Monitoring Plan

Bowman Bay Restoration Project

September 15, 2014

Prepared for Skagit County Marine Resources Committee

Prepared by Northwest Straits Marine Conservation Foundation

Skagit County Contract #C20130527

This project has been funded wholly or in part by the United States Environmental Protection Agency. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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Introduction

The Northwest Straits Foundation has prepared a monitoring plan as part of the Bowman Bay Bulkhead Removal and Nearshore Enhancement Project. The project site is located on the east side of Bowman Bay within Deception Pass State Park, Skagit County, WA. Bowman Bay is a pocket beach on the southwest shore of Fidalgo Island. The site was armored to protect a fish hatchery and marine biology station which were demolished and have not been in use since the early 1970s. The armoring consists of a rock revetment bulkhead stretching 540 ft. along the shoreline.

Bowman Bay has been documented by Washington Department of Fish and Wildlife (WDFW) as surf smelt spawning grounds and by U.S. Fish and Wildlife Service as critical and essential habitat for foraging and migration of bull trout. Bowman Bay is also used extensively by juvenile salmon. The project will remove rip rap along 540 ft. of shoreline, and enhance nearshore sediments and vegetation with the goal of restoring and improving nearshore habitat for forage fish spawning, salmon and bull trout migration, and serve as an example and demonstration site for alternatives to shoreline armoring. Physical and biological parameters will be monitored to determine the success and long-term effects of the restoration project.

Existing Site Conditions

Coastal Geologic Services performed a feasibility analysis documenting existing conditions. Analysis included performing a site assessment and topographical survey to determine the feasibility of the project and potential benefits. The beach is mixed sand and gravel composed primarily of gravel. There is a wooden pier located within the south end of the site and a concrete boat ramp immediately north of the armoring. The existing rock revetment consists of approximately 2,050 tons of armor stone and quarry spell extending 540 ft. along the shoreline. The uplands from the project location consist of an expansive lawn, large parking area, trail, waterfront benches, restroom facilities, septic system, drainage culverts, and other park infrastructure (CGS 2014). North and south of the armoring is 1560 ft. of undisturbed shoreline which will be used as reference sites during monitoring efforts.

Project Description

The restoration project is designed to restore natural erosion and sediment transport along the shoreline creating a viable habitat for bull trout and juvenile salmon migration, and forage fish spawning. Rip rap armoring increases turbulence and wave energy resulting in a poor habitat for juvenile salmon and bull trout, and coarse beach sediment unsuitable for forage fish spawning. The project will include full armor removal with re-grading, minor upper intertidal beach nourishment, and substantial upland vegetation enhancement. Some armor will remain under the approach to the pier for stability.

Monitoring Plan

The monitoring plan is designed to determine the effectiveness of the restoration project and learn more about the effects of shoreline armoring. Pre and post-construction monitoring will be performed to determine what changes in habitat and habitat usage have occurred. The length of the monitoring period is subject to available funding. Monitoring should occur for 5 years after construction is complete.

Physical Monitoring

Project Goal

Enhance nearshore physical habitat conditions by removal of rip rap armoring, beach nourishment and riparian vegetation enhancement. Create a demonstration site for alternatives to shoreline armoring.

Project Objectives

1. Restore a beach profile that will accumulate large woody debris and retain substrates which are suitable for forage fish spawning.
2. Improve sediment transport processes.
3. Increase forage fish spawning area.
4. Increase density and complexity of large woody debris and beach wrack.

Performance Standards

Monitoring data will be used to evaluate the following hypotheses in determining the long-term effects of the restoration project, and document and verify that physical performance standards are met.

1. As sea level rises, the amount of intertidal habitat will be maintained over the long term. The slope of the upper shore will be reduced allowing fine sediments to settle and become a dominant part of the upper beach substrate.
2. The shoreline will retain a substrate which is suitable for forage fish spawning.
3. The reduced slope of upper shore and removed armoring will allow for the accumulation of large woody debris.
4. There will be an increase in wrack volume and complexity providing habitat for invertebrate species important to the nearshore food web.

Monitoring Protocols

Pre-Construction

Pre-Construction monitoring will be conducted to establish baseline data as reference for analyzing changes in physical habitat over time.

