MUSSEL WATCH PROGRAM MANUAL

By Amy Johnson

Snohomish County Marine Resources Committee

September 2008

Mussel Watch Manual 2008-2009
Table of Contents

Introduction and Background

The National Mussel Watch Program is the longest continuous contaminant program in the United States Coastal Waters. The program, which is within the National Status and Trends Program of the National Oceanic and Atmospheric Administration, has been in existence since 1986. At over 292 sites, Mussel Watch utilizes mussels and oysters to "monitor spatial distributions and temporal trends of chemical concentrations in coastal and estuarine regions of the US," (p.2). There are 20 sites in Washington as part of the National Program, and they are sampled biennially during the winter season.

Bivalve mollusks feed by filtering large amounts of water, and are valuable indicators pf contaminants in marine waters. Their tissue metabolizes the contaminants within 30 days, providing researchers with a snapshot of water quality during recent exposures. Although widely distributed, there is no single species of mollusk found in all coastal waters of the United States; on the West Coast, *Mytilus edulis* (blue mussel), and *Mytilus californianus* (California sea mussel, rock mussel, big mussel) are used for Mussel Watch.

At a low tide (on at least one date) between November and March, volunteers collect two composites of 50-100 mussels (one composite is used for testing persistent organic compounds, and the other, for trace elements). The mussels are put on ice and sent to a lab within 24 hours of collection. At the lab, the whole soft tissue of each mussel is removed to be analyzed. The analysis includes tests for over 100 chemical contaminants (45 PAHs, 37 PCBs, 24 pesticides, 10 persistent organic compounds, and 17 trace metals). These chemicals, even if found in nature, are all contaminants because concentrations now present have been altered by human activities. Contaminant sources include point sources (waste water treatment plants, industry), surface water run-off, spills, historical input and atmospheric deposition.

Throughout the United States, the concentrations of some of these chemicals show decreasing trends (particularly for those of banned chemicals such as DDT, etc). However, in some areas, erratic high concentrations for specific chemicals in different parts of the country indicate potential hot spots, and remain areas of interest. For example, Everett Harbor, one of the Snohomish County sites, has tested higher than the national average for both polycyclic aromatic hydrocarbons (PAHs) and lead.

Using protocols established by NOAA, the Snohomish County Marine Resources Committee (MRC) augmented NOAA's local two-site Mussel Watch sampling program to six sites in Snohomish County, and an additional one at Cavelaro County Park in

Island County. In addition, the MRC increased sampling for local sites from every other year to twice a year. By augmenting NOAA's sampling schedule, this allows the MRC to obtain current information on marine and estuarine water quality in Snohomish County with the ability to compare results to water quality around the nation, and between wet and dry seasons.

O'Connor, Thomas P and Gunnar G. Lauestein. (2006). Trends in chemical concentrations in mussels and oysters collected along the US coast: Update to 2003. Marine Environmental Research, 62, 261-285.

http://www8.nos.noaa.gov/cit/nsandt/download/mw_monitoring.aspx

Important Contacts

Laboratory Contacts

Juan Ramirez, TDI Brooks (979) 693-3446; juanramirez@tdi-bi.com

Juan is the contact at the TDI Brooks Laboratory in College Station, TX. Contact him by phone and email regarding invoices, data retrieval, etc. Note: There is a two-hour time difference, and you will be unable to leave messages after hours.

Amanda Jo Fryer, TDI Brooks (979) 693-3446; amandafryer@tdi-bi.com

Amanda is the Sample Custodian at the TDI Brooks Laboratory. She is the one to inform about the upcoming sample dates, and the shipment of the samples. The best way to contact her is through email.

Younger Kim, Rutgers (856) 785-0074 x 4341; ykim@hsrl.rutgers.edu

Younger is the contact for the Rutgers, Haskin Shellfish Laborartoy, Histopathological analysis. Snohomish County MRC requests Rutgers samples to be done only once at a new site, so further contact with him will likely be minimal.

NOAA Contacts

Gunnar Lauenstein, NOAA (301) 713-3028 x 152; gunnar.lauenstein@noaa.gov

Gunnar is the head of the National Status and Trends Department at NOAA. He is best reached by email. It's important to CC him on any email conversations dealing with NOAA region-wide sampling. It's not always necessary to contact him directly.

Alan Mearns, NOAA (206) 526-6336; alan.mearns@noaa.gov

Alan is a former MRC member, and NOAA Representative for the Mussel Watch Program. He is the "go-to" guy for any questions relating to Mussel Watch. He is also the one to contact for data synthesis and analysis. It's best to reach him by telephone, but is also convenient to email him.

Permit Contacts

Dave Gadwa (360) 902-2473; gadwadlg@dfw.wa.gov

Dave is the Special Licensing Permit Tech with Washington Department of Fish and Wildlife. He is the contact for any questions regarding our Scientific Collection Permit, including submitting our annual report, and renewing our permit.

Carol Stedman (360) 902-2474; stedmcas@dfw.wa.gov

Carol works in the Licensing Division of Washington Department of Fish and Wildlife. If Dave Gadwa is unavailable, and the deadline is approaching for adding new names to the contact, Carol will be able to add the names.

Sampling Agency Contacts

Graham Anderson (425) 388-0703; grahama@portofeverett.com

Graham is the Senior Environmental Planner for the Port of Everett. Contact him to inform him of the Everett Harbor sampling date and time. He will likely have you contact Ed Madura to gain access to the site.

Ed Madura (425) 259-5428; (425) 754-0382; edm@portofeverett.com

Ed is the head of the Security at the Port of Everett terminal. Contact him before sampling Everett Harbor to ensure access to the site. Inform him of each individual who will be sampling.

Sally Lider (425) 771-0227; lider@ci.edmonds.wa.us

Sally is the Environmental Education Coordinator with the City of Edmonds Parks and Recreation Department. Contact her to inform her of the sampling date if sampling the Edmonds site, or with any questions about our Shoreline Sanctuary Permit with the City of Edmonds. It is best to contact her by e-mail.

Jerry Smith (360) 652-7992; jerry.smith@co.snohomish.wa.us

Jerry is the Senior Park Ranger at Kayak Point County Park. Contact him to inform him of the sampling date if the MRC is sampling Kayak Point.

John Garrett (360) 445-4441; garrejgg@dfw.wa.gov

John is the Skagit/Snoqualmie Wildlife Area Manager for Washington Department of Fish and Wildlife. Contact him to inform him of the sampling date if sampling Eide Road, or with questions regarding the Right-of-Access Permit.

