) and the 2021-2022 Ecopia land cover classes (bottom). SKA2006 is the same as (i.e., lines overlap) SKA2025 for stream types F & S.

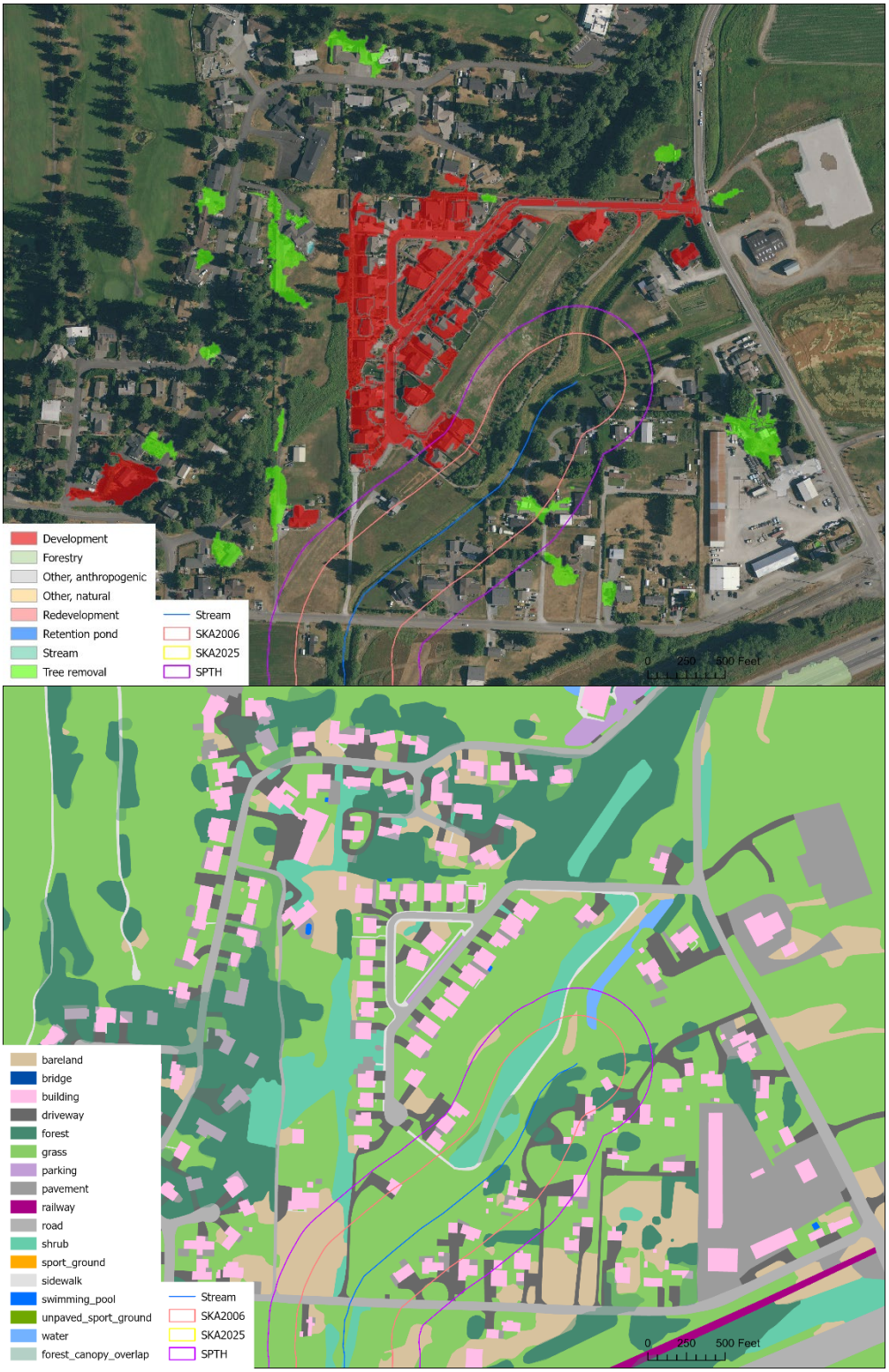

Figure 15. UGA land use category: the three fully dissolved buffer scenarios shown with the 2006-2019 HRCD dataset (top) and the 2021-2022 Ecopia land cover classes (bottom). SKA2006 is the same as (i.e., lines overlap) SKA2025 for stream types F & S.

Comment #16

Robby Eckroth

From: Mark Ammons <markammons33@gmail.com>
Sent: Friday, November 14, 2025 5:30 AM
To: PDS comments
Subject: Skagit County 2025 criical areas ordinance update

Please update the critical areas ordinance to the state recommended standard to the 1(one) mile standard.
In the best interest of the public that you represent and have the obligation to serve as you are public servants not employees of moneyed interests.
Ecology department recommends that local governments require development projects to submit off site analysis report that assess the off site water report.
This is not tool to stop development just a system to assure that an unscrupulous company that is more interested in higher profits than the well-being of their less financially fortunate neighbors.
Which seems to me to be the main function of the local governments.