Site Photos

Site photo points are used to document changes in physical habitat over time. The Northwest Straits Foundation established photo points on July 22, 2014. The site locations, camera directions and angles were determined based on visibility of key habitat characteristics and documented in relation to and distance from noted permanent features.

Beach Profile

The purpose of assessing the beach profile is to determine potential sediment accretion, erosion, and distribution as these measurements provide information about the extent and condition of available forage fish spawning habitat (Herrera 2013). Profile points were established and baseline beach profiles were surveyed from July 14 – 15, 2014 by the Skagit County Beach Watchers. Beach profiles were surveyed using the "Two Stick Method" established by the Island County/WSU Beach Watchers. The profile locations include two sites within the restoration area and two reference sites north and south of the project area. Included in the data collection is an inventory of substrates, plants and animals along each profile line. Coastal Geologic Services surveyed beach profile from six points within the restoration area as part of the feasibility analysis on January 21, 2014. Information gathered from the surveys will be used as baseline data along with a subsequent pre-construction survey to be completed during summer 2015.

Sediment Characteristics

Specific sediment sizes are targeted by forage fish for spawning grounds and have an effect on the animal and plant life within the substrate. Along each profile line sediment size, plants and animals are surveyed and documented for presence. Baseline data was collected by Skagit County Beach Watchers during the beach profile surveys conducted on June 14 and 15, 2014. Additional baseline data will be collected during summer 2015 beach profile surveys.

Large Woody Debris

The amount of large woody debris (LWD) present is important for beach stabilization and as a food source and habitat for aquatic insects and wildlife. LWD will be surveyed during April and September along 50 m transects perpendicular to each profile line. Using protocol from Toft's "Shoreline Monitoring Toolbox," the width of the logline perpendicular to the transect line will be measured from 5 randomly selected points along each transect line. The distance from the seaward most edge logs to the landward most edge of logs will be measured. A count of large and small logs (longer or shorter than 2m) crossing the perpendicular will be recorded and characterized as "natural" logs or human-altered. Full protocol details are provided in Appendix A.

Beach Wrack

The availability and composition of beach wrack is an important source of food and shelter for invertebrates and foraging habitat for shorebirds. Beach wrack will be surveyed concurrently with LWD

along two 50 m transect lines perpendicular to each profile line, one at the most recent high tide line containing "fresh wrack," and the second just above MHHW. Sampling will occur on an ebbing tide when the upper beach +6' MLLW and above is exposed. Following protocol from Toft's "Shoreline Monitoring Toolbox," ten random points along the transect line will be selected for wrack sampling. Percent composition of algae and algae type, eelgrass, terrestrial plant material and trash will be determined using a .1m² quadrat placed on the beach surface. The quadrat is divided into 25 6x6 cm squares, each representing 4% to aid in percent composition estimates. Full protocol details are provided in Appendix B.

Post-Construction

Monitoring of physical habitat characteristics should continue for 5 years after construction is complete.

Site Photos

Site photographs will be taken from previously determined photo points to visually evaluate habitat change over time. Photographs will be taken around the same time of year during low tides. Previous photos and documentation will be on hand to ensure camera directions and angles are duplicated.

Beach Profile

Beach profiles will be surveyed once a year during a summer low tide of -2 ft. or lower. Profiles will be surveyed at four previously determined sites which are referenced for location in Appendix C. Using the "Two Stick Method," two people, each holding a profile pole connected by a 10 ft. rope will work their way down the beach measuring changes in elevation using horizon measurement markings on the poles. General categories of substrate, plants and animals will be surveyed along the profile line. Details for this procedure can be found in the Island County/WSU Beach Watchers' "Beach Monitoring Procedures" manual at http://beachwatchers.wsu.edu/island/monitoring/data/manual03.pdf. Beach profiling procedures are located on pages 15 – 19 and a copy of the data form on page 43.

Sediment Characteristics

Sediment size, plants and animals will be surveyed once a year as part of each beach profile survey. Protocol for surveying sediment characteristics is included in beach profiling procedures.

Large Woody Debris

Large woody debris will be surveyed twice a year during April and September, and concurrent with beach wrack surveys. LWD will be surveyed along a 50 m transect line perpendicular to each profile line. Density of LWD will be determined using the protocol discussed in pre-construction monitoring and available in Appendix A.