Chuck Motson (360) 444-6611; hioffice@hatisland.com

Chuck is the Hat Island Manager, and should be informed of the sampling date if sampling Hat Island. It is best to contact him by email.

Paul Plesha (425) 743-3307 x229; paul.d.plesha@noaa.gov

Paul is the Biological Station Manager at NOAA's Mukilteo Station. Contact him to inform him of the sampling for Mukilteo.

Sheriff Contacts

Scot Fenter, Snohomish County Sheriff's Office (425) 754-6509; scot.fenter@co.snohomish.wa.us

Scot is the Sergeant in charge of the Marine Division Unit with the Snohomish County Sheriff's Office. He is the contact for arranging transportation to Hat Island for sampling. Contact Scot first by phone, and follow-up with email.

Ryan Gausman, Snohomish County Sheriff's Office (425) 388-5255; ryan.gausman@co.snohomish.wa.us

Ryan is the Detective for the Marine Division Unit, and assists with the transportation to Hat Island for sampling. Contact Scot Fenter first, but will likely finalize arrangements with Ryan, depending on his schedule.

Snohomish County MRC Contacts

Stef Frenzl, Snohomish County MRC (425) 388-6466; stef.frenzl@co.snohomish.wa.us

Stef is the lead staff for the Snohomish County MRC. He is the contact for any questions regarding the Mussel Watch coordination in Snohomish County. CC him on emails related to Mussel Watch.

Amy Johnson (425) 780-9351; amyhj@myuw.net

Amy is the former WCC IP and Mussel Watch Coordinator. Contact her if necessary for any questions regarding previous samplings she was responsible for. Best to contact her by phone.

Chris Betchley (425) 870-5590; chrisbe1@juno.com

Chris is the former Associate Planner for the Snohomish County MRC, and previous Mussel Watch Coordinator. Contact her if necessary for any questions regarding previous samplings she was responsible for. Best to contact her by phone.

Stillaguamish Tribe Contacts

Jen Sevigny, Stillaguamish Tribe (360) 631-2372; jense@stillaguamish.nsn.us

Jen is a former MRC member, representing the Stillaguamish Tribe as a Wildlife Biologist. The Tribe conducts sampling at Cavelero County Park, and Kayak Point County Park. Contact Jen on matters regarding sampling at either of those sites. Also update her on general sampling plans for the MRC (i.e. when we're planning to sample).

Robbie Hutton, Stillaguamish Tribe rhutton@stillaguamish.nsn.us

Robbie is the Fish and Wildlife Technician for the Stillaguamish Tribe. CC her on any emails sent to Jen regarding the sampling at Cavelero or Kayak Point.

Snohomish County MRC Involvement

Snohomish County Marine Resources Committee (MRC) first became involved in the Mussel Watch Program in 2004, when Alan Mearns suggested to NOAA to add Edmonds and Mukilteo as part of the program. NOAA had already been sampling Everett Harbor and Possession Point. In 2006, Jen Sevigny and Alan Mearns brought Cavelero County Park as a National Site with NOAA. In 2007, Chris Betchley began coordinating the efforts to add three additional Snohomish County sites (Eide Road, Kayak Point, Hat Island) to the Mussel Watch Program. As of September 2008, there are eight sites in Snohomish and Island County, and are sampled by either NOAA, Snohomish County MRC, or the Stillaguamish Tribe:

- Edmonds Ferry
- Mukilteo Ferry
- Everett Harbor
- Hat Island
- Kayak Point County Park
- Eide Road
- Cavalero County Park
- Possession Point

Site Descriptions

PUGET SOUND EDMONDS FERRY: PSEF

TARGET SPECIES: *Mytilus edulis*
NOMINAL SITE CENTER: 47.81398 N; 122.38229 W
LOCATED ON NOS CHART #: 18446-1

SITE ACCESS:
From I-5, take WA-104 (Exit 177) west to Edmonds ferry landing. On the right, just after crossing the railroad tracks, is Brackett's Landing Park. The site is on the south side of the jetty north of the parking lot. Walk north from the parking lot to the beach to access the sample sites.

SITE DESCRIPTION:
Site is located on the south side of the jetty at Brackett's Landing Park north of the ferry terminal in downtown Edmonds. Mussels are very abundant and easily accessible at any low tide (less than +1 feet).

SITE PHOTOS:

Aerial view of Edmonds Ferry Terminal and Brackett's Landing Park. Site is on south side of rock Jetty north of the parking lot. Red arrow points to site location. Yellow arrow indicates parking location.

Looking northwest towards the sample site at Edmonds Jetty. People in photograph indicate location of sampling stations.

Overview photograph of sampling site taken from Brackett's Landing Park parking lot. Site is on south side of rock jetty. Red arrow indicates site location.

PUGET SOUND MUKILTEO FERRY: PSMF

TARGET SPECIES: *Mytilus edulis*
NOMINAL SITE CENTER: 47.94968 N; 122.30158 W
LOCATED ON NOS CHART #: 18473-1

SITE ACCESS:
From I-5 take exit 189 and go west on Hwy 526 to Hwy 525. Turn right on Hwy 525 and follow signs indicating "To Mukilteo Ferry". Approaching the ferry landing, turn right on Front Street, and park at the Silver Cloud Inn. You can also turn left on Front Street, and park in the Mukilteo Lighthouse Park parking lot. The site is accessed by walking down the stairway located between the Silver Cloud Inn and the NOAA Mukilteo Biological Station.

SITE DESCRIPTION:
Site is located in the intertidal zone between the Silver Cloud Inn and NOAA's Biological Station in downtown Mukilteo (north of the ferry terminal). Mussels are very abundant in the rock riprap and easily accessible at any low tide (less than +1 feet).

SITE PHOTOS:

Aerial view of Mukilteo Ferry sampling site. Site located between Silver Cloud Inn and NOAA's Mukilteo Biological Station. Red arrow indicates site location. Yellow arrow indicates parking lot.

Looking northwest towards the sample site at Mukilteo. People in photograph indicate location of sampling stations.

Looking northeast from sampling stations towards NOAA's Biological Station.

Looking southeast from sampling station towards Mukilteo's Silver Cloud Inn. Beach access is located north of the Inn, and south of NOAA's Biological Station.

Looking east towards the stairs and parking lot used for site access.