Skagit Audubon Society
P.O. Box 1101
Mount Vernon, WA 98273

November 14, 2025

Planning and Development Services
Comments on "Third Draft, 2025 Development Regulations and Critical Areas Ordinance Update"
1800 Continental Place
Mount Vernon WA 98273

Dear Skagit County Commissioners, Planning Commission, and Planning & Development Services Staff:

We appreciate the opportunity to comment on the third draft of the updated Skagit County Critical Areas Ordinance (CAO). The following comments are on behalf of the 487 members of Skagit Audubon Society, the National Audubon chapter focused on Skagit County. Skagit Audubon's members share an interest in protecting birds and other wildlife and preserving and restoring wildlife habitat. All Skagit Audubon members appreciate that our county's natural and managed landscapes support numerous bird species and, in many cases, significant numbers of these species. This abundance attracts people to visit or live in Skagit County. Our organization is dedicated to preserving and enhancing what is best about our home in this regard. We appreciate Skagit County's rural lands, its undeveloped habitat areas, and its bays and rivers that support avian diversity and abundance. We want our county's Critical Areas Ordinance to support the preservation and restoration of areas important to perpetuating this area's diverse wildlife.

We appreciate the work of all involved in updating the CAO. Please accept the following comments on the third draft. All page references are to the red-lined version. The words of the CAO are in bold.

1. **14.24.090 Protected critical areas (PCA) requirements**
   (5)(e) PCA Maintenance. The PCA is to be left undisturbed in its natural state.

As stated in our comments on the earlier drafts, we appreciate the emphasis here and elsewhere in the CAO on leaving Protected Critical Areas (PCA) in their natural state. However, we repeat our suggestion that the following be added:

> "Owners are encouraged to remove non-native vegetation, particularly invasive species in addition to those whose removal is required by regulation, such as Class A weeds listed by the Skagit County Noxious Weed Board."

Non-native plant species are often invasive and crowd out plants which better support wildlife and which contribute to biodiversity.[1]

2. **14.24.230 Wetland protection standards;**
(7) (b) "Wetlands less than 1,000 square feet may be exempted from buffer provisions contained in this Chapter when criteria (a)(i) through (vi) above are met."[2]

[1] Critical Areas Ordinance, third draft, red-line version, p.18
[2] Ibid., p.37

The stated standard provides an easy path to providing no protection for this smallest category of wetland. Best available science finds that small wetlands surrounded by vegetation are effective habitat for many species of birds, as one example.[3] Even a small wetland with a buffer as narrow as 25 feet vegetated with natural species adds significant habitat capacity and diversity. The Critical Areas Ordinance should mandate protection and vegetated buffers for these small wetlands.

The *Gap Analysis* prepared to inform the CAO update under "Exemptions for small wetlands" provides support for protecting these habitat elements. It states, in part:

> "SCC 14.24.230(6)(a) provides a complete exemption for wetland standards for Category III and IV wetlands that are less than 1,000 square feet, when isolated and other criteria are met. Even small wetlands provide important functions so mitigation should be required to meet the stated goals of no net loss of ecological function, including hydrological function in areas with downgradient drainage issues. We would recommend that if Skagit County wishes to continue allowing impacts to small wetlands, that they, at a minimum, require full mitigation to ensure no net loss of ecological function. Furthermore, all wetlands are protected by Ecology under the Water Pollution Control Act and the Skagit County Water Pollution Code SCC 16.32, even when they are not considered jurisdictional by the Corps under Clean Water Act jurisdiction. To prevent circumstances where applicants circumvent or are unaware of state law, then state and federal approval should also be required when wetland fill is authorized by Skagit County. If the county wishes to maintain flexibility for Category III and IV wetlands less than 1,000 square feet, buffer reductions may be considered in lieu of full exemption from statutory requirements. (our emphasis)" [4]

We recommend that Skagit County follow the clearly implied advice of the *Gap Analysis* consultant and require buffers around these small wetlands. A straightforward approach would be to treat all wetlands under 4,000 square feet the same as described in the draft CAO for wetlands between 1,000 and 4,000 square feet.

3. 14.24.520 Fish and wildlife habitat conservation area site assessment requirements
(3) Bald Eagle habitats ...[5]

We repeat our comment that the information about what is required before development in proximity to Bald Eagle nests and roost sites needs specificity. As written, the standard makes it easy for those failing to get permits to claim ignorance since there is no specific distance from the protected habitat stated in the regulation. Please reconsider the suggestion in our May 8, 2025, comment letter:

> "We appreciate the updated information about protecting bald eagle habitats and the inclusion of roost sites as well as nest locations. The wording calls for a cooperative management plan to be developed in coordination with the U.S. Fish & Wildlife Service and the Washington Department of Fish & Wildlife, 'whenever activities that alter habitat are proposed near a verified nest territory or communal roost.'"

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[3] Department of Ecology re Best Available Science for wetlands: Best available science - Washington State Department of Ecology. Also, Wetlands in Washington State - Volume 1: A Synthesis of the Science

[4] *Gap Analysis, Skagit County Critical Areas Ordinance Update*, (Facet), Feb. 25, 2025, p. 12

[5] Op. cit., CAO redline version, p.68

More specificity is needed about what would constitute "near." At a minimum, the section could state that proposed development within 800 feet of an eagle nest or roost site (Washington Department of Fish & Wildlife's standard before the Bald Eagle's delisting) should trigger consultation with Planning & Development Services. It would also be helpful for the section to include reference to the guidance provided by the U.S. Fish & Wildlife Service which recommends different buffers depending on site conditions and nearby activities.[6]

4. Beavers

We note that the CAO still has no reference to beavers or the areas of their activity where development could be at risk. Development permit issuance should take into account the potential for problems in the areas of Skagit County with a history of beaver activity. It is unrealistic and incomplete to establish wetland regulations without considering the effects of beaver activity including both the important role this animal plays in creating habitat and the effects beaver activity can have on existing or planned development. The ordinance should at the least discourage development in places long affected by beaver activity or most likely to be affected in the future. We recommend inserting the following in "14.24.520 Fish and Wildlife conservation area wildlife assessment requirements:"

> (6) In areas with known or predicted beaver activity, a fish and wildlife habitat assessment should incorporate recommendations related to beaver activity. In areas with potential conflict, nonlethal methods like fencing, pond levelers, or managing vegetation can enable coexistence with beavers.