Beach Wrack

Beach wrack surveys will be conducted twice a year during April and September when high wrack accumulation is common, and concurrent with LWD surveys. Transects are dependent on tide lines and are expected to change over time as beach elevation changes. It is important to sample the "fresh wrack" located at the most recent high tide line and the more permanent wrack just above the MHHW (Toft n.d.). Beach wrack will be surveyed using the protocol discussed in pre-construction monitoring and available in Appendix B.

Biological Monitoring

Project Goal

Restore nearshore habitat conditions to provide a viable site for forage fish spawning, juvenile salmon and bull trout migration, and habitat and food source for shorebirds, aquatic insects, other invertebrates and wildlife.

Project Objectives

1. Enhance forage fish spawning activity.
2. Increase nearshore fish use including juvenile salmon and bull trout.

Performance Standards

Monitoring data will be used to evaluate the following hypotheses to determine the long-term effects of the restoration project and document and verify that biological performance standards are met.

1. A suitable habitat for forage fish spawning will be provided including appropriate sediment composition and vegetative shading.
2. Surface epifauna and algae abundance and diversity will change over time.
3. The presence of terrestrial insects as a source of prey will increase with vegetation enhancement and established connectivity of terrestrial and intertidal habitat.

Monitoring Protocols

Pre-Construction

Pre-Construction monitoring will be conducted to establish baseline data as a reference for analyzing changes in habitat usage over time.

Forage Fish Spawning

Surf smelt spawning activity has been documented by WDFW on the shoreline of Bowman Bay. Surf smelt are an important food source for salmon, bull trout and other larger fish, marine mammals and shorebirds. Forage fish spawning will be monitored using the bulk sampling method following WDFW established protocols. Beach characteristics and visible presence or absence of eggs are documented at collection sites. Collected samples are winnowed in the field using a series of sieves providing a smaller sample for lab analysis. Detailed protocol handouts including copies of appropriate data forms can be found at http://wdfw.wa.gov/conservation/research/projects/marine_beach_spawning/.

Citizen volunteers, under the guidance of the Skagit Marine Resources Committee, have continued to collect bulk sediment samples at an interval of approximately every two weeks since December 2013. Bulk sediment samples are collected starting from a random distance between 0 and 200 feet from an established reference point north of the restoration area. From there samples are collected every 200 feet until sampling has been completed well past the project area to within the southern reference site. GPS coordinates of each sample location are recorded on the field data sheets.

Nearshore Fish Use

Bowman Bay has been a habitat for nearshore fish use including surf smelt, bull trout and juvenile salmon. To monitor changes in nearshore fish use, beach seining will be conducted following protocol from Skagit River System Cooperative Research Department. Fish samples will be collected using a 24.4 m x 1.8 m 0.3 m mesh knotless nylon net. The net is set by anchoring one end on the beach while the opposite end is deployed from a floating tote while wading "upstream" against the current, returning to the shoreline in a half circle (SRSC 2003).

Fish captured in the net will be identified and counted by species. Catch will be handled with wet bare hands and returned as quickly as possible for minimal impact. Fork length will be recorded for the first 20 of each species. Catch will be stored in a bucket of collected sea water while measurements are taken. Temperature, salinity and dissolved oxygen will be measured using a YSI meter as a factor in the presence or absence of fish.

Surface Epifauna and Algae

Surface Epifauna and Algae are important components of the nearshore food web. The plants and animals that live on intertidal substrates require certain physical and biological needs. Monitoring the abundance and biodiversity of surface epifauna and algae provides valuable information for understanding the health of the habitat including its biodiversity and physical parameters (Toft n.d.). Species abundance will be monitored using the quadrat sampling protocol described in Island County Beach Watchers' "Beach Monitoring Procedures." Quadrat sampling will be concurrent with beach profile surveys and occur at the -1 ft., 0 ft. and +1 ft tide lines. Initial baseline data was collected during the July 14 – 15, 2014 beach profile surveys conducted by Skagit County Beach Watchers. Details for the protocol can be found at http://beachwatchers.wsu.edu/island/monitoring/data/manual03.pdf. Quadrat sampling procedures are located on pages 21 – 24 and a copy of the data form on page 44.