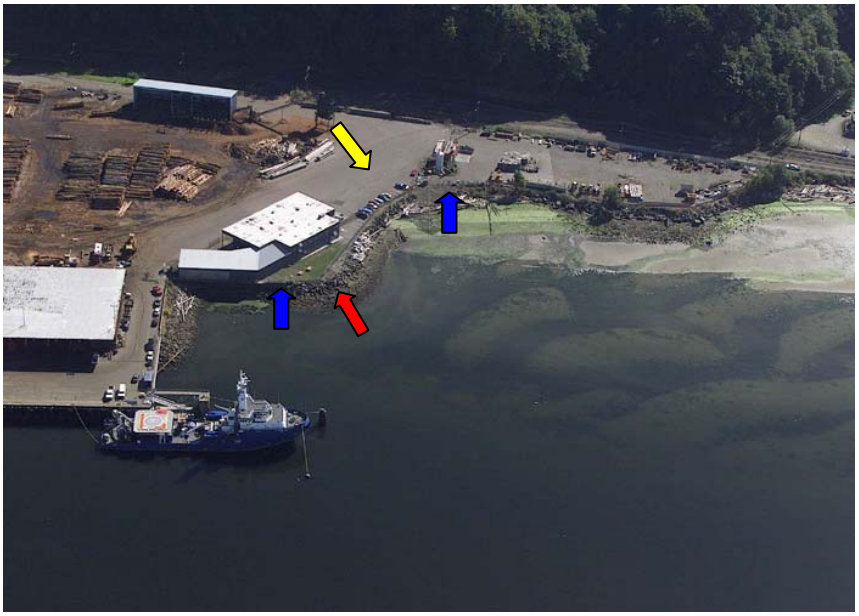
PUGET SOUND EVERETT HARBOR: PSEH

TARGET SPECIES: *Mytilus edulis*
NOMINAL SITE CENTER: 47° 58.36' N 122° 13.82' W
LOCATED ON NOAA CHART #: 18444

SITE ACCESS:
Prior permission has to be obtained from Ed Madura and Graham Anderson, from the Port of Everett, as access is needed to their property. Take Exit 192 on I-5 in Everett, and go west on 41st. Turn right onto Rucker Ave. Follow Rucker, and turn left onto Everett Avenue. Continue to follow it over the new bridge as it becomes Terminal Avenue. Continue to follow Terminal Avenue to where there's a guard station. All samplers need to show ID at the gate. Once through the gate, continue to follow the road until you reach the Port Maintenance Center (you'll see a fence marked Gate S14). Park next to the Maintenance Shop, call Ed Madura, Security Supervisor, and he will send someone down to open either Gate S10 or Gate S1.

SITE DESCRIPTION:
Site is located in the intertidal zone below the Port of Everett's Maintenance Shop, along the Everett waterfront. Mussels are very abundant in the rock riprap and easily accessible at any low tide (less than +1 feet).

SITE PHOTOS:



Aerial view of Everett Harbor sampling site. Mussels located on riprap rock in intertidal zone below the Port Maintenance Shop. Red arrow indicates site location.

Blue arrows indicate gate locations (left arrow: Gate S1; right arrow: Gate S10). Yellow arrow indicates parking lot.

Panoramic view of sampling site at Everett Harbor. People in photograph indicate location of sampling stations. Note: panorama is deceiving; the actual sampling site is parabolic shaped (see aerial photo).

Overview photograph of sampling site taken from upland area. Maintenance building is shown here in upper right corner, with Gate S1 located to the left of the building, leading down to the intertidal zone. Red arrow indicates site sampling location. Blue arrow indicates Gate S1 location.

PUGET SOUND HAT ISLAND: PSHI

TARGET SPECIES: *Mytilus edulis* (*M. trossulus*)
NOMINAL SITE CENTER: 48 34.36N 122 19.33 W
LOCATED ON NOS CHART #: 18443

SITE DESCRIPTION:
Site consists of remnants of an old pier structure with 20+ pilings and a cement structure on Hat Island (Gedney Island). Two populations of *Mytilus edulis* (*M. trossulus*) were located in sufficient numbers. One was located on non-creosote* pilings from the old pier structure. A second population is located on the cement structure with mussels measuring 1/2" or less, and can potentially be large enough for collection in winter 2009. Mussels on pilings are of suitable size (>1") and numbers for collection. Mussels are located 12 feet from the seafloor, and are not accessible by land. Mussel collectors must have boat transport to access the island and to sample the mussels.

**Original October 2007 site visit determined the pilings to be non-creosote. In March 2008, during sampling, potential creosote oozing was discovered. Confirmation will be made following lab analysis of piling sample collected Summer 2008.*

SITE ACCESS:
Piling samples can only be accessed by boat. Snohomish County Sheriff's Office is willing to transport staff and volunteers to island for sampling, and can use any of their boats, as long as the boat can be tied off to the pilings in order to sample. Options include: 33' boat, with or without a zodiac, or their two 20' boats. The Sheriffs will meet staff and volunteers at 10th Street Boat Launch or 14th Street Boat Launch on the Everett Waterfront (depending on the boat used).

SITE PHOTOS:

Aerial view of west side of Hat Island. Old pier structure consisting of 20+ pilings and cement structure in lower right corner. Red arrow indicates site location.

Looking east from boat – the cement structure is on the left and 20+ pilings on the right. Taken March 12, 2008.

Close-up of sampling station on pilings; mussels can only be collected from boat (no land access). Taken March 12, 2008.

Looking west from Hat Island shore towards sample stations on pilings. Taken March 12, 2008.

PUGET SOUND KAYAK POINT: PSKP

The site description still needs to be developed. The original site visit by Chris Betchley and Alan Mearns discovered a population of mussels located southeast of the large picnic shelter (see original site description here: X:\\Site Descriptions\Kayak Point MW Site.doc). However, the Stillaguamish Tribe developed a site description (and sampled accordingly) indicating the population of mussels were located north of the fishing pier (see here: X:\\Site Descriptions\Mussel Watch Program Station-Kayak Pt. .doc). Discussions between the Stillaguamish Tribe, Alan Mearns, and the Snohomish County MRC must occur to ensure the site description is accurate. Furthermore, concerns over the health of the mussel population north of the pier may result in a reclassification of sampling location.