While removing beavers from an area of intended development may seem an easy solution, it is both destructive of habitat and well-known to be ineffective in the long term.

5. Better define protection for heronries

Skagit County has several communal nesting sites used by Great Blue Herons, including the March Point heronry, quite possibly the largest on the U.S. West Coast. Given that the land on which this large heronry is located is divided between the City of Anacortes and Skagit County, it would make sense to have a uniform approach to protecting this important habitat. Skagit Audubon recommends that the county adopt into its CAO the well-considered approach taken in the Anacortes CAO, which complies with Washington Department of Fish and Wildlife (WDFW) recommendations.

6. Please follow WDFW's recommendation to not allow timber harvest in riparian zones.

WDFW's *Skagit County Riparian Buffer Evaluation* (Whittaker & Fuchs, July 1, 2025) found that the county's 2006 buffers have resulted in the loss of thousands of acres of riparian tree cover and thus have prevented meeting a standard of no net loss of ecological functions (pgs. 16 & 17). We appreciate, therefore, that the draft CAO update provides for increased buffer widths. However, the third draft continues to have a provision allowing timber harvest in riparian zones despite the objection of WDFW and conservation organizations that this

[6] National Bald Eagle Management Guidelines, U.S. Fish & Wildlife Service, 2007 (Microsoft Word - Guidelines - June11. 2007.v2.doc)

compromises the intended and necessary function of those areas.[7] WDFW's comment to this effect appears in their May 8, 2025, comment letter (#27):

> "Allowing timber harvest within riparian buffers, regardless of conditions or proposed performance standards, compromises the critical ecological functions and values these areas are intended to protect....For these reasons, we strongly recommend eliminating this provision and reinforcing protections for intact riparian vegetation to maintain water quality, fish habitat, and the long-term resilience of riparian ecosystems." (p.9)[8]

Besides reducing shade and recruitment of woody debris and providing for dietary needs of fish and aquatic invertebrates, timber harvest involves machinery that impacts understory vegetation and compacts soils. A more conservative approach is needed to protecting riparian zones if they are to meet the required standard of no net loss of ecological functions.

We appreciate your attention to our comments. Please direct questions about any of these to conservation@skagitaudubon.org (Skagit Audubon Society, PO Box 1101, Mount Vernon, WA 98273).

Sincerely,

Timothy Manns
Conservation Chair
for the Skagit Audubon Board

[7] Op.cit., CAO third draft, p.75
[8] FINAL Comment List & Complied Comments_CAO Update & Development Regulations 05082025.pdf

Robby Eckroth Comment #18

From: Ellen Bynum <skye@cnw.com>
Sent: Friday, November 14, 2025 12:34 PM
To: PDS comments
Subject: Skagit County 2025 Critical Areas Ordinance Update

November 14, 2025

To: Commissioners Peter Browning, Lisa Janicki and Ron Wesen
Skagit County Board of County Commissioners
1800 Continental Place
Mount Vernon, WA 98273

From: Ellen Bynum, Friends of Skagit County
PO Box 2632
Mount Vernon, WA 98273-2632

RE: Comments on the Skagit County Critical Areas Ordinance (CAO) 2025 update

Thank you for the opportunity to comment on the proposed changes to update the 2025 CAO 14.24 development regulations (codes).

The Growth Management Act (GMA) requires counties to first identify and designate all natural resource lands and critical areas, and protect their functions and values. Critical areas management and protection are the basis for a large part of environmental and land use protections in WA State. The Department of Commerce, Growth Management Services published the Critical Areas Handbook (all combined), A Handbook for Reviewing Critical Areas Regulations by consolidating technical, legal and administrative chapters through 2023, as guidance for counties and cities to use in conducting updates. The handbook is helpful in reviewing draft and final update proposals.

The drafts of the CAO update reorganize and propose many changes to the development regulations. From our review, we list below areas which may need additional review before the CAO is adopted.

Loss of citations in the development regulations.
We previously commented to the Planning Commission and Planning and Development Services (PDS) staff about the loss of citations, including ordinances, resolutions, RCWs, WACs and sections of the SCC, that disappeared in the updating process. In May we requested PDS restore the citations for the "Big Lake protection rule" which were added to earlier Comprehensive Plan and code versions by a settlement between Skagit County and Friends of Skagit County after a 1996 Growth Management Hearings Board Appeal(s). After confirming in May that the citation (Ordinance #O20030012) would be retained, PDS replied that due to the reorganization, it was not "feasible to retain the old ordinance citations beneath each code section, as much of the content was completely reorganized". We note that some older ordinance citations are retained, though this one was not.