Terrestrial Insects

Terrestrial insects are an important food source for juvenile salmon and bull trout. Passive fallout traps will be used to simulate insects that could fall on the surface of the water and be available as fish prey. At each profile point, three insect fall out traps will be placed along a 50 ft. transect parallel to shore. Fallout traps will remain for approximately 24 hours, with insect presence being documented by total

counts the following day. Pre-construction sampling will coincide with beach profile surveys to be completed in summer 2015. Full protocol details are provided Appendix D.

Post-Construction

Monitoring of habitat usage should continue for 5 years after construction is complete.

Forage Fish Spawning

Post-construction monitoring of forage fish spawning will be conducted approximately every two weeks following protocols discussed in pre-construction monitoring.

Nearshore Fish Use

Samish Indian Nation DNR will complete post-construction monitoring of nearshore fish use using beach seining methods discussed in pre-construction monitoring.

Surface Epifauna and Algae

The abundance and diversity of surface epifauna and algae will be surveyed using the quadrat sampling method described in Island County Beach Watchers' "Beach Monitoring Procedures." Quadrat sampling will take place once a year during summer low tides and concurrent with beach profile surveys. Quadrat sampling transects were established during preconstruction monitoring. Diagrams of transect locations are provided in Appendix E.

Terrestrial Insects

Terrestrial insect monitoring will coincide with beach profile surveys in June – July when vegetation and insect communities are developed and juvenile salmon are feeding along the shoreline (Toft n.d.). Terrestrial insects will be sampled using the protocol discussed in pre-construction monitoring and provided in detail in Appendix D.

Vegetation

Skagit Fisheries Enhancement Group (SFEG) will complete the vegetation enhancement portion of the project and conduct post-construction monitoring. The purpose of the monitoring is to track vegetation survival and document ground cover to determine if adaptive management is needed including planting of replacement or additional plants. All vegetation will be sampled and evaluated for health when feasible; otherwise subsamples will be taken using 4 ft. × 4 ft. quadrats throughout the planting zone.

Quality Assurance/Quality Control

All monitors will be trained by the appropriate parties to ensure standard procedures are followed. It is important that monitors are appropriately trained and understand the importance of careful data collection and recording. Monitoring procedures have been established to assure data collection is consistent and accurate. Any variations from standard procedures will be documented and evaluated to determine if the variations are necessary and meet performance standards.

Salish Sea Stewards will provide trainings for volunteers to conduct beach profile surveys. Included in the beach profiling trainings are methods for identifying sediment characteristics and completing quadrat surveys of surface epifauna and algae. The Northwest Straits Foundation (NWSF) will provide training for large woody debris, beach wrack and insect fallout surveys and coordinate forage fish survey trainings with WDFW and Washington Department of Natural Resources.

Monitoring teams will be accompanied by a team member experienced in the protocols to be used during each site visit. All data will be reviewed for accuracy by monitoring coordinators who will subsequently oversee data entry. Photographs will be analyzed to ensure site locations, monitoring procedures and sample identifications are consistent and accurate.

Forage fish monitoring involves a lab component which will require further quality control measures. The Northwest Straits Foundation is currently in discussions to arrange quality control analysis of lab samples with WDFW biologists. The monitoring plan will be updated with the quality control protocol for forage fish lab samples once that becomes available.

References

CGS (Coastal Geologic Services). 2014. Bowman Bay Bulkhead Removal and Nearshore Enhancement, Preliminary Design Report. Prepared for Northwest Straits Foundation, by Alexis Blue, Jim Johannessen and Andrea MacLennan, Bellingham, WA.

Herrera. 2013. Physical Processes Monitoring Plan – Secret Harbor Estuary Restoration. Prepared for Washington State Department of Natural Resources, by Herrera Environmental Consultants Inc., Seattle, WA

SRSC (Skagit River System Cooperative) Research Department. 2003. Estuarine Fish Sampling Methods, March 2003.