PUGET SOUND EIDE ROAD: PSER

TARGET SPECIES: *Mytilus edulis*
NOMINAL SITE CENTERS:
Station 1: 48 13.618; 122 23.139
Station 2: 48 13.616; 122 23.137
Station 3: 48 13.616; 122 23.141

SITE ACCESS:
From the I-5 heading north, take a left onto highway 532 (Exit 212). Head west on the Stanwood-Bryant Rd. and continue through Stanwood past the Twin City Food plant on the south side of the road. After exiting into the open flats, you will take a sharp left turn onto Eide Rd before going up the hill. Travel to the end of the road and park. Up to four cars are permitted to park in WDFW designated areas. The site is accessible on foot. Walk about 1/2 mile south along edge of farm field to the tide gates, where you'll see a culvert inflow heading east towards the slough. At this point, walk east climbing up and over the dike. Once on the top of the dike, you'll see the culvert's outflow where sampling occurs.

SITE DESCRIPTION:
Site is on the nearshore intertidal portion of the slough. Mussels are located in the riprap underneath the culvert outflow. Mussel abundance is relatively low, and as of August 2008, it was advised to cease sampling site until at least winter 2009. Additional sites are located north and south of this point on rocks and root balls. There may be other outfalls to research in case this portion of the Eide Road site may never fully recover.

SITE PHOTOS:

Aerial view of Eide Road. Site is located on the east side of Leque Island at the mouth of the Stillaguamish River. Red arrow indicates site location.

Looking west on the landward side of the Eide Road site entrance, indicated by the tide gate culvert.

Looking east on the waterward side of the entrance to the Eide Road site, indicated by the culvert outflow.

View of tide gate culvert outflow looking southwest towards Port Susan. Mussels are located underneath the culvert mixed in the boulder outcrops.

PUGET SOUND CAVALERO COUNTY PARK: PSCC

TARGET SPECIES: *Mytilus edulis*

NOMINAL STATION CENTERS:

Station 1: 48 10 31.2; -122 28 42.3
Station 2: 48 10 30.7; -122 28 42.7
Station 3: 48 10 30.7; -122 28 41.2

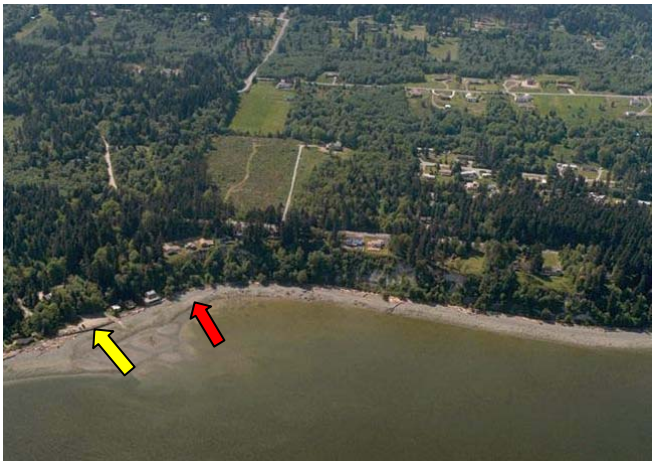
SITE ACCESS:

From I-5, take exit #212 and turn left on West 532 towards Stanwood/Camano Island. Follow WA-532 W approximately 10 miles, and take a slight left on NE Camano Drive, and follow this road for approximately 5 miles. Turn left on Cavalero Road, then another left on Simonson Place. Signs to County Boat Launch Park (located in residential community) can also be followed if necessary. Parking is located south of the boat launch, and site is accessed by walking north over the ramp to the beach.

SITE DESCRIPTION:

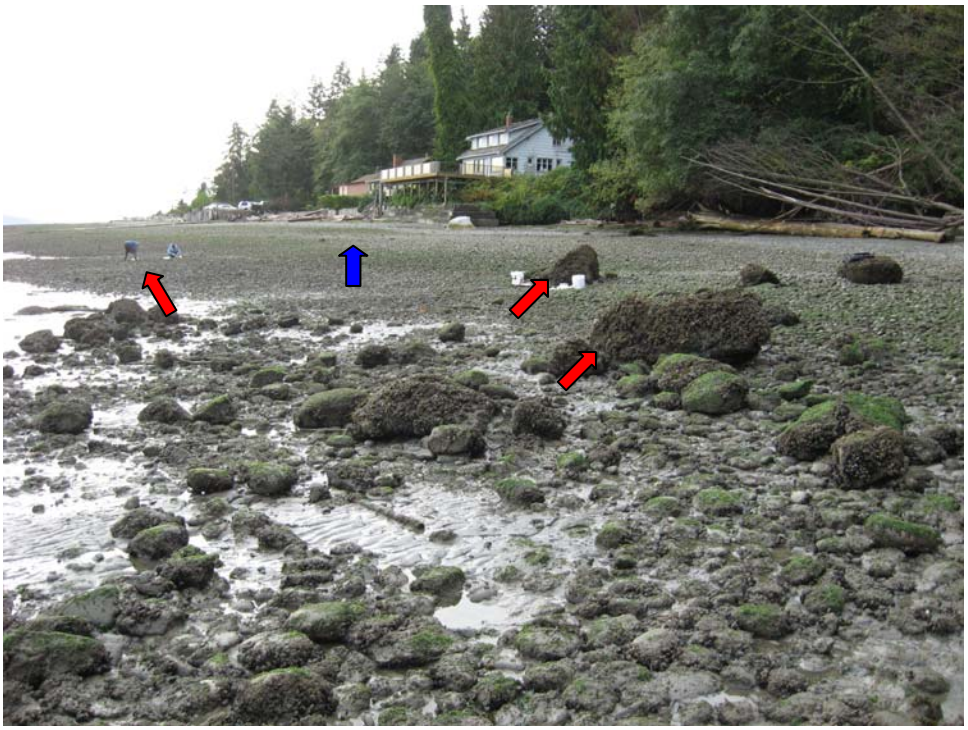
The PSCC site collection area is a 30 x 100 m cobble beach, with scattered boulders, centered about 100 m north northwest of the Cavalero County Park boat launch ramp and parking lot, Camano Island, Island County, Washington. Mussels are found in the intertidal zone on patchy boulders, and within cobble beaches. Stations 1 and 2 are 1-2 meter sized boulders located 56 feet (19 m) apart. When standing north of the station 2 boulder these two boulders form a straight line-of-sight south to a house with a deck jutting over the beach. Station 3 is cobble only (no boulder) and located 33 meters to the southeast of the Station 1 boulder.

SITE PHOTOS:



Aerial view of Cavalero County Park. Site is northeast of the boat launch ramp in the intertidal zone. Red arrow indicates site location. Yellow arrow indicates parking.

Overview of Cavalero site, looking northeast from the boat ramp towards the sampling stations.