Past practices in the update process follow the RCW and WAC style which includes references to previously passed changes at the bottom of the pages. In the Comprehensive Plan, policies and codes

citatios to ordinances and resolutions were in parentheses after the revised section. We understand these may have been removed to shorten the document, but we see no way for a reader to be able to fully understand and trace the decisions without these references.

PDS states that prior versions of the code can be seen by using the drop-down menu and that those versions would have the original ordinance citations. While this is true, in this instance the meaning, context and authority of the FOSC settlement with the County on the Overlook Crest development above Big Lake may be affected.

Please restore the citations for this particular part of the code as it alerts members of the public who may be unfamiliar with the GMHB decision, and/or do not have access to prior versions of the code, that the changes proposed have legal meaning and should be retained as created in future updates for the CAO, Comprehensive Plans, policies and other codes.

The original citation was at the end of the current 14.11.300 Rural Village Residential (RVR) code as Ordinance #20030012 which includes the requirements of the settlement for Skagit County to achieve compliance with the GMA. This was replaced by Ordinance #O20250005 § 2 (Exh. A) which is the final update of the 2025 Comprehensive Plan and Development Regulations and does not contain the original citation.

We ask you to direct PDS to please retain the correct citation(s) in the code, Comp Plan and policies, including any historical citations that would be needed to access a clear understanding of the requirements for developments in the Big Lake watershed, including protection of critical areas.

Concurrence with other commenters.
We concur with the comments submitted by Futurewise requesting clarification of when a critical areas review is required, supporting the improved seawater intrusion areas regulations and the explanations on how the Growth Management Act (GMA) requires that development regulations must protect the environment including critical areas. We join their request for the County to require an Off-Site Analysis Report for development projects that discharge stormwater off-site to address potential and/or actual water quality or other degradation in the currently uprotected 1 mile area adjacent to the development.

In addition, we concur with the comments submitted by Big Lake residents and the comments of stormwater expert Dr. Richard Horner. Their concerns about the stormwater management system for the 105 new homes in the proposed development above Big Lake, Overlook Crest, includes potential and actual pollution to Big Lake and Nookachamps Creek, protection of critical areas and conversion of natural resource zoned lands.

We urge you to direct PDS to adopt Ecology's additional protections from the 2024 State Stormwater Management Manual, in particular, the requirement to evaluate stormwater effects on water quality within one mile of a proposed development, rather than the current limit of 200'/300'. The County has corrected the language so that future updates of the State Stormwater Management Manual will be adopted; however, actions suggested in the Manual needs to be added to the development regulations to provide actual protection, such as with downstream water quality issues.

We ask you to instruct PDS to review and adopt the verified and replicable methodology of the historic and valuable stream data and best available science compiled by Skagit Cattlemen's Association and others. These reports were used to establish best management practices for riparian buffers on

Agricultural - Natural Resource Lands (Ag-NRL) that ensure protection of riparian areas, guarantees no loss of function and is applicable to Fish and Wildlife Habitat Conservation Areas (FWHCA) and the conservation of riparian areas, including other critical areas. Please see comments by Randy Good on this topic with references.

Other suggested revisions.
Please add more details about stormwater pollution prevention plans (SWPPP) that are required during infrastructure installation and construction.

On page 50, (3) Surface Water Source Limited (SWSL) Stream Mitigation Protection, (b) If a project is located within 1/2 mile of any of the streams identified in Subsection (3)(dc) of this Section as SWSL onsite stormwater dispersion or infiltration will be required using BMP designs specified by SCC 14.32. Nookachamps Creek and 9 others are SWSLs. Big Lake empties into Nookachamps Creek, the first major tributary on the Skagit River and habitat for migrating salmon and forage fish.

The new chapters in the 2025 Skagit County Comprehensive Plan update, including Climate Change, may need additional supporting codes that help implement the new chapters.

Minor organizational and administrative changes in SCC 14.24.010.
At 14.24.240 Wetland performance-based buffer alternatives and mitigation standards.(5)(c), please use the complete title of Department of Ecology's WA State Stormwater Management Manual and provide a citation and/or link to the most current publication. A reader might wonder if there is a Skagit Stormwater Management Manual because of the incomplete title.

In the introduction, we see that RCW 36.70A.030(6), a reference to "Agricultural land" definition, has been removed. We assume this was included in error in the 2nd draft revision process.

Also in 14.24.010 Introduction (1)(b). We suggest adding "health" to the sentence at "...human health and safety".

Additional questions.
Are the changes to the exemptions of various wetland categories coming from changes in the Department of Ecology's suggested changes to sizes for each wetland category or from other requirements?

Is there a PDS and Public Works Administrative Manual available (hardcopy or digital) that contains standard operating procedures and best management practices? Has such administrative manual been updated? Does it receive public review before its update(s)? We note the new and added responsibilities assigned to the PDS Director in this update which seem to require broad knowledge and experience to implement. A best practices and procedures manual would be critical to the Director's decision making and success.

Do the changes proposed to the CAO improve the retention of CAOs and protect their functions?

How will we know if the code changes achieve compliance with the GMA prior to the next periodic update of the CAO?

Thanks again for the opportunity to comments. Should you have questions or need more or different information, please contact us.