Toft, Jason. n.d. Shoreline Monitoring Toolbox. Washington Sea Grant. Web. 15 Sept. 2014. http://wsg.washington.edu/toolbox

APPENDIX A

Large Woody Debris Survey Protocol

Materials

- Two 50 m Measuring Tapes
- Copy of Beach Profile Reference Points
- GPS
- Compass
- Camera

Procedure[1]

- Survey large woody debris on an ebbing tide when the upper beach +6' MLLW and above is exposed.
- Locate established beach profile point using a copy of the beach profile reference points, a GPS and compass.
- Establish a transect by laying a 50 m measuring tape on the beach perpendicular to the profile line and parallel to shore.
- Count the number of fallen trees along the 50 m transect.
- Select five random points along the 50 m transect to collect the following data.
- Using the second 50 m measuring tape, measure the distance from the seaward-most edge of logs to the landward-most edge. This will be the width of the logline.
- Count the number of large (>2 m) and small (<2 m) logs along the width of the logline.
- Identify logs as natural or human-altered (e.g. poles, dock material)
- Take a photo of the width of the log line and the 50 m transect parallel to shore.

[1] LWD procedure derived from Toft's "Shoreline Monitoring Toolbox."

APPENDIX B

Beach Wrack Survey Protocol

Materials

- 50 m Measuring Tape
- 32 cm × 32 cm Quadrat – divided with string into 25 - 6 cm × 6 cm squares
- Copy of Beach Profile Reference Points
- GPS
- Compass
- Camera

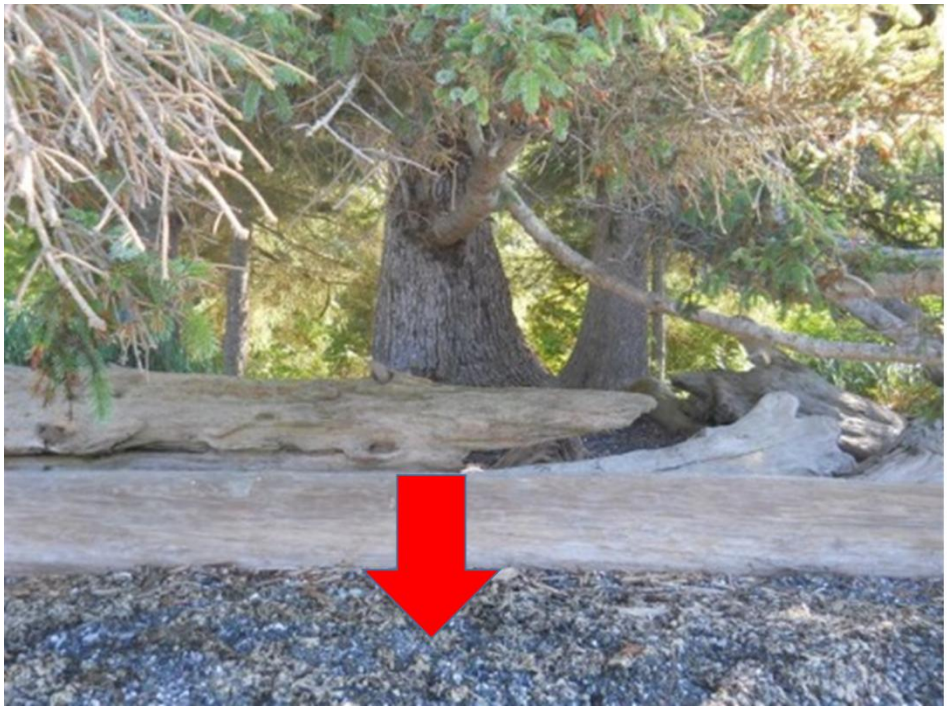
Procedure[2]

- Sample beach wrack on an ebbing tide when the upper beach +6' MLLW and above is exposed.
- Locate established beach profile point using a copy of the beach profile reference points, a GPS and compass.
- Establish two transects by identifying the most recent high tide line that has fresh wrack, and just above MHHW in the older wrack. If there is a bluff or armoring within the MHHW, sample at the base.
- Start with the most recent high tide line and lay a 50 m measuring tape on the beach parallel to shore.
- Select ten random points within the wrack along the 50 m transect to collect the following data.
- Place the quadrat on the beach and visually estimate the percent composition of red algae, green algae, brown algae, eelgrass, terrestrial plant material, and trash. Each 6 cm × 6 cm square represents 4% of the quadrat to aid in estimating percent composition.
- Take a photo of each quadrat.
- Move on to the MHHW transect and repeat data collection procedures.