Overview of sampling stations looking southwest towards the boat launch. Red arrows indicate sampling locations. Blue arrow indicates boat ramp site access location.

Partner Organizations

Coordinating a Mussel Watch Program in Snohomish County could not have been possible without extensive help from our partner organizations: NOAA, Stillaguamish Tribe, WSU Beach Watchers, and Snohomish County Sheriff's Office.

We strive to ensure that our partners are acknowledged for their hard work and assistance. Writing thank you notes, and baking cookies (the Sheriff's office expects them during the sampling day), are great ways of recognizing our wonderful partners.

Budget

Mussel Watch Sampling - Both Eide and Kayak Samples

	Winter 08	Summer 08	Winter 09	
Edmonds				
Lab	0	867	867	
Shipping	0	58.91	58.91	
Mukilteo				
Lab	0	867	867	
Shipping	0	58.91	58.91	
Everett				
Lab	0	867	867	
Shipping	0	58.91	58.91	
Hat Island				
Lab	867	867	867	
Shipping	235.64	58.91	58.91	
Kayak				
Lab	867	0	867	
Shipping	0	0	58.91	
Eide Road				
Lab	N/A	N/A	867	
Shipping	N/A	N/A	58.91	
Total				
Total Lab	1734	3468	5202	
Total Shipping	235.64	235.64	353.46	
Final Costs	1969.64	3703.64	5555.46	11228.74

*Stef Frenzl, MRC Lead Staff, has developed a more extensive budget which includes staff time, and will include in this manual at a later time.

Volunteers

Current Volunteers

As of September 2008, the following are individuals who have participated in the Mussel Watch Program. Continual updates will need to occur as more volunteers are recruited. You can find the Excel document entitled, "Mussel Watch Volunteers."

Name	Affliation	Email	Phone
Thomas Hoban	MRC Member; WSU Beach Watcher	tomhobansr@verizon.net	360-653-1771
Maureen Hoban	WSU Beach Watcher		360-653-1771
Bernie Busch	WSU Beach Watcher	bernie_busch@comcast.net	425-359-3221
Ann Uhl	WSU Beach Watcher	sawtooth99@aol.com	425-252-5902
Chris Betchley	WSU Beach Watcher	chrisbe1@juno.com	360-435-3918
Lynn McCort	WSU Beach Watcher	jolynnam@comcast.net	360-658-7245
Brigid Stockton	Skagit Valley Community College	blakebrigid@yahoo.com	360-724-0541
Emily Brodin	ORCA	BrodinTeam@verizon.net	
Liza Schmidt	ORCA	siza@verizon.net	
Brielle Kemis	ORCA	kemiscritter@hotmail.com	
Theda Houck	WSU Beach Watcher	thedahouck@verizon.net	
Judi Schwarz	WSU Beach Watcher	iduj1234@comcast.net	
Nancy McDonald	WSU Beach Watcher	nanmcdonald@verizon.net	
Joan Douglas	WSU Beach Watcher	j.abraham@gte.net	
Fran Van Roekel	WSU Beach Watcher	franvan@msn.com	
Jerry Anderson	WSU Beach Watcher	doris-jerry@comcast.net	360-668-9259
Mary Cunningham	MRC Member	mcunningham@ci.everett.wa.us	
Doris Maahs	WSU Beach Watcher	dmaahs@gmail.com	425-239-2310
PJ Juttner	WSU Beach Watcher	juttp@hotmail.com	
Bob Overstreet	WSU Beach Watcher	boverstreet7@verizon.net	

Recruitment

In addition to recruiting MRC member involvement, additional volunteers can be solicited through local partner organizations, such as People For Puget Sound, WSU Beach Watchers, Everett Community College Ocean Research College Academy (ORCA), Edmonds Community College LEAF School, Snohomish-Camano Nearshore Cooperative, Puget Soundkeeper Alliance (Citizen Soundkeepers), and Stilly Snohomish Fisheries Enhancement Task Force.

Permitting

If new volunteers are recruited, they must be added to the Scientific Collection Permit, as sub-permit holders. To add them, you need their full name and birthday. Send this information to Dave Gadwa in WDFW Licensing, Special Permits. Allow a minimum of one week before sampling date to process new additions.

Training

Training volunteers is essential in maintaining accuracy and consistency in collection methods. A training packet has been made and is located here: X:\ESA\MRC\Projects\MarineWaterQuality\Mussel Watch\Volunteers. The training packet is also included in the appendix of this manual.

Coordinating

In order to ensure efficient collection, we must limit the number of individuals involved on the actual sampling day. The northern site (Hat Island) can only take 2 volunteers in addition to the site lead, because of limitations on the boat. The southern site group should have a maximum of 8 volunteers (including the site lead). Too many volunteers can hinder the process of efficiency and effectiveness for collecting within the tidal timeframe.

Once the volunteers are chosen, keep in regular contact with them to ensure they're aware of the sampling day logistics. Create a plan for the day for each sampling group, and send it to the volunteers. See here for examples: X:\ESA\MRC\Projects\MarineWaterQuality\Mussel Watch\Volunteers\Volunteer Instructions. An example is also included as part of the appendix to this manual.

Pre-sample Prep

Tides

In determining the best dates for collection, review the tide calendars, or retrieve tide data online at the following sites:

- http://www.saltwatertides.com
- http://tbone.biol.sc.edu/tide/

During the winter, because of late night low tides and early sunsets we tend to look at dates closer to the end of February or early March. Ideally we should choose a negative tide during the afternoon with enough time for sampling before sunset. Sampling for each group (northern vs. southern sites) takes about 4 hours to complete.

During the summer, we look for morning tides in August or September.