Ellen Bynum, Executive Director
Friends of Skagit County
PO Box 2632 (mailing)
Mount Vernon, WA 98273-2632
360-419-0988; friends@fidalgo.net
www.friendsofskagitcounty.org
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nfggive.org

Comment #19

Robby Eckroth

From: Jan Edelstein <jmeten@comcast.net>
Sent: Friday, November 14, 2025 12:55 PM
To: PDS comments
Cc: 'Jake Koopmans'
Subject: 2025 Critical Areas Ordinance Update - Public Comment
Attachments: CAO Update Public Comment Filed November 14 2025 - Jan Edelstein.pdf

Hello,

I submit the attached public comment and the supporting documentation contained in the following Google Shared Drive:
https://drive.google.com/drive/folders/1f6xRVauE7frGv5En-29YdTPTi5PbbVHY?usp=sharing

Please let me and Jake (e-mail above) know if you have any difficulty accessing the supporting information which documents my efforts over the past year to bring this issue, supported by Best Available Science, to the decision makers' attention.

Regards,
Jan M. Edelstein
17173 West Big Lake Blvd.
Mt. Vernon, WA 98274
208-720-0709

Jan M. Edelstein
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jmeten@comcast.net
208-720-0709

November 14, 2025

Skagit County Commissioners
Via e-mail: pdscomments@co.skagit.wa.us

Critical Areas Ordinance Update 2025
Additional Public Comment – Nov. 14, 2025

Dear Commissioners,

As you know, I have submitted "public comment" throughout the Skagit County Critical Areas Ordinance (CAO) 2025 Update process. This submission summarizes my comments over the past year and provides additional data to support my prior statements describing Best Available Science.

A. I submit the CAO fails to comply with the requirements of the Growth Management Act, and fails to be consistent with the Comprehensive Plan, because it fails to protect critical areas more than 200' (300' in case of wetlands) from the individual and cumulative off-site impacts of new subdivisions, land disturbing activities, and other activities which require a permit ('projects').

   1. The functions and values of critical areas more than 200'/300' from the project boundary are simply not protected by the CAO. The CAO as proposed restricts the scope of the Director's authority to require, and the Applicant's obligation to provide, a Critical Area site report regarding all off-site impacts[1] of the proposed project on critical areas beyond 200'/300' feet of the project boundary. Further, without this information, an assessment of the cumulative impacts experienced by a critical area from multiple projects are not considered in the County's land use decision making process.

   2. The current development regulations as applied by the CAO fail to comply with RCW 36.70A.020 which requires the County to ensure that public facilities and services necessary to support development are adequate to serve the development at project occupancy. The current development regulations do NOT require projects in rural areas that might adversely impact critical areas, and especially anadromous fisheries, to demonstrate the adequacy of public stormwater management facilities to manage stormwater impacts after development of the proposed project. SCC 14.62.40.

[1] Although my focus has been on off-site stormwater impacts, critical areas are to be protected from all off-site impacts, including, but not limited to, artificial light at night (ALAN), for which I have provided citations to Best Available Science regarding its impact on anadromous fish. It is only recently recognized that ALAN can contribute to toxic algae blooms. https://phys.org/news/2025-04-pollution-cyanobacterial-growth-metabolic-lakes.html#:~:text=Ten%20of%20the%2015%20enclosures,pollution%20in%20lakes%20to%20date.

3. There is nothing in the CAO ordinance to require public notice of the review and permitting of land disturbance or other projects which could affect critical areas as required by state law.[2] Under Skagit County Code, as interpreted and applied by the Planning and Development Services Department, land disturbance permits are listed for review process "Type 1 Director Decision Without Notice."[3] "Without Notice" is defined in the code to include not only no notice of an application or opportunity for public comment before the decision is made, but also that, once the decision is made, there is no public notice required of the issuance of said permit or for what activity the permit was granted. This is contrary to RCW 36.70B.020 which defines project permits for which "notice" is required to include "permits or approvals required by critical areas ordinances." This situation is documented in the Skagit County Hearing Examiner's records for APL 2026-005 and the resulting appeal to the Superior Court Case No. 25-200786-29.

B. To complete the PDS 'public process' record, I submit the following written documents I have submitted to PDS outside of the formal public comment process for the 2025 Update of the Skagit County Critical Areas Ordinance. These are submitted to further demonstrate my efforts to reason with the County on the basis of "Best Available Science." I also provide documents from the PDS permitting files to support the "Big Lake Case Studies" which I assert in this and my earlier filed comments.

   The following are submitted separately to pdscomments@co.skagit.wa.us via a shared link to Goggle drive.

   1. December 10, 2024: E-mail to PDS and consultant "to bring to your attention the failure of the Skagit County Ordinances to protect Critical Areas from new stormwater runoff".

   2. Dec. 17, 2024: Written version of my oral presentation to the Board of County Commissioners (BOCC) at its general public comment period on December 17, 2024.

   3. May 8, 2025: E-mail submitted to Planning and Development Services (PDS) to answer the question asked of me at the end of the hearing by Planning Commissioner Susan Day.

   4. June 15, 2025: Written submission supporting oral presentation to BOCC on June 16, 2025, addressing permit procedure, lack of review for public stormwater infrastructure for new projects that affect critical areas, lack of review for off-site impacts on critical areas, including impact of Artificial Light at Night and viewshed.