[2] Beach wrack procedure derived from Toft's "Shoreline Monitoring Toolbox."

APPENDIX C

Beach Profile Reference Points



Start Point for Bowman Bay #1 is directly in front of a large spruce that hangs over the beach.

48°25'01"N

122°39'06"W

Start Point for Bowman Bay #2 is 20.4 feet below the bench on top of the bulkhead. It is in direct alignment with the space between eh edge of the house and the park bench, as well as the drainage pipe on the beach

48°24'57.0"N

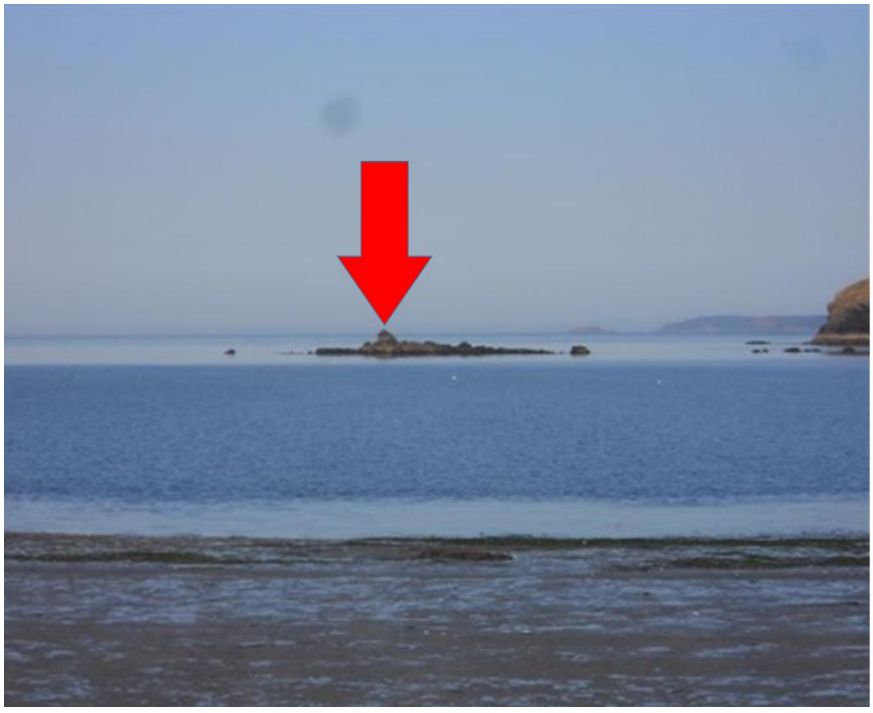
122°39'03.1"W

Image not available for this site #3.

Start Point for Bowman Bay #3 is two feet below the marker on the half wall/footbridge

48°25‘01"N 122°39'03 6"W

Start Point for Bowman Bay #4 is 42 feet from tall pine across from trail. It is in direct alignment with the large downed log.



Compass Readings for Profile line, or from starting point to horizon (magnetic north)

- Site #1- 212 degrees
- Site #2- 241 degrees
- Site # 3- 248 degrees
- Site # 4- 253 degrees

Reference Point #1 Bowman Bay Rosario Head Compass Readings (Magnetic North) from

- **Site #1- 245 degrees**
- **Site #2- 252 degrees**
- **Site # 3- 260 degrees**
- **Site # 4- 263 degrees**

Reference Point #1 Bowman Bay Rosario Head Compass Readings (Magnetic North) from

- **Site #1- 245 degrees**
- **Site #2- 252 degrees**
- **Site # 3- 260 degrees**
- **Site # 4- 263 degrees**

Reference Point #3 Bowman Bay Beach Bluff Compass Readings (Magnetic North) from

- **Site #1-150 degrees**
- **Site #2- 164 degrees**
- **Site # 3- 165 degrees**
- **Site # 4- 174 degrees**