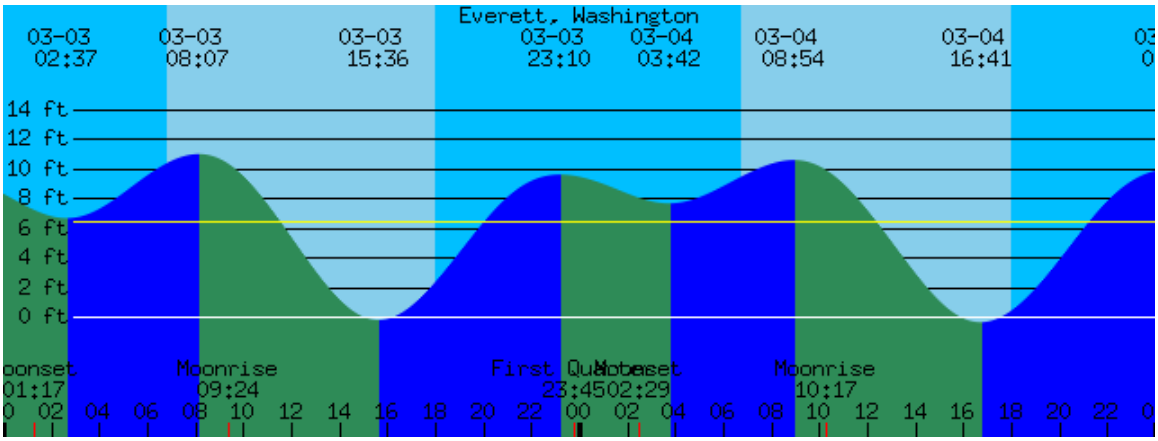
Projected Tides for Winter Sampling 2009

Found on http://www.saltwatertides.com

March

Tu	3	Low	2:33 AM	6.9	6:45 AM	Set 1:19 AM	34
	3	High	8:13 AM	11.0	5:57 PM	Rise 9:25 AM	
	3	**Low**	**3:33 PM**	**-0.2**	***		
	3	High	11:02 PM	9.4			
W	4	Low	3:41 AM	7.9	6:43 AM	Set 2:30 AM	45
	4	High	9:03 AM	10.5	5:58 PM	Rise 10:18 AM	
	4	Low	4:37 PM	-0.3			
Th	5	High	12:56 AM	9.7	6:41 AM	Set 3:31 AM	56
	5	Low	5:23 AM	8.4	6:00 PM	Rise 11:26 AM	
	5	High	10:12 AM	10.1			
	5	Low	5:47 PM	-0.5			

Found on http://tbone.biol.sc.edu/tide/



Best option for Winter Sampling 2009 is Tuesday March 3, 2009. The -0.2 low-tide occurs at 3:33/3:36, which gives ample time for sampling before sunset. Start sampling approximately 1.5 hours before low-tide, and wrap up sampling approximately 1.5 hours after low-tide.

Notification of Sampling

Once a date and time has been decided, notify the agencies involved of the sampling date approximately four weeks before the sampling date to ensure any questions and concerns are addressed before the session.

- Chuck Motson, Hat Island Manager
- Sally Lider, Environmental Education Coordinator, City of Edmonds Parks, Recreation and Cultural Services
- Paul Plesha, Biological Station Manager, NOAA Fisheries, Mukilteo
- Graham Anderson, Senior Planner, Port of Everett
- Ed Madura, Facility Security Supervisor, Port of Everett
- John Garrett, Skagit/Snoqualmie Wildlife Area Manager, Eide Road (if sampling)
- Jerry Smith, Senior Park Ranger, Kayak Point County Park (if sampling)

Boats

The only site requiring a boat for access and sampling is Hat Island. Snohomish County Sheriff's office has a 33' boat and crew that we are able to use to transport volunteers to the island. The mussels are located on the pilings (see site description), and are inaccessible by land. The Sheriff's boat can be motored close enough to the pilings to sample from boat. Because of the limited space on the boat, no more than 2 non-staff volunteers are able to assist at Hat Island.

Sample Equipment

Sampling supplies need to be inventoried at least three weeks prior to the Mussel Watch sampling date to ensure all supplies are stocked. See following section for ordering information.

The following is a list of supplies needed for a complete sampling session. All labels, sample logs, and data sheets must be printed on Rite-in-the-Rain paper.

Sampling Supplies for ONE SITE:

Each site:

- 3 plastic containers
- 3 brushes
- 3 knives
- 1 garbage bag
- 4 sharpies
- 4 pencils
- 1 bag medium gloves
- 1 bag large gloves

If an already existing site:

- 6 1-quart pre-labeled Ziploc bags (2 for each station)
- 3 1-gallon pre-labeled Ziploc bags (1 for each station)
- 6 bag labels

If a new site:

- 12 1-quart pre-labeled Ziploc bags (4 for each station)
- 6 1-gallon pre-labeled Ziploc bags (2 for each station)
- 12 bag labels

Sampling Supplies for ONE SAMPLING GROUP:

Most sampling days will have 2 volunteer sampling groups:
1) South Sampling (Edmonds, Mukilteo, Everett), and
2) North Sampling (Hat Island)

Each sampling group will need:

- 1 GPS unit
- 1 YSI 550A
- 1 refractometer
- 1 thermometer
- 1 30m transect tape
- 1 quadrat
- 1 camera
- 1 metal clipboard (include permits, flyers, sampling logs and water quality data sheets for each site, and extra Ziploc bags, labels, sharpies, and pencils)
- Life jackets for volunteers (Hat Island only)

Shipping Supplies for ALL SITES:

- ice chests (# depends on number of mussels collected; North Sampling: 1 ice chest, South Sampling: 3 ice chests)
- bags of ice (# depends on number of mussels collected; North Sampling: 1 bag of ice; South Sampling: bags of ice)
- SWM pre-labeled FedEx mailing labels for each ice chest
- 1-3 rolls of packing tape

Location of Sample Equipment

Surface Water Management Storage Room: Buckets, bags of gloves, metal clipboards, transect tapes, plastic containers, brushes, knives, quadrats, and sign boards.

Office (2nd drawer/left side of desk): extra gloves, extra labels, Ziploc bags, garbage bags and refractometers.

X-Drive: water quality data sheets, sampling logs, bag labels, quadrat labels, site descriptions, and flyers.

Other: Allan Wahl – YSI 550A, and other water quality measurement tools; Jake Jacobsen – GPS units, extra thermometers; SWM Front Desk – FedEx Mailing labels.

Buying New Equipment

Before ordering equipment, check with Stef Frenzl to ensure adequate funding. Small supplies, such as more garbage and Ziploc bags, plastic containers, and ice are purchased through the QFC account with Surface Water Management. New transect tapes can be purchased at Bill's Blueprint at 2920 Rockefeller Ave, Everett, WA 98201

(SWM has an account with them). New coolers can be purchased with the Tegrant Corporation at www.tegrant.com. Discuss with Stef Frenzl about purchasing life jackets for use by the Snohomish County Marine Resources Committee.

Volunteer Site Leads

Because sampling sessions are split between two groups (northern and southern sampling), volunteer site leads need to be designated at each site. Staff can be used for one group, and it's likely that an experienced volunteer will be the site lead for the other group. Alan Mearns, Chris Betchley, Amy Johnson, and Stef Frenzl are good candidates for being site leads because of their familiarity and experience with the Mussel Watch Program.