   5. July 15, 2025: E-mail to PDS staff asking them to explain what appears to this writer to be an arbitrary limitation, unsupported by best available science, on the scope of critical area review (only review impacts on critical areas within 200 or 300' of the new project

[2] See RCW 36.70B.110, 130, and 140 requiring notice of various elements of review for "project permits" to the public and/or "parties of record." Described more fully in Comment submitted July 22, 2025.
[3] SCC 14.06.150 Tables 1 and 2

boundary). This e-mail was sent to prepare for submitting comments to BOCC on July, 20, 2025, in advance of the July 28, 2025 public hearing. No response received.

6. September 15, 2025: E-mail to Director and Staff of PDS attempting to obtain an explanation of the reasoning for the staff recommendations to maintain the limitation of critical area review for new development to critical areas or their buffers within 200' (300' for wetlands) of the project boundary. No response received.

7. October 6, 2025: Power point presentation presented to the BOCC at its general public comment period on October 6, 2025. NOTE TO JAN-NOT YET SAVED.

8. October 25, 2025: E-mail to a PDS staff member reminding them of the Department of Ecology advocacy for local development codes that require review of stormwater impacts "up to one mile" downstream from the new project. Includes excerpts from from Department of Ecology's 2024 Stormwater Management Manual for Western Washington, which are attached. No response received.

9. October 28, 2025: E-mail to a PDS staff member inquiring as to which provision in the Skagit County Code he referred when he told the Commissions during the 2025 Critical Ordinance Update work session that day that County code requires a new project Applicant to provide information regarding the impact of stormwater pollutant discharge on the water quality of the receiving water body. No response received.

10. November 4: 2025: Written version of my oral presentation to the BOCC at its general public comment period on November 4, 2025,

11. Excerpts from Department of Ecology 2024 Stormwater Management Manual for Western Washington, pages 149 – 154.

12. To supplement the Big Lake Case Studies cited throughout my comments:

    a. PL07-0465: Excerpts from the Planning and Development Services Department (PDS) record showing SEPA DNS issued with no review of off-site impacts of Overlook Crest development on Big Lake, a critical area anadromous fishery approximately 300 from the closed point of the project.
    b. PL22-0528: Excerpts from the PDS record. This is a shoreline use permit application to expand to 42" an existing public shoreline discharge pipe to Big Lake to accommodate the impact of new stormwater discharge to Big Lake, a critical area for anadromous fish, from 18+acres of proposed new impervious area for a residential development on the hillside above Big Lake.
        i. Skagit County Ordinance 20030012 (Excerpt attached; Pages 1-8 History of Special Provisions to protect Big Lake from Overlook residential development)
        ii. 2010 Overlook Crest SEPA Checklist
        iii. Critical Areas Checklist.
        iv. Applicant's Wildlife Habitat report.
        v. SEPA Threshold Determination

vi. Appellants Brief in Appeal to BOCC of Hearing Examiner approval.
vii. PDS reply Brief.
viii. BOCC R20240241 remanding permit approval for testimony on impact of the "totality" of the proposed Overlook Crest project's stormwater on Big Lake, the receiving critical area body of water.

c. BP21-0785
   i. Checklists and Threshold Determination
   ii. Initial Opinion of Dr. Richard Horner dated May 12, 2025 on the "no-notice" revisions to 2013 plat and its prior engineering, concluding that Overlook Crest LLC's revised 2025 Stormwater Site Plan will send pollution and degradation to Big Lake.. [Dr. Horner's November, 2024 report on the state of Big Lake and potential adverse impact of 2013 approved subdivision plan with its 2024 engineering and stormwater plan, is already a part of the record.]

13. Errata: Correction to placement of quotation marks in various documents quoting Department of Ecology's acknowledgement that even if all 'Best Management Practices" contained in its Stormwater Manual are used, some degradation of receiving waters will continue, and "some beneficial uses will continue to be impaired or lost due to new development."[4]

Thank you for again considering these comments and submissions of "best available science" as reflected in the references to Department of Ecology statements, the County's "Best Available Science" review by FASET, and the Big Lake case studies.

Very truly yours,
Jan M. Edelstein
Jan M. Edelstein

[4] The following is the complete quote from pdf page 60, 2024 SMMWW Manual.

The engineered stormwater conveyance, treatment, and detention systems advocated by this and other stormwater manuals can reduce the impacts from development to water quality and hydrology. However, they cannot replicate the natural hydrologic functions of the natural watershed that existed before development, nor can they remove enough pollutants to replicate the water quality of pre-development conditions. Ecology understands that despite the application of appropriate practices and technologies identified in this manual, some degradation of urban and suburban receiving waters will continue, and some beneficial uses will continue to be impaired or lost due to new development. This is because land development, as practiced today, is incompatible with the achievement of sustainable ecosystems. Unless development methods are adopted that cause significantly less disruption of the hydrologic cycle, the cycle of new development followed by beneficial use impairments will continue.

Comment #20

Robby Eckroth

From: Sophia Steele Conley <ssteele@wspa.org>
Sent: Friday, November 14, 2025 2:18 PM
To: PDS comments
Cc: Jessica Spiegel
Subject: Skagit County 2025 Critical Areas Ordinance Update
Attachments: WSPA Comment Letter on Skagit Third Draft Critical Areas Ordinance Final.pdf

Good afternoon,

On behalf of the Western States Petroleum Association (WSPA) we appreciate the opportunity to comment on the third version of the Critical Areas Ordinance. Please see the attached comment letter. We are more than happy to be a resource for you and your team as you move forward in this process. If you have any questions regarding our comments, please don't hesitate to reach out.