APPENDIX D

Insect Fallout Survey Protocol

Materials

- 13 in. × 8 in. × 5 in. Plastic Storage Bins
- Natural Dishwashing Soap (biodegradable and odorless)
- Fine Mesh Sieve
- Two 5 Gallon Buckets
- Measuring Tape
- Spray Bottle
- 1 ft. × 1 ft. Board – Divided with a marker into four 6 in. × 6 in. squares
- Camera

Procedure for Setting Fallout Traps

- Fallout traps should be set up approximately 24 hours prior to collection of samples.
- Place three bins randomly along a 50 ft. transect parallel to shore. The bins should be placed past the high tide mark, above the influence of tides.
- Fill one 5 gallon bucket with water. Sieve the collected water into the empty 5 gallon bucket. This will insure no invertebrates will contaminate the sample.
- Pour a few drops of natural odorless dishwashing soap into the bottom of the bins. Fill the bins with about 2 ½ in. of sieved water.

Procedure for Data Collection

- Drain collection bin through fine mesh sieve.
- Fill spray bottle with sieved water. Spray insects from sieve onto 1 ft. x 1 ft. board.
- Spread out and count total number of insects.
- Take a picture of insects spread out across the board.
- While the counting of all insects present is desired, a subsample may be counted should the total sample be too large to process in an appropriate amount of time.
    - Divide total sample into four visually estimated subsamples, one in each 6 in. × 6 in. quadrat on the board.
    - Count the total number of insects in one randomly selected quadrat.
    - Take a picture of the insects divided and spread out across the board. Take an additional picture of the quadrat sampled.

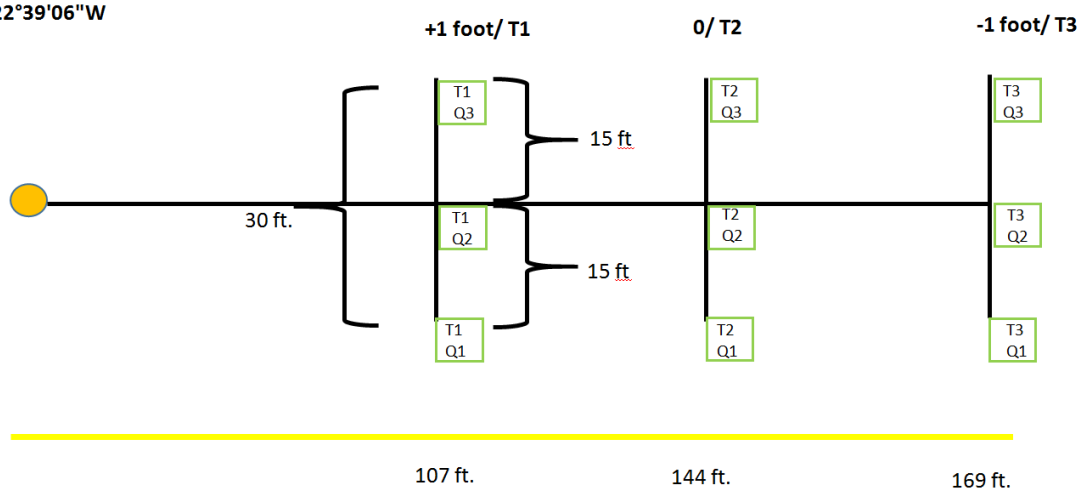
APPENDIX E

Surface Epifauna and Algae Quadrat Locations

Start Point:

48°25‘01"N

122°39'06"W

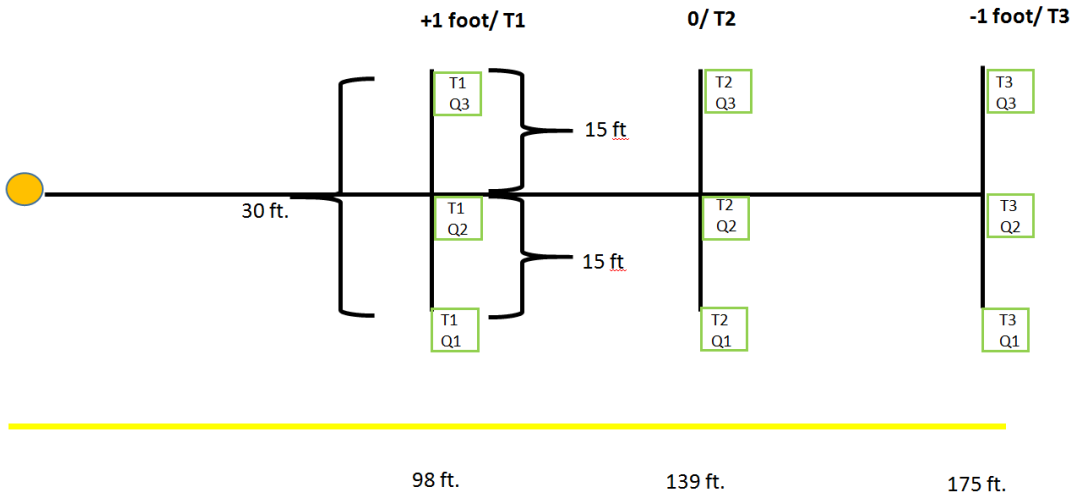


Site: Bowman Bay #1

Start Point:

48°24'57.0"N

122°39'03.1"W

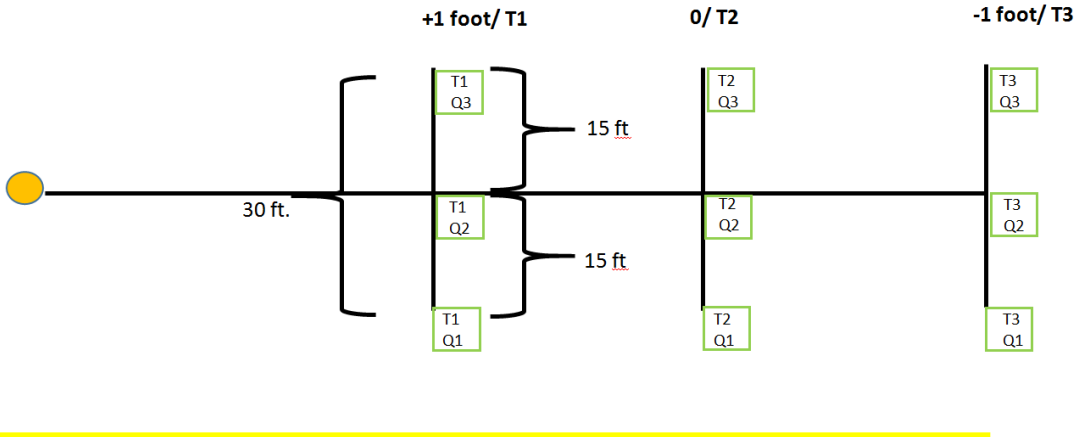


Site: Bowman Bay #2

Start Point:

48°24'55.5"N

122°39'02.5"W



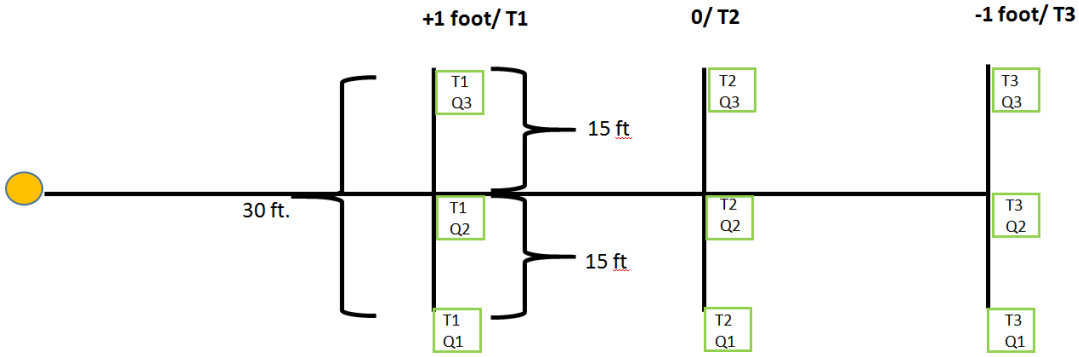
101 ft. Missing Missing

Site: Bowman Bay #3

Start Point:

48°24'55.60"N

122°39''19.05 "W



60 ft. 166 ft. 222 ft.

Site: Bowman Bay #4