Once a volunteer site lead is chosen, logistics of the sampling day need to be shared with them, and all the materials need to be transferred for their use during the day. Staff needs to ensure that site leads are trained on the proper use of the equipment, sampling methods, and all the details of the sampling day. After completing the sampling, the site lead needs to coordinate with staff to relinquish the mussels as well as the sampling materials.

Sampling Day

Overview

On the sampling day, volunteers will meet up at the first site they're assigned to, and the day will begin. Sampling takes about 4 hours for each sampling group; it starts about 1.5 hours before low tide, and ends about 2 hours after low tide. For the southern end with multiple sites, the southern most site is first, and sites are sampled in a northerly direction.

Sampling Methods

For Established Sites:

1) Find the established central point using GPS, and disperse in three directions to establish three stations at least 50 feet from the central point, or within the 50 foot radius if no mussels are found at 50 foot mark. Distinct sample regions can also be selected if there are limited sample sites.

2) At the central point, collect water temperature, salinity, and tide data (mandatory). If the YSI 550 is available, then collect conductivity and dissolved oxygen data.

3) Develop written description of the stations on sampling log; take GPS coordinates for the central point and each station. Take photos of each station.

4) At each station, lay down a $0.25m^2$ quadrat on a representative area of the station. Label the quadrat by placing a card down identifying the site, station #, and date. Take a picture of the quadrat, with the label included.

5) At each station, collect 50 mussels by cutting their byssus threads, brushing off as much sediment as possible, and rinsing them in a bucket of marine water. Place mussels into 2 labeled quart-sized Ziploc bags (25 mussels each) and place Rite-in-the-Rain labels (station #, bag #, and collectors) in the bag. Place the two quart sized Ziplocs into a large gallon Ziploc with outside labeled in black sharpie: site location, date, time, sampler ID, station #, and contact information. Remember to use latex gloves when handling the mussels, labels and bags. Should **collect 150 total mussels** for each site.

6) Place all sealed bags for each site in a plastic garbage bag, and immediately place on ice in a cooler.

7) Ship the samples on ice in a cooler by FedEx overnight shipping to TDI Brooks for chemical analysis. If necessary, they can be placed in a freezer overnight, and shipped FedEx overnight the following day. See the shipping section for more details.

For New Sites:

1) Select a central point and disperse in three directions to establish three stations at least 50 feet from the central point, or within the 50 foot radius if no mussels found at 50 foot mark. Distinct sample regions can also be selected if there are limited sample sites.

2) At the central point, collect water temperature, salinity, and tide data (mandatory). If the YSI 550 is available, then collect conductivity and dissolved oxygen data.

3) Develop written description of the stations on sampling log; take GPS coordinates for the central point and each station. Take photos of each station.

4) At each station, lay down a $0.25m^2$ quadrat on a representative area of the station. Label the quadrat by placing a card down identifying the site, station #, and date. Take a picture of the quadrat, with the label included.

5) At each station, collect 100 mussels by cutting their byssus threads, brushing off as much sediment as possible, and rinsing them in a bucket of marine water. Place mussels into 4 labeled quart-sized Ziploc bags (25 mussels each) and place Rite-in-the-Rain labels (station #, bag #, and collectors) in the bag. Place the four quart sized Ziplocs into large gallon Ziplocs with outside labeled in black sharpie: site location, date, time, sampler ID, station #, and contact information. Remember to use latex gloves when handling the mussels, labels and bags. Should collect **300 total mussels** for each site.

6) Place all sealed gallon Ziploc bags for each site in a plastic garbage bag, and immediately place on ice in a cooler.

7) Ship the samples on ice in a cooler by FedEx overnight shipping to TDI Brooks Laboratory for chemical analysis. If necessary, they can be placed in a freezer overnight, and shipped FedEx overnight the following day. See shipping section for more details.

For Rutgers Mussels:

1) Rutgers mussels are only collected one time for new sites for Snohomish County Marine Resources Committee. Collect a mixture of 50 mussels from all three stations (approximately 17 from each station) in two quart-sized Ziploc bags. Label according to procedures above.

2) Ship the samples on ice in a cooler by FedEx overnight shipping to Rutgers Haskin Shellfish Lab for histopathological analysis. If necessary, they can be placed in a freezer overnight, and shipped FedEx overnight the following day. See shipping section for more details.

Shipping Samples

After collecting the mussels, they need to be properly packaged and shipped in shippable, heavy duty coolers. Once all mussels are transported to the County office, preparing the samples for shipping will take approximately 2.5 hours for 2 people.

Checklist

- Check that all bag labels and sample data logs are properly filled out.
- Put the ice in plastic garbage bags, and place in the cooler.
- Place mussel bags in plastic garbage bags, and pack mussels into cooler to ensure mussels are surrounded by ice, but have multiple layers of plastic buffering to ensure fresh water does not enter the mussel bag.
- Make copies of the water quality data sheets and sampling logs on Rite-In-The-Rain paper, and place inside their corresponding coolers (originals kept with the MRC).
- Tape coolers closed with packing tape, and ensure all edges are reinforced with layers of tape to stabilize the styrofoam to ensure safe shipping. This is especially important if not placed in a cardboard box for shipping.
- Label shipping container with arrows indicating "up" and "fragile."
- Fill out SWM mailing labels (one for each cooler; see file for examples), and take coolers to shipping location (SnoCo Mailroom or Everett Pack-Man). Weigh the coolers, and send them off.
- Make copies of the final mailing labels, and place the original copies back in the SWM folder for payment.

During winter sampling sessions, the mussels will need to be held overnight due to the timing of the low tides (last pick-up is 4:30pm). The packed coolers will need to be stored in the fridge overnight, and repacked with more ice in the morning. Samples can be shipped from the Snohomish County mailroom in the basement of the Admin-West

building before 1:30pm. Check with the mail room prior to every sampling to ensure shipping times have not changed.

During summer sampling sessions, the mussels can be shipped the same day. Because of the time it takes to prepare the samples, it is not necessary to rush to send out the samples by the 1:30 deadline in the Snohomish County mailroom. Instead, the Everett Pack-Man's last pick-up for FedEx Overnight is at 4:30pm. They are located at: 2625 Colby Avenue #3, Everett, WA 98201. Just bring along the pre-labeled SWM packing sheets with the SWM account number.

Data Retrieval and Analysis

Data from TDI Brooks takes about six months to process, after which, you can begin to request Juan Ramirez to send the results. The results come as an Excel file through email, and should be sent to MRC staff, the Stillaguamish Tribe (Jen Sevingy and Robbie Hutton), and Alan Mearns (NOAA).

Data Synthesis Team

Alan Mearns, our NOAA Representative and former MRC member, has taken the lead on analyzing and synthesizing the data we've received from the lab. He created a rough PowerPoint Presentation on the results from 2004-present. In order to lighten the load on Alan, a data synthesis team needs to be created. Mary Cunningham, an MRC member, and Judi Schwarz, a WSU Beach Watcher, have expressed interest in being part of the team. We recommend that the MRC budgets adequate staff time to assist with data synthesis and dissemination to the MRC and partners.

Contracts and Permits

TDI Brooks Laboratory

TDI Brooks was chosen as the lab of choice because it's the same lab that NOAA uses for their national monitoring program. The contract was established through the County's purchasing department, and the intent-to-purchase bid document becomes the lab contract.

On September 26, 2008, Snohomish County accepted a one-year contract extension for the Lab Services for Analysis of Mussels, Annual Contract, Bid No. 99-I-07. All prices, terms, and conditions remained unchanged from the original contract. This contract will be effective from August 15, 2008 through August 14, 2009. For contract renewal after that time, coordinate with Stef Frenzl, MRC Lead Staff, and Dave Gibson, Purchasing Manager at Snohomish County.

WDFW Scientific Collection Permit

The Scientific Collection Permit (SCP) with Washington Department of Fish and Wildlife is valid for one full year. The permit used to collect samples Summer 2007 – Summer 2008 expired on September 6, 2008, and an extension was granted until October 6, 2008 to include Cavalero resampling on September 26, 2008. The SCP will need to be renewed before sampling occurs for Winter 2009. The renewal process is the same as the application process. Submit this form found here: X:\\Permits\Collection Permit\scp_application_8-26-08.doc to WDFW. The permit fee is $12.

Allow 60 days from the time of renewal before receiving a new permit. Following the expiration of the permit, submitting an annual report is required within 60 days. In October 2008, the annual report for the Summer 2007 – Summer 2008 samples was submitted to WDFW. The annual report form can be found here: X:\\Permits\Collection Permit\annual_report_form.doc. Copies of the expired permit, the application form, and the annual report form are also included in the appendix.

City of Edmonds Shoreline Sanctuary Permit

Because Edmonds Beach is a Marine Sanctuary, we are required to have a permit from the City of Edmonds before sampling. The current Shoreline Sanctuary Permit will last through the Winter '09 sampling, but will need to be renewed if additional sampling sessions are to be scheduled. A requirement for this permit is to have signage posted at Edmonds Beach during sampling and having flyers available to the interested public. The permit can be found here: X:\\Permits\Shoreline Sanctuary Permit Edmonds\ShorelineSanctuaryPermit-MRC07.doc. A copy is also included in the appendix.

WDFW Right-of-Entry Permit

Because Eide Road is owned by the Washington Department of Fish and Wildlife, we are required to have a right-of-entry permit, including parking pass validation. The permit expired on August 28th, 2008. If sampling is to occur at Eide Road, this permit will need to be renewed and/or resubmitted.

Appendices

A. Sampling Overview and Responsibility Table

Organization Responsibility Table 2004-2007	2004 Winter Wet (NOAA)		2006 Winter Wet (NOAA)		2007 Summer Dry (MRC)	
Sample Locations	Collection	Funding	Collection	Funding	Collection	Funding
Possession Point (WIPP)	NOAA	NOAA	NOAA	NOAA		
Edmonds Ferry (PSEF)	NOAA	NOAA	NOAA	NOAA	MRC	MRC
Mukilteo Ferry (PSMF)	NOAA	NOAA	NOAA	NOAA	MRC	MRC
Everett Harbor (PSEH)	NOAA	NOAA	No Sample	-	MRC	MRC
Hat Island (PSHI)						
Kayak Point (PSKP)					Tribes	Tribes
Eide Road (PSER)					MRC	MRC
Cavalero Park (PSCC)			Tribes	NOAA	Tribes	Tribes

Organization Responsibility Table 2008-2010	2008 Winter Wet (MRC)		2008 Summer Dry (MRC)		2009 Winter Wet (MRC)		2010 Winter Wet (NOAA)	
Sample Locations	Collection	Funding	Collection	Funding	Collection	Funding	Collection	Funding
Possession Point (WIPP)	NOAA	NOAA					NOAA	NOAA
Edmonds Ferry (PSEF)	NOAA	NOAA	MRC	MRC	MRC	MRC	NOAA	NOAA
Mukilteo Ferry (PSMF)	NOAA	NOAA	MRC	MRC	MRC	MRC	NOAA	NOAA
Everett Harbor (PSEH)	NOAA	NOAA	MRC	MRC	MRC	MRC	NOAA	NOAA
Hat Island (PSHI)	MRC	MRC	MRC	MRC	MRC	MRC	MRC	MRC
Kayak Point (PSKP)	Tribes	MRC	N/A - Samples Ruined		Tribes?	MRC?	Tribes?	NOAA?
Eide Road (PSER)					?	?	?	?
Cavalero Park (PSCC)	Tribes	NOAA	MRC	Tribes	Tribes?	Tribes?	Tribes	NOAA

Table showing sampling schedule and organization responsibility starting in winter 2004. Question marks indicate sampling is pending due to potential impact on the mussel population.

B. Map


Oak Harbor
Skagit Bay
Stanwood
Eide Road
Cavalero Park
Port Susan
Kayak Point
Arlington
Marysville
Hat Island
Possession Sound
Everett Harbor
Puget Sound
Everett
Mukilteo Ferry
Snohomish
Possession Point
Mukilteo
Edmonds
Edmonds Ferry
Bothell

C. Training Packet Example

SEE FOLLOWING PAGES

D. Sampling Group Instructions Example

SEE FOLLOWING PAGES

E. TDI Laboratory Contract

SEE FOLLOWING PAGES

F. WDFW Scientific Collection Permit (SCP)

SEE FOLLOWING PAGES

G. WDFW SCP Application Form

SEE FOLLOWING PAGES

H. WDFW SCP Annual Report

SEE FOLLOWING PAGES

I. City of Edmonds Shoreline Sanctuary Permit

SEE FOLLOWING PAGES

J. WDFW Right-of-Entry Permit

SEE FOLLOWING PAGES