Thank you,

Sophia Steele Conley
Sr. Manager, Northwest Region
WSPA

C: 425.890.9723
O 360.352.4516

Sophia Steele
Senior Manager, NW Region

November 14, 2025

Skagit County Planning and Development Services
1800 Continental Place
Mount Vernon, WA 98273
pdscomments@co.skagit.wa.us

Re: Skagit County 2025 Critical Areas Ordinance Update

The Western States Petroleum Association ("WSPA") appreciates the opportunity to provide comments on Skagit County's third draft update to Chapter 14.24 of the Skagit County Code ("SCC"), the Critical Areas Ordinance ("CAO"). As noted in our May 8, 2025 letter, WSPA is a non-profit trade association representing companies that provide energy needed for Washington's transportation, including renewable diesel and other low-carbon fuels, electric vehicle charging infrastructure, carbon management, and traditional petroleum products that remain essential to the state's energy mix. WSPA members own and operate major facilities in Skagit County including Marathon Petroleum Corporation and HF Sinclair Corporation that are already subject to rigorous federal and state regulation and oversight.

In addition to the comments in our May 8, 2025 letter, WSPA offers the following comments on the County's third draft COA. WSPA shares the County's goals to protect critical areas and believes the below-requested clarifications provide a more administrable path for the County, developers, and businesses operating in Skagit County, consistent with best available science and applicable state and federal laws.

1. **Remove seawater intrusion areas from the list of Category I CARAs, because these areas are already regulated by SCC 14.24.380.**

Because seawater intrusion areas are already subject to more specific protections in SCC 14.24.380, WSPA requests the County exclude these areas from the generic critical aquifer recharge area ("CARA") provisions, or, alternatively, require site-specific hydrogeologic delineation and limit CARA obligations to those necessary to protect groundwater quality.

The third draft COA adds that "areas identified by the County as potential or existing sea water intrusion areas" will be treated as a "Category I" critical aquifer recharge area. SCC 14.24.380, in turn, defines "seawater intrusion areas" to includes all areas within one-half mile of a marine shoreline and the entirety of Guemes, Sinclair, Cypress, and Vendovi Islands, regardless of a demonstrated hydraulic connection between saline waters and an aquifer. Designation of these areas as Category I CARAs layers on significant additional review by subjecting these areas to CARA baseline, site assessment, and mitigation/protection plan requirements that are not specifically tailored to risks presented by potential seawater intrusion.

By contrast, the COA's existing seawater intrusion provisions in SCC 14.24.380 directly address these risks through robust application requirements, development standards, sampling requirements, and denial/mitigation pathways. These standards reflect state chloride-based standards and ensure any new well or development in a seawater intrusion area undergoes careful review in order to better protect aquifers and groundwater. For this reason, WSPA believes layering on CARA protections is unnecessary, confusing for applicants, and could potentially lead to duplicative, conflicting or inconsistent requirements.

Alternatively, if the County requires seawater intrusion areas to be regulated both by SCC 14.24.380 and the CARA provisions, WSPA requests limiting application of CARA provisions to "areas near marine waters where aquifers may be subject to saltwater intrusion"—consistent with state regulations. *See* WAC 365-190-100(4)(b)(iv). To ensure that such designation is based on best available science (*see* RCW 36.70A.172), the designation should consider tidal influence, saline gradients, chloride concentration levels in nearby wells, water elevation, and hydrogeologic discontinuity—and not simply geographic proximity to the coastline.

Likewise, to avoid overbroad regulation, WSPA recommends edits to SCC 14.24.310(1)(c), which now subjects a whole project to Category I scrutiny where "any portion" of a parcel area is within a Category I CARA. While this can be appropriate in concept, it should be coupled with clear pathways for risk-based differentiation, sub-parcel delineation, and an exemption where credible data shows that the development does not pose a negative impact to a CARA on the parcel—for example, due to hydraulic separation.

2. **Specify objective parameters for Director's authority to modify standards and require additional protective measures.**

Several critical aquifer recharge area provisions confer expansive discretionary authority without objective criteria, which can create uncertainty and a risk of ad hoc conditions, especially for facilities already subject to stringent state and federal controls.

For example, the CARA standards provide the Director/Health Officer unbounded authority to require any "additional protective measures" to protect public health or safety (SCC 14.24.320(2)(f), (3)(d)), "apply standards deemed necessary to mitigate any negative impacts that may be associated with the proposed development" (SCC 14.24.320(4)), and require best management practices which meet the requirements of any "other applicable requirement established by the Director" (SCC 14.24.320(5)(b)).

Further, the CARA site assessment requirements state broadly that "reporting requirements for a particular project can be modified, at the discretion of the Director, if it is determined that the preparation of a site assessment is not likely to provide additional information that will aid in the assessment of likely impacts to groundwater quality or quantity." And finally, the CARA protection plan provision allows the Director

to impose any "additional required corrective actions where such measures are necessary to protect groundwater resources or human health" (SCC 14.24.340)(1)(c)).

These provisions should be framed with objective criteria to provide predictability and avoid incongruent expectations across similar projects.[1] To protect due process and ensure consistent application, WSPA recommends the County:

- Define objective triggers for supplemental measures (e.g., specific risk profiles, monitoring exceedances, or failure of baseline BMPs).
- Cross-reference applicable state/federal standards (e.g., AKART obligations under state water quality law) and require findings that local measures are necessary to address a discrete gap not covered by existing programs.
- Require written findings tied to best available science and the record for any non-standard condition.

3. Remove new language that allows reopening settled approvals.

There are several new provisions in the draft COA that impact existing uses and developments that were previously approved through established County development review. Of these, SCC 14.24.100(3) is the most concerning. As revised, this provision would allow reopening critical areas review even after approval—and even after property transfer—based on new information or changed site conditions, with no time limitation. This is extremely open ended, especially because new information is constantly being made available.

Previously, reopening was limited to cases of applicant misinformation. WSPA believes this prior limit more appropriately adheres to Washington's vested rights doctrine and due process principles, which counsel against indefinite reopening of settled approvals absent very limited circumstances (like fraud and misinformation) and clear procedures.[2] And, there is always an opportunity for additional or new review at the time

---

[1] Washington courts have deemed ordinances that lack clear, objective criteria to be unconstitutionally vague. *See Anderson v. City of Issaquah*, 70 Wn. App. 64, 75, 851 P.2d 744 (1993) ("purpose of the void for vagueness doctrine is to limit arbitrary and discretionary enforcements of the law"); *Burien Bark Supply v. King County,* 106 Wn.2d 868, 871, 725 P.2d 994 (1986) (rejecting general, subjective performance standards and finding "citizen[s] should not be subjected to ad hoc interpretations of the law by county officials").

[2] In Washington, there is a "strong policy favoring administrative finality in land use decisions." *See generally Samuel's Furniture, Inc. v. Ecology*, 147 Wn.2d 440 458, 54 P.3d 1194 (2002) (citation omitted). Accordingly, vesting "fixes" the rules that govern land development, regardless of later changes in zoning or other land use regulations, and "is based upon constitutional principles of fairness and due process, acknowledging that development rights are valuable and protected property interests." *Weyerhaeuser v. Pierce Cnty.,* 95 Wn. App. 883, 891, 976 P.2d 1279 (1999) (citing *Friends of the Law v. King County,* 123 Wn.2d 518, 522, 869 P.2d 1056 (1994); *West Main Assocs. v. City of Bellevue,* 106 Wn.2d 47, 50-51, 720 P.2d 782 (1986), *abrogated on other grounds by Yim v. City of Seattle*, 194 Wn.2d 682, 451 P.3d 694 (2019). By contrast, reopening or modifying finalized permits or approvals indefinitely without a clear procedural framework raises due process concerns and undermines the vested rights doctrine.

of new/expanded development. For this reason, WSPA requests rejecting the edits to SCC 14.24.100 that would also allow reopening critical area review if "site conditions have changed, or if new information is available."

Alternatively, WSPA recommends:

- Limiting post-approval reopening to material misrepresentations by the applicant, fraud, or significant, demonstrable site changes that create an imminent risk to public health or critical area functions not reasonably foreseeable at the time of approval, and imposing a reasonable time limit.
- Requiring a formal process with notice, opportunity to respond, and written findings tied to best available science.
- Clarifying that previously issued permits and approvals remain governed by regulations in effect at the time of the original building permit application, consistent with state law.

The draft COA also makes changes to recognized buffers. For wetlands, the draft would disregard previously recorded buffers unless they meet a new "50% width plus vegetation" threshold, otherwise applying current widths. *See* SCC 14.24.230(5). The draft contains similar provisions for Fish and Wildlife Habitat Conservation Areas. *See* SCC 14.24.530(3). This risks retroactive imposition of current standards on previously approved buffers without a clear scientific showing of deficiency at the site and raises vested rights concerns. WSPA recommends the County:

- Continue to honor previously recorded buffers approved under prior code unless a site-specific, science-based determination shows that the buffer cannot perform intended functions and values under existing conditions.
- Provide a corrective pathway limited to documented functional deficiencies, with proportional, site-specific adjustments based on best available science and a defined set of criteria.

4. Restore reasonable use exception as a limited path for seeking relief from standards.

Under the revised draft COA, the reasonable use exception is now limited to single-family residential (SCC 14.24.140). Restricting reasonable use exceptions to single-family residences forecloses a critical administrative relief mechanism for other property types, including long-standing industrial facilities. WSPA recommends restoring this option for non-residential uses under limited circumstances that:

- Requires mitigation sequencing and best available science;
- Focuses on demonstrable site-specific hardship not of the owner's making; and
- Ensures no net loss of critical area functions and values through tailored, objective conditions.

This calibrated pathway avoids limiting complex industrial uses to the variance path, which only addresses relief from dimensional standards (*see* SCC 14.24.150).

Conclusion
WSPA appreciates the County's continued work on this important update and the opportunity to remain engaged throughout the process. We respectfully request the revisions outlined above to ensure the CAO remains clear, administrable, and aligned with best available science and established legal frameworks. These adjustments will help maintain strong environmental protections while providing predictable, workable pathways for facilities and projects that operate under stringent state and federal oversight. We look forward to continued collaboration with Skagit County as this update moves forward.

If you have any questions regarding our comments, please contact me directly at (360) 352-4516 or via email at ssteele@wspa.org.

Sincerely,

CC: Jessica Spiegel, Vice President NW